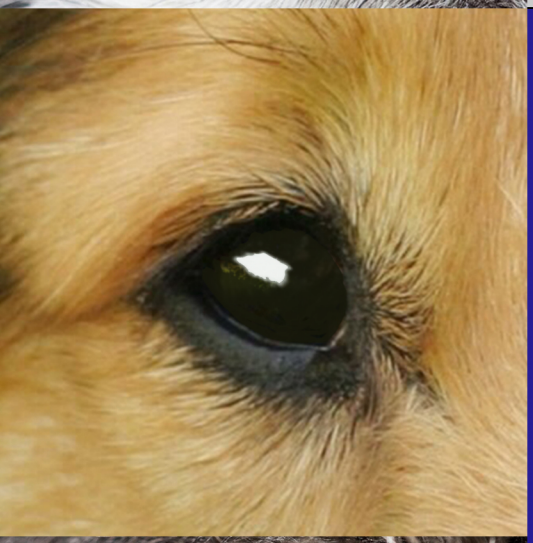

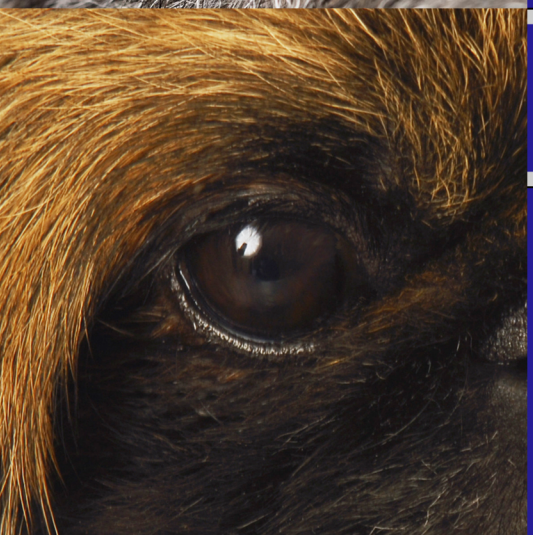

THE BLUE BOOK

Ocular Disorders
Presumed To Be Inherited in Purebred Dogs

2018

Genetics Committee of the
American College of Veterinary Ophthalmologists

ELEVENTH EDITION

Foreword

Ocular disorders, proven or presumed to be inherited in purebred dogs, have been a topic of intense dialogue by Diplomates of the American College of Veterinary Ophthalmologists (ACVO) for many years. Discussions commenced in the latter half of the 20th century during the early days of this College's inception, have continued into the 21st century, and will no doubt continue for years to come. Our knowledge of the existence, nature, progression, and inheritance of ocular disorders continues to expand as this field of veterinary science evolves. The Genetics Committee of the ACVO was originally formed in response to requests by registries, breed groups, and veterinarians, with the intent to provide a scientific advisory panel and guidelines regarding ocular disorders in purebred dogs. The Genetics Committee of today remains engaged in an ongoing effort to update information on ocular disorders for this purpose.

The content of this production has originated from several sources as the ACVO recently created a Companion Animal Eye Registry (CAER), which is a joint effort between the Orthopedic Foundation for Animals (OFA) and the ACVO. The addition of eye examination results to the OFA database makes the OFA the most complete source of canine health screening results in the world, allowing responsible breeders to make more informed breeding decisions in an effort to reduce the incidence of inherited disease.

The generation of statistical information is made possible by the efforts of dedicated breeders of purebred dogs who present their dogs to Diplomates of the ACVO for an OFA Companion Animal Eye Registry examination. The research copies of these examinations are then conscientiously submitted to OFA by the examining Veterinary Ophthalmologists. These data generate annual statistics. The statistics for each breed are then reviewed by the Genetics Committee for the most recent year and from the previous 5 years. Recommendations regarding the ocular disorders listed for each breed and the breeding advice are compiled following guidelines detailed elsewhere in this publication. A comprehensive review of the scientific literature since the last published edition was undertaken by all committee members. The scientific articles and breed disorders from the statistical and literature review have been added to the information on each breed in the production of this document. The collective educated clinical experience of the committee members is utilized to reach a consensus of opinion in areas where there remains a paucity of hard scientific proof regarding certain identified breed problems.

The current Genetics Committee has instituted an annual scientific literature search, in addition to the previously established yearly statistical data review. This information is compiled and submitted in an effort to maintain a bank of current information for future editions and versions of this document. The content of all editions past, present, and future will remain dynamic and ever changing as more precise technologies advance the study of the canine genome, as continued scientific research expands our knowledge, and as the database grows.

It is an honor and a privilege to serve the ACVO, our fellow Diplomates, reputable dog breeders, and our most trusted canine companions in this endeavor.

Genetics Committee 2018
Renee Carter, Jessica Meekins, Caroline Betbeze, Adam King, Hans Westermeyer, Kathy Barrie, Charlie Martin and Jane Ashley Huey
Gus Aguirre – Advisor
Ingrid Allgoewer – Advisor
Katie Diehl – OFA Liaison

11th Edition
2018 Version Acknowledgements

The following groups and individuals deserve credit for the production of this edition of Ocular Disorders Presumed to be Inherited in Purebred Dogs ("The Blue Book"):

The ACVO Board of Regents

Genetics Committee Chairs Dr. Andras Komaromy 2006-2008, Dr. Katie Diehl (2009-2011), Dr. Jacqueline Pearce (2011-2012), Dr. Carrie Breaux (2011-2013), Dr. Kenneth Pierce (2014), Dr. Wendy Townsend (2015), Ellen Belknap (2016), Jessica Meekins (2017), Renee Carter (2018) and all previous Genetics Committee members

Eddie Dziuk, Chief Operating Officer, and Erika Werne, CAER Program Manager, for the OFA

Introduction

What is the purpose of this book?

The Orthopedic Foundation for Animals (OFA), Canine Eye Registration Foundation (CERF), other breed registry groups, breed clubs, and practicing veterinarians have requested that the American College of Veterinary Ophthalmologists (ACVO) provide a scientific advisory panel to furnish guidelines regarding ocular disorders of major concern to purebred dogs. The Genetics Committee of the ACVO was formed in response to these requests and is engaged in an ongoing effort to update information on ocular disorders proven or suspected to be hereditary in purebred dogs. The compendium of ocular disorders and breeding recommendations which follow are interim guidelines. They are reviewed regularly and revised whenever additional information becomes available.

How can this information be used?

National and international breed clubs are encouraged to submit their input regarding breeding decisions for ocular disorders found in their breeds. **Local breed clubs** can participate by encouraging and organizing ocular examination clinics and forwarding their requests and concerns to their national organization. **Practicing veterinarians** are encouraged to contribute by informing all owners of potential breeding animals of the value and availability of ocular examinations, prior to breeding. Information regarding ocular disorders found in litters or individuals can be forwarded to the Genetics Committee via any ACVO diplomate. **Individual breeders** wishing to uphold high ethical standards for the improvement of their breed are urged to contribute by annual examination of their breeding animals and by encouraging the same from other breeders. Further information can be obtained from the Orthopedic Foundation for Animals (OFA): 2300 E Nifong Boulevard, Columbia, MO, 65201-3806, 573-442-0418. Only through increased awareness of the problems and a sustained cooperative effort to disseminate accurate information, will we be able to control and/or eliminate hereditary eye diseases in purebred dogs.

How do we identify an inherited eye disease?

Although there are noteworthy exceptions, most of the ocular diseases of dogs which are presumed to be hereditary have not been adequately documented. Genetic studies require examination of large numbers of related animals in order to characterize the disorder (age of onset, characteristic appearance, rate of progression) and to define the mode of inheritance (recessive, dominant). In a clinical situation, related animals are frequently not available for examination once a disorder suspected to be inherited is identified in an individual dog. Maintaining a number of dogs for controlled breeding trials through several generations is a long and costly process. Both of these obstacles are compounded by the fact that many ocular conditions do not develop until later in life.

Until the genetic basis of an ocular disorder is defined in a published report, we rely on what statistical information is available from registry organizations, informed opinions and consensus from ACVO diplomates, and must satisfy ourselves with terms like "presumed inherited" and "suspected to be inherited." Several companies provide information on genetic testing which greatly assists in providing more information and data to aid in defining the canine genetics of ocular diseases.

When do we suspect that a disorder is inherited in a given breed?

- When the frequency is greater than in other breeds
- When the frequency increases in a given breed as a whole
- When the frequency is greater in related dogs within a breed
- When it has a characteristic appearance and location
- When it has a characteristic age of onset and course of progression (predictable stages of development and time for each stage to develop)
- When it looks identical to an entity which has been proven to be inherited in another breed

Guidelines Used by the ACVO Genetics Committee in Making Breeding Recommendations

In this book, we chose the term "**BREEDING ADVICE**" and intentionally avoided the words "certifiable" and "registerable." The ACVO does not serve as a registry organization. Registry organizations operate independently of the ACVO and set their own standards for registration. However, the OFA does follow the guidelines set forth by the ACVO Genetics Committee in this publication. Any registry organization may use the information in this compendium and results of examinations performed by ACVO Diplomates in the registering of animals with regard to breeding suitability as they see fit.

It is important to recognize that the sensitivity of genetic disorder detection is greater when large numbers of dogs are examined. The extensive number of disorders listed in this book for some breeds may reflect the popularity of the breed and the numbers of animals evaluated. Conversely, the lack of disorders listed for other breeds often reflects only the paucity of examinations reported for each breed. For these reasons, the ACVO Genetics Committee strongly recommends annual evaluations of dogs of all breeds as the imperative first step in the control of hereditary ocular disorders. We would like to acknowledge the contribution of the Orthopedic Foundation for Animals (OFA) and Canine Eye Registration Foundation (CERF) for providing statistical summaries of ophthalmic examinations from their files.

For each breed, specific ocular disorders have been listed which are known or suspected to be inherited based on one or more of the following criteria:

1) There are published reports in the scientific literature regarding a condition in a particular breed with evidence of inheritance.

2) The incidence of affected animals (from OFA and CERF reports) is greater than or equal to 1% of the examined population with a minimum of five affected animals per five year period. Regardless of the population of dogs examined, if 50 or more affected individuals are identified in a five year period, the entity will be listed for that breed.

3) A specific request from a breed club that a condition be included for their breed may be considered at the ACVO annual meeting of the Genetics Committee if information is received by August 1. Such requests are reviewed critically and must include specific documentation as to the disorder in question and the numbers seen. Further information from the breed club may be requested. The request must receive agreement by a majority of the committee.

4) There is overwhelming opinion by a majority of the Genetics Committee members that clinical experience by ACVO Diplomates would indicate a particular condition should be listed for a breed, in spite of the absence of direct evidence of affected animals on OFA or CERF reports.

5) Results of genetic laboratory research and genetic testing.

The "Breeding Advice" given is determined by the significance of the condition to vision and/or very strong evidence of heritability:

Two categories of advice regarding breeding have been established:

> **NO**: Substantial evidence exists to support the heritability of this entity AND/OR the entity represents a potential compromise of vision or other ocular function.
>
> **BREEDER OPTION**: Entity is suspected to be inherited but does not represent potential compromise of vision or other ocular function.

When the breeding advice is "**NO,**" even a minor clinical form of the entity would make this animal unsuitable for breeding. When the advice is "**BREEDER OPTION,**" caution is advised. In time, it may be appropriate to modify this stand to "**NO**" based on accumulated evidence. If, in time, it becomes apparent that there is insufficient evidence that an entity is inherited, it may be deleted from the list.

There are currently eleven disorders for which there is an unequivocal recommendation <u>against</u> breeding in all breeds:

These are conditions which frequently result in blindness and for which there is definite evidence of heritability in one or more breeds. However, these disorders will not be listed on the individual breed page for a given breed, unless they also meet the criteria described above.

- **Keratoconjunctivitis sicca (KCS)** – Breeding is not recommended for any animal demonstrating keratitis consistent with KCS. The prudent approach is to assume KCS to be hereditary except in cases suspected to be non-genetic in origin. See *note.
- **Glaucoma** – See *note.
- **Persistent Pupillary Membranes**
  - **Iris to Lens**
  - **Iris to Cornea**
  - **Iris Sheets**
- **Cataract** – Breeding is not recommended for any animal demonstrating partial or complete opacity of the lens or its capsule *unless the examiner has also checked the box for "suspect not inherited" or unless specified otherwise for the particular breed*. See *note.
- **Lens luxation or subluxation** – See *note.
- **Persistent hyperplastic primary vitreous (PHPV)/persistent hyperplastic tunica vasculosa lentis (PHTVL)** – See *note.
- **Retinal detachment** – See *note.
- **Retinal atrophy – generalized (PRA)** - Breeding is not advised for any animal demonstrating bilaterally symmetric retinal degeneration (considered to be PRA unless proven otherwise).
- **Retinal dysplasia, geographic or detached forms** – See *note.
- **Optic nerve coloboma**
- **Optic nerve hypoplasia**

*Note: The prudent approach of these disorders is to assume they are hereditary except in cases specifically known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, or nutritional deficiencies.

In breeds recognized with Persistent Pupillary Membrane (PPM) as an inherited problem there is an unequivocal recommendation against breeding when there is PPM iris to lens, or PPM iris to cornea, or iris sheets. Breeding advice is **"NO."**

The following breeds are recommended to have a preliminary examination prior to initial pharmacological dilation to best facilitate identification of these disorders:

Dalmatian – iris hypoplasia/sphincter dysplasia
Australian Shepherd – iris coloboma
Miniature American Shepherd/Miniature Australian Shepherd – iris coloboma
Toy Australian Shepherd – iris coloboma
Louisiana Catahoula Leopard Dog – iris coloboma/persistent pupillary membrane

What can be detected during an Eye Certification Examination?

A routine eye screening examination includes indirect ophthalmoscopy and slit lamp biomicroscopy following pharmacological dilation of the pupils. Gonioscopy, tonometry, Schirmer tear test, electroretinography, and ultrasonography are not routinely performed; thus, dogs with goniodysgenesis, glaucoma, keratoconjunctivitis sicca, or some early cases of progressive retinal atrophy might not be detected without further testing.

The diagnoses obtained during an ophthalmic eye certification examination refer only to the **phenotype** (clinical appearance) of an animal. Thus, it is possible for a clinically normal animal to be a carrier (abnormal **genotype**) of genetic abnormalities.

An individual ACVO Diplomate may disagree with the breeding advice contained in this compendium. It is appropriate for this examiner to contact the ACVO Genetics Committee to voice disagreement, initiate change, or suggest additions. The members of the Genetics Committee represent the ACVO but acknowledge that the information generated for a breed may not agree with the knowledge and clinical experience of every individual ACVO Diplomate.

What is the role of the responsible dog breeder?

The final beneficiary of the information in this book is the dog breeder. It is up to the conscientious breeder to use this information along with other criteria in selecting which animals to breed. To assist this determination, current certification is recommended. Animals currently free of heritable eye disease will be issued a certificate on receipt of the examination/application by OFA. To avoid confusion between a normal animal (no evidence of heritable eye disorders) and one that may have a minor fault coming under the advice of Breeder Option, the Breeder Option category will be printed on the certificate. This is intended to stimulate conversation as to the specific nature of the Breeder Option condition found in that particular animal, allowing breeders using a dog in a breeding program to make an informed decision.

There are many ocular conditions which are a direct result of selection for a facial conformation considered desirable by breeders.

These include:

- Entropion
- Ectropion
- Macroblepharon
- Exposure keratopathy syndrome

Facial conformation with excessively prominent eyes, heavy facial folds, or eyelids which are either inverted or everted predispose animals to corneal irritation, discomfort, and if left untreated, can lead to loss of vision. A responsible breeding program should recognize and select away from these exaggerated facial features.

THE ROLE OF GENETIC TESTING IN THE DETECTION OF OCULAR DISEASE

Genetic testing plays a very important role in the diagnosis of disease. However, it is important to be aware of the limitations of genetic testing and understand its role in the detection and control of genetically inherited diseases.

Genetically inherited diseases are caused by a deleterious sequence change (mutation) in the DNA that results in an abnormal protein (protein can be absent, have insufficient function, or have an abnormal function) that results in disease.

Genetic tests are developed by comparing the DNA sequence of a normal animal to that of an animal with disease. This allows the identification of a particular DNA sequence that can be causally associated with the disease. This is an extremely powerful tool that, in some cases, allows for identification of disease even before it is evident clinically.

However, a particular test is only capable of detecting the DNA sequence it was designed to detect. That is, the DNA test only tests for a specific change in the DNA that can cause disease. For example, a DNA test specific for the *PDE6B* gene mutation (responsible for the rcd1 form of PRA in the Irish Setter) will not detect any abnormalities in other breeds or mixed breeds that have other mutations in the same gene. Thus the specificity of a DNA test is also its limitation, and in the case of PRA in Irish Setters it is specific for the Irish Setter defect and not for any other defects.

In polygenic disorders, a genetic test cannot evaluate the integrity of all the proteins that make up a particular cellular process. Thus, it is possible for a DNA test that has been associated with a disease to be normal and yet the disease can still be present. The disease could be caused by an abnormality in one of the other genes that are involved with that particular cellular process. The defect in the other protein still results in an abnormal cellular process, which still results in disease. A perfect example of this is observed in oculo-skeletal dysplasia in Labrador Retrievers and Samoyed dogs. In both breeds the diseases are clinically identical, yet caused by mutations in different genes involved in fibril formation of a specific kind of collagen molecule.

Thus, obtaining a DNA test that is normal does not guarantee absence of disease. It only guarantees that the particular change the DNA test was designed to detect is not present, and that disease from that particular change will not occur. This is why genetic testing should be combined with ophthalmic examination for maximum efficacy. An ophthalmic exam evaluates the sum total or “result” of all the cellular processes required to maintain ocular health and result in vision, and is an essential part of the ocular wellness exam to ensure that other important clinically recognizable diseases are not present.

Breeder Option Codes

A – Eyelids

A1 Entropion
A2 Ectropion
A3 Distichiasis
A4 Ectopic Cilia
A5 Macroblepharon

B – Nicitans

B1 Cartilage Anomaly/Eversion
B2 Gland Prolapse

C – Cornea

C1 Corneal Dystrophy – Epithelial/Stromal
C2 Corneal Dystrophy – Endothelial
C4 Exposure/Pigmentary Keratitis

D – Uvea

D1 Uveal Cyst
D2 Iris Coloboma
D3 Persistent Pupillary Membranes – Iris to Iris
D4 Iris Hypoplasia

E – Lens

E1 Cataract – Suspect Not Inherited
E2 Posterior Y Tip Suture Opacities

F – Vitreous

F1 Persistent Hyaloid Artery
F2a Vitreous Degeneration – Syneresis
F2b Vitreous Degeneration – Anterior Chamber

G – Fundus

G1 Retinal Dysplasia – Folds
G5 Micropapilla
G6 Retinopathy

Breeds Not Listed for Insufficient Data

Attempts have been made to confirm information on the following list of breeds/rare breeds. This list is not an endorsement of the breed status and may change from time to time as additional information is available.

To date there are no published reports of inherited ocular conditions in these breeds and/or the numbers of individuals for which examinations are recorded are too low to identify the presence of significant ocular disorders. Examinations are encouraged to accumulate information and reduce the likelihood of undetected conditions becoming problematic.

Aatu Tamaskan
Alano
Alapaha Blue-Blood Bulldog
American Alsatian
American Bandogge Mastiff
American Bully
American English Coonhound
American Foxhound
American Husky
American Leopard Hound
Anatolian Shepherd
Armenian Gampr
Australian Koolie
Azawakh
Bavarian Mountain Scent Hound
Bergamasco
Berger des Pyrenees
Blue Lacy
Blue Mountain Shepherd
Bluetick Coonhound
Boz Shepherd
Braque d'Auvergne
Braque du Bourbonnais
Braque Francais
Braque Francais Pyrenees
Ca De Bou
Cao De Castro Laboreiro
Carolina Dog
Catalan Sheepdog
Caucasian Shepherd
Central Asian Shepherd
Chart Polski
Chinook Hybrid
Cirneco Dell'Etna
Czechoslovakian Vlcak
Danish Broholmer
Danish Swedish Farmhound
Drentsch Partrijshond
Drever
ECT Landseer
English Coonhound
English Foxhound
English Jack Russell Terrier
Epagneul Breton
Estrela Mountain Dog
Fila Brasileiro
French Pointer
French Spaniel
German Longhaired Pointer
German Spaniel
Greenland Dog
Hanoverian Hound
Hovawart
Jindo
Kishu Ken
Korean Poongsan
Kromforhlander
Large Munsterlander
Llewellin Setter
Magyar Agar
McNab
Munsterlander
Native American Indian Dog
Native American Village Dog
New Zealand Huntaway
North American Shepherd
Otterhound
Picardy Spaniel
Polish Tatra Sheepdog
Porcelaine Hound
Portuguese Podengo
Portuguese Pointer
Pudelpointer
Pumi
Pyrenean Mastiff
Redbone Coonhound
Scottish Deerhound
Seppala Siberian Sled Dog
Shorty Bull
Skye Terrier
Slovakian Wirehaired Pointer
Small Munsterlander
Spanish Greyhound
Spanish Mastiff
Stabyhoun
Treeing Walker
Wachtelhund
Welsh Sheepdog
White Swiss Shepherd
Windsprite
Working Kelpie
Yakutian Laika

Glossary of Terms

(For more detailed definitions, the reader is referred to medical and genetic scientific texts.)

Achromatopsia: see **Day blindness**

Canine multifocal retinopathy: characterized by numerous distinct (i.e. multifocal), roughly circular patches of elevated retina (multifocal bullous retinal detachments). The condition includes numerous distinct (i.e. multi-focal), roughly circular patches of elevated retina with accumulation of material that produces gray-tan-pink colored lesions (multifocal bullous retinal detachments). These lesions, looking somewhat like blisters, vary in location and size, although typically they are present in both eyes of the affected dog.

The disease generally develops in young dogs and might not progress or progress slowly, or may appear to heal with discrete areas of tapetal hyper-reflectivity or hyperpigmentation. Most dogs exhibit no noticeable problem with vision despite their abnormal appearing retinas.

Cataract: any opacity of the lens and/or its capsule, regardless of size or location within the lens. Cataracts are assumed to be hereditary unless associated with known trauma, ocular inflammation, specific metabolic diseases, or nutritional deficiencies.

Ceroid lipofuscinosis: an inherited disease of man and animals characterized by the accumulation of lipopigment in various tissues of the body including the eye. It results in progressive neurologic disease including blindness. (Also called Batten's disease.)

Choroidal hypoplasia: a congenital, inherited, non-progressive defect primarily affecting the choroid resulting in some or all of the following: decreased or lack of pigment in the retinal pigment epithelium or choroid, tapetal thinning, and reduced or abnormal choroidal blood vessels.

Chronic superficial keratitis (CSK): see **Pannus**

Collie eye anomaly: a congenital syndrome of ocular anomalies characterized by bilateral and often symmetrical defects including any combination of **choroidal hypoplasia**, **coloboma**, and **retinal detachment(s)**.

Coloboma: a congenital abnormality in ocular development usually characterized by focal absence of tissue, commonly (though not exclusively) located at the 6 o'clock position associated with failure of closure of the optic fissure.

Cone degeneration: the loss of photopic vision caused by selective degeneration of the cone photoreceptors. Also known as day blindness, hemeralopia, or achromatopsia.

Corneal degeneration: opacification of one or more of the corneal layers frequently resulting from deposition of lipid or mineral and occurring secondary to chronic inflammation.

Corneal dystrophy: non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers (**epithelium, stroma, endothelium**). The term dystrophy implies an inherited condition. It is usually bilateral although not necessarily symmetrical and the onset in one eye may precede the other.

> **Corneal dystrophy - endothelial:** breed-related loss or dysfunction of corneal endothelial cells resulting in bilateral, progressive corneal edema.

Corneal dystrophy - epithelial, stromal: breed-related, non-inflammatory, white to silver-colored opacification of the corneal epithelium and/or stroma frequently resulting from deposition of lipid.

Day blindness: see **Cone degeneration**

Dermoid: a congenital, non-cancerous growth occurring on the cornea, conjunctiva, or eyelid typified by the presence of skin-like structures.

Distichiasis: the presence of abnormally oriented eyelashes, frequently protruding from Meibomian gland ductal openings.

Dry eye: see **Keratoconjunctivitis sicca**

Dysplasia: abnormality of development.

Dystrophy: non-inflammatory, developmental, nutritional, or metabolic abnormality; dystrophy implies a possible hereditary basis and is usually bilateral.

Ectopic cilia: aberrant hairs emerging through the palpebral conjunctiva which often causes ocular discomfort and corneal disease.

Ectropion: a conformational defect resulting in eversion of the eyelid margin, which may cause ocular irritation due to exposure. It is likely that ectropion is influenced by several factors defining the skin and other structures, which make up the eyelids, orbital contents, and conformation of the skull.

Entropion: a conformational defect resulting in inversion of the eyelid margin which may cause ocular irritation. It is likely that entropion is influenced by several factors defining the skin and other structures, which make up the eyelids, orbital contents, and conformation of the skull.

Euryblepharon: an exceptionally long eyelid marginal length, which may lead to Ectropion or Entropion. Euryblepharon is synonymous with the term macropalpebral fissure.

Exposure/pigmentary keratitis: a condition characterized by variable degrees of superficial vascularization, fibrosis, and/or pigmentation of the cornea. May be associated with excessive exposure/irritation of the globe due to shallow orbits, lower eyelid medial entropion, lagophthalmos, and macropalpebral fissure.

Glaucoma: characterized by an elevation of intraocular pressure (IOP) which causes optic nerve and retinal degeneration and results in blindness. Diagnosis and classification of glaucoma requires tonometry and gonioscopy, which are not part of a routine eye certification examination.

Glaucoma, pigmentary: see O**cular melanosis**

Goniodysgenesis: congenital anomaly characterized by the persistence of a variably fenestrated sheet of uveal tissue spanning the iridocorneal angle, extending from the iris base to the peripheral cornea. Diagnosis is by gonioscopy, which is not part of a routine eye certification examination.

Hemeralopia: see **Cone degeneration**

Imperforate lacrimal punctum: developmental anomaly resulting in an imperforate opening of the lacrimal puncta. An imperforate lower punctum may result in epiphora, an overflow of tears onto the face.

Iridocorneal angle: the junction between the iris and the cornea; the drainage angle. Aqueous humor leaves the anterior chamber via the trabecular meshwork within the iridocorneal angle into the venous circulation.

Iris coloboma: a congenital abnormality in iris development usually characterized by a full-thickness defect in iris tissue, commonly (though not exclusively) located at the 6 o'clock position associated with failure of closure of the optic fissure. A partial-thickness defect in iris tissue should be recorded as iris hypoplasia on the eye certification form.

Iris cyst: see **Uveal cyst**

Iris hypoplasia: a congenital abnormality in iris development usually characterized by a reduced quantity of tissue identified as a partial-thickness defect in iris tissue. Full-thickness iris hypoplasia is rare and should be recorded as an iris coloboma on the eye certification form.

Iris melanoma: see **Uveal melanoma**

Iris sphincter dysplasia: a congenital abnormality in iris development usually characterized by a full-thickness defect in iris tissue at the level of the iris sphincter, causing pupillary dilation. This abnormality has been noted in the Dalmatian breed.

Keratitis: inflammation of the cornea.

Keratitis, punctate: inflammation of the cornea accompanied by multifocal, coalescing areas of stromal corneal ulceration of variable depth.

Keratoconjunctivitis sicca (KCS): an abnormality of the tear film attributed to deficiency of the aqueous portion of the tears. Progressive KCS may result in ocular surface irritation and/or vision impairment via corneal opacification. Also called dry eye. The test for this condition is the Schirmer Tear Test, which is not part of a routine eye certification examination.

Lens subluxation/luxation: partial (subluxation) or complete displacement of the lens from the normal anatomic site. Lens luxation may result in elevated intraocular pressure (secondary glaucoma), causing vision impairment, pain, and/or retinal detachment.

Lenticonus: an anomaly of the lens in which the anterior or posterior surface protrudes in a conical form; usually congenital.

Macroblepharon: an exceptionally large palpebral fissure. Macroblepharon in conjunction with laxity of the lateral canthal structures may lead to lower lid ectropion and upper lid entropion. Either of these conditions may lead to severe ocular irritation.

Merle: an incompletely dominant phenotype in which heterozygous (M/m) dogs exhibit a coat color phenotype of various dilute color patches, while homozygous (M/M) dogs exhibit marked hypopigmentation and ocular defects, including microphthalmia, blindness and colobomas, and deafness. Deafness and ocular defects are sometimes seen in heterozygous individuals.

Micropapilla: a congenital anomaly which results in a small optic disk diameter without vision loss. Contrast with optic nerve hypoplasia, which may have a similar ophthalmoscopic appearance with vision loss.

Microphakia: a congenital anomaly in which there is an abnormally small lens.

Microphthalmos: a congenital anomaly in which the globe is abnormally small. Commonly associated with multiple ocular malformations and when severe, may affect vision.

Nictitans cartilage anomaly/eversion: a congenital anomaly in the nictitating membrane in which the T-shaped cartilage is malformed and/or folded.

Nictitans gland prolapse: protrusion of the tear-producing gland of the nictitating membrane from its normal position posterior to the nictitating membrane, to a position superior to the free margin of this structure.

Nodular granulomatous episclerokeratitis (NGE): an inflammatory disorder of the sclera and episclera, with occasional corneal involvement, characterized by granulomatous infiltrates. Previously known as **Proliferative keratoconjunctivitis**. This condition is most commonly seen in the Collie.

Nyctalopia: loss of scotopic (night) vision. Causes include genetic defects in photoreceptors and in retinal pigment epithelium, either dystrophy or degeneration of affected cells.

Ocular melanosis: progressive bilateral and sometimes asymetrical increase in pigmentation with melanocytic accumulation the uveal tract and adjacent tissues. Ultimately progresses to glaucoma and loss of vision in most cases (melanocytic glaucoma). Not associated with systemic disease or metastases. Most often recognized in Cairn Terriers.

Optic nerve coloboma: a congenital abnormality of the optic nerve commonly associated with failure of closure of the optic fissure, resulting in a defect in the optic nerve in the anterior-posterior plane. May result in partial or total vision loss.

Optic nerve hypoplasia: a congenital anomaly, which results in a small optic disk diameter and vision loss. Contrast with micropapilla, which may have a similar ophthalmoscopic appearance but without loss of vision.

Pannus: a bilateral inflammatory disease of the cornea which usually starts as a grayish haze to the inferior or inferiotemporal cornea, followed by the formation of a vascularized subepithelial opacity that begins to spread toward the central cornea; pigmentation may follow the vascularization. If severe, vision impairment occurs. Plasma cell infiltration of the nictitans may occur in conjunction with CSK, or on its own. (Also called “CSK”.)

Persistent hyaloid artery (PHA): congenital defect resulting from abnormalities in the development and regression of the hyaloid artery. The blood vessel remnant can be present in the vitreous as a small patent vascular strand (PHA) or as a non-vascular strand that appears gray-white (persistent hyaloid remnant).

Persistent hyperplastic primary vitreous (PHPV): congenital defect resulting from abnormalities in the regression of the hyaloid artery (the primary vitreous) and the interaction of the blood vessel with the posterior lens capsule/cortex during embryogenesis. This condition is often associated with congenital cataracts and frequently seen with PHTVL.

Persistent hyperplastic tunica vasculosa lentis (PHTVL): congenital defect resulting from failure of regression of the embryonic vascular network which surrounds the developing lens. Often associated with PHPV and a patent hyaloid artery.

Persistent pupillary membranes (PPM): persistent blood vessel remnants in the anterior chamber which fail to regress normally by 3 months of age. These strands arise from the iris collaret and may bridge from iris to iris, iris to lens, iris to cornea, or form sheets of tissue in the anterior chamber.

Persistent tunica vasculosa lentis (PTVL): clinically insignificant posterior epicapsular lenticular opacities resulting from incomplete regression of the embryonic vascular network which surrounds the developing lens.

Pigmentary glaucoma: see **Ocular melanosis**

Pigmentary uveitis: see **Uveitis, pigmentary**

Pigmentary keratopathy: a condition reported in Pugs in which the cornea becomes pigmented, often resulting in vision impairment. Development of pigmentary keratopathy is associated with congenital uveal pathology – iris hypoplasia and the presence of persistent pupillary membranes – but not with other factors such as Schirmer tear test values or medial canthal entropion.

Plasmoma: see **Pannus**. Also called Atypical Pannus. Bilateral thickening and depigmentation of the nictitans due to invasion of lymphocytes and plasma cells. It may or may not be associated with corneal involvement (Pannus).

Progressive rod-cone degeneration (PRCD) (see also **PRA**): Typically refers to recessively inherited generalized loss of rod photoreceptors followed by cone degeneration. Many different genetic mutations result in a similar phenotypic presentation.

Progressive retinal atrophy (PRA): an umbrella term used to describe a group of inherited dysplastic, dystrophic, or degenerative diseases of the retinal visual cells (photoreceptors, retinal pigment epithelium, or both).

Proliferative keratoconjunctivitis: see **Nodular granulomatous episclerokeratitis**

Retinal atrophy: a non-specific term used to describe a decrease in the number and deterioration of the cells of the retina, regardless of cause.

Retinal degeneration: see **Retinal atrophy**

Retinal detachment: a separation of the neurosensory retina from the retinal pigment epithelium.

Retinal dysplasia: abnormal development of the retina present at birth. This condition is non-progressive and recognized in 3 forms: **folds**, **geographic**, **detached**.

> **Retinal dysplasia – folds:** seen ophthalmoscopically as linear, triangular, curved or curvilinear foci of retinal folding. May be single or multiple. In puppies, retinal folds can be seen as a transient phenomenon, resolving as the eye retains maturity.
>
> **Retinal dysplasia – geographic:** an irregularly shaped area of retinal development containing both areas of thinning and areas of elevation. This form may be associated with visual impairment.
>
> **Retinal dysplasia – detached:** severe retinal disorganization associated with separation of the neurosensory retina from the retinal pigmented epithelium. This form results in visual impairment.

Retinopathy: any non-inflammatory condition of the retina. These conditions can usually be detected by ophthalmoscopic examination, but an electroretinogram (ERG) may be required in some instances (e.g. canine multifocal retinopathy).

Rod-cone dysplasia: an inherited retinal disease characterized by abortive or abnormal development of rods and cones. Affected animals become blind early in life, usually within the first 6 months, with the exception of *rcd4* in the Gordon and Irish Setter dogs. See specific breed pages for rod-cone dysplasia type descriptions.

Rod dysplasia: abnormal development of the visual cells resulting in vision impairment in dim light by 6 months and total blindness at 3-5 years.

Uveal cyst: a pigmented, fluid-filled epithelial-lined structure arising from the posterior iris or ciliary body epithelium. Cysts may remain attached to the pupil margin, iris, or ciliary body, or may detach and be free-floating within the anterior chamber. They may rupture and adhere to the cornea or anterior lens capsule. Uveal cysts may occur in any breed. Uveal cysts are commonly benign, although they may be associated with other pathologic conditions in various breeds.

> **Uveal cyst, anterior chamber:** a pigmented, fluid-filled, epithelial-lined structure arising from the posterior iris or ciliary body epithelium which has detached from its site of origin and is free-floating in the anterior chamber.
>
> **Uveal cyst, ciliary body:** a pigmented, fluid-filled, epithelial-lined structure arising from the ciliary body epithelium and attached to the ciliary body.
>
> **Uveal cyst, iris:** a pigmented, fluid-filled, epithelial-lined structure arising from the posterior iris epithelium and attached to the iris.

Uveal melanoma: a locally invasive melanocytic neoplasm arising within the uveal tract, may be benign (melanocytoma) or malignant (malignant melanoma). Uveal melanomas are reported in higher frequency in German Shepherd Dogs and Labrador Retrievers. Inherited iris melanoma has been reported in Labrador Retrievers.

Uveitis, pigmentary: a specific form of uveitis most commonly seen in middle-aged to older Golden Retrievers. Clinically manifests early as pigment deposition in a radial fashion on the anterior lens capsule with iridociliary cysts. Later stages are associated with posterior synechia, fibrinous anterior uveitis, cataract, and ultimately glaucoma. Not associated with systemic disease; may be asymmetric in presentation.

Uveodermatologic syndrome: an immune-mediated syndrome of anterior uveitis, chorioretinitis, dermal depigmentation (vitiligo), and hair depigmentation (poliosis). A similar syndrome in humans, called Vogt-Koyanagi-Harada syndrome (VKH), is an autoimmune disease directed against melanocytes. Secondary glaucoma and/or retinal detachment are frequent complications of this disease. Seen most commonly in the Akita, Samoyed, and Siberian Husky breeds.

Vitreous degeneration: Liquefaction of the vitreous gel which may predispose to retinal detachment resulting in blindness.

OCULAR DISORDERS REPORT
AATU TAMASKAN

There are insufficient breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the AATU TAMASKAN breed. Therefore, there are no conditions listed with breeding advice.

OCULAR DISORDERS REPORT
AATU TAMASKAN

Diagnostic Name		1991-2013 TOTAL DOGS EXAMINED 6 #	%	2014-2018 70 #	%
EYELIDS					
25.110	distichiasis	0		1	1.4%
UVEA					
93.710	persistent pupillary membranes, iris to iris	0		1	1.4%
93.999	uveal cysts	0		1	1.4%
LENS					
100.302	punctate cataract, posterior cortex	0		1	1.4%
100.305	punctate cataract, posterior sutures	0		1	1.4%
100.312	incipient cataract, posterior cortex	0		1	1.4%
100.322	incomplete cataract, posterior cortex	0		1	1.4%
100.327	incomplete cataract, capsular	0		1	1.4%
100.999	*significant cataracts (summary)*	*0*		*5*	*7.1%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	0		1	1.4%
RETINA					
120.960	retinopathy	0		1	1.4%
OTHER					
900.100	other, not inherited	0		2	2.9%
NORMAL					
0.000	normal globe	6	100.0%	60	85.7%

AFFENPINSCHER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Distichiasis	Not defined	1	Breeder option
B.	Persistent pupillary membranes - iris to iris	Not defined	2	Breeder option
C.	Cataract	Not defined	3	NO

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

C. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Affenpinscher breed. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 2008 and/or Data from CERF All-Breeds Report, 2003-2007.

2. ACVO Genetics Committee, 2011 and/or Data from CERF All-Breeds Report, 2009.

3. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

OCULAR DISORDERS REPORT
AFFENPINSCHER

Diagnostic Name		1991-2013 TOTAL DOGS EXAMINED 315 #	%	2014-2018 136 #	%
GLOBE					
0.110	microphthalmia	1	0.3%	0	
EYELIDS					
20.140	ectopic cilia	1	0.3%	1	0.7%
25.110	distichiasis	18	5.7%	3	2.2%
NASOLACRIMAL					
40.910	keratoconjunctivitis sicca	1	0.3%	1	0.7%
NICTITANS					
52.110	prolapsed gland of the third eyelid	1	0.3%	0	
CORNEA					
70.700	corneal dystrophy	6	1.9%	3	2.2%
UVEA					
93.710	persistent pupillary membranes, iris to iris	18	5.7%	20	14.7%
93.730	persistent pupillary membranes, iris to cornea	1	0.3%	0	
93.740	persistent pupillary membranes, iris sheets	1	0.3%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	2	0.6%	3	2.2%
LENS					
100.200	cataract, unspecified	3	1.0%	0	
100.210	cataract. suspect not inherited/significance unknown	7	2.2%	1	0.7%
100.302	punctate cataract, posterior cortex	1	0.3%	0	
100.311	incipient cataract, anterior cortex	1	0.3%	0	
100.312	incipient cataract, posterior cortex	3	1.0%	0	
100.316	incipient cataract, nucleus	0		1	0.7%
100.328	posterior suture tip opacities	0		1	0.7%
100.330	generalized/complete cataract	3	1.0%	0	
100.999	*significant cataracts (summary)*	*11*	*3.5%*	*1*	*0.7%*
VITREOUS					
110.200	vitritis	0		1	0.7%
110.320	vitreal degeneration	4	1.3%	0	
RETINA					
120.170	retinal dysplasia, folds	2	0.6%	0	
OPTIC NERVE					
130.120	optic nerve hypoplasia	0		1	0.7%
OTHER					
900.000	other, unspecified	3	1.0%	0	
900.100	other, not inherited	8	2.5%	2	1.5%
900.110	other. suspect not inherited/significance unknown	1	0.3%	1	0.7%
NORMAL					
0.000	normal globe	271	86.0%	99	72.8%

AFGHAN HOUND

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Distichiasis	Not defined	1	Breeder option
B.	Corneal dystrophy - epithelial/stromal	Not defined	2, 3	Breeder option
C.	Persistent pupillary membranes - iris to iris	Not defined	2	Breeder option
D.	Cataract	Not defined	2, 4-7	NO

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Corneal Dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

C. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

D. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

The characteristic cataract in the Afghan Hound begins as equatorial lens vacuoles in dogs

from 4 months to 2 years of age. The opacities then extend into the anterior and posterior cortices. Rapid progression can occur with visual impairment in young adults. Test breedings have been done which support a hereditary basis; however, the exact mode of inheritance is unknown.

References

1. ACVO Genetics Committee, 2008 and/or Data from CERF All-Breeds Report, 2003-2007.

2. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

3. Vainisi SJ, Goldberg MF. *Animal models of inherited disease. In: Genetic and Metabolic Eye Disease* Little Brown and Company, Boston, 1974.

4. Roberts SR, Helper LC. Cataracts in Afghan hounds. *J Am Vet Med Assoc*. 1972; 160: 427.

5. Roberts SR. Hereditary cataracts. *Vet Clin North Am*. 1973; 3: 433.

6. Barnett KC. The diagnosis and differential diagnosis of cataract in the dog. *J Small Anim Pract*. 1985; 26: 305.

7. Barnett KC. Hereditary cataract in the dog. *J Small Anim Pract*. 1978; 19: 109-120.

OCULAR DISORDERS REPORT
AFGHAN HOUND

		1991-2013 2001		2014-2018 429	
	TOTAL DOGS EXAMINED				
Diagnostic Name		#	%	#	%
GLOBE					
0.110	microphthalmia	0		1	0.2%
10.000	glaucoma	2	0.1%	0	
EYELIDS					
21.000	entropion, unspecified	2	0.1%	0	
25.110	distichiasis	24	1.2%	4	0.9%
NASOLACRIMAL					
32.110	imperforate lower nasolacrimal punctum	1	0.0%	0	
40.910	keratoconjunctivitis sicca	1	0.0%	0	
NICTITANS					
51.100	third eyelid cartilage anomaly	0		1	0.2%
CORNEA					
70.210	corneal pannus	3	0.1%	0	
70.700	corneal dystrophy	211	10.5%	53	12.4%
70.730	corneal endothelial degeneration	3	0.1%	0	
UVEA					
93.710	persistent pupillary membranes, iris to iris	55	2.7%	13	3.0%
93.720	persistent pupillary membranes, iris to lens	1	0.0%	0	
93.730	persistent pupillary membranes, iris to cornea	1	0.0%	0	
93.740	persistent pupillary membranes, iris sheets	2	0.1%	0	
93.760	persistent pupillary membranes, endothelial opacity/no strands	1	0.0%	0	
93.810	uveal melanoma	0		1	0.2%
93.999	uveal cysts	4	0.2%	0	
LENS					
100.200	cataract, unspecified	9	0.4%	0	
100.210	cataract. suspect not inherited/significance unknown	111	5.5%	39	9.1%
100.301	punctate cataract, anterior cortex	1	0.0%	2	0.5%
100.302	punctate cataract, posterior cortex	1	0.0%	1	0.2%
100.303	punctate cataract, equatorial cortex	1	0.0%	1	0.2%
100.305	punctate cataract, posterior sutures	7	0.3%	4	0.9%
100.306	punctate cataract, nucleus	1	0.0%	0	
100.307	punctate cataract, capsular	3	0.1%	0	
100.311	incipient cataract, anterior cortex	4	0.2%	3	0.7%
100.312	incipient cataract, posterior cortex	1	0.0%	3	0.7%
100.313	incipient cataract, equatorial cortex	2	0.1%	0	
100.314	incipient cataract, anterior sutures	2	0.1%	1	0.2%
100.315	incipient cataract, posterior sutures	9	0.4%	3	0.7%
100.316	incipient cataract, nucleus	3	0.1%	0	
100.317	incipient cataract, capsular	2	0.1%	1	0.2%
100.321	incomplete cataract, anterior cortex	1	0.0%	2	0.5%
100.322	incomplete cataract, posterior cortex	1	0.0%	2	0.5%
100.323	incomplete cataract, equatorial cortex	0		2	0.5%
100.324	incomplete cataract, anterior sutures	1	0.0%	0	
100.325	incomplete cataract, posterior sutures	1	0.0%	0	

LENS CONTINUED		1991-2013		2014-2018	
100.326	incomplete cataract, nucleus	1	0.0%	3	0.7%
100.328	posterior suture tip opacities	8	0.4%	22	5.1%
100.330	generalized/complete cataract	2	0.1%	0	
100.375	subluxation/luxation, unspecified	1	0.0%	0	
100.999	*significant cataracts (summary)*	*53*	*2.6%*	*28*	*6.5%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	1	0.0%	0	
110.135	PHPV/PTVL	1	0.0%	0	
110.200	vitritis	0		4	0.9%
110.320	vitreal degeneration	7	0.3%	3	0.7%
FUNDUS					
97.120	coloboma	2	0.1%	0	
RETINA					
120.170	retinal dysplasia, folds	5	0.2%	1	0.2%
120.180	retinal dysplasia, geographic	2	0.1%	0	
120.310	generalized progressive retinal atrophy (PRA)	9	0.4%	0	
120.960	retinopathy	1	0.0%	2	0.5%
OPTIC NERVE					
130.150	optic disc coloboma	3	0.1%	0	
OTHER					
900.000	other, unspecified	20	1.0%	0	
900.100	other, not inherited	40	2.0%	10	2.3%
900.110	other. suspect not inherited/significance unknown	11	0.5%	0	
NORMAL					
0.000	normal globe	1607	80.3%	296	69.0%

AIREDALE TERRIER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Distichiasis	Not defined	1	Breeder option
B.	Corneal dystrophy - epithelial/stromal	Not defined	2	Breeder option
C.	Persistent pupillary membranes			
	- iris to iris	Not defined	1, 2	Breeder option
	- iris to cornea	Not defined	2	NO
D.	Cataract	Not defined	2	NO
E.	Vitreous degeneration	Not defined	3	Breeder option
F.	Retinal dysplasia - folds	Not defined	4	Breeder option

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Corneal Dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

C. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

D. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

E. Vitreous degeneration

Liquefaction of the vitreous gel which may predispose to retinal detachment.

F. Retinal Dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and the more severe forms of retinal dysplasia is undetermined.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Airedale Terrier breed. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

2. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

3. ACVO Genetics Committee, 2014 and/or Data from OFA/CERF All-Breeds Report, 2013.

4. ACVO Genetics Committee 2017 and/or Data from CERF/OFA All-Breeds Report, 2010-2016.

OCULAR DISORDERS REPORT
AIREDALE TERRIER

Diagnostic Name		1991-2013 712 #	%	2014-2018 161 #	%
GLOBE					
0.110	microphthalmia	3	0.4%	0	
EYELIDS					
20.140	ectopic cilia	2	0.3%	0	
21.000	entropion, unspecified	4	0.6%	0	
25.110	distichiasis	48	6.7%	12	7.5%
CORNEA					
70.210	corneal pannus	1	0.1%	0	
70.700	corneal dystrophy	9	1.3%	0	
70.730	corneal endothelial degeneration	3	0.4%	0	
UVEA					
93.710	persistent pupillary membranes, iris to iris	23	3.2%	8	5.0%
93.720	persistent pupillary membranes, iris to lens	7	1.0%	1	0.6%
93.730	persistent pupillary membranes, iris to cornea	20	2.8%	2	1.2%
93.740	persistent pupillary membranes, iris sheets	2	0.3%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	1	0.1%	8	5.0%
93.760	persistent pupillary membranes, endothelial opacity/no strands	2	0.3%	4	2.5%
93.999	uveal cysts	1	0.1%	0	
97.150	chorioretinal coloboma, congenital	0		1	0.6%
LENS					
100.200	cataract, unspecified	7	1.0%	0	
100.210	cataract. suspect not inherited/significance unknown	46	6.5%	10	6.2%
100.301	punctate cataract, anterior cortex	7	1.0%	1	0.6%
100.302	punctate cataract, posterior cortex	6	0.8%	0	
100.303	punctate cataract, equatorial cortex	2	0.3%	0	
100.304	punctate cataract, anterior sutures	1	0.1%	0	
100.305	punctate cataract, posterior sutures	4	0.6%	1	0.6%
100.306	punctate cataract, nucleus	1	0.1%	0	
100.307	punctate cataract, capsular	1	0.1%	0	
100.311	incipient cataract, anterior cortex	8	1.1%	1	0.6%
100.312	incipient cataract, posterior cortex	9	1.3%	0	
100.313	incipient cataract, equatorial cortex	5	0.7%	2	1.2%
100.315	incipient cataract, posterior sutures	3	0.4%	1	0.6%
100.316	incipient cataract, nucleus	2	0.3%	0	
100.317	incipient cataract, capsular	2	0.3%	1	0.6%
100.328	posterior suture tip opacities	0		1	0.6%
100.330	generalized/complete cataract	4	0.6%	0	
100.999	*significant cataracts (summary)*	*62*	*8.7%*	*7*	*4.3%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	3	0.4%	1	0.6%
110.135	PHPV/PTVL	1	0.1%	0	
110.320	vitreal degeneration	7	1.0%	0	

		1991-2013		2014-2018	
FUNDUS					
97.120	coloboma	1	0.1%	0	
RETINA					
120.170	retinal dysplasia, folds	19	2.7%	2	1.2%
120.180	retinal dysplasia, geographic	9	1.3%	0	
120.310	generalized progressive retinal atrophy (PRA)	12	1.7%	0	
120.910	retinal detachment without dialysis	1	0.1%	0	
OTHER					
900.000	other, unspecified	8	1.1%	0	
900.100	other, not inherited	38	5.3%	14	8.7%
900.110	other. suspect not inherited/significance unknown	5	0.7%	0	
NORMAL					
0.000	normal globe	525	73.7%	109	67.7%

AKBASH DOG

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Cataract	Not defined	1	NO

Description and Comments

A. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Akbash Dog breed. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

OCULAR DISORDERS REPORT
AKBASH DOG

Diagnostic Name		1991-2013 TOTAL DOGS EXAMINED 38 #	 %	2014-2018 1 #	 %
GLOBE					
0.110	microphthalmia	1	2.6%	0	
EYELIDS					
21.000	entropion, unspecified	3	7.9%	0	
22.000	ectropion, unspecified	1	2.6%	0	
UVEA					
93.999	uveal cysts	2	5.3%	0	
LENS					
100.210	cataract. suspect not inherited/significance unknown	2	5.3%	0	
100.303	punctate cataract, equatorial cortex	1	2.6%	0	
100.316	incipient cataract, nucleus	1	2.6%	0	
100.330	generalized/complete cataract	1	2.6%	0	
100.999	*significant cataracts (summary)*	*3*	*7.9%*	*0*	
VITREOUS					
110.120	persistent hyaloid artery/remnant	1	2.6%	0	
NORMAL					
0.000	normal globe	31	81.6%	1	100.0%

AKITA

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Microphthalmia with multiple ocular defects	Not defined	1, 2	NO
B.	Entropion	Not defined	1, 3	Breeder option
C.	Distichiasis	Not defined	4	Breeder option
D.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder option
E.	Cataract	Not defined	1	NO
F.	Retinal atrophy - generalized	Not defined	1, 5	NO
G.	Retinal dysplasia - folds	Not defined	1	Breeder option
H.	Strabismus	Not defined	6	NO
I.	Uveodermatologic syndrome	Not defined	1, 7-15	NO

Description and Comments

A. Microphthalmia with multiple ocular defects

Multiple ocular defects consisting of small eye (microphthalmia), opacity of the lens (cataract), conical shape of the posterior lens (posterior lenticonus), and folding of the retina into rosettes (retinal dysplasia) have been reported in related Akita pups. Cataracts affected primarily the nuclear and cortical lens. Retinal dysplasia affected the superior retina overlying the tapetal fundus. Affected dogs may have severe visual dysfunction. An autosomal recessive mode of inheritance is suspected but not proven.

B. Entropion

A conformational defect resulting in an "in-rolling" of one or both of the eyelids which may cause ocular irritation. It is likely that entropion is influenced by several genes (polygenic), defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull. OFA/CERF data indicates that entropion in the Akita usually occurs by 2 years of age.

C. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make strong recommendations with regard to breeding dogs with this entity. The hereditary basis has not been established, although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

D. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

In the Akita, many of these strands bridge between the iris and lens, thus resulting in focal cataract and possible vision impairment.

E. Cataract

Lens opacity which may affect one or both eyes and may involve the lens partially or completely. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membranes, persistent hyaloid, or nutritional deficiencies.

F. Retinal atrophy - generalized

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as Progressive Retinal Atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. Except for X-linked PRA in the Siberian Husky, in all breeds studied to date, PRA is inherited as an autosomal recessive trait.

The age of onset has been reported to be between 2 and 3 years of age with initial loss of night vision progressing to complete blindness.

G. Retinal Dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and the more severe forms of retinal dysplasia is undetermined.

H. Strabismus

Strabismus is characterized as the deviation of one or both eyes from the normal position; the eyes may turn in, out, up or down. In the Akita, a severe unilateral or bilateral ventral (down) or ventromedial (down and in) strabismus has been described with resulting vision loss. The strabismus was caused by restrictive fibrosis (scarring) of the extraocular muscles (the muscles that rotate the eye in different directions), possibly due to chronic inflammation (extraocular myositis).

I. Uveodermatologic syndrome

Uveodermatologic syndrome in the Akita bears many similarities to a condition in people called Vogt-Koyanagi-Harada (or VKH) syndrome. Thus, the condition in dogs is often referred to as VKH or VKH-like syndrome. It is an immune-mediated disease in which pigmented cells (melanocytes) in the eye and in the skin are destroyed by white blood cells (lymphocytes). The first clinical signs are usually inflammation of the intraocular structures (or uveitis) in both eyes. The uveitis is very difficult to control medically and ultimately results in blindness in most affected dogs. Whitening of the hair (poliosis) and skin (vitiligo) may also be noted in advanced cases. The genetics of this condition are unclear, but some genetic predisposition is indicated by the higher prevalence of this disorder in Akitas compared with other dog breeds. Affected dogs are generally young, ranging in age between 1 ½ to 4 years.

References

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OCULAR DISORDERS REPORT
AKITA

		1991-2013 10286		2014-2018 1023	
	TOTAL DOGS EXAMINED				
Diagnostic Name		#	%	#	%
GLOBE					
0.110	microphthalmia	32	0.3%	2	0.2%
10.000	glaucoma	2	0.0%	0	
EYELIDS					
21.000	entropion, unspecified	103	1.0%	5	0.5%
22.000	ectropion, unspecified	15	0.1%	0	
25.110	distichiasis	63	0.6%	11	1.1%
NASOLACRIMAL					
32.110	imperforate lower nasolacrimal punctum	6	0.1%	2	0.2%
NICTITANS					
51.100	third eyelid cartilage anomaly	7	0.1%	0	
CORNEA					
70.700	corneal dystrophy	52	0.5%	7	0.7%
UVEA					
93.150	iris coloboma	1	0.0%	0	
93.710	persistent pupillary membranes, iris to iris	248	2.4%	31	3.0%
93.720	persistent pupillary membranes, iris to lens	37	0.4%	0	
93.730	persistent pupillary membranes, iris to cornea	21	0.2%	6	0.6%
93.740	persistent pupillary membranes, iris sheets	3	0.0%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	2	0.0%	12	1.2%
93.760	persistent pupillary membranes, endothelial opacity/no strands	1	0.0%	2	0.2%
93.999	uveal cysts	1	0.0%	0	
LENS					
100.200	cataract, unspecified	28	0.3%	0	
100.210	cataract. suspect not inherited/significance unknown	224	2.2%	35	3.4%
100.301	punctate cataract, anterior cortex	6	0.1%	1	0.1%
100.302	punctate cataract, posterior cortex	7	0.1%	1	0.1%
100.303	punctate cataract, equatorial cortex	4	0.0%	0	
100.304	punctate cataract, anterior sutures	3	0.0%	0	
100.305	punctate cataract, posterior sutures	29	0.3%	8	0.8%
100.306	punctate cataract, nucleus	2	0.0%	0	
100.307	punctate cataract, capsular	4	0.0%	3	0.3%
100.311	incipient cataract, anterior cortex	10	0.1%	2	0.2%
100.312	incipient cataract, posterior cortex	37	0.4%	1	0.1%
100.313	incipient cataract, equatorial cortex	8	0.1%	0	
100.314	incipient cataract, anterior sutures	2	0.0%	0	
100.315	incipient cataract, posterior sutures	15	0.1%	3	0.3%
100.316	incipient cataract, nucleus	6	0.1%	0	
100.317	incipient cataract, capsular	8	0.1%	1	0.1%
100.322	incomplete cataract, posterior cortex	1	0.0%	0	
100.324	incomplete cataract, anterior sutures	0		1	0.1%
100.328	posterior suture tip opacities	0		20	2.0%
100.330	generalized/complete cataract	23	0.2%	3	0.3%
100.375	subluxation/luxation, unspecified	1	0.0%	0	

LENS CONTINUED		1991-2013		2014-2018	
100.999	*significant cataracts (summary)*	*193*	*1.9%*	*24*	*2.3%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	12	0.1%	8	0.8%
110.135	PHPV/PTVL	5	0.0%	0	
110.320	vitreal degeneration	8	0.1%	2	0.2%
RETINA					
120.170	retinal dysplasia, folds	192	1.9%	18	1.8%
120.180	retinal dysplasia, geographic	21	0.2%	1	0.1%
120.190	retinal dysplasia, detached	4	0.0%	0	
120.310	generalized progressive retinal atrophy (PRA)	87	0.8%	3	0.3%
120.910	retinal detachment without dialysis	6	0.1%	0	
120.920	retinal detachment with dialysis	1	0.0%	0	
120.960	retinopathy	0		1	0.1%
OPTIC NERVE					
130.120	optic nerve hypoplasia	8	0.1%	0	
130.150	optic disc coloboma	2	0.0%	0	
OTHER					
900.000	other, unspecified	52	0.5%	0	
900.100	other, not inherited	183	1.8%	37	3.6%
900.110	other. suspect not inherited/significance unknown	70	0.7%	3	0.3%
NORMAL					
0.000	normal globe	9218	89.6%	838	81.9%

OCULAR DISORDERS REPORT
ALANO

There are insufficient breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the ALANO breed. Therefore, there are no conditions listed with breeding advice.

OCULAR DISORDERS REPORT
ALANO

Diagnostic Name	TOTAL DOGS EXAMINED	1991-2013 1 # %	2014-2018 0 # %
NORMAL			
0.000 normal globe		1 100.0%	0

OCULAR DISORDERS REPORT
ALAPAHA BLUE-BLOOD BULLDOG

There are insufficient breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the ALAPAHA BLUE-BLOOD BULLDOG breed. Therefore, there are no conditions listed with breeding advice.

OCULAR DISORDERS REPORT
ALAPAHA BLUE-BLOOD BULLDOG

Diagnostic Name	TOTAL DOGS EXAMINED	1991-2013 0 #	%	2014-2018 1 #	%
UVEA					
93.710	persistent pupillary membranes, iris to iris	0		1	100.0%

ALASKAN KLEE KAI

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Distichiasis	Not defined	1	Breeder option
B.	Corneal dystrophy - epithelial/stromal	Not defined	2	Breeder option
C.	Persistent pupillary membranes			
	- iris to iris	Not defined	3	Breeder option
	- iris sheets	Not defined	4, 5	NO
D.	Cataract	Not defined	6	NO
E.	Vitreous degeneration	Not defined	2	Breeder Option

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Corneal Dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

C. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

D. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

E. Vitreous degeneration

Liquefaction of the vitreous gel which may predispose to retinal detachment.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Alaskan Klee Kai breed. The conditions listed above are generally recognized to exist in the breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 2011 and/or Data from CERF All-Breeds Report, 2010.

2. ACVO Genetics Committee, 2015 and Data from OFA All-Breeds Report, 2014-2015.

3. ACVO Genetics Committee, 2006 and/or Data from CERF All-Breeds Report, 2001-2005.

4. ACVO Genetics Committee, 2007 and/or Data from CERF All-Breeds Report, 2002-2006.

5. ACVO Genetics Committee, 2008 and/or Data from CERF All-Breeds Report, 2003-2007.

6. ACVO Genetics Committee, 2017 and/or Data from CERF/OFA All-Breeds Report, 2010-2016.

OCULAR DISORDERS REPORT
ALASKAN KLEE KAI

Diagnostic Name		1991-2013 465 #	1991-2013 465 %	2014-2018 309 #	2014-2018 309 %
EYELIDS					
25.110	distichiasis	43	9.2%	15	4.9%
NASOLACRIMAL					
32.110	imperforate lower nasolacrimal punctum	0		3	1.0%
CORNEA					
70.220	pigmentary keratitis	2	0.4%	0	
70.700	corneal dystrophy	10	2.2%	2	0.6%
70.730	corneal endothelial degeneration	1	0.2%	1	0.3%
UVEA					
93.710	persistent pupillary membranes, iris to iris	6	1.3%	5	1.6%
93.730	persistent pupillary membranes, iris to cornea	1	0.2%	0	
93.740	persistent pupillary membranes, iris sheets	5	1.1%	0	
LENS					
100.210	cataract. suspect not inherited/significance unknown	8	1.7%	11	3.6%
100.301	punctate cataract, anterior cortex	0		1	0.3%
100.304	punctate cataract, anterior sutures	0		1	0.3%
100.307	punctate cataract, capsular	1	0.2%	0	
100.311	incipient cataract, anterior cortex	6	1.3%	2	0.6%
100.312	incipient cataract, posterior cortex	1	0.2%	0	
100.999	*significant cataracts (summary)*	*8*	*1.7%*	*4*	*1.3%*
VITREOUS					
110.320	vitreal degeneration	8	1.7%	1	0.3%
RETINA					
120.170	retinal dysplasia, folds	5	1.1%	0	
OTHER					
900.000	other, unspecified	6	1.3%	0	
900.100	other, not inherited	6	1.3%	12	3.9%
NORMAL					
0.000	normal globe	404	86.9%	259	83.8%

ALASKAN MALAMUTE

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Glaucoma	Not defined	1, 2	NO	
B.	Distichiasis	Not defined	1	Breeder option	
C.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder option	
D.	Cataract	Not defined	1	NO	
E.	Cone degeneration - day blindness	Autosomal recessive	1, 3-9	NO	Mutation in the *CNGB3* gene

Descriptions and Comments

A. Glaucoma

An elevation of intraocular pressure (IOP) which, when sustained, causes intraocular damage resulting in blindness. The elevated IOP occurs because the fluid cannot leave through the iridocorneal angle. Diagnosis and classification of glaucoma require measurement of IOP (tonometry) and examination of the iridocorneal angle (gonioscopy). Neither of these tests are part of a routine breed eye screening exam.

B. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

C. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

D. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

E. Cone degeneration - day blindness or hemeralopia

Autosomal recessively inherited early degeneration of the cone photoreceptors. Affected puppies develop day-blindness, color blindness, and photophobia between 8 and 12 weeks of age. Affected dogs remain ophthalmoscopically normal their entire life. Electroretinography is required to definitively diagnose the disorder. Genetically, the condition results from a deletion in the *CNGB3* gene. A DNA test is available.

References

1. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

2. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

3. Rubin LF, Bourns TKR, Lord LH. Hemeralopia in Dogs - Heredity of Hemeralopia in Alaskan Malamutes. *Am J Vet Res*. 1967;28:355-7.

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OCULAR DISORDERS REPORT
ALASKAN MALAMUTE

	TOTAL DOGS EXAMINED	1991-2013 8143		2014-2018 1283	
Diagnostic Name		#	%	#	%
GLOBE					
0.110	microphthalmia	2	0.0%	0	
10.000	glaucoma	2	0.0%	0	
EYELIDS					
20.140	ectopic cilia	1	0.0%	0	
21.000	entropion, unspecified	5	0.1%	0	
22.000	ectropion, unspecified	1	0.0%	0	
25.110	distichiasis	179	2.2%	26	2.0%
NASOLACRIMAL					
40.910	keratoconjunctivitis sicca	2	0.0%	0	
NICTITANS					
51.100	third eyelid cartilage anomaly	1	0.0%	0	
52.110	prolapsed gland of the third eyelid	1	0.0%	0	
CORNEA					
70.220	pigmentary keratitis	0		1	0.1%
70.700	corneal dystrophy	67	0.8%	12	0.9%
UVEA					
93.140	corneal endothelial pigment without PPM	1	0.0%	0	
93.150	iris coloboma	3	0.0%	0	
93.710	persistent pupillary membranes, iris to iris	516	6.3%	100	7.8%
93.720	persistent pupillary membranes, iris to lens	35	0.4%	4	0.3%
93.730	persistent pupillary membranes, iris to cornea	12	0.1%	0	
93.740	persistent pupillary membranes, iris sheets	4	0.0%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	5	0.1%	7	0.5%
93.760	persistent pupillary membranes, endothelial opacity/no strands	4	0.0%	0	
93.810	uveal melanoma	2	0.0%	0	
93.999	uveal cysts	6	0.1%	1	0.1%
LENS					
100.200	cataract, unspecified	125	1.5%	0	
100.210	cataract. suspect not inherited/significance unknown	313	3.8%	70	5.5%
100.301	punctate cataract, anterior cortex	19	0.2%	2	0.2%
100.302	punctate cataract, posterior cortex	136	1.7%	9	0.7%
100.303	punctate cataract, equatorial cortex	13	0.2%	3	0.2%
100.304	punctate cataract, anterior sutures	16	0.2%	1	0.1%
100.305	punctate cataract, posterior sutures	62	0.8%	3	0.2%
100.306	punctate cataract, nucleus	8	0.1%	4	0.3%
100.307	punctate cataract, capsular	25	0.3%	7	0.5%
100.311	incipient cataract, anterior cortex	27	0.3%	2	0.2%
100.312	incipient cataract, posterior cortex	340	4.2%	33	2.6%
100.313	incipient cataract, equatorial cortex	38	0.5%	5	0.4%
100.314	incipient cataract, anterior sutures	7	0.1%	1	0.1%
100.315	incipient cataract, posterior sutures	71	0.9%	11	0.9%
100.316	incipient cataract, nucleus	18	0.2%	3	0.2%
100.317	incipient cataract, capsular	37	0.5%	3	0.2%

LENS CONTINUED		1991-2013		2014-2018	
100.321	incomplete cataract, anterior cortex	0		3	0.2%
100.322	incomplete cataract, posterior cortex	4	0.0%	22	1.7%
100.323	incomplete cataract, equatorial cortex	0		1	0.1%
100.324	incomplete cataract, anterior sutures	0		1	0.1%
100.325	incomplete cataract, posterior sutures	1	0.0%	2	0.2%
100.326	incomplete cataract, nucleus	2	0.0%	1	0.1%
100.327	incomplete cataract, capsular	0		4	0.3%
100.328	posterior suture tip opacities	1	0.0%	10	0.8%
100.330	generalized/complete cataract	80	1.0%	1	0.1%
100.375	subluxation/luxation, unspecified	6	0.1%	2	0.2%
100.999	*significant cataracts (summary)*	*1029*	*12.6%*	*122*	*9.5%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	9	0.1%	2	0.2%
110.135	PHPV/PTVL	6	0.1%	0	
110.320	vitreal degeneration	13	0.2%	0	
FUNDUS					
97.110	choroidal hypoplasia	3	0.0%	0	
97.120	coloboma	1	0.0%	0	
RETINA					
120.170	retinal dysplasia, folds	60	0.7%	0	
120.180	retinal dysplasia, geographic	19	0.2%	1	0.1%
120.190	retinal dysplasia, detached	2	0.0%	0	
120.310	generalized progressive retinal atrophy (PRA)	17	0.2%	1	0.1%
120.400	retinal hemorrhage	2	0.0%	0	
120.910	retinal detachment without dialysis	10	0.1%	0	
120.920	retinal detachment with dialysis	0		1	0.1%
120.960	retinopathy	1	0.0%	0	
OPTIC NERVE					
130.110	micropapilla	2	0.0%	1	0.1%
130.120	optic nerve hypoplasia	8	0.1%	1	0.1%
130.150	optic disc coloboma	2	0.0%	1	0.1%
OTHER					
900.000	other, unspecified	75	0.9%	0	
900.100	other, not inherited	274	3.4%	68	5.3%
900.110	other. suspect not inherited/significance unknown	50	0.6%	5	0.4%
NORMAL					
0.000	normal globe	6457	79.3%	924	72.0%

ALASKAN NOBLE COMPANION DOG

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder option

Description and Comments

A. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Alaskan Noble Companion Dog breed. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 2017 and/or Data from CERF/OFA All-Breeds Report, 2010-2016.

OCULAR DISORDERS REPORT
ALASKAN NOBLE COMPANION DOG

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2013 25 #	%	2014-2018 80 #	%
UVEA						
93.710	persistent pupillary membranes, iris to iris		2	8.0%	5	6.2%
93.999	uveal cysts		0		2	2.5%
LENS						
100.210	cataract. suspect not inherited/significance unknown		0		1	1.2%
100.312	incipient cataract, posterior cortex		0		1	1.2%
100.999	*significant cataracts (summary)*		*0*		*1*	*1.2%*
RETINA						
120.170	retinal dysplasia, folds		0		1	1.2%
NORMAL						
0.000	normal globe		25	100.0%	72	90.0%

OCULAR DISORDERS REPORT
AMERICAN ALSATIAN

There are insufficient breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the AMERICAN ALSATIAN breed. Therefore, there are no conditions listed with breeding advice.

OCULAR DISORDERS REPORT
AMERICAN ALSATIAN

Diagnostic Name	TOTAL DOGS EXAMINED	1991-2013 0 #	%	2014-2018 12 #	%
EYELIDS					
25.110 distichiasis		0		1	8.3%
CORNEA					
70.220 pigmentary keratitis		0		1	8.3%
NORMAL					
0.000 normal globe		0		10	83.3%

OCULAR DISORDERS REPORT
AMERICAN BANDOGGE MASTIFF

There are insufficient breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the AMERICAN BANDOGGE MASTIFF breed. Therefore, there are no conditions listed with breeding advice.

OCULAR DISORDERS REPORT
AMERICAN BANDOGGE MASTIFF

Diagnostic Name	TOTAL DOGS EXAMINED	1991-2013 0 #	%	2014-2018 1 #	%
NORMAL					
0.000 normal globe		0		1	100.0%

AMERICAN BULLDOG

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Glaucoma	Not defined	1	NO	
B.	Entropion	Not defined	2	Breeder option	
C.	Distichiasis	Not defined	3	Breeder option	
D.	Persistent pupillary membranes - iris to iris	Not defined	4	Breeder Option	
E.	Multifocal retinopathy - *cmr1*	Autosomal recessive	5	Breeder Option	Mutation in the *BEST1* gene

Description and Comments

A. Glaucoma

Glaucoma is characterized by an elevation of intraocular pressure which, when sustained even for a brief period of time, causes intraocular damage resulting in blindness. The elevated intraocular pressure occurs because the fluid cannot leave through the iridocorneal angle. Diagnosis and classification of glaucoma requires measurement of IOP (tonometry) and examination of the iridocorneal angle (gonioscopy). Neither of these tests are part of a routine breed eye screening exam.

American Bulldogs with glaucoma were reported to have uveal cysts (evident on ophthalmic exam, ultrasound biomicroscopy and/or histopathology), goniodysgenesis, and anterior segment inflammation. Consistent clinical findings among reported individuals included an absent menace response, diminished to absent light perception, mydriasis, and elevated intraocular pressures.

B. Entropion

A conformational defect resulting in an "in-rolling" of one or both of the eyelids which may cause ocular irritation. It is likely that entropion is influenced by several genes (polygenic), defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

C. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

D. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

E. Multifocal retinopathy

Canine Multifocal Retinopathy type 1 (*cmr1*) is characterized by numerous distinct (i.e. multifocal), roughly circular patches of elevated retina (multifocal bullous retinal detachments). There may be a serous subretinal fluid, or accumulation of subretinal material that produces gray-tan-pink colored lesions. These lesions, looking somewhat like blisters, vary in location and size, although typically they are present in both eyes of the affected dog.

The disease generally develops in young dogs between 11-20 weeks of age and there is minimal progression after 1 year of age. The lesions may flatten, leaving areas of retinal thinning and RPE hypertrophy, hyperplasia, and pigmentation. Discrete areas of tapetal hyper-reflectivity may be seen in areas of previous retinal and RPE detachments. Most dogs exhibit no noticeable problem with vision or electroretinographic abnormalities despite their abnormal appearing retinas. A DNA test is available.

Canine Multifocal Retinopathy type 1 is caused by a mutation in the Bestrophin 1 gene (*BEST1*) and is described to be recessively inherited in the Great Pyrenees, Dogue de Bordeaux, Bullmastiff, and Mastiff.

References

1. Pumphrey SA, Pizzirani S, Pirie CG, et al. Glaucoma associated with uveal cysts and goniodysgenesis in American Bulldogs: a case series. *Vet Ophthalmol*. 2012:1-9.

2. ACVO Genetics Committee, 2016 and/or Data from CERF/OFA All-Breeds Report, 2010-2015.

3. ACVO Genetics Committee, 2013-2014 and Data from OFA All-Breeds Report, 2013-2014.

4. ACVO Genetics Committee, 2017 and Data from OFA All-Breeds Report 2013-2017.

5. Guziewicz KE, Zangerl B, Lindauer SJ, et al. Bestrophin gene mutations cause canine multifocal retinopathy: a novel animal model for best disease. *Invest Ophthalmol Vis Sci.* 2007 May;48:1959-1967.

OCULAR DISORDERS REPORT
AMERICAN BULLDOG

Diagnostic Name		1991-2013 TOTAL DOGS EXAMINED 119 #	 %	2014-2018 29 #	 %
EYELIDS					
20.160	macropalpebral fissure	3	2.5%	0	
21.000	entropion, unspecified	9	7.6%	0	
22.000	ectropion, unspecified	2	1.7%	0	
25.110	distichiasis	30	25.2%	1	3.4%
NASOLACRIMAL					
40.910	keratoconjunctivitis sicca	4	3.4%	0	
CORNEA					
70.220	pigmentary keratitis	1	0.8%	0	
UVEA					
93.710	persistent pupillary membranes, iris to iris	1	0.8%	4	13.8%
93.720	persistent pupillary membranes, iris to lens	0		1	3.4%
93.730	persistent pupillary membranes, iris to cornea	1	0.8%	0	
93.999	uveal cysts	1	0.8%	0	
LENS					
100.210	cataract. suspect not inherited/significance unknown	1	0.8%	2	6.9%
100.305	punctate cataract, posterior sutures	0		1	3.4%
100.999	*significant cataracts (summary)*	*0*		*1*	*3.4%*
RETINA					
120.170	retinal dysplasia, folds	3	2.5%	0	
OTHER					
900.000	other, unspecified	16	13.4%	0	
900.100	other, not inherited	1	0.8%	0	
NORMAL					
0.000	normal globe	83	69.7%	21	72.4%

OCULAR DISORDERS REPORT
AMERICAN BULLY

There are insufficient breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the AMERICAN BULLY breed. Therefore, there are no conditions listed with breeding advice.

OCULAR DISORDERS REPORT
AMERICAN BULLY

Diagnostic Name		1991-2013 TOTAL DOGS EXAMINED 0 #	%	2014-2018 51 #	%
EYELIDS					
25.110	distichiasis	0		3	5.9%
CORNEA					
70.700	corneal dystrophy	0		1	2.0%
UVEA					
93.710	persistent pupillary membranes, iris to iris	0		4	7.8%
LENS					
100.210	cataract. suspect not inherited/significance unknown	0		3	5.9%
100.328	posterior suture tip opacities	0		1	2.0%
RETINA					
120.170	retinal dysplasia, folds	0		2	3.9%
120.310	generalized progressive retinal atrophy (PRA)	0		1	2.0%
OTHER					
900.100	other, not inherited	0		5	9.8%
NORMAL					
0.000	normal globe	0		34	66.7%

OCULAR DISORDERS REPORT
AMERICAN ENGLISH COONHOUND

There are insufficient breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the AMERICAN ENGLISH COONHOUND breed. Therefore, there are no conditions listed with breeding advice.

OCULAR DISORDERS REPORT
AMERICAN ENGLISH COONHOUND

Diagnostic Name	TOTAL DOGS EXAMINED	1991-2013 2 # %	2014-2018 0 # %
NORMAL			
0.000 normal globe		2 100.0%	0

AMERICAN ESKIMO DOG

(all varieties)

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Cataract	Not defined	1	NO	
B.	Lens luxation	Autosomal recessive	2	NO	Mutation in the *ADAMTS17* gene
C.	Retinal atrophy – generalized (*prcd*)	Autosomal recessive	3	NO	Mutation in the *prcd* gene

Description and Comments

A. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

B. Lens luxation

Partial (subluxation) or complete displacement of the lens from the normal anatomic site behind the pupil. Lens luxation not associated with trauma or inflammation is presumed to be inherited. Lens luxation may result in elevated intraocular pressure (glaucoma) causing vision impairment or blindness. A mutation in *ADAMTS17* has been associated with primary lens luxation. A DNA test is available.

C. Retinal atrophy - generalized (*prcd)*

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

Studies have shown that the principal form of PRA in the American Eskimo is *prcd* which is a late-onset form of PRA inherited as autosomal recessive. The mutation is allelic to that present in Miniature Poodles, Labrador Retrievers, English and American Cocker Spaniels, and others. The locus is termed the progressive rod-cone degeneration (*prcd*) gene and at least 30+ breeds are affected. In most affected dogs to date, the disease is recognized clinically in dogs 3-6 years of age or older. However in the American Eskimo Dog the phenotype can be very variable in the age of onset. This photoreceptor degeneration is characterized by slow death of visual cells following their normal development. The disease

begins clinically with signs of night blindness followed by day blindness. A DNA test is available.

Other forms of retinal degeneration that are not *prcd* are recognized in the breed. The currently available genetic test will not detect these other forms of PRA.

References

1. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

2. Gould D, Pettitt L, McLaughlin B, et al. ADAMTS17 mutation associated with primary lens luxation is widespread among breeds. *Vet Ophthalmol*. 2011;14:378-384.

3. Zangerl B, Goldstein O, Philp AR, et al. Identical mutation in a novel retinal gene causes progressive rod-cone degeneration in dogs and retinitis pigmentosa in humans. *Genomics*. 2006;88:551-563.

OCULAR DISORDERS REPORT
AMERICAN ESKIMO DOG

Diagnostic Name		1991-2013 TOTAL DOGS EXAMINED 2325 #	 %	2014-2018 221 #	 %
EYELIDS					
21.000	entropion, unspecified	4	0.2%	0	
25.110	distichiasis	15	0.6%	4	1.8%
NASOLACRIMAL					
32.110	imperforate lower nasolacrimal punctum	1	0.0%	0	
CORNEA					
70.700	corneal dystrophy	8	0.3%	2	0.9%
70.730	corneal endothelial degeneration	4	0.2%	0	
UVEA					
93.710	persistent pupillary membranes, iris to iris	18	0.8%	3	1.4%
93.720	persistent pupillary membranes, iris to lens	1	0.0%	0	
93.730	persistent pupillary membranes, iris to cornea	4	0.2%	1	0.5%
93.740	persistent pupillary membranes, iris sheets	4	0.2%	0	
93.999	uveal cysts	4	0.2%	0	
LENS					
100.200	cataract, unspecified	3	0.1%	0	
100.210	cataract. suspect not inherited/significance unknown	129	5.5%	18	8.1%
100.301	punctate cataract, anterior cortex	23	1.0%	3	1.4%
100.302	punctate cataract, posterior cortex	8	0.3%	1	0.5%
100.303	punctate cataract, equatorial cortex	6	0.3%	0	
100.304	punctate cataract, anterior sutures	3	0.1%	0	
100.305	punctate cataract, posterior sutures	4	0.2%	0	
100.306	punctate cataract, nucleus	3	0.1%	0	
100.307	punctate cataract, capsular	3	0.1%	1	0.5%
100.311	incipient cataract, anterior cortex	20	0.9%	5	2.3%
100.312	incipient cataract, posterior cortex	23	1.0%	0	
100.313	incipient cataract, equatorial cortex	11	0.5%	2	0.9%
100.314	incipient cataract, anterior sutures	5	0.2%	0	
100.315	incipient cataract, posterior sutures	2	0.1%	1	0.5%
100.316	incipient cataract, nucleus	5	0.2%	2	0.9%
100.317	incipient cataract, capsular	5	0.2%	1	0.5%
100.323	incomplete cataract, equatorial cortex	0		1	0.5%
100.327	incomplete cataract, capsular	0		2	0.9%
100.328	posterior suture tip opacities	3	0.1%	3	1.4%
100.330	generalized/complete cataract	10	0.4%	0	
100.340	resorbing/hypermature cataract	0		1	0.5%
100.375	subluxation/luxation, unspecified	1	0.0%	2	0.9%
100.999	*significant cataracts (summary)*	*134*	*5.8%*	*20*	*9.0%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	5	0.2%	2	0.9%
110.135	PHPV/PTVL	2	0.1%	1	0.5%
110.200	vitritis	0		1	0.5%
110.320	vitreal degeneration	16	0.7%	2	0.9%

		1991-2013		2014-2018	
RETINA					
120.170	retinal dysplasia, folds	8	0.3%	0	
120.180	retinal dysplasia, geographic	2	0.1%	0	
120.310	generalized progressive retinal atrophy (PRA)	176	7.6%	8	3.6%
120.910	retinal detachment without dialysis	1	0.0%	0	
120.960	retinopathy	0		1	0.5%
OPTIC NERVE					
130.110	micropapilla	2	0.1%	0	
130.120	optic nerve hypoplasia	1	0.0%	0	
130.150	optic disc coloboma	3	0.1%	0	
OTHER					
900.000	other, unspecified	8	0.3%	0	
900.100	other, not inherited	91	3.9%	12	5.4%
900.110	other. suspect not inherited/significance unknown	12	0.5%	0	
NORMAL					
0.000	normal globe	1873	80.6%	162	73.3%

OCULAR DISORDERS REPORT
AMERICAN FOXHOUND

There are insufficient breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the AMERICAN FOXHOUND breed. Therefore, there are no conditions listed with breeding advice.

OCULAR DISORDERS REPORT
AMERICAN FOXHOUND

Diagnostic Name	TOTAL DOGS EXAMINED	1991-2013 9 # %	2014-2018 2 # %
EYELIDS			
25.110	distichiasis	0	2 100.0%
UVEA			
93.710	persistent pupillary membranes, iris to iris	6 66.7%	0
RETINA			
120.170	retinal dysplasia, folds	2 22.2%	2 100.0%
OTHER			
900.000	other, unspecified	1 11.1%	0
NORMAL			
0.000	normal globe	6 66.7%	0

AMERICAN HAIRLESS TERRIER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Lens luxation	Autosomal recessive	1, 2	NO	Mutation in the *ADAMTS17* gene
B.	Retinal atrophy – generalized (*prcd*)	Autosomal recessive	3	NO	Mutation in the *prcd* gene

Description and Comments

A. Lens luxation

Partial (subluxation) or complete displacement of the lens from the normal anatomic site behind the pupil. Lens luxation not associated with trauma or inflammation is presumed to be inherited. Lens luxation may result in elevated intraocular pressure (glaucoma), causing vision impairment or blindness. A mutation in *ADAMTS17* has been associated with primary lens luxation. A DNA test is available.

B. Retinal atrophy - generalized (*prcd)*

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

Studies have shown that the principal form of PRA in the American Hairless Terrier is *prcd* which is a late-onset form of PRA inherited as autosomal recessive. The mutation is allelic to that present in Miniature Poodles, Labrador Retrievers, English and American Cocker Spaniels, and others. The locus is termed the progressive rod-cone degeneration (*prcd*) gene and at least 30+ breeds are affected. In most affected dogs to date, the disease is recognized clinically in dogs 3-6 years of age or older. However in the American Eskimo Dog the phenotype can be very variable in the age of onset. This photoreceptor degeneration is characterized by slow death of visual cells following their normal development. The disease begins clinically with signs of night blindness followed by day blindness. A DNA test is available.

Other forms of retinal degeneration that are not PRCD are recognized in the breed. The currently available genetic test will not detect these other forms of PRA.

References

1. Farias FH, Johnson GS, Taylor JF, et al. An ADAMTS17 splice donor site mutation in dogs with primary lens luxation. *Invest Ophthalmol Vis Sc*i. 2010 Sep;51:4716-4721.

2. Gould D, Pettitt L, McLaughlin B, et al. ADAMTS17 mutation associated with primary lens luxation is widespread among breeds. *Vet Ophthalmol.* 2011 Nov;14:378-384.

3. ACVO Genetics Committee, 2016 and/or Data from CERF/OFA All-Breeds Report, 2010-2015.

OCULAR DISORDERS REPORT
AMERICAN HAIRLESS TERRIER

Diagnostic Name	TOTAL DOGS EXAMINED	1991-2013 17 #	 %	2014-2018 55 #	 %
EYELIDS					
25.110	distichiasis	0		1	1.8%
UVEA					
93.710	persistent pupillary membranes, iris to iris	1	5.9%	1	1.8%
LENS					
100.210	cataract. suspect not inherited/significance unknown	1	5.9%	0	
100.305	punctate cataract, posterior sutures	0		1	1.8%
100.999	*significant cataracts (summary)*	*0*		*1*	*1.8%*
RETINA					
120.170	retinal dysplasia, folds	0		1	1.8%
120.910	retinal detachment without dialysis	1	5.9%	0	
OTHER					
900.000	other, unspecified	1	5.9%	0	
NORMAL					
0.000	normal globe	14	82.4%	51	92.7%

OCULAR DISORDERS REPORT
AMERICAN HUSKY

There are insufficient breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the AMERICAN HUSKY breed. Therefore, there are no conditions listed with breeding advice.

OCULAR DISORDERS REPORT
AMERICAN HUSKY

Diagnostic Name	TOTAL DOGS EXAMINED	1991-2013 0 #	%	2014-2018 1 #	%
NORMAL					
0.000 normal globe		0		1	100.0%

OCULAR DISORDERS REPORT
AMERICAN LEOPARD HOUND

There are insufficient breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the AMERICAN LEOPARD HOUND breed. Therefore, there are no conditions listed with breeding advice.

OCULAR DISORDERS REPORT
AMERICAN LEOPARD HOUND

Diagnostic Name	TOTAL DOGS EXAMINED	1991-2013 0 #	%	2014-2018 3 #	%
UVEA					
93.710	persistent pupillary membranes, iris to iris	0		1	33.3%
NORMAL					
0.000	normal globe	0		2	66.7%

AMERICAN PIT BULL TERRIER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder option	
B.	Retinal atrophy - cone-rod dystrophy 2 (*crd2*)	Autosomal recessive	2-4	NO	Mutation in the *IQCB1* gene
C.	Retinal atrophy - cone-rod dystrophy 1 (*CRD1/rcd1b)*	Autosomal recessive	5	NO	Mutation in the *PDE6B* gene

Description and Comments

A. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

B. Retinal Atrophy - Cone-rod dystrophy 2 (*crd2*)

A cone rod dystrophy characterized by initial loss of cones (day vision) followed by degeneration of the rods (night vision). Evidence of vision loss is evident at an early age with severe retinal degeneration and complete blindness by a year of age. The disease is a severe early onset retinal blindness more appropriately considered a form of Leber congenital amaurosis (LCA). The condition is inherited as an autosomal recessive trait and caused by a mutation in *IQCB1.* A DNA test is available. (Gustavo Aguirre, personal communication, 2016).

C. Retinal Atrophy - Rod-cone dysplasia 1b [previously considered cone-rod dystrophy 1(*crd1*)]

The disease was previously considered a cone-rod dystrophy (crd1) based on incorrect phenotype ascertainment using ERG (Aguirre, personal communication, 2016). The term crd1 should no longer be used to refer to the disease in this breed. The disease is more appropriately classified as rod-cone dysplasia 1b (rcd1b). In affected dogs there is evidence of vision loss at an early age with severe retinal degeneration and complete blindness by early adulthood, and ophthalmoscopic evidence of advanced retinal degeneration by 1 year of age. The disease is caused by a mutation in the *PDE6B* gene, with clinical abnormalities similar to what is found in rcd1-affected Irish Setters and rcd1a affected Sloughis. A DNA test is available.

References

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3. Goldstein O, Mezey JG, Schweitzer P, et al. IQCB1 and PDE6B mutations cause similar early onset retinal degenerations in two closely related terrier dog breeds. *Invest Ophthalmol*. 2013;54:7005-7019.

4. Kijas JW, Zanger B, Miller B, et al. Cloning of the canine ABCA4 gene and evaluation in canine cone-rod dystrophies and progressive retinal atrophies. *Mol Vis*. 2004;10:223-232.

5. ACVO Genetics Committee, 2016 and/or Data from CERF/OFA All-Breeds Report, 2010-2015.

OCULAR DISORDERS REPORT
AMERICAN PIT BULL TERRIER

Diagnostic Name		1991-2013 TOTAL DOGS EXAMINED 176 #	 %	2014-2018 45 #	 %
EYELIDS					
25.110	distichiasis	5	2.8%	2	4.4%
CORNEA					
70.700	corneal dystrophy	1	0.6%	0	
70.730	corneal endothelial degeneration	1	0.6%	0	
UVEA					
93.710	persistent pupillary membranes, iris to iris	4	2.3%	2	4.4%
93.720	persistent pupillary membranes, iris to lens	2	1.1%	0	
93.730	persistent pupillary membranes, iris to cornea	2	1.1%	0	
93.740	persistent pupillary membranes, iris sheets	1	0.6%	0	
LENS					
100.210	cataract. suspect not inherited/significance unknown	6	3.4%	1	2.2%
100.301	punctate cataract, anterior cortex	1	0.6%	0	
100.302	punctate cataract, posterior cortex	2	1.1%	0	
100.305	punctate cataract, posterior sutures	1	0.6%	0	
100.326	incomplete cataract, nucleus	0		1	2.2%
100.375	subluxation/luxation, unspecified	1	0.6%	0	
100.999	*significant cataracts (summary)*	*4*	*2.3%*	*1*	*2.2%*
RETINA					
120.170	retinal dysplasia, folds	2	1.1%	0	
120.180	retinal dysplasia, geographic	1	0.6%	0	
120.310	generalized progressive retinal atrophy (PRA)	2	1.1%	0	
OTHER					
900.000	other, unspecified	1	0.6%	0	
900.100	other, not inherited	10	5.7%	2	4.4%
900.110	other. suspect not inherited/significance unknown	0		1	2.2%
NORMAL					
0.000	normal globe	151	85.8%	36	80.0%

AMERICAN STAFFORDSHIRE TERRIER*

*Please note that since 1972 the AKC considers the Staffordshire Bull Terrier a different breed from the American Staffordshire Terrier. Since the latter breed evolved from the former, it is possible that the same genetic diseases exist in both.

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Distichiasis	Not defined	2	Breeder option	
B.	Persistent pupillary membranes - iris to iris	Not defined	2, 3	Breeder option	
C.	Cataract	Not defined	1, 4, 5	NO	
D.	Persistent hyperplastic primary vitreous/ persistent hyperplastic tunica vasculosa lentis (PHPV/PHVL)	Not defined	1, 6, 7	NO	
E.	Retinal atrophy - cone-rod dystrophy 2 (*crd2*)	Autosomal recessive	8	NO	Mutation in the *IQCB1* gene
F.	Retinal atrophy - cone-rod dystrophy 1 (*CRD1/rcd1b)*	Autosomal recessive	9-11	NO	Mutation in the *PDE6B* gene
G.	Retinal dysplasia - folds	Not defined	2	Breeder option	

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make strong recommendations with regard to breeding dogs with this entity. The hereditary basis has not been established, although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

C. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

In this breed, cataracts usually develop by one year of age. There is initial opacification of the suture lines progressing to nuclear and cortical cataract formation; complete cataracts and blindness develop by three years of age. A simple autosomal recessive mode of inheritance has been proposed; however, the genetics have not been defined and additional studies will be required.

D. Persistent hyperplastic primary vitreous (PHPV)/Persistent hyperplastic tunica vasculosa lentis (PHTVL)

Persistent hyperplastic primary vitreous is a congenital defect resulting from abnormalities in the development and regression of the hyaloid artery (the primary vitreous) and the interaction of this blood vessel with the posterior lens capsule/cortex during embryogenesis. This condition is often associated with persistent hyperplastic tunica vasculosa lentis (PHTVL) which results from failure of regression of the embryologic vascular network which surrounds the developing lens.

The majority of affected dogs have a retrolental fibrovascular plaque and variable lenticular defects which include posterior lenticonus/globus, colobomata, intralenticular hemorrhage, and/or secondary cataracts. Vision impairment may result. The disease is an inherited disorder in the breed, but the mode of inheritance has not been defined. The results of current studies cannot rule out autosomal recessive or a dominant trait with incomplete penetrance.

E. Retinal Atrophy - Cone-rod dystrophy 2 (*crd2*)

A cone rod dystrophy characterized by initial loss of cones (day vision) followed by degeneration of the rods (night vision). Evidence of vision loss is evident at an early age with severe retinal degeneration and complete blindness by a year of age. The disease is a severe early onset retinal blindness more appropriately considered a form of Leber congenital amaurosis (LCA). The condition is inherited as an autosomal recessive trait and caused by a mutation in *IQCB1.* A DNA test is available. (Gustavo Aguirre, personal communication, 2016).

F. Retinal Atrophy - Rod-cone dysplasia 1b [previously considered cone-rod dystrophy 1(*crd1*)]

The disease was previously considered a cone-rod dystrophy (crd1) based on incorrect phenotype ascertainment using ERG (Aguirre, personal communication, 2016). The term crd1 should no longer be used to refer to the disease in this breed. The disease is more appropriately classified as rod-cone dysplasia 1b (rcd1b). In affected dogs there is evidence of vision loss at an early age with severe retinal degeneration and complete blindness by early adulthood, and ophthalmoscopic evidence of advanced retinal degeneration by 1 year of age. The disease is caused by a mutation in the *PDE6B* gene, with clinical abnormalities similar to what is found in rcd1-affected Irish Setters and rcd1a affected Sloughis. A DNA test is available.

G. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

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OCULAR DISORDERS REPORT
AMERICAN STAFFORDSHIRE TERRIER

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2013 694 #	1991-2013 694 %	2014-2018 104 #	2014-2018 104 %
EYELIDS						
21.000	entropion, unspecified		2	0.3%	0	
25.110	distichiasis		34	4.9%	2	1.9%
CORNEA						
70.210	corneal pannus		1	0.1%	0	
70.220	pigmentary keratitis		1	0.1%	1	1.0%
70.730	corneal endothelial degeneration		1	0.1%	0	
UVEA						
93.710	persistent pupillary membranes, iris to iris		30	4.3%	3	2.9%
93.720	persistent pupillary membranes, iris to lens		2	0.3%	0	
93.730	persistent pupillary membranes, iris to cornea		1	0.1%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands		1	0.1%	0	
93.760	persistent pupillary membranes, endothelial opacity/no strands		1	0.1%	0	
93.999	uveal cysts		1	0.1%	1	1.0%
LENS						
100.200	cataract, unspecified		1	0.1%	0	
100.210	cataract. suspect not inherited/significance unknown		28	4.0%	4	3.8%
100.301	punctate cataract, anterior cortex		1	0.1%	0	
100.302	punctate cataract, posterior cortex		2	0.3%	0	
100.303	punctate cataract, equatorial cortex		2	0.3%	0	
100.304	punctate cataract, anterior sutures		1	0.1%	0	
100.305	punctate cataract, posterior sutures		1	0.1%	0	
100.311	incipient cataract, anterior cortex		4	0.6%	0	
100.312	incipient cataract, posterior cortex		3	0.4%	0	
100.313	incipient cataract, equatorial cortex		4	0.6%	0	
100.323	incomplete cataract, equatorial cortex		0		1	1.0%
100.328	posterior suture tip opacities		0		2	1.9%
100.330	generalized/complete cataract		1	0.1%	0	
100.375	subluxation/luxation, unspecified		2	0.3%	0	
100.999	*significant cataracts (summary)*		*20*	*2.9%*	*1*	*1.0%*
VITREOUS						
110.120	persistent hyaloid artery/remnant		2	0.3%	0	
110.320	vitreal degeneration		3	0.4%	0	
RETINA						
120.170	retinal dysplasia, folds		8	1.2%	0	
120.180	retinal dysplasia, geographic		2	0.3%	0	
120.310	generalized progressive retinal atrophy (PRA)		3	0.4%	0	
OTHER						
900.000	other, unspecified		8	1.2%	0	
900.100	other, not inherited		30	4.3%	10	9.6%
900.110	other. suspect not inherited/significance unknown		3	0.4%	0	

	1991-2013	2014-2018
NORMAL		
0.000 normal globe	594 85.6%	82 78.8%

AMERICAN WATER SPANIEL

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Entropion	Not defined	1	Breeder option
B.	Distichiasis	Not defined	1	Breeder option
C.	Persistent pupillary membranes			
	- iris to iris	Not defined	2	Breeder option
	- lens pigment foci/no strands	Not defined	3	Passes with no notation
D.	Cataract	Not defined	1	NO

Description and Comments

A. Entropion

A conformational defect resulting in an "in-rolling" of one or both of the eyelids which may cause ocular irritation. It is likely that entropion is influenced by several genes (polygenic), defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

B. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established, although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

C. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

D. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the American Water Spaniel breed. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

2. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

3. ACVO Genetics Committee, 2016 and/or Data from CERF/OFA All-Breeds Report, 2010-2015.

OCULAR DISORDERS REPORT
AMERICAN WATER SPANIEL

Diagnostic Name		1991-2013 TOTAL DOGS EXAMINED 1000 #	%	2014-2018 138 #	%
GLOBE					
0.110	microphthalmia	2	0.2%	0	
10.000	glaucoma	3	0.3%	0	
EYELIDS					
20.160	macropalpebral fissure	2	0.2%	0	
21.000	entropion, unspecified	6	0.6%	2	1.4%
22.000	ectropion, unspecified	2	0.2%	0	
25.110	distichiasis	315	31.5%	58	42.0%
CORNEA					
70.220	pigmentary keratitis	1	0.1%	0	
70.700	corneal dystrophy	4	0.4%	2	1.4%
UVEA					
93.150	iris coloboma	2	0.2%	0	
93.710	persistent pupillary membranes, iris to iris	10	1.0%	2	1.4%
93.730	persistent pupillary membranes, iris to cornea	1	0.1%	0	
93.740	persistent pupillary membranes, iris sheets	2	0.2%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	2	0.2%	5	3.6%
93.999	uveal cysts	1	0.1%	0	
LENS					
100.200	cataract, unspecified	5	0.5%	0	
100.210	cataract. suspect not inherited/significance unknown	36	3.6%	5	3.6%
100.301	punctate cataract, anterior cortex	4	0.4%	1	0.7%
100.302	punctate cataract, posterior cortex	6	0.6%	1	0.7%
100.303	punctate cataract, equatorial cortex	1	0.1%	1	0.7%
100.305	punctate cataract, posterior sutures	4	0.4%	4	2.9%
100.306	punctate cataract, nucleus	1	0.1%	0	
100.307	punctate cataract, capsular	1	0.1%	1	0.7%
100.311	incipient cataract, anterior cortex	7	0.7%	0	
100.312	incipient cataract, posterior cortex	11	1.1%	2	1.4%
100.315	incipient cataract, posterior sutures	5	0.5%	1	0.7%
100.317	incipient cataract, capsular	1	0.1%	1	0.7%
100.322	incomplete cataract, posterior cortex	0		1	0.7%
100.328	posterior suture tip opacities	1	0.1%	6	4.3%
100.330	generalized/complete cataract	1	0.1%	0	
100.999	*significant cataracts (summary)*	*47*	*4.7%*	*13*	*9.4%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	2	0.2%	0	
110.135	PHPV/PTVL	0		1	0.7%
110.320	vitreal degeneration	0		1	0.7%
RETINA					
120.170	retinal dysplasia, folds	8	0.8%	0	
120.180	retinal dysplasia, geographic	1	0.1%	0	
120.310	generalized progressive retinal atrophy (PRA)	5	0.5%	0	
120.960	retinopathy	1	0.1%	0	

	1991-2013		2014-2018	
OPTIC NERVE				
130.110 micropapilla	0		2	1.4%
OTHER				
900.000 other, unspecified	5	0.5%	0	
900.100 other, not inherited	18	1.8%	5	3.6%
900.110 other. suspect not inherited/significance unknown	1	0.1%	0	
NORMAL				
0.000 normal globe	637	63.7%	58	42.0%

OCULAR DISORDERS REPORT
ANATOLIAN SHEPHERD

There are insufficient breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the ANATOLIAN SHEPHERD breed. Therefore, there are no conditions listed with breeding advice.

OCULAR DISORDERS REPORT
ANATOLIAN SHEPHERD

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2013 25 #	%	2014-2018 28 #	%
GLOBE						
0.110	microphthalmia		1	4.0%	0	
UVEA						
93.710	persistent pupillary membranes, iris to iris		1	4.0%	0	
LENS						
100.210	cataract. suspect not inherited/significance unknown		2	8.0%	2	7.1%
100.328	posterior suture tip opacities		0		1	3.6%
OTHER						
900.100	other, not inherited		1	4.0%	1	3.6%
NORMAL						
0.000	normal globe		21	84.0%	24	85.7%

ARGENTINE DOGO

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder option

Description and Comments

A. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Argentine Dogo breed. The conditions listed above are generally recognized to exist in the breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

OCULAR DISORDERS REPORT
ARGENTINE DOGO

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2013 123 #	 %	2014-2018 18 #	 %
EYELIDS						
25.110	distichiasis		0		1	5.6%
CORNEA						
70.700	corneal dystrophy		1	0.8%	2	11.1%
70.730	corneal endothelial degeneration		1	0.8%	0	
UVEA						
93.710	persistent pupillary membranes, iris to iris		14	11.4%	0	
93.720	persistent pupillary membranes, iris to lens		1	0.8%	0	
LENS						
100.200	cataract, unspecified		1	0.8%	0	
100.210	cataract. suspect not inherited/significance unknown		1	0.8%	0	
100.302	punctate cataract, posterior cortex		1	0.8%	0	
100.312	incipient cataract, posterior cortex		2	1.6%	1	5.6%
100.316	incipient cataract, nucleus		2	1.6%	0	
100.330	generalized/complete cataract		1	0.8%	0	
100.999	*significant cataracts (summary)*		*7*	*5.7%*	*1*	*5.6%*
VITREOUS						
110.120	persistent hyaloid artery/remnant		1	0.8%	0	
OTHER						
900.100	other, not inherited		1	0.8%	0	
900.110	other. suspect not inherited/significance unknown		1	0.8%	0	
NORMAL						
0.000	normal globe		104	84.6%	14	77.8%

OCULAR DISORDERS REPORT
ARMENIAN GAMPR

There are insufficient breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the ARMENIAN GAMPR breed. Therefore, there are no conditions listed with breeding advice.

OCULAR DISORDERS REPORT
ARMENIAN GAMPR

Diagnostic Name	TOTAL DOGS EXAMINED	1991-2013 2 # %	2014-2018 2 # %
NORMAL			
0.000 normal globe		2 100.0%	2 100.0%

AUSTRALIAN CATTLE DOG

(Queensland Heeler or Blue Heeler)

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Glaucoma	Not defined	1	NO	
B.	Corneal dystrophy - epithelial/stromal	Not defined	2	Breeder option	
C.	Persistent pupillary membranes - iris to iris	Not defined	3	Breeder option	
D.	Cataract	Not defined	4	NO	
E.	Lens luxation	Autosomal recessive	4-6	NO	Mutation in the *ADAMTS17* gene
F.	Retinal atrophy – generalized (*prcd*)	Autosomal recessive	4, 7, 8	NO	Mutation in the *prcd* gene
G.	Retinal atrophy - rod-cone dysplasia type 4	Autosomal recessive	9	NO	Mutation in the *C2orf71* gene
H.	Retinal dysplasia - folds	Not defined	10	Breeder option	

Description and Comments

A. Glaucoma

An elevation of intraocular pressure (IOP) which, when sustained, causes intraocular damage resulting in blindness. The elevated IOP occurs because the fluid cannot leave through the iridocorneal angle. Diagnosis and classification of glaucoma requires measurement of IOP (tonometry) and examination of the iridocorneal angle (gonioscopy).

B. Corneal Dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

C. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to

lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

D. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

E. Lens luxation

Partial (subluxation) or complete displacement of the lens from the normal anatomic site behind the pupil. Lens luxation not associated with trauma or inflammation is presumed to be inherited. Lens luxation may result in elevated intraocular pressure (glaucoma) causing vision impairment or blindness. A mutation in *ADAMTS17* has been associated with primary lens luxation. A DNA test is available.

F. Retinal atrophy - generalized *(prcd)*

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

Studies have shown that one form of PRA in the Australian Cattle Dog is *prcd* which is a late-onset form of PRA inherited as autosomal recessive. The mutation is allelic to that present in Miniature Poodles, Labrador Retrievers, English and American Cocker Spaniels and others. The locus is termed the progressive rod-cone degeneration (*prcd*) gene and at least 30+ breeds are affected. In most affected dogs to date, the disease is recognized clinically in dogs 3-6 years of age or older. However in the Australian Cattle Dog the phenotype can be very variable in the age of onset. This photoreceptor degeneration is characterized by slow death of visual cells following their normal development. The disease begins clinically with signs of night blindness followed by day blindness. A DNA test is available.

Other forms of retinal degeneration that are not PRCD are recognized in the breed. The currently available genetic test will not detect these other forms of PRA.

G. Retinal atrophy - rod-cone dysplasia, type 4 (*rcd4*)

A form of PRA identified also in the Australian Cattle Dog breed. Clinical night blindness is observed on average as late as 10 years of age and progresses to total blindness. This form of PRA has been referred to as late-onset PRA (LOPRA). The disorder is caused by a mutation present in the *C2orf71* gene. A DNA test is available. The test is accurate only for this mutation and is of no value in identifying other forms of PRA.

H. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

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OCULAR DISORDERS REPORT
AUSTRALIAN CATTLE DOG

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2013 4421 #	%	2014-2018 586 #	%
GLOBE						
0.110	microphthalmia		0		1	0.2%
EYELIDS						
22.000	ectropion, unspecified		1	0.0%	0	
25.110	distichiasis		14	0.3%	2	0.3%
NASOLACRIMAL						
32.110	imperforate lower nasolacrimal punctum		1	0.0%	0	
NICTITANS						
50.210	pannus of third eyelid		1	0.0%	1	0.2%
CORNEA						
70.210	corneal pannus		2	0.0%	0	
70.700	corneal dystrophy		23	0.5%	5	0.9%
70.730	corneal endothelial degeneration		4	0.1%	0	
UVEA						
93.710	persistent pupillary membranes, iris to iris		40	0.9%	7	1.2%
93.720	persistent pupillary membranes, iris to lens		2	0.0%	0	
93.730	persistent pupillary membranes, iris to cornea		3	0.1%	0	
93.740	persistent pupillary membranes, iris sheets		6	0.1%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands		0		2	0.3%
93.760	persistent pupillary membranes, endothelial opacity/no strands		2	0.0%	0	
93.999	uveal cysts		10	0.2%	5	0.9%
LENS						
100.200	cataract, unspecified		35	0.8%	0	
100.210	cataract. suspect not inherited/significance unknown		266	6.0%	40	6.8%
100.301	punctate cataract, anterior cortex		37	0.8%	7	1.2%
100.302	punctate cataract, posterior cortex		31	0.7%	9	1.5%
100.303	punctate cataract, equatorial cortex		19	0.4%	0	
100.304	punctate cataract, anterior sutures		3	0.1%	0	
100.305	punctate cataract, posterior sutures		12	0.3%	6	1.0%
100.306	punctate cataract, nucleus		4	0.1%	0	
100.307	punctate cataract, capsular		4	0.1%	0	
100.311	incipient cataract, anterior cortex		43	1.0%	7	1.2%
100.312	incipient cataract, posterior cortex		67	1.5%	4	0.7%
100.313	incipient cataract, equatorial cortex		50	1.1%	5	0.9%
100.314	incipient cataract, anterior sutures		2	0.0%	3	0.5%
100.315	incipient cataract, posterior sutures		18	0.4%	1	0.2%
100.316	incipient cataract, nucleus		4	0.1%	3	0.5%
100.317	incipient cataract, capsular		4	0.1%	2	0.3%
100.321	incomplete cataract, anterior cortex		0		2	0.3%
100.322	incomplete cataract, posterior cortex		0		2	0.3%
100.323	incomplete cataract, equatorial cortex		0		2	0.3%
100.326	incomplete cataract, nucleus		0		3	0.5%
100.327	incomplete cataract, capsular		0		1	0.2%
100.328	posterior suture tip opacities		3	0.1%	11	1.9%

LENS CONTINUED		1991-2013		2014-2018	
100.330	generalized/complete cataract	22	0.5%	1	0.2%
100.340	resorbing/hypermature cataract	0		1	0.2%
100.375	subluxation/luxation, unspecified	3	0.1%	1	0.2%
100.999	*significant cataracts (summary)*	*355*	*8.0%*	*59*	*10.1%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	8	0.2%	0	
110.135	PHPV/PTVL	1	0.0%	0	
110.320	vitreal degeneration	13	0.3%	2	0.3%
FUNDUS					
97.110	choroidal hypoplasia	3	0.1%	0	
97.120	coloboma	1	0.0%	0	
RETINA					
120.170	retinal dysplasia, folds	36	0.8%	2	0.3%
120.180	retinal dysplasia, geographic	12	0.3%	2	0.3%
120.190	retinal dysplasia, detached	1	0.0%	0	
120.310	generalized progressive retinal atrophy (PRA)	248	5.6%	7	1.2%
120.400	retinal hemorrhage	1	0.0%	0	
120.910	retinal detachment without dialysis	3	0.1%	0	
120.960	retinopathy	1	0.0%	4	0.7%
OPTIC NERVE					
130.120	optic nerve hypoplasia	2	0.0%	0	
130.150	optic disc coloboma	1	0.0%	0	
OTHER					
900.000	other, unspecified	20	0.5%	0	
900.100	other, not inherited	131	3.0%	43	7.3%
900.110	other. suspect not inherited/significance unknown	17	0.4%	1	0.2%
NORMAL					
0.000	normal globe	3644	82.4%	446	76.1%

AUSTRALIAN KELPIE

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Cataract	Not defined	1	NO
B.	Retinal atrophy - generalized	Not defined	2	NO

Description and Comments

A. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

B. Retinal atrophy - generalized

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as Progressive Retinal Atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. Except for X-linked PRA in the Siberian Husky, in all breeds studied to date, PRA is inherited as an autosomal recessive trait.

The age of onset has been reported to be between 2 and 3 years of age with initial loss of night vision progressing to complete blindness.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Australian Kelpie breed. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

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2. ACVO Genetics Committee, 2000-2002 and/or Data from CERF All-Breeds Report, 2000-2002.

OCULAR DISORDERS REPORT
AUSTRALIAN KELPIE

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2013 214 #	 %	2014-2018 24 #	 %
CORNEA						
70.700	corneal dystrophy		1	0.5%	0	
UVEA						
93.710	persistent pupillary membranes, iris to iris		1	0.5%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands		0		1	4.2%
93.810	uveal melanoma		3	1.4%	0	
LENS						
100.200	cataract, unspecified		5	2.3%	0	
100.210	cataract. suspect not inherited/significance unknown		27	12.6%	6	25.0%
100.301	punctate cataract, anterior cortex		5	2.3%	2	8.3%
100.302	punctate cataract, posterior cortex		8	3.7%	0	
100.306	punctate cataract, nucleus		1	0.5%	0	
100.311	incipient cataract, anterior cortex		9	4.2%	0	
100.312	incipient cataract, posterior cortex		7	3.3%	0	
100.313	incipient cataract, equatorial cortex		2	0.9%	0	
100.315	incipient cataract, posterior sutures		1	0.5%	0	
100.330	generalized/complete cataract		1	0.5%	0	
100.999	*significant cataracts (summary)*		*39*	*18.2%*	*2*	*8.3%*
VITREOUS						
110.320	vitreal degeneration		3	1.4%	0	
FUNDUS						
97.110	choroidal hypoplasia		1	0.5%	0	
RETINA						
120.170	retinal dysplasia, folds		5	2.3%	0	
120.310	generalized progressive retinal atrophy (PRA)		11	5.1%	0	
OTHER						
900.000	other, unspecified		7	3.3%	0	
900.100	other, not inherited		8	3.7%	1	4.2%
900.110	other. suspect not inherited/significance unknown		1	0.5%	0	
NORMAL						
0.000	normal globe		163	76.2%	14	58.3%

OCULAR DISORDERS REPORT
AUSTRALIAN KOOLIE

There are insufficient breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the AUSTRALIAN KOOLIE breed. Therefore, there are no conditions listed with breeding advice.

OCULAR DISORDERS REPORT
AUSTRALIAN KOOLIE

Diagnostic Name	TOTAL DOGS EXAMINED	1991-2013 1 #	% 	2014-2018 4 #	%
NORMAL					
0.000 normal globe		1	100.0%	4	100.0%

AUSTRALIAN LABRADOODLE

(Labradoodle, Australian Cobber Dog)

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Glaucoma	Not defined	1	NO	
B.	Entropion	Not defined	2-4	Breeder option	
C.	Ectropion	Not defined	2	Breeder option	
D.	Distichiasis	Not defined	2	Breeder option	
E.	Corneal dystrophy - epithelial/stromal	Not defined	2, 5	Breeder option	
F.	Uveal cysts	Not defined	6	Breeder option	
G.	Persistent pupillary membranes				
	- iris to iris	Not defined	2, 6	Breeder option	
	- iris to cornea	Not defined	7	NO	
	- iris sheets	Not defined	6	NO	
	- lens pigment foci no strands	Not defined	8	Passes with no notation	
H.	Cataract				
		Presumed dominant with incomplete penetrance	2-4, 9-11	NO	
		Autosomal recessive	12	NO	
		Not defined	32	NO	
I.	Persistent hyperplastic primary vitreous/ persistent hyperplastic tunica vasculosa lentis (PHPV/PHTVL)	Not defined	2	NO	
J.	Persistent hyaloid artery	Not defined	2	Breeder option	

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
K.	Vitreous degeneration	Not defined	13, 14	Breeder option	
L.	Retinal atrophy - generalized (*prcd*)	Autosomal recessive	2, 15-19	NO	Mutation of the *prcd* gene
M.	Achromatopsia Type 1 (ACHM – Type 1)	Autosomal recessive	20	NO	Deletion in the *CNGA3* gene
N.	Retinal dysplasia - folds	Presumed autosomal recessive	2, 21-29	NO (Breeder option with Normal DNA test)	Mutation of the *COL9A3* gene
O.	Retinal dysplasia - geographic/ detached (without skeletal defects)	Presumed autosomal recessive	2, 21-29	NO	
P.	Retinal dysplasia - folds/geographic/ detached (with skeletal defects)	Autosomal recessive with incomplete dominance for the eyes	2, 21-30	NO	Mutation of the *COL9A3* gene
Q.	Limbal melanoma	Not defined	31	NO	

Description and Comments

A. Glaucoma

Glaucoma is characterized by an elevation of intraocular pressure which, when sustained even for a brief period of time, causes intraocular damage resulting in blindness. The elevated intraocular pressure occurs because the fluid cannot leave through the iridocorneal angle. Diagnosis and classification of glaucoma requires measurement of IOP (tonometry) and examination of the iridocorneal angle (gonioscopy). Neither of these tests is part of a routine breed eye screening examination.

B Entropion

A conformational defect resulting in an "in-rolling" of one or both of the eyelids which may cause ocular irritation. It is likely that entropion is influenced by several genes (polygenic), defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull. Selection should be directed against entropion and toward a head conformation that reduces or eliminates the likelihood of the defect.

C. Ectropion

A conformational defect resulting in eversion of the eyelid(s), which may cause ocular irritation due to exposure. It is likely that ectropion is influenced by several genes (polygenic) defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

D. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established, although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

E. Corneal dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral. In Labrador Retrievers in Europe, one form of corneal dystrophy has been shown to be caused by accumulations of glycosaminoglycans in the corneal stroma. This form of corneal dystrophy is caused by a mutation in the CHST6 gene.

F. Uveal cysts

Fluid filled sacs arising from the posterior surface of the iris, to which they may remain attached or break free and float into the anterior chamber. Usually occur in mature dogs.

This disorder may be observed in any breed but retriever breeds tend to be predisposed. There is usually no effect on vision unless the cysts are heavily clustered and impinge on the pupillary area. Less frequently, the cysts may rupture and adhere to the cornea or anterior lens capsule. Multiple cysts may occlude the iridocorneal angle and cause glaucoma.

G. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

In the Labrador Retriever, this is a potentially serious problem as many of the PPM's identified on routine screening examinations bridge from the iris to the cornea and/or from iris sheets bridging the pupils. These forms may cause vision impairment.

H. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts

to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

The most frequently reported cataracts in the Labradoodle (Australian) are bilateral or unilateral, focal, posterior polar (posterior cortical)/subcapsular cataracts, which usually present between 1-3 years of age. These are generally stationary or very slowly progressive and generally do not interfere with vision. It has been suggested that these cataracts are inherited as dominant with incomplete penetrance, but definitive breeding studies are still required to verify this hypothesis.

A second type of cataract is a progressive cortical cataract which may involve the entire lens. It is not clear whether this is a distinct entity, or an aberrant form of the posterior polar cataract.

I. Persistent hyperplastic primary vitreous (PHPV)/persistent hyperplastic tunica vasculosa lentis (PHTVL)

A congenital defect resulting from abnormalities in the development and regression of the hyaloid artery (the primary vitreous) and the interaction of this blood vessel with the posterior lens capsule/cortex during embryogenesis. This condition is often associated with persistent hyperplastic tunica vasculosa lentis (PHTVL) which results from failure of regression of the embryologic vascular network which surrounds the developing lens.

The majority of affected dogs have a retrolental fibrovascular plaque and variable lenticular defects which include posterior lenticonus/globus, colobomata, intralenticular hemorrhage and/or secondary cataracts. Vision impairment may result.

J. Persistent hyaloid artery (PHA)

A congenital defect resulting from abnormalities in the development and regression of the hyaloid artery. The blood vessel remnant can be present in the vitreous as a small vascular strand (PHA) or as a non-vascular strand that appears gray-white (persistent hyaloid remnant).

K. Vitreous degeneration

Liquefaction of the vitreous gel, which may predispose to retinal detachment.

L. Retinal atrophy - generalized (*prcd*)

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

Studies have shown that the principal form of PRA in the Labradoodle is *prcd* which is a late-onset form of PRA inherited as autosomal recessive. The mutation is allelic to that present in Miniature Poodles, English and American Cocker Spaniels, and others. The locus is termed the progressive rod-cone degeneration (*prcd*) gene and at least 30+ breeds are affected. In most affected dogs to date, the disease is recognized clinically in dogs 3-6 years of age or older. This photoreceptor degeneration is characterized by slow death of visual cells following their normal development. The disease begins clinically with signs of night blindness followed by day

blindness. A DNA test is available.

M. Achromatopsia Type 2 (ACHM – Type 2)

A congenital form of day blindness. Visual deficits become apparent between 8-10 weeks of age. Normal vision is present in low light conditions. Clinical examination is normal. Cone responses are absent on an electroretinogram. The causative genetic mutation of the *CNGA3* gene (3nt deletion in exon 7). A DNA test is available.

N. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness.

In the Labrador Retriever, the presence of retinal folds may be seen in the heterozygous state described in “R” below, thus the recommendation against breeding.

The breeding advice for Labrador Retrievers and Samoyeds diagnosed with "retinal dysplasia - folds" will be changed from "No" to "Breeder option" if the owner of the dog provides the registering office with results of the DNA test for the affected dog, showing that it is not a carrier of the *COL9A3* mutation.

O. Retinal dysplasia - geographic, detached without skeletal defects

Abnormal development of the retina present at birth; however, in the Golden Retriever, Labrador Retriever, and German Shepherd Dog it has been demonstrated that the geographic form of retinal dysplasia may not be apparent before dogs are 10 weeks of age.

Retinal dysplasia - geographic: Any irregularly shaped area of abnormal retinal development containing both areas of thinning and areas of elevation representing folds and retinal disorganization.

Retinal dysplasia - detached: Severe retinal disorganization associated with separation (detachment) of the retina.

These two forms are associated with vision impairment or blindness. Retinal dysplasia is known to be inherited in many breeds. The genetic relationship between the three forms of retinal dysplasia is not known for all breeds

In Europe, this condition has been documented as an autosomal recessive condition and results in early retinal detachment and blindness. Lens and corneal opacities can also be present, but skeletal abnormalities (see below) are not present. The condition of generalized retinal dysplasia with retinal detachment but without skeletal abnormalities has been reported primarily in Europe, and is rarely if ever seen in the United States.

In the United States, the milder forms of retinal dysplasia (folds/geographic) are seen in Labradors. These may represent the heterozygous form of the condition in which the homozygote also displays skeletal malformations (see “R” below) or it may represent a

genetically distinct entity with an undetermined mode of inheritance. It is not possible clinically to make this distinction. Thus, Labradors with any form of retinal dysplasia should not be used for breeding.

P. Retinal dysplasia - folds or detachment with skeletal defects

This condition is also known as oculo-skeletal dysplasia (OSD) or dwarfism with retinal dysplasia type 1 (DRD1) in the Labrador Retriever. A similar condition, DRD2, occurs in the Samoyed. The condition is autosomal recessive and homozygous affected dogs have shortened forelimbs ("downhill" conformation) with valgus deformity. They have severe ocular defects including cataract, retinal folds/multifocal retinal dysplasia, vitreal degeneration and retinal detachment. The ocular abnormalities result in blindness in most dogs. Heterozygous dogs can have either a normal ocular exam or have multiple retinal folds, vitreal membranes, or vitreal degeneration suggesting a semi-dominant mechanism with respect to the eyes. It is important to note that generally the retinal folds present in heterozygous dogs tend to cluster around the major superior blood vessels of the central tapetal region. The condition is caused by a 1 base pair insertion of *COL9A3.* A DNA test is available.

Q. Limbal melanoma

Most limbal melanomas are really epibulbar melanocytomas, but there is a possibility of an extension of an intraocular melanoma extending outward and presenting as a limbal melanoma. An epibulbar melanocytoma originates from the superficial pigment lining the limbus and the lesion may eventually extend into the eye. Metastasis has not been documented and the mass is characterized by large epithelioid cells. The lesion presents as a subconjunctival smooth mass most commonly in the dorsolateral limbal region and extends later into the cornea and posterior on the sclera. Breed predisposition has been noted in the German Shepherd, Labrador and Golden Retriever.

Historical Note:

Central progressive retinal atrophy was previously a condition listed for this breed. However as the condition is no longer identified in the breed, the condition has been removed. Central progressive retinal atrophy was a progressive retinal degeneration in which photoreceptor death occurred secondary to disease of the underlying pigment epithelium. Progression was slow and some animals never lost vision. CPRA occurred in England, but was uncommon elsewhere.

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OCULAR DISORDERS REPORT
AUSTRALIAN LABRADOODLE

		1991-2013		2014-2018	
	TOTAL DOGS EXAMINED	2472		5831	
Diagnostic Name		#	%	#	%
EYELIDS					
21.000	entropion, unspecified	1	0.0%	0	
25.110	distichiasis	9	0.4%	123	2.1%
NASOLACRIMAL					
32.110	imperforate lower nasolacrimal punctum	1	0.0%	8	0.1%
NICTITANS					
51.100	third eyelid cartilage anomaly	0		2	0.0%
CORNEA					
70.210	corneal pannus	0		2	0.0%
70.700	corneal dystrophy	5	0.2%	131	2.2%
UVEA					
93.110	iris hypoplasia	0		1	0.0%
93.150	iris coloboma	0		1	0.0%
93.710	persistent pupillary membranes, iris to iris	42	1.7%	388	6.7%
93.720	persistent pupillary membranes, iris to lens	3	0.1%	6	0.1%
93.730	persistent pupillary membranes, iris to cornea	1	0.0%	1	0.0%
93.750	persistent pupillary membranes, lens pigment foci/no strands	13	0.5%	187	3.2%
93.760	persistent pupillary membranes, endothelial opacity/no strands	0		2	0.0%
93.810	uveal melanoma	0		1	0.0%
97.150	chorioretinal coloboma, congenital	0		1	0.0%
LENS					
100.210	cataract. suspect not inherited/significance unknown	19	0.8%	208	3.6%
100.301	punctate cataract, anterior cortex	3	0.1%	21	0.4%
100.302	punctate cataract, posterior cortex	0		9	0.2%
100.303	punctate cataract, equatorial cortex	1	0.0%	3	0.1%
100.304	punctate cataract, anterior sutures	0		2	0.0%
100.305	punctate cataract, posterior sutures	2	0.1%	29	0.5%
100.306	punctate cataract, nucleus	1	0.0%	6	0.1%
100.307	punctate cataract, capsular	1	0.0%	14	0.2%
100.311	incipient cataract, anterior cortex	1	0.0%	13	0.2%
100.312	incipient cataract, posterior cortex	0		11	0.2%
100.313	incipient cataract, equatorial cortex	1	0.0%	4	0.1%
100.314	incipient cataract, anterior sutures	0		2	0.0%
100.315	incipient cataract, posterior sutures	0		2	0.0%
100.316	incipient cataract, nucleus	0		4	0.1%
100.317	incipient cataract, capsular	0		5	0.1%
100.321	incomplete cataract, anterior cortex	0		4	0.1%
100.322	incomplete cataract, posterior cortex	0		4	0.1%
100.323	incomplete cataract, equatorial cortex	1	0.0%	2	0.0%
100.325	incomplete cataract, posterior sutures	0		3	0.1%
100.326	incomplete cataract, nucleus	1	0.0%	2	0.0%
100.327	incomplete cataract, capsular	0		2	0.0%
100.328	posterior suture tip opacities	4	0.2%	60	1.0%
100.330	generalized/complete cataract	0		1	0.0%
100.375	subluxation/luxation, unspecified	0		2	0.0%

LENS CONTINUED	1991-2013		2014-2018	
100.999 significant cataracts (summary)	*12*	*0.5%*	*143*	*2.5%*
VITREOUS				
110.120 persistent hyaloid artery/remnant	1	0.0%	18	0.3%
110.135 PHPV/PTVL	1	0.0%	1	0.0%
110.200 vitritis	0		4	0.1%
110.320 vitreal degeneration	0		9	0.2%
RETINA				
120.170 retinal dysplasia, folds	7	0.3%	52	0.9%
120.960 retinopathy	1	0.0%	3	0.1%
OPTIC NERVE				
130.110 micropapilla	2	0.1%	14	0.2%
130.120 optic nerve hypoplasia	0		2	0.0%
130.150 optic disc coloboma	0		3	0.1%
OTHER				
900.100 other, not inherited	30	1.2%	255	4.4%
900.110 other. suspect not inherited/significance unknown	0		10	0.2%
NORMAL				
0.000 normal globe	458	18.5%	4492	77.0%

AUSTRALIAN SHEPHERD

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Microphthalmia with multiple ocular defects	Presumed autosomal recessive with incomplete penetrance	1-6	NO	
B.	Distichiasis	Not defined	1, 7	Breeder option	
C.	Corneal dystrophy - epithelial/stromal	Not defined	8	Breeder option	
D.	Iris coloboma	Not defined	1	NO	
E.	Iris hypoplasia	Not defined	9	Breeder option	
F.	Persistent pupillary membranes - iris to iris - all other forms	 Not defined Not defined	 1 1, 8	 Breeder option NO	
G.	Cataract	Autosomal co-dominant	1, 10, 11	NO	Mutation in the *HSF4* gene
H.	Vitreous degeneration	Not defined	21	Breeder option	
I.	Persistent hyaloid artery	Not defined		Breeder option	
J.	Retinal atrophy - generalized	Autosomal recessive	1, 9, 13, 14	NO	Mutation in the *prcd* gene
K.	Cone degeneration - day blindness	Autosomal recessive	15	NO	Mutation in the *CNGB3* gene
L.	Multifocal retinopathy - *cmr1*	Autosomal recessive	16	Breeder option	Mutation in the *BEST1* gene
M.	Retinal dysplasia - folds	Not defined	8	Breeder option	

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
N.	Choroidal hypoplasia (Collie Eye Anomaly) - optic nerve coloboma - retinal detachment - retinal hemorrhage - staphyloma/ coloboma	Autosomal recessive	1, 7, 17-20	NO	Mutation in the *NHEJ1* gene
O.	Coloboma/staphyloma without microphthalmia	Not defined	1	NO	
P.	Micropapilla	Not defined	21	Breeder option	

It is recommended that this breed be examined prior to pharmacological dilation to best facilitate identification of iris coloboma.

Description and Comments

A. Microphthalmia with multiple ocular defects

Microphthalmia is a congenital defect characterized by a small eye with associated defects of the cornea, iris (coloboma), anterior chamber, lens (cataract) and/or retina (dysplasia). In the Australian Shepherd, microphthalmia has long been suspected to be associated with merle coat coloration but a definitive genetic relationship has not been established. The eyes of affected homozygous merle (usually white) dogs have extreme forms of this entity and are usually blind at birth. Affected heterozygous merle-coated dogs demonstrate less severe manifestations.

B. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

C. Corneal Dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

D. Iris coloboma

A congenital abnormality in iris development usually characterized by a full-thickness defect in iris tissue, commonly (though not exclusively) located at the 6 o'clock position associated with failure of closure of the optic fissure. A partial-thickness defect in iris tissue should be recorded as iris hypoplasia on the OFA form.

E. Iris hypoplasia

A congenital abnormality in iris development usually characterized by a reduced quantity of tissue identified as a partial-thickness defect in iris tissue. Full-thickness iris hypoplasia is rare and should be recorded as an iris coloboma on the OFA form.

F. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

G. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

In the Australian Shepherd, a mutation in *HSF4* (heat shock transcription factor 4), the HSF4-2 mutation, has been shown to increase the likelihood of cataract formation. The mutation is inherited in a co-dominant manner. Dogs with one copy of the mutation develop bilateral posterior cataracts and homozygotes develop a nuclear cataract that typically progresses to a mature cataract. A DNA test is available for this mutation. Other genetic factors can contribute to cataract formation in this breed and will not be detected by this test.

H. Vitreous degeneration

A liquefaction of the vitreous gel which may predispose to retinal detachment.

I. Persistent hyaloid artery (PHA)

Congenital defect resulting from abnormalities in the development and regression of the hyaloid artery. The blood vessel remnant can be present in the vitreous as a small patent vascular strand (PHA) or as a non-vascular strand that appears gray-white (persistent hyaloid remnant).

J. Retinal atrophy - generalized (*prcd*)

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

Studies have shown that the principal form of PRA in the Australian Shepherd is *prcd* which is a late-onset form of PRA inherited as autosomal recessive. The mutation is allelic to that present in Miniature Poodles, Labrador Retrievers, English and American Cocker Spaniels, and others. The locus is termed the progressive rod-cone degeneration (*prcd*) gene and at least 30+ breeds are affected. In most affected dogs to date, the disease is recognized clinically in dogs 3-6 years of age or older. This photoreceptor degeneration is characterized by slow death of visual cells following their normal development. The disease begins clinically with signs of night blindness followed by day blindness. A DNA test is available.

K. Cone degeneration - day blindness or hemeralopia

Autosomal recessively inherited early degeneration of the cone photoreceptors. Affected puppies develop day-blindness, color blindness, and photophobia between 8 and 12 weeks of age. Affected dogs remain ophthalmoscopically normal their entire life. Electroretinography is required to definitively diagnose the disorder. Genetically, the condition results from a mutation in the *CNGB3* gene. A DNA test is available.

L. Multifocal retinopathy

Canine Multifocal Retinopathy type 1 (*cmr1*) is characterized by numerous distinct (i.e. multi-focal), roughly circular patches of elevated retina (multifocal bullous retinal detachments). There may be a serous subretinal fluid, or accumulation of subretinal material that produces gray-tan-pink colored lesions. These lesions, looking somewhat like blisters, vary in location and size, although typically they are present in both eyes of the affected dog.

The disease generally develops in young dogs between 11-20 weeks of age and there is minimal progression after 1 year of age. The lesions may flatten, leaving areas of retinal thinning and RPE hypertrophy, hyperplasia, and pigmentation. Discrete areas of tapetal hyper-reflectivity may be seen in areas of previous retinal and RPE detachments. Most dogs exhibit no noticeable problem with vision or electroretinographic abnormalities despite their abnormal appearing retinas.

Canine Multifocal Retinopathy type 1 is caused by a mutation in the Bestrophin 1 gene (*BEST1*) and is described to be recessively inherited in the Great Pyrenees, Dogue de Bordeaux, Bullmastiff, and Mastiff.

M. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal

dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

N. Choroidal hypoplasia (Collie Eye Anomaly)
- staphyloma/coloboma
- retinal detachment
- retinal hemorrhage
- optic nerve coloboma

A spectrum of malformations present at birth and ranging from inadequate development of the choroid (choroidal hypoplasia) to defects of the choroid, sclera, and/or optic nerve (coloboma/staphyloma) to complete retinal detachment (with or without hemorrhage). Mildly affected animals will have no detectable vision deficit.

This disorder is collectively referred to as "Collie Eye Anomaly." The choroidal hypoplasia component is caused by a 7799 base pair deletion with the gene *NHEJ1.* The mutation is a recessive trait. A DNA test is available and is diagnostic only for the choroidal hypoplasia component of CEA. For colobomas to develop, an additional mutation in a second gene has to be present; that gene is still unknown.

O. Coloboma/staphyloma (unassociated with microphthalmia)

A coloboma is a congenital defect which may affect the iris, choroid or optic disc. Iris colobomas are seen as notches in the pupillary margin. Scleral ectasia is defined as a congenital thinning and secondary distention of the sclera; when lined by uveal tissue it is called a staphyloma. These may be anteriorly located, apparent as a bulge beneath the upper eyelid or posteriorly located, requiring visualization with an ophthalmoscope. These conditions may or may not be genetically related to the same anomalies seen associated with microphthalmia (entity "A" above).

P. Micropapilla

Micropapilla refers to a small optic disc which is not associated with vision impairment.

Optic nerve hypoplasia refers to a congenital defect of the optic nerve which causes blindness and abnormal pupil response in the affected eye. It may be difficult to differentiate between micropapilla and optic nerve hypoplasia on a routine (dilated) screening ophthalmoscopic exam.

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8. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

9. ACVO Genetics Committee, 2011 and/or Data from CERF All-Breeds Report, 2010.

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12. ACVO Genetics Committee, 2016 and/or Data from CERF/OFA All-Breeds Report, 2010-2015.

13. Zangerl B, Goldstein O, Philp AR, et al. Identical mutation in a novel retinal gene causes progressive rod-cone degeneration in dogs and retinitis pigmentosa in humans. *Genomics*. 2006;88:551-563.

14. ACVO Genetics Committee, 2013-2014 and Data from OFA All-Breeds Report, 2013-2014.

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21. ACVO Genetics Committee, 2007 and/or Data from CERF All-Breeds Report, 2002-2006.

OCULAR DISORDERS REPORT
AUSTRALIAN SHEPHERD

Diagnostic Name		1991-2013 TOTAL DOGS EXAMINED 87196 #	%	2014-2018 23290 #	%
GLOBE					
0.110	microphthalmia	87	0.1%	12	0.1%
10.000	glaucoma	8	0.0%	0	
EYELIDS					
20.110	eyelid dermoid	1	0.0%	0	
20.140	ectopic cilia	5	0.0%	0	
20.160	macropalpebral fissure	4	0.0%	0	
21.000	entropion, unspecified	12	0.0%	4	0.0%
22.000	ectropion, unspecified	6	0.0%	0	
25.110	distichiasis	1443	1.7%	320	1.4%
NASOLACRIMAL					
32.110	imperforate lower nasolacrimal punctum	3	0.0%	6	0.0%
40.910	keratoconjunctivitis sicca	0		1	0.0%
NICTITANS					
51.100	third eyelid cartilage anomaly	4	0.0%	0	
52.110	prolapsed gland of the third eyelid	2	0.0%	1	0.0%
CORNEA					
70.210	corneal pannus	7	0.0%	2	0.0%
70.220	pigmentary keratitis	1	0.0%	0	
70.700	corneal dystrophy	368	0.4%	203	0.9%
70.730	corneal endothelial degeneration	14	0.0%	1	0.0%
UVEA					
93.110	iris hypoplasia	167	0.2%	138	0.6%
93.140	corneal endothelial pigment without PPM	1	0.0%	0	
93.150	iris coloboma	1317	1.5%	253	1.1%
93.710	persistent pupillary membranes, iris to iris	3903	4.5%	1663	7.1%
93.720	persistent pupillary membranes, iris to lens	83	0.1%	16	0.1%
93.730	persistent pupillary membranes, iris to cornea	42	0.0%	5	0.0%
93.740	persistent pupillary membranes, iris sheets	92	0.1%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	16	0.0%	21	0.1%
93.760	persistent pupillary membranes, endothelial opacity/no strands	19	0.0%	4	0.0%
93.810	uveal melanoma	7	0.0%	1	0.0%
93.999	uveal cysts	39	0.0%	5	0.0%
97.150	chorioretinal coloboma, congenital	2	0.0%	22	0.1%
LENS					
100.200	cataract, unspecified	169	0.2%	0	
100.210	cataract. suspect not inherited/significance unknown	2122	2.4%	476	2.0%
100.301	punctate cataract, anterior cortex	200	0.2%	42	0.2%
100.302	punctate cataract, posterior cortex	299	0.3%	47	0.2%
100.303	punctate cataract, equatorial cortex	79	0.1%	9	0.0%
100.304	punctate cataract, anterior sutures	29	0.0%	5	0.0%
100.305	punctate cataract, posterior sutures	187	0.2%	54	0.2%
100.306	punctate cataract, nucleus	132	0.2%	40	0.2%
100.307	punctate cataract, capsular	72	0.1%	33	0.1%

LENS CONTINUED		1991-2013		2014-2018	
100.311	incipient cataract, anterior cortex	283	0.3%	50	0.2%
100.312	incipient cataract, posterior cortex	697	0.8%	82	0.4%
100.313	incipient cataract, equatorial cortex	178	0.2%	25	0.1%
100.314	incipient cataract, anterior sutures	23	0.0%	3	0.0%
100.315	incipient cataract, posterior sutures	147	0.2%	20	0.1%
100.316	incipient cataract, nucleus	186	0.2%	29	0.1%
100.317	incipient cataract, capsular	99	0.1%	21	0.1%
100.321	incomplete cataract, anterior cortex	0		14	0.1%
100.322	incomplete cataract, posterior cortex	2	0.0%	30	0.1%
100.323	incomplete cataract, equatorial cortex	0		7	0.0%
100.325	incomplete cataract, posterior sutures	0		4	0.0%
100.326	incomplete cataract, nucleus	2	0.0%	6	0.0%
100.327	incomplete cataract, capsular	1	0.0%	3	0.0%
100.328	posterior suture tip opacities	20	0.0%	99	0.4%
100.330	generalized/complete cataract	225	0.3%	9	0.0%
100.340	resorbing/hypermature cataract	1	0.0%	0	
100.375	subluxation/luxation, unspecified	17	0.0%	1	0.0%
100.999	*significant cataracts (summary)*	*3011*	*3.5%*	*533*	*2.3%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	435	0.5%	157	0.7%
110.135	PHPV/PTVL	102	0.1%	18	0.1%
110.200	vitritis	2	0.0%	10	0.0%
110.320	vitreal degeneration	234	0.3%	52	0.2%
FUNDUS					
97.110	choroidal hypoplasia	121	0.1%	52	0.2%
97.120	coloboma	96	0.1%	0	
RETINA					
120.170	retinal dysplasia, folds	811	0.9%	263	1.1%
120.180	retinal dysplasia, geographic	42	0.0%	4	0.0%
120.190	retinal dysplasia, detached	8	0.0%	4	0.0%
120.310	generalized progressive retinal atrophy (PRA)	130	0.1%	6	0.0%
120.400	retinal hemorrhage	13	0.0%	0	
120.910	retinal detachment without dialysis	61	0.1%	0	
120.920	retinal detachment with dialysis	2	0.0%	14	0.1%
120.960	retinopathy	5	0.0%	7	0.0%
OPTIC NERVE					
130.110	micropapilla	159	0.2%	104	0.4%
130.120	optic nerve hypoplasia	109	0.1%	20	0.1%
130.150	optic disc coloboma	137	0.2%	30	0.1%
OTHER					
900.000	other, unspecified	545	0.6%	0	
900.100	other, not inherited	1348	1.5%	516	2.2%
900.110	other. suspect not inherited/significance unknown	255	0.3%	33	0.1%
NORMAL					
0.000	normal globe	76978	88.3%	19036	81.7%

AUSTRALIAN STUMPY TAIL CATTLE DOG

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Retinal atrophy - generalized	Autosomal recessive	1	NO	Mutation in the *prcd* gene

Description and Comments

A. Retinal atrophy - generalized (*prcd*)

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

Studies have shown that the principal form of PRA in the Australian Stumpy Tail Cattle Dog is *prcd*, which is a late-onset form of PRA inherited as autosomal recessive. The mutation is allelic to that present in Miniature Poodles, Labrador Retrievers, English and American Cocker Spaniels and others. The locus is termed the progressive rod-cone degeneration (*prcd*) gene and at least 30+ breeds are affected. In most affected dogs to date, the disease is recognized clinically in dogs 3-6 years of age or older. This photoreceptor degeneration is characterized by slow death of visual cells following their normal development. The disease begins clinically with signs of night blindness followed by day blindness. A DNA test is available.

References

There are no breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the Australian Stumpy Tail Cattle Dog. The condition listed above is currently noted solely due to the availability of a genetic test for the disease.

1. Zangerl B, Goldstein O, Philp AR, et al. Identical mutation in a novel retinal gene causes progressive rod-cone degeneration in dogs and retinitis pigmentosa in humans. *Genomics*. 2006 Nov;88:551-563.

OCULAR DISORDERS REPORT
AUSTRALIAN STUMPY TAIL CATTLE DOG

Diagnostic Name		1991-2013 TOTAL DOGS EXAMINED 44 #	 %	2014-2018 0 #	 %
LENS					
100.210	cataract. suspect not inherited/significance unknown	2	4.5%	0	
100.301	punctate cataract, anterior cortex	1	2.3%	0	
100.305	punctate cataract, posterior sutures	1	2.3%	0	
100.311	incipient cataract, anterior cortex	1	2.3%	0	
100.312	incipient cataract, posterior cortex	2	4.5%	0	
100.313	incipient cataract, equatorial cortex	2	4.5%	0	
100.316	incipient cataract, nucleus	1	2.3%	0	
100.999	*significant cataracts (summary)*	*8*	*18.2%*	*0*	
RETINA					
120.170	retinal dysplasia, folds	1	2.3%	0	
120.180	retinal dysplasia, geographic	1	2.3%	0	
120.310	generalized progressive retinal atrophy (PRA)	3	6.8%	0	
OTHER					
900.100	other, not inherited	1	2.3%	0	
900.110	other. suspect not inherited/significance unknown	1	2.3%	0	
NORMAL					
0.000	normal globe	38	86.4%	0	

AUSTRALIAN TERRIER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Persistent pupillary membranes			
	- iris to iris	Not defined	1	Breeder option
	- lens pigment foci/no strands	Not defined	2	Passes with no notation
B.	Cataract	Not defined	3	NO

Description and Comments

A. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

B. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Australian Terrier breed. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 2007 and/or Data from CERF All-Breeds Report, 2002-2006.

2. ACVO Genetics Committee, 2016 and/or Data from CERF/OFA All-Breeds Report, 2010-2015.

3. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

OCULAR DISORDERS REPORT
AUSTRALIAN TERRIER

		1991-2013		2014-2018	
	TOTAL DOGS EXAMINED	**729**		**239**	
Diagnostic Name		**#**	**%**	**#**	**%**
GLOBE					
10.000	glaucoma	1	0.1%	0	
EYELIDS					
21.000	entropion, unspecified	2	0.3%	0	
25.110	distichiasis	3	0.4%	0	
CORNEA					
70.220	pigmentary keratitis	0		1	0.4%
70.700	corneal dystrophy	4	0.5%	0	
UVEA					
93.710	persistent pupillary membranes, iris to iris	15	2.1%	36	15.1%
93.720	persistent pupillary membranes, iris to lens	1	0.1%	0	
93.730	persistent pupillary membranes, iris to cornea	3	0.4%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	4	0.5%	9	3.8%
93.760	persistent pupillary membranes, endothelial opacity/no strands	1	0.1%	0	
LENS					
100.200	cataract, unspecified	2	0.3%	0	
100.210	cataract. suspect not inherited/significance unknown	22	3.0%	14	5.9%
100.301	punctate cataract, anterior cortex	3	0.4%	0	
100.302	punctate cataract, posterior cortex	2	0.3%	0	
100.303	punctate cataract, equatorial cortex	0		2	0.8%
100.305	punctate cataract, posterior sutures	2	0.3%	0	
100.306	punctate cataract, nucleus	1	0.1%	1	0.4%
100.311	incipient cataract, anterior cortex	5	0.7%	0	
100.312	incipient cataract, posterior cortex	4	0.5%	0	
100.313	incipient cataract, equatorial cortex	4	0.5%	1	0.4%
100.314	incipient cataract, anterior sutures	1	0.1%	0	
100.316	incipient cataract, nucleus	0		1	0.4%
100.317	incipient cataract, capsular	0		1	0.4%
100.323	incomplete cataract, equatorial cortex	0		1	0.4%
100.326	incomplete cataract, nucleus	0		1	0.4%
100.330	generalized/complete cataract	8	1.1%	0	
100.375	subluxation/luxation, unspecified	1	0.1%	0	
100.999	*significant cataracts (summary)*	*32*	*4.4%*	*8*	*3.3%*
VITREOUS					
110.320	vitreal degeneration	2	0.3%	1	0.4%
RETINA					
120.170	retinal dysplasia, folds	3	0.4%	0	
120.310	generalized progressive retinal atrophy (PRA)	3	0.4%	0	
120.400	retinal hemorrhage	1	0.1%	0	
OPTIC NERVE					
130.110	micropapilla	0		1	0.4%

		1991-2013		2014-2018	
OTHER					
900.000	other, unspecified	4	0.5%	0	
900.100	other, not inherited	9	1.2%	4	1.7%
900.110	other. suspect not inherited/significance unknown	1	0.1%	1	0.4%
NORMAL					
0.000	normal globe	659	90.4%	179	74.9%

OCULAR DISORDERS REPORT
AZAWAKH

There are insufficient breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the AZAWAKH breed. Therefore, there are no conditions listed with breeding advice.

OCULAR DISORDERS REPORT
AZAWAKH

Diagnostic Name	1991-2013 TOTAL DOGS EXAMINED 5 # %	2014-2018 9 # %
LENS		
100.210 cataract. suspect not inherited/significance unknown	0	1 11.1%
OTHER		
900.000 other, unspecified	1 20.0%	0
NORMAL		
0.000 normal globe	5 100.0%	8 88.9%

BARBET

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Retinal atrophy – generalized (*prcd*)	Autosomal recessive	1, 2	NO	Mutation in the *prcd* gene

Description and Comments

A. Retinal atrophy - generalized (*prcd*)

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

Studies have shown that the principal form of PRA in the Barbet is *prcd*, which is a late-onset form of PRA inherited as autosomal recessive. The mutation is allelic to that present in Miniature Poodles, Labrador Retrievers, English and American Cocker Spaniels and others. The locus is termed the progressive rod-cone degeneration (*prcd*) gene and at least 30+ breeds are affected. In most affected dogs to date, the disease is recognized clinically in dogs 3-6 years of age or older. This photoreceptor degeneration is characterized by slow death of visual cells following their normal development. The disease begins clinically with signs of night blindness followed by day blindness. A DNA test is available.

References

1. Zangerl B, Goldstein O, Philp AR, et al. Identical mutation in a novel retinal gene causes progressive rod-cone degeneration in dogs and retinitis pigmentosa in humans. *Genomics*. 2006 Nov;88:551-563.

2. ACVO Genetics Committee, 2017 and/or Data from CERF/OFA All-Breeds Report, 2010-2016.

OCULAR DISORDERS REPORT
BARBET

Diagnostic Name		1991-2013 90 #	1991-2013 90 %	2014-2018 166 #	2014-2018 166 %
EYELIDS					
25.110	distichiasis	6	6.7%	5	3.0%
CORNEA					
70.700	corneal dystrophy	0		1	0.6%
UVEA					
93.710	persistent pupillary membranes, iris to iris	2	2.2%	4	2.4%
93.750	persistent pupillary membranes, lens pigment foci/no strands	1	1.1%	5	3.0%
93.999	uveal cysts	0		2	1.2%
LENS					
100.210	cataract. suspect not inherited/significance unknown	12	13.3%	20	12.0%
100.301	punctate cataract, anterior cortex	1	1.1%	0	
100.303	punctate cataract, equatorial cortex	1	1.1%	0	
100.305	punctate cataract, posterior sutures	0		1	0.6%
100.311	incipient cataract, anterior cortex	0		1	0.6%
100.312	incipient cataract, posterior cortex	0		1	0.6%
100.313	incipient cataract, equatorial cortex	0		1	0.6%
100.328	posterior suture tip opacities	1	1.1%	7	4.2%
100.330	generalized/complete cataract	0		1	0.6%
100.999	*significant cataracts (summary)*	*2*	*2.2%*	*5*	*3.0%*
VITREOUS					
110.320	vitreal degeneration	0		1	0.6%
FUNDUS					
97.110	choroidal hypoplasia	1	1.1%	0	
RETINA					
120.170	retinal dysplasia, folds	1	1.1%	0	
120.310	generalized progressive retinal atrophy (PRA)	0		2	1.2%
120.920	retinal detachment with dialysis	0		1	0.6%
120.960	retinopathy	0		2	1.2%
OPTIC NERVE					
130.110	micropapilla	0		2	1.2%
OTHER					
900.000	other, unspecified	2	2.2%	0	
900.100	other, not inherited	0		12	7.2%
900.110	other. suspect not inherited/significance unknown	0		2	1.2%
NORMAL					
0.000	normal globe	80	88.9%	117	70.5%

BASENJI

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Corneal dystrophy - epithelial/stromal	Not defined	1	Breeder option	
B.	Corneal dystrophy - endothelial	Not defined	1	NO	
C.	Persistent pupillary membranes				
	- iris to iris	Not defined	1-6	Breeder option	
	- iris to cornea	Not defined	6	NO	
	- iris to lens	Not defined	6	NO	
	- endothelial opacity/no strands	Not defined	7	NO	
D.	Cataract	Not defined	1	NO	
E.	Retinal atrophy - generalized	Not defined	1, 8, 9	NO	
	- Bas_PRA1	Autosomal recessive	1, 8, 9	NO	Mutation in the S-antigen (*SAG)*
F.	Optic nerve coloboma	Not defined	1, 2	NO	

Description and Comments

A. Corneal dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

B. Corneal dystrophy - endothelial

Corneal endothelial dystrophy is an abnormal loss of the inner lining of the cornea that causes progressive fluid retention (edema). With time the edema results in keratitis and decreased vision. This usually does not occur until the animal is older. In the Basenji, this condition is less common than corneal endothelial disease caused by attachment of persistent pupillary membranes.

C. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

In the Basenji, this is a particularly significant problem with many cases reported where the strands bridge between the iris and the cornea resulting in localized corneal opacities which may cause vision impairment. This has also been associated with optic nerve coloboma (see "F" below).

D. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

E. Retinal atrophy - generalized

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. Except for X-linked PRA in the Siberian Husky, in all breeds studied to date, PRA is inherited as an autosomal recessive trait.

Bas_PRA1

A specific mutation has been located in the S-antigen (*SAG)* gene that causes a late onset form of retinal degeneration in the Basenji. The condition is inherited in an autosomal recessive fashion. Initial thinning of the retina evidenced by irregular hypo and hyper-reflectivity of the tapetal fundus is typically noted at 5 years of age with retinal vascular attenuation noted by 6-7 years of age. Clinically the disease closely resembles *prcd*-PRA. The retinal degeneration progresses gradually and ultimately results in complete vision loss. This mutation is responsible for the majority, but not all cases of PRA within the Basenji breed.

F. Optic nerve coloboma

A congenital cavity in the optic nerve which, if large, may cause blindness or vision impairment.

In the Basenji, this condition has been associated with persistent pupillary membranes (see "C" above).

References

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4. Mason TA. Persistent pupillary membrane in the Basenji. *Aust Vet J*. 1976 Aug;52:343-344.

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9. Goldstein O, Jordan JA, Aguirre GD, et al. A non-stop S-antigen gene mutation is associated with late onset hereditary retinal degeneration in dogs. *Mol Vis*. 2013;19:1871-1884.

OCULAR DISORDERS REPORT
BASENJI

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2013 9912 #	%	2014-2018 1499 #	%
GLOBE						
0.110	microphthalmia		8	0.1%	0	
EYELIDS						
20.160	macropalpebral fissure		1	0.0%	0	
21.000	entropion, unspecified		5	0.1%	1	0.1%
22.000	ectropion, unspecified		1	0.0%	0	
25.110	distichiasis		57	0.6%	13	0.9%
CORNEA						
70.210	corneal pannus		2	0.0%	0	
70.220	pigmentary keratitis		2	0.0%	0	
70.700	corneal dystrophy		293	3.0%	47	3.1%
70.730	corneal endothelial degeneration		229	2.3%	23	1.5%
UVEA						
90.250	pigmentary uveitis		1	0.0%	0	
93.110	iris hypoplasia		0		1	0.1%
93.140	corneal endothelial pigment without PPM		18	0.2%	0	
93.150	iris coloboma		9	0.1%	0	
93.710	persistent pupillary membranes, iris to iris		4945	49.9%	968	64.6%
93.720	persistent pupillary membranes, iris to lens		435	4.4%	32	2.1%
93.730	persistent pupillary membranes, iris to cornea		1055	10.6%	113	7.5%
93.740	persistent pupillary membranes, iris sheets		39	0.4%	4	0.3%
93.750	persistent pupillary membranes, lens pigment foci/no strands		11	0.1%	14	0.9%
93.760	persistent pupillary membranes, endothelial opacity/no strands		124	1.3%	115	7.7%
93.999	uveal cysts		1	0.0%	1	0.1%
97.150	chorioretinal coloboma, congenital		1	0.0%	0	
LENS						
100.200	cataract, unspecified		47	0.5%	0	
100.210	cataract. suspect not inherited/significance unknown		437	4.4%	59	3.9%
100.301	punctate cataract, anterior cortex		42	0.4%	3	0.2%
100.302	punctate cataract, posterior cortex		16	0.2%	1	0.1%
100.303	punctate cataract, equatorial cortex		9	0.1%	0	
100.304	punctate cataract, anterior sutures		3	0.0%	2	0.1%
100.305	punctate cataract, posterior sutures		60	0.6%	18	1.2%
100.306	punctate cataract, nucleus		15	0.2%	2	0.1%
100.307	punctate cataract, capsular		57	0.6%	15	1.0%
100.311	incipient cataract, anterior cortex		26	0.3%	5	0.3%
100.312	incipient cataract, posterior cortex		26	0.3%	2	0.1%
100.313	incipient cataract, equatorial cortex		17	0.2%	4	0.3%
100.314	incipient cataract, anterior sutures		3	0.0%	0	
100.315	incipient cataract, posterior sutures		29	0.3%	7	0.5%
100.316	incipient cataract, nucleus		21	0.2%	0	
100.317	incipient cataract, capsular		22	0.2%	4	0.3%
100.328	posterior suture tip opacities		5	0.1%	20	1.3%
100.330	generalized/complete cataract		22	0.2%	0	
100.375	subluxation/luxation, unspecified		8	0.1%	1	0.1%
100.999	*significant cataracts (summary)*		*415*	*4.2%*	*63*	*4.2%*

		1991-2013		2014-2018	
VITREOUS					
110.120	persistent hyaloid artery/remnant	8	0.1%	2	0.1%
110.135	PHPV/PTVL	8	0.1%	1	0.1%
110.200	vitritis	0		2	0.1%
110.320	vitreal degeneration	29	0.3%	0	
FUNDUS					
97.110	choroidal hypoplasia	1	0.0%	0	
97.120	coloboma	13	0.1%	0	
RETINA					
120.170	retinal dysplasia, folds	18	0.2%	3	0.2%
120.180	retinal dysplasia, geographic	19	0.2%	1	0.1%
120.190	retinal dysplasia, detached	4	0.0%	0	
120.310	generalized progressive retinal atrophy (PRA)	375	3.8%	6	0.4%
120.400	retinal hemorrhage	5	0.1%	0	
120.910	retinal detachment without dialysis	7	0.1%	0	
120.960	retinopathy	5	0.1%	8	0.5%
OPTIC NERVE					
130.110	micropapilla	1	0.0%	0	
130.120	optic nerve hypoplasia	3	0.0%	0	
130.150	optic disc coloboma	98	1.0%	7	0.5%
OTHER					
900.000	other, unspecified	78	0.8%	0	
900.100	other, not inherited	232	2.3%	58	3.9%
900.110	other. suspect not inherited/significance unknown	223	2.2%	6	0.4%
NORMAL					
0.000	normal globe	4000	40.4%	350	23.3%

BASSET FAUVE DE BRETAGNE

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Glaucoma - POAG	Autosomal recessive	1-7	NO	Mutation in the *ADAMTS17* gene
B.	Persistent pupillary membranes - lens pigment foci/no strands	Not defined	8	Passes with no notation	
C.	Cataract	Not defined	8	NO	

Description and Comments

A. Glaucoma

Glaucoma is characterized by an elevation of intraocular pressure which, when sustained even for a brief period of time, causes intraocular damage resulting in blindness. The elevated intraocular pressure occurs because the fluid cannot leave through the iridocorneal angle. Diagnosis and classification of glaucoma requires measurement of IOP (tonometry) and examination of the iridocorneal angle (gonioscopy). Neither of these tests is part of a routine breed eye screening exam.

In the Basset Fauve de Bretagne, both closed angle (PCAG) and open angle (POAG) forms of glaucoma are present. Some Basset Fauve de Bretagnes have an abnormality of the iridocorneal angle termed goniodysgenesis. This abnormality is not visible during routine ophthalmologic examination using an indirect ophthalmoscope or a slit-lamp microscope. There appears to be an association between goniodysgenesis and glaucoma, but the mechanism by which the angle defect results in glaucoma has not been determined. It is suspected that mild to severe anterior uveitis impairs outflow of aqueous through the small perforations that are present in the sheet of tissue in the iridocorneal angle; this results in a secondary and often irreversible rise in intraocular pressure that causes blindness.

The inheritance of PCAG and goniodysgenesis in the Basset Fauve de Bretagne are not known. Until the inheritance is determined, control should be directed to removing dogs from breeding that have glaucoma and have goniodysgenesis, as well as those dogs that produce progeny affected with glaucoma. Three genetic loci, *COL1A2, RAB22A,* and *NEB,* have been implicated as possible contributors to the development of PCAG in the Basset Fauve de Bretagne. One is an autosomal recessive missense mutation of a nebulin (NEB) residue on chromosome 19. Because 33% of unaffected animals were homozygous for the risk allele, it was hypothesized that modifying factors may be present. A genetic

test is not yet available for PCAG.

POAG in the Basset Fauve de Bretagne is caused by a 19 base pair deletion in exon 2 of *ADAMTS17.* This deletion alters the reading frame and is suspected to cause a truncated protein. The trait shows an autosomal recessive mode of inheritance. A DNA test is available.

B. Persistent pupillary membranes (PPM)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

C. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

References

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2. Bedford PG. The aetiology of primary glaucoma in the dog. *J Small Anim Pract*. 1975;16:217-239.

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OCULAR DISORDERS REPORT
BASSET FAUVE DE BRETAGNE

Diagnostic Name	TOTAL DOGS EXAMINED	1991-2013 10 #	%	2014-2018 68 #	%
GLOBE					
10.000	glaucoma	0		2	2.9%
EYELIDS					
25.110	distichiasis	0		1	1.5%
UVEA					
93.710	persistent pupillary membranes, iris to iris	0		2	2.9%
93.750	persistent pupillary membranes, lens pigment foci/no strands	3	30.0%	16	23.5%
LENS					
100.210	cataract. suspect not inherited/significance unknown	1	10.0%	6	8.8%
100.328	posterior suture tip opacities	0		1	1.5%
VITREOUS					
110.120	persistent hyaloid artery/remnant	0		1	1.5%
OTHER					
900.100	other, not inherited	0		4	5.9%
NORMAL					
0.000	normal globe	7	70.0%	40	58.8%

BASSET HOUND

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Glaucoma - POAG	Autosomal recessive	1-8	NO	Mutation in the *ADAMTS17* gene
B.	Entropion	Not defined	1	Breeder option	
C.	Ectropion	Not defined	1, 9, 10	Breeder option	
D.	Macroblepharon	Not defined	9, 10	Breeder option	
E.	Distichiasis	Not defined	11	Breeder option	
F.	Nictitans cartilage anomaly/eversion	Not defined	12	Breeder option	
G.	Persistent pupillary membranes				
	- iris to iris	Not defined	1, 13	Breeder option	
	- iris to cornea	Not defined	13	NO	
H.	Cataract	Not defined	1	NO	

Description and Comments

A. Glaucoma

Glaucoma is characterized by an elevation of intraocular pressure which, when sustained even for a brief period of time, causes intraocular damage resulting in blindness. The elevated intraocular pressure occurs because the fluid cannot leave through the iridocorneal angle. Diagnosis and classification of glaucoma requires measurement of IOP (tonometry) and examination of the iridocorneal angle (gonioscopy). Neither of these tests is part of a routine breed eye screening exam.

In the Basset Hound, both closed angle (PCAG) and open angle (POAG) forms of glaucoma are present. Some Basset Hounds have an abnormality of the iridocorneal angle termed goniodysgenesis. This abnormality is not visible during routine ophthalmologic examination using an indirect ophthalmoscope or a slit-lamp microscope. There appears to be an association between goniodysgenesis and glaucoma, but the mechanism by which the angle defect results in glaucoma has not been determined. It is suspected that mild to severe anterior uveitis impairs outflow of aqueous through the small perforations that are present in the sheet of tissue in the iridocorneal angle; this results in a secondary and often irreversible rise in intraocular pressure that causes blindness.

The inheritance of PCAG and goniodysgenesis in the Basset Hound are not known. Until the

inheritance is determined, control should be directed to removing dogs from breeding that have glaucoma and have goniodysgenesis, as well as those dogs that produce progeny affected with glaucoma. Three genetic loci, *COL1A2, RAB22A,* and *NEB,* have been implicated as possible contributors to the development of PCAG in the Basset Hound. One is an autosomal recessive missense mutation of a nebulin (NEB) residue on chromosome 19. Because 33% of unaffected animals were homozygous for the risk allele, it was hypothesized that modifying factors may be present. A genetic test is not yet available for PCAG.

POAG in the Basset Hound is caused by a 19 base pair deletion in exon 2 of *ADAMTS17.* This deletion alters the reading frame and is suspected to cause a truncated protein. The trait shows an autosomal recessive mode of inheritance. A DNA test is available.

B. Entropion

A conformational defect resulting in an "in-rolling" of one or both of the eyelids which may cause ocular irritation. It is likely that entropion is influenced by several genes (polygenic) defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

C. Ectropion

A conformational defect resulting in eversion of the eyelids, which may cause ocular irritation. It is likely that ectropion is influenced by several genes (polygenic) defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

In the Basset Hound, ectropion is associated with an exceptionally large palpebral fissure (macroblepharon) and laxity of the canthal structures. Central lower lid ectropion is often associated with entropion of the adjacent lid segment. This causes severe ocular irritation.

It is acknowledged that factors other than genetics may play a role or be the cause of entropion and/or ectropion. However, when non-genetic factors can be ruled out, selection should be directed to a more normal head conformation that minimizes or eliminates the likelihood of the defects.

D. Macroblepharon

Defined as an exceptionally large palpebral fissure, macroblepharon in conjunction with laxity of the lateral canthal structures may lead to lower lid ectropion and upper lid entropion. Either of these conditions may lead to severe ocular irritation. This terms is no longer listed on the CAER form. Please mark other conditions suspected as inherited and write macroblepharon in the comments section.

E. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded;

breeding discretion is advised.

F. Nictitans cartilage anomaly/eversion

A scroll-like curling of the cartilage of the third eyelid, usually everting the margin. This condition may occur in one or both eyes and may cause mild ocular irritation.

G. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

H. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

References

1. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

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3. Bedford PG. The aetiology of primary glaucoma in the dog. *J Small Anim Pract*. 1975;16:217-239.

4. Bedford PGC. A gonioscopic study of the iridocorneal angle in the English and America breeds of Cocker Spaniel and the Bassest Hound. *J Small Anim Pract*. 1977;18:631-642.

5. Slater MR, Erb HN. Effects of risk factors and prophylactic treatment on primary glaucoma in the dog. *J Am Vet Med Assoc*. 1986;188:1028-1030.

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13. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

OCULAR DISORDERS REPORT
BASSET HOUND

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2013 1711 #	%	2014-2018 189 #	%
GLOBE						
0.110	microphthalmia		1	0.1%	0	
EYELIDS						
20.140	ectopic cilia		1	0.1%	0	
20.160	macropalpebral fissure		17	1.0%	0	
21.000	entropion, unspecified		18	1.1%	7	3.7%
22.000	ectropion, unspecified		121	7.1%	15	7.9%
25.110	distichiasis		23	1.3%	3	1.6%
NASOLACRIMAL						
40.910	keratoconjunctivitis sicca		4	0.2%	2	1.1%
NICTITANS						
51.100	third eyelid cartilage anomaly		16	0.9%	5	2.6%
52.110	prolapsed gland of the third eyelid		9	0.5%	1	0.5%
CORNEA						
70.210	corneal pannus		3	0.2%	0	
70.220	pigmentary keratitis		2	0.1%	1	0.5%
70.700	corneal dystrophy		4	0.2%	0	
70.730	corneal endothelial degeneration		4	0.2%	1	0.5%
UVEA						
93.140	corneal endothelial pigment without PPM		1	0.1%	0	
93.710	persistent pupillary membranes, iris to iris		47	2.7%	8	4.2%
93.720	persistent pupillary membranes, iris to lens		11	0.6%	0	
93.730	persistent pupillary membranes, iris to cornea		28	1.6%	0	
93.740	persistent pupillary membranes, iris sheets		1	0.1%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands		1	0.1%	0	
93.760	persistent pupillary membranes, endothelial opacity/no strands		4	0.2%	0	
93.999	uveal cysts		4	0.2%	1	0.5%
LENS						
100.200	cataract, unspecified		6	0.4%	0	
100.210	cataract. suspect not inherited/significance unknown		48	2.8%	8	4.2%
100.301	punctate cataract, anterior cortex		17	1.0%	0	
100.302	punctate cataract, posterior cortex		8	0.5%	2	1.1%
100.303	punctate cataract, equatorial cortex		4	0.2%	1	0.5%
100.304	punctate cataract, anterior sutures		3	0.2%	0	
100.305	punctate cataract, posterior sutures		6	0.4%	2	1.1%
100.306	punctate cataract, nucleus		2	0.1%	1	0.5%
100.307	punctate cataract, capsular		4	0.2%	2	1.1%
100.311	incipient cataract, anterior cortex		7	0.4%	0	
100.312	incipient cataract, posterior cortex		12	0.7%	2	1.1%
100.313	incipient cataract, equatorial cortex		2	0.1%	0	
100.314	incipient cataract, anterior sutures		1	0.1%	0	
100.315	incipient cataract, posterior sutures		3	0.2%	0	
100.316	incipient cataract, nucleus		3	0.2%	1	0.5%
100.317	incipient cataract, capsular		3	0.2%	1	0.5%

LENS CONTINUED		1991-2013		2014-2018	
100.326	incomplete cataract, nucleus	0		2	1.1%
100.327	incomplete cataract, capsular	0		1	0.5%
100.328	posterior suture tip opacities	0		1	0.5%
100.330	generalized/complete cataract	5	0.3%	0	
100.375	subluxation/luxation, unspecified	2	0.1%	0	
100.999	*significant cataracts (summary)*	*86*	*5.0%*	*15*	*7.9%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	7	0.4%	0	
110.135	PHPV/PTVL	1	0.1%	0	
110.320	vitreal degeneration	5	0.3%	0	
RETINA					
120.170	retinal dysplasia, folds	10	0.6%	1	0.5%
120.310	generalized progressive retinal atrophy (PRA)	2	0.1%	0	
120.400	retinal hemorrhage	1	0.1%	0	
120.910	retinal detachment without dialysis	2	0.1%	0	
OPTIC NERVE					
130.120	optic nerve hypoplasia	1	0.1%	0	
OTHER					
900.000	other, unspecified	19	1.1%	0	
900.100	other, not inherited	41	2.4%	14	7.4%
900.110	other. suspect not inherited/significance unknown	91	5.3%	8	4.2%
NORMAL					
0.000	normal globe	1326	77.5%	125	66.1%

OCULAR DISORDERS REPORT
BAVARIAN MOUNTAIN SCENT HOUND

There are insufficient breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the BAVARIAN MOUNTAIN SCENT HOUND breed. Therefore, there are no conditions listed with breeding advice.

OCULAR DISORDERS REPORT
BAVARIAN MOUNTAIN SCENT HOUND

Diagnostic Name	TOTAL DOGS EXAMINED	1991-2013 0 #	%	2014-2018 24 #	%
UVEA					
93.710	persistent pupillary membranes, iris to iris	0		1	4.2%
NORMAL					
0.000	normal globe	0		23	95.8%

BEAGLE

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Microphthalmia with multiple ocular defects	See below	1, 2	NO	
B.	Glaucoma	Presumed autosomal recessive	1, 3-14	NO	For POAG, mutation in the *ADAMTS10* gene
C.	Distichiasis	Not defined	1	Breeder option	
D.	Prolapsed gland of third eyelid	Not defined	1	Breeder option	
E.	Corneal dystrophy - epithelial/stromal	Not defined	15-20	Breeder option	
F.	Persistent pupillary membranes - iris to iris	Not defined	21	Breeder option	
G.	Cataract	Not defined	21-23	NO	
H.	Tapetal degeneration	Presumed autosomal recessive	24-27	Breeder option	
I.	Retinal atrophy - generalized	Not defined	1	NO	
J.	Retinal dysplasia - folds	Not defined	1	Breeder option	
K.	Congenital stationary night blindness	Autosomal recessive	28	NO	Mutation in the *RPE65* gene

Description and Comments

A. Microphthalmia with multiple congenital ocular defects

A developmental anomaly in which the eyeball is abnormally small. This is often associated with other ocular malformations, including defects of the cornea, anterior chamber, lens, and/or retina.

In the Beagle, the condition may be present unilaterally or bilaterally and is characterized by a small globe and associated ocular defects which are variable. Several forms of the condition, all apparently different, are recognized:

1) In one study, complete lens opacities were noted by 5-6 months of age; the severity of the cataract correlated closely with the extent of microphthalmia. Severely microphthalmic eyes also had multiple retinal folds. The disorder appeared to be inherited; the exact mode was not fully defined, although an X-linked disorder could not be ruled out.

2) A different form of microphthalmia is recognized in association with microphakia and persistent pupillary membrane (PPM). Based on a limited pedigree of one cross, a dominant inheritance was proposed; heterozygotes have PPM and microphakia/cataract and homozygous affected show microphthalmia and multiple congenital ocular anomalies.

3) A third form of microphthalmia is recognized in the breed. This condition is usually unilateral and the fellow eye is normal. The mode of inheritance has not been defined, but autosomal recessive inheritance is suspected.

B. Glaucoma

Glaucoma is an elevation of intraocular pressure (IOP) which, when sustained, causes intraocular damage resulting in blindness. The elevated IOP occurs because the fluid cannot leave through the iridocorneal angle. Diagnosis and classification of glaucoma requires measurement of IOP (tonometry) and examination of the iridocorneal angle (gonioscopy). Neither of these tests is part of a routine breed eye screening exam.

Primary open angle glaucoma is present in the breed, and extensive breeding studies have demonstrated its inheritance as autosomal recessive. By one year of age, the intraocular pressure (IOP) is elevated, but the filtration angle is open (early glaucoma). Animals with moderate glaucoma show sustained elevations of IOP, focal disinsertions of the lens zonules and focal closures of the iridocorneal angle. Later the globe enlarges, the lens luxates and the eyes become blind and show the effects of chronic glaucoma. The causative mutation in *ADAMTS10* causes an arginine for glycine substitution at position 661. A DNA test is available.

C. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

D. Prolapsed gland of the third eyelid

Protrusion of the tear gland associated with the third eyelid. The mode of inheritance of this disorder is unknown. The exposed gland may become irritated. Commonly referred to as "cherry eye." In the Beagle, there is an association between this condition and keratoconjunctivitis sicca (KCS).

E. Corneal dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

In the Beagle, corneal dystrophy has been described as an oval opacity located at the junction at the middle and inferior thirds of the cornea. The opacities are caused by accumulation of cholesterol and other lipids within the cornea. Progression was noted with possible vision impairment.

F. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur

G. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

Several different types of cataract (anterior capsular, posterior cortical, other) have been reported in the Beagle, but the mode of inheritance of the defects is unknown. When one considers that this breed, particularly the laboratory-bred Beagle, has been the subject of extensive ophthalmological examination, the relatively low incidence of cataracts is surprising.

H. Tapetal degeneration

The tapetum lucidum is a modified choroidal structure present in the eyes of many animals that have good night vision. In Beagles there is a recessively inherited defect of the tapetal layer. Absence of this layer is determined by ophthalmoscopy which shows that the fundus has a uniform reddish coloration. The degeneration of the tapetum occurs as a result of abnormal postnatal development of this structure. The degeneration of the tapetum does not affect vision and does not result in functional or structural damage to the retina. As such, the condition probably represents an insignificant inherited variation of no functional significance.

I. Retinal atrophy - generalized (PRA)

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality may be detected by electroretinogram before it is apparent clinically. In all breeds studied to date, PRA is recessively inherited. The disease in the Beagle has not been characterized sufficiently to establish the disease frequency, the disease mechanism, or the age when early diagnosis by ophthalmoscopy and/or electroretinography is possible.

J. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

K. Congenital stationary night blindness (CSNB)

A non-progressive retinal disease characterized by night blindness; day vision is normal. This condition is very rare and has only been found to date in a research colony in Japan. The condition is inherited in an autosomal recessive manner. Affected dogs had normal retinas on clinical examination, but no detectable rod photoreceptor responses with an electroretinogram (ERG). A DNA test is available.

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OCULAR DISORDERS REPORT
BEAGLE

		1991-2013		2014-2018	
	TOTAL DOGS EXAMINED	**1469**		**358**	
Diagnostic Name		**#**	**%**	**#**	**%**
GLOBE					
0.110	microphthalmia	4	0.3%	0	
EYELIDS					
21.000	entropion, unspecified	2	0.1%	4	1.1%
22.000	ectropion, unspecified	1	0.1%	0	
25.110	distichiasis	259	17.6%	80	22.3%
NASOLACRIMAL					
32.110	imperforate lower nasolacrimal punctum	1	0.1%	8	2.2%
40.910	keratoconjunctivitis sicca	2	0.1%	1	0.3%
NICTITANS					
51.100	third eyelid cartilage anomaly	1	0.1%	0	
52.110	prolapsed gland of the third eyelid	10	0.7%	1	0.3%
CORNEA					
70.220	pigmentary keratitis	1	0.1%	0	
70.700	corneal dystrophy	6	0.4%	1	0.3%
70.730	corneal endothelial degeneration	2	0.1%	0	
UVEA					
93.710	persistent pupillary membranes, iris to iris	19	1.3%	1	0.3%
93.730	persistent pupillary membranes, iris to cornea	3	0.2%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		1	0.3%
93.760	persistent pupillary membranes, endothelial opacity/no strands	1	0.1%	0	
93.999	uveal cysts	1	0.1%	3	0.8%
LENS					
100.200	cataract, unspecified	9	0.6%	0	
100.210	cataract. suspect not inherited/significance unknown	40	2.7%	13	3.6%
100.301	punctate cataract, anterior cortex	6	0.4%	3	0.8%
100.302	punctate cataract, posterior cortex	6	0.4%	0	
100.303	punctate cataract, equatorial cortex	1	0.1%	1	0.3%
100.305	punctate cataract, posterior sutures	3	0.2%	0	
100.306	punctate cataract, nucleus	0		1	0.3%
100.307	punctate cataract, capsular	3	0.2%	0	
100.311	incipient cataract, anterior cortex	3	0.2%	0	
100.312	incipient cataract, posterior cortex	13	0.9%	1	0.3%
100.313	incipient cataract, equatorial cortex	6	0.4%	2	0.6%
100.315	incipient cataract, posterior sutures	1	0.1%	0	
100.316	incipient cataract, nucleus	4	0.3%	1	0.3%
100.317	incipient cataract, capsular	2	0.1%	0	
100.322	incomplete cataract, posterior cortex	0		1	0.3%
100.323	incomplete cataract, equatorial cortex	0		1	0.3%
100.328	posterior suture tip opacities	0		1	0.3%
100.330	generalized/complete cataract	18	1.2%	1	0.3%
100.375	subluxation/luxation, unspecified	1	0.1%	0	
100.999	*significant cataracts (summary)*	*75*	*5.1%*	*12*	*3.4%*

		1991-2013		2014-2018	
VITREOUS					
110.120	persistent hyaloid artery/remnant	1	0.1%	0	
110.135	PHPV/PTVL	1	0.1%	0	
110.320	vitreal degeneration	4	0.3%	4	1.1%
RETINA					
120.170	retinal dysplasia, folds	32	2.2%	2	0.6%
120.180	retinal dysplasia, geographic	4	0.3%	2	0.6%
120.310	generalized progressive retinal atrophy (PRA)	8	0.5%	0	
120.910	retinal detachment without dialysis	2	0.1%	0	
OPTIC NERVE					
130.110	micropapilla	1	0.1%	0	
130.120	optic nerve hypoplasia	4	0.3%	0	
130.150	optic disc coloboma	1	0.1%	0	
OTHER					
900.000	other, unspecified	18	1.2%	0	
900.100	other, not inherited	50	3.4%	14	3.9%
900.110	other. suspect not inherited/significance unknown	8	0.5%	0	
NORMAL					
0.000	normal globe	1102	75.0%	230	64.2%

BEARDED COLLIE

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Distichiasis	Not defined	1	Breeder option	
B.	Corneal dystrophy - epithelial/stromal	Not defined	2	Breeder option	
C.	Persistent pupillary membranes - iris to iris	Not defined	2,3	Breeder option	
D.	Cataract	Not defined	2	NO	
E.	Retinal dysplasia - folds	Not defined	2	Breeder option	
F.	Choroidal hypoplasia (Collie Eye Anomaly) - staphyloma/coloboma - retinal detachment - retinal hemorrhage - optic nerve coloboma	Autosomal recessive	3-6	NO	Mutation in the *NHEJ1* gene

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Corneal dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

C. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

D. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

E. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached), which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

F. Choroidal hypoplasia (Collie Eye Anomaly)
- Staphyloma/coloboma
- Retinal detachment
- Retinal hemorrhage
- Optic nerve coloboma

A spectrum of malformations present at birth and ranging from inadequate development of the choroid (choroidal hypoplasia) to defects of the choroid, sclera, and/or optic nerve (coloboma/staphyloma) to complete retinal detachment (with or without hemorrhage). Mildly affected animals will have no detectable vision deficit.

This disorder is collectively referred to as "Collie Eye Anomaly." The choroidal hypoplasia component is caused by a 7799 base pair deletion with the gene *NHEJ1.* The mutation is a recessive trait. A DNA test is available and is diagnostic only for the choroidal hypoplasia component of CEA. For colobomas to develop, an additional mutation in a second gene has to be present; that gene is still unknown.

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OCULAR DISORDERS REPORT
BEARDED COLLIE

Diagnostic Name		1991-2013 TOTAL DOGS EXAMINED 3595 #	%	2014-2018 502 #	%
GLOBE					
0.110	microphthalmia	2	0.1%	0	
EYELIDS					
25.110	distichiasis	21	0.6%	9	1.8%
CORNEA					
70.700	corneal dystrophy	45	1.3%	7	1.4%
70.730	corneal endothelial degeneration	1	0.0%	0	
UVEA					
93.150	iris coloboma	1	0.0%	0	
93.710	persistent pupillary membranes, iris to iris	143	4.0%	25	5.0%
93.720	persistent pupillary membranes, iris to lens	7	0.2%	2	0.4%
93.730	persistent pupillary membranes, iris to cornea	2	0.1%	0	
93.740	persistent pupillary membranes, iris sheets	1	0.0%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		2	0.4%
93.999	uveal cysts	5	0.1%	5	1.0%
LENS					
100.200	cataract, unspecified	12	0.3%	0	
100.210	cataract. suspect not inherited/significance unknown	354	9.8%	64	12.7%
100.301	punctate cataract, anterior cortex	36	1.0%	7	1.4%
100.302	punctate cataract, posterior cortex	15	0.4%	1	0.2%
100.303	punctate cataract, equatorial cortex	28	0.8%	2	0.4%
100.304	punctate cataract, anterior sutures	5	0.1%	0	
100.305	punctate cataract, posterior sutures	21	0.6%	6	1.2%
100.306	punctate cataract, nucleus	5	0.1%	2	0.4%
100.307	punctate cataract, capsular	6	0.2%	3	0.6%
100.311	incipient cataract, anterior cortex	35	1.0%	4	0.8%
100.312	incipient cataract, posterior cortex	29	0.8%	5	1.0%
100.313	incipient cataract, equatorial cortex	22	0.6%	3	0.6%
100.314	incipient cataract, anterior sutures	3	0.1%	0	
100.315	incipient cataract, posterior sutures	10	0.3%	1	0.2%
100.316	incipient cataract, nucleus	12	0.3%	3	0.6%
100.317	incipient cataract, capsular	9	0.3%	3	0.6%
100.321	incomplete cataract, anterior cortex	2	0.1%	1	0.2%
100.322	incomplete cataract, posterior cortex	0		1	0.2%
100.327	incomplete cataract, capsular	0		1	0.2%
100.328	posterior suture tip opacities	2	0.1%	22	4.4%
100.330	generalized/complete cataract	5	0.1%	0	
100.375	subluxation/luxation, unspecified	5	0.1%	2	0.4%
100.999	*significant cataracts (summary)*	*255*	*7.1%*	*43*	*8.6%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	6	0.2%	0	
110.320	vitreal degeneration	6	0.2%	2	0.4%
FUNDUS					
97.110	choroidal hypoplasia	22	0.6%	0	
97.120	coloboma	4	0.1%	0	

		1991-2013		2014-2018	
RETINA					
120.170	retinal dysplasia, folds	52	1.4%	0	
120.180	retinal dysplasia, geographic	1	0.0%	2	0.4%
120.310	generalized progressive retinal atrophy (PRA)	8	0.2%	0	
120.960	retinopathy	1	0.0%	1	0.2%
OPTIC NERVE					
130.150	optic disc coloboma	1	0.0%	0	
OTHER					
900.000	other, unspecified	37	1.0%	0	
900.100	other, not inherited	75	2.1%	31	6.2%
900.110	other. suspect not inherited/significance unknown	20	0.6%	0	
NORMAL					
0.000	normal globe	2917	81.1%	339	67.5%

BEAUCERON

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Persistent pupillary membranes - lens pigment foci/no strands	Not defined	1	Passes with no notation
B.	Vitreous degeneration	Not defined	1	Breeder option

Description and Comments

A. Persistent pupillary membranes (PPM)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

B. Vitreous degeneration

A liquefaction of the vitreous gel which may predispose to retinal detachment.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Beauceron breed. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 2017 and/or Data from CERF/OFA All-Breeds Report, 2010-2016.

OCULAR DISORDERS REPORT
BEAUCERON

Diagnostic Name		1991-2013 TOTAL DOGS EXAMINED 52 #	 %	2014-2018 280 #	 %
GLOBE					
0.110	microphthalmia	1	1.9%	0	
EYELIDS					
25.110	distichiasis	0		3	1.1%
CORNEA					
70.210	corneal pannus	1	1.9%	0	
70.700	corneal dystrophy	0		1	0.4%
UVEA					
93.710	persistent pupillary membranes, iris to iris	1	1.9%	8	2.9%
93.720	persistent pupillary membranes, iris to lens	0		1	0.4%
93.750	persistent pupillary membranes, lens pigment foci/no strands	2	3.8%	22	7.9%
LENS					
100.210	cataract. suspect not inherited/significance unknown	2	3.8%	8	2.9%
100.302	punctate cataract, posterior cortex	0		1	0.4%
100.305	punctate cataract, posterior sutures	0		2	0.7%
100.307	punctate cataract, capsular	0		1	0.4%
100.311	incipient cataract, anterior cortex	0		2	0.7%
100.315	incipient cataract, posterior sutures	0		2	0.7%
100.316	incipient cataract, nucleus	0		2	0.7%
100.317	incipient cataract, capsular	0		1	0.4%
100.328	posterior suture tip opacities	1	1.9%	2	0.7%
100.375	subluxation/luxation, unspecified	0		2	0.7%
100.999	*significant cataracts (summary)*	*0*		*11*	*3.9%*
VITREOUS					
110.320	vitreal degeneration	0		6	2.1%
RETINA					
120.170	retinal dysplasia, folds	0		1	0.4%
120.180	retinal dysplasia, geographic	1	1.9%	0	
OTHER					
900.000	other, unspecified	3	5.8%	0	
900.100	other, not inherited	0		11	3.9%
NORMAL					
0.000	normal globe	49	94.2%	215	76.8%

BEDLINGTON TERRIER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Distichiasis	Not defined	1	Breeder option
B.	Imperforate lacrimal punctum	Not defined	1, 2	Breeder option
C.	Persistent pupillary membranes - iris to iris	Not defined	3, 4	Breeder option
D.	Cataract	Not defined	1	
E.	Retinal dysplasia - geographic - detached	Presumed autosomal recessive	1, 5, 6	NO

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded. Breeding discretion is advised.

B. Imperforate lacrimal punctum

A developmental anomaly resulting in failure of opening of the lacrimal duct located at the medial lid margins. The lower punctum is more frequently affected. This defect usually results in epiphora, an overflow of tears onto the face.

C. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

D. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

E. Retinal dysplasia - geographic, detached

Abnormal development of the retina present at birth.

Retinal dysplasia - geographic: Any irregularly shaped area of abnormal retinal development containing both areas of thinning and areas of elevation representing folds and retinal disorganization.

Retinal dysplasia - detached: Severe retinal disorganization associated with separation (detachment) of the retina.

These two forms are associated with vision impairment or blindness. Retinal dysplasia is known to be inherited in many breeds. The genetic relationship among the three forms of retinal dysplasia is not known for all breeds.

In the Bedlington Terrier, studies have indicated an autosomal recessive mode of inheritance for this form of retinal dysplasia. Affected animals are generally blind at birth due to complete retinal detachment and disorganization. Cataracts may also be seen with this condition.

References

1. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

2. Barnett KC. Imperforate and micro-lachrymal puncta in the dog. *J Small Anim Pract*. 1979 Aug;20:481-490.

3. ACVO Genetics Committee, 2000-2002 and/or Data from CERF All-Breeds Report, 2000-2002.

4. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

5. Rubin LF. Heredity of retinal dysplasia in the Bedlington terrier. *J Am Vet Med Assoc*. 1968;152:260.

6. Rubin LF. Hereditary retinal detachment in Bedlington terriers. *Vet Med Small Anim Clin*. 1963;3:387.

OCULAR DISORDERS REPORT
BEDLINGTON TERRIER

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2013 1445 #	%	2014-2018 314 #	%
GLOBE						
0.110	microphthalmia		4	0.3%	1	0.3%
EYELIDS						
20.140	ectopic cilia		2	0.1%	0	
21.000	entropion, unspecified		2	0.1%	0	
25.110	distichiasis		111	7.7%	25	8.0%
NASOLACRIMAL						
32.110	imperforate lower nasolacrimal punctum		6	0.4%	9	2.9%
NICTITANS						
52.110	prolapsed gland of the third eyelid		1	0.1%	0	
CORNEA						
70.220	pigmentary keratitis		1	0.1%	0	
70.700	corneal dystrophy		7	0.5%	0	
UVEA						
93.710	persistent pupillary membranes, iris to iris		109	7.5%	42	13.4%
93.720	persistent pupillary membranes, iris to lens		2	0.1%	0	
93.730	persistent pupillary membranes, iris to cornea		5	0.3%	0	
93.740	persistent pupillary membranes, iris sheets		3	0.2%	0	
93.760	persistent pupillary membranes, endothelial opacity/no strands		1	0.1%	0	
LENS						
100.200	cataract, unspecified		13	0.9%	0	
100.210	cataract. suspect not inherited/significance unknown		92	6.4%	39	12.4%
100.301	punctate cataract, anterior cortex		7	0.5%	3	1.0%
100.302	punctate cataract, posterior cortex		3	0.2%	1	0.3%
100.303	punctate cataract, equatorial cortex		7	0.5%	3	1.0%
100.304	punctate cataract, anterior sutures		2	0.1%	0	
100.305	punctate cataract, posterior sutures		11	0.8%	6	1.9%
100.307	punctate cataract, capsular		2	0.1%	2	0.6%
100.311	incipient cataract, anterior cortex		37	2.6%	2	0.6%
100.312	incipient cataract, posterior cortex		18	1.2%	0	
100.313	incipient cataract, equatorial cortex		31	2.1%	0	
100.314	incipient cataract, anterior sutures		4	0.3%	0	
100.315	incipient cataract, posterior sutures		7	0.5%	2	0.6%
100.316	incipient cataract, nucleus		3	0.2%	0	
100.317	incipient cataract, capsular		1	0.1%	0	
100.321	incomplete cataract, anterior cortex		0		1	0.3%
100.322	incomplete cataract, posterior cortex		0		1	0.3%
100.328	posterior suture tip opacities		1	0.1%	5	1.6%
100.330	generalized/complete cataract		14	1.0%	2	0.6%
100.375	subluxation/luxation, unspecified		1	0.1%	0	
100.999	*significant cataracts (summary)*		*160*	*11.1%*	*23*	*7.3%*

	1991-2013		2014-2018	
VITREOUS				
110.320 vitreal degeneration	5	0.3%	3	1.0%
RETINA				
120.170 retinal dysplasia, folds	6	0.4%	4	1.3%
120.190 retinal dysplasia, detached	1	0.1%	0	
120.310 generalized progressive retinal atrophy (PRA)	3	0.2%	0	
120.910 retinal detachment without dialysis	1	0.1%	0	
120.960 retinopathy	1	0.1%	0	
OPTIC NERVE				
130.120 optic nerve hypoplasia	1	0.1%	0	
130.150 optic disc coloboma	5	0.3%	0	
OTHER				
900.000 other, unspecified	13	0.9%	0	
900.100 other, not inherited	35	2.4%	17	5.4%
900.110 other. suspect not inherited/significance unknown	6	0.4%	1	0.3%
NORMAL				
0.000 normal globe	1099	76.1%	190	60.5%

BELGIAN LAEKENOIS

There are 4 varieties of Belgian Shepherd- the Groenendael, Laekenois, Malinois and Tervuren. In Europe these varieties may be interbred and are not considered genetically distinct, thus it is likely that the same genetic diseases exist in all four. In the United States the Groenendael (known as the Belgian Sheepdog), Malinois, Tervuren and Laekenois are recognized as separate breeds.

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Distichiasis	Not defined	1	Breeder option

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Belgian Laekenois breed. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 2007 and/or Data from CERF All-Breeds Report, 2002-2006.

OCULAR DISORDERS REPORT
BELGIAN LAEKENOIS

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2013 135 #	%	2014-2018 54 #	%
EYELIDS						
25.110	distichiasis		5	3.7%	0	
NICTITANS						
52.110	prolapsed gland of the third eyelid		0		2	3.7%
CORNEA						
70.700	corneal dystrophy		1	0.7%	0	
UVEA						
93.710	persistent pupillary membranes, iris to iris		1	0.7%	1	1.9%
93.750	persistent pupillary membranes, lens pigment foci/no strands		0		1	1.9%
LENS						
100.210	cataract. suspect not inherited/significance unknown		13	9.6%	4	7.4%
100.311	incipient cataract, anterior cortex		0		1	1.9%
100.999	*significant cataracts (summary)*		*0*		*1*	*1.9%*
VITREOUS						
110.320	vitreal degeneration		5	3.7%	0	
RETINA						
120.170	retinal dysplasia, folds		6	4.4%	0	
120.310	generalized progressive retinal atrophy (PRA)		0		1	1.9%
OTHER						
900.000	other, unspecified		4	3.0%	0	
900.100	other, not inherited		4	3.0%	2	3.7%
NORMAL						
0.000	normal globe		111	82.2%	45	83.3%

BELGIAN MALINOIS

There are 4 varieties of Belgian Shepherd- the Groenendael, Laekenois, Malinois and Tervuren. In Europe these varieties may be interbred and are not considered genetically distinct, thus it is likely that the same genetic diseases exist in all four. In the United States the Groenendael (known as the Belgian Sheepdog), Malinois, Tervuren and Laekenois are recognized as separate breeds.

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Chronic superficial keratitis/pannus	Not defined	1	NO
B.	Persistent pupillary membranes - iris to iris	Not defined	2	Breeder option
C.	Cataract	Not defined	3	NO
D.	Vitreous degeneration	Not defined	4	Breeder Option
E.	Retinal dysplasia - folds	Not defined	3	Breeder option
F.	Retinal atrophy - generalized/retinopathy	Not defined	2, 5	NO

Description and Comments

A. Chronic superficial keratitis/pannus

A bilateral inflammatory disease of the cornea which usually starts as a grayish haze to the ventral or ventrolateral cornea, followed by the formation of a vascularized subepithelial growth that begins to spread toward the central cornea; pigmentation follows the vascularization. If severe, vision impairment occurs. Pannus may be associated with plasma cell infiltration of the nictitans.

B. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

C. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

In the Belgian Malinois, cataract most often occurs as a non-progressive, triangular opacity in the posterior cortex.

D. Vitreous degeneration

Liquefaction of the vitreous gel which may predispose to retinal detachment.

E. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

F. Retinal degeneration – generalized/Retinopathy

A unilateral or bilateral retinal disease which can be progressive. When bilateral, the ophthalmoscopic lesions are sometimes asymmetrical, particularly in the early stages of the disease. Fundus examination shows initially single or multiple focal retinal lesions that appear active (local infiltrative inflammation or granulation) or inactive. The lesions can progress resulting in widespread retinal atrophy. The end-stage ophthalmoscopic lesions vary and may appear indistinguishable from PRA, or may be more characteristic of an inflammatory retinopathy. The asymmetry of the fundus abnormalities and the presence of inflammatory lesions in the retina and choroid help to differentiate this disorder from PRA. The mode of inheritance of this disease is not known; however, studies of different families suggest that it is possibly inherited.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Belgian Malinois breed. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 2000-2002 and/or Data from CERF All-Breeds Report, 2000-2002.

2. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

3. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

4. ACVO Genetics Committee, 2009 and/or Data from CERF All-Breeds Report, 2008.

5. ACVO Genetics Committee, 2002-2003 and/or Data from CERF All-Breeds Report, 2002-2003.

OCULAR DISORDERS REPORT
BELGIAN MALINOIS

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2013 2317 #	%	2014-2018 786 #	%
GLOBE						
0.110	microphthalmia		1	0.0%	1	0.1%
EYELIDS						
21.000	entropion, unspecified		0		1	0.1%
22.000	ectropion, unspecified		1	0.0%	0	
25.110	distichiasis		2	0.1%	1	0.1%
NICTITANS						
50.210	pannus of third eyelid		0		1	0.1%
51.100	third eyelid cartilage anomaly		0		3	0.4%
CORNEA						
70.210	corneal pannus		10	0.4%	1	0.1%
70.220	pigmentary keratitis		1	0.0%	0	
70.700	corneal dystrophy		14	0.6%	3	0.4%
70.730	corneal endothelial degeneration		2	0.1%	0	
UVEA						
93.710	persistent pupillary membranes, iris to iris		28	1.2%	13	1.7%
93.750	persistent pupillary membranes, lens pigment foci/no strands		0		1	0.1%
93.760	persistent pupillary membranes, endothelial opacity/no strands		1	0.0%	0	
93.999	uveal cysts		9	0.4%	1	0.1%
LENS						
100.200	cataract, unspecified		3	0.1%	0	
100.210	cataract. suspect not inherited/significance unknown		88	3.8%	58	7.4%
100.301	punctate cataract, anterior cortex		11	0.5%	4	0.5%
100.302	punctate cataract, posterior cortex		7	0.3%	2	0.3%
100.303	punctate cataract, equatorial cortex		1	0.0%	0	
100.304	punctate cataract, anterior sutures		2	0.1%	0	
100.305	punctate cataract, posterior sutures		10	0.4%	5	0.6%
100.306	punctate cataract, nucleus		2	0.1%	0	
100.307	punctate cataract, capsular		1	0.0%	1	0.1%
100.311	incipient cataract, anterior cortex		12	0.5%	4	0.5%
100.312	incipient cataract, posterior cortex		20	0.9%	6	0.8%
100.313	incipient cataract, equatorial cortex		6	0.3%	0	
100.314	incipient cataract, anterior sutures		7	0.3%	0	
100.315	incipient cataract, posterior sutures		8	0.3%	1	0.1%
100.316	incipient cataract, nucleus		14	0.6%	1	0.1%
100.317	incipient cataract, capsular		1	0.0%	2	0.3%
100.324	incomplete cataract, anterior sutures		0		1	0.1%
100.328	posterior suture tip opacities		0		10	1.3%
100.330	generalized/complete cataract		5	0.2%	1	0.1%
100.375	subluxation/luxation, unspecified		1	0.0%	0	
100.999	*significant cataracts (summary)*		*110*	*4.7%*	*28*	*3.6%*
VITREOUS						
110.120	persistent hyaloid artery/remnant		1	0.0%	1	0.1%
110.135	PHPV/PTVL		2	0.1%	0	

VITREOUS CONTINUED		1991-2013		2014-2018	
110.320	vitreal degeneration	17	0.7%	6	0.8%
FUNDUS					
97.120	coloboma	1	0.0%	0	
RETINA					
120.170	retinal dysplasia, folds	22	0.9%	4	0.5%
120.180	retinal dysplasia, geographic	5	0.2%	2	0.3%
120.190	retinal dysplasia, detached	1	0.0%	0	
120.310	generalized progressive retinal atrophy (PRA)	13	0.6%	1	0.1%
120.910	retinal detachment without dialysis	4	0.2%	0	
120.920	retinal detachment with dialysis	0		6	0.8%
120.960	retinopathy	1	0.0%	1	0.1%
OPTIC NERVE					
130.150	optic disc coloboma	1	0.0%	2	0.3%
OTHER					
900.000	other, unspecified	21	0.9%	0	
900.100	other, not inherited	78	3.4%	42	5.3%
900.110	other. suspect not inherited/significance unknown	9	0.4%	0	
NORMAL					
0.000	normal globe	2075	89.6%	641	81.6%

BELGIAN SHEEPDOG

(BELGIAN SHEPHERD-GROENENDAEL)

There are 4 varieties of Belgian Shepherd- the Groenendael, Laekenois, Malinois and Tervuren. In Europe these varieties may be interbred and are not considered genetically distinct, thus it is likely that the same genetic diseases exist in all four. In the United States the Groenendael (known as the Belgian Sheepdog), Malinois, Tervuren and Laekenois are recognized as separate breeds.

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Corneal dystrophy - epithelial/stromal	Not defined	1	Breeder option
B.	Chronic superficial keratitis/pannus	Not defined	1	NO
C.	Persistent pupillary membranes - iris to iris	Not defined	1, 2	Breeder option
D.	Cataract	Not defined	1	NO
E.	Retinal atrophy - generalized	Presumed autosomal recessive	1, 3	NO
F.	Retinal dysplasia - folds	Not defined	2, 4	Breeder option
G.	Micropapilla	Not defined	1	Breeder option
H.	Achiasmic optic nerves with nystagmus	Autosomal recessive	5	NO

Description and Comments

A. Corneal dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

B. Chronic superficial keratitis/pannus

A bilateral inflammatory disease of the cornea which usually starts as a grayish haze to the ventral or ventrolateral cornea, followed by the formation of a vascularized subepithelial growth that begins to spread toward the central cornea; pigmentation follows the vascularization. If severe, vision impairment occurs. Pannus may be associated with plasma cell infiltration of the nictitans.

C. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

D. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

In the Belgian Sheepdog, cataract most often occurs as a non-progressive, triangular opacity in the posterior cortex.

E. Retinal atrophy - generalized

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. Limited breeding studies in the Belgian Sheepdog suggest an autosomal recessive mode of inheritance.

F. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

G. Micropapilla

Micropapilla refers to a small optic disc which is not associated with vision impairment. Optic nerve hypoplasia refers to a congenital defect of the optic nerve which causes blindness and abnormal pupil response in the affected eye. It may be difficult to differentiate between micropapilla and optic nerve hypoplasia on a routine (dilated) screening ophthalmoscopic exam.

H. Achiasmatic optic nerves with nystagmus

Achiasmatic optic nerves with nystagmus have been described in a small family of black Belgian Sheepdogs. Congenital nystagmus is the clinical sign most commonly noted. All retinal ganglion cell axons extend directly into the ipsilateral optic disc with no chiasmal decussation. No optic nerve hypoplasia/micropapilla was noted in the animals studied and

reported.

References

1. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

2. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

3. Miller TR. Generalized retinopathy in the Belgian shepherds. *Invest Ophthalmol Vis Sci*. 1986;27 (Suppl):310.

4. ACVO Genetics Committee, 2002-2003 and/or Data from CERF All-Breeds Report, 2002-2003.

5. Hogan D and Williams RW. Analysis of the retinas and optic nerves of achiasmatic Belgian sheepdogs. *The Journal of comparative neurology.* 1995 Feb 13;352:367-380.

OCULAR DISORDERS REPORT
BELGIAN SHEEPDOG

Diagnostic Name	TOTAL DOGS EXAMINED	1991-2013 5266 #	%	2014-2018 1007 #	%
GLOBE					
10.000	glaucoma	1	0.0%	0	
EYELIDS					
22.000	ectropion, unspecified	1	0.0%	0	
25.110	distichiasis	11	0.2%	2	0.2%
NICTITANS					
50.210	pannus of third eyelid	1	0.0%	7	0.7%
51.100	third eyelid cartilage anomaly	1	0.0%	2	0.2%
CORNEA					
70.210	corneal pannus	42	0.8%	20	2.0%
70.220	pigmentary keratitis	3	0.1%	1	0.1%
70.700	corneal dystrophy	30	0.6%	4	0.4%
70.730	corneal endothelial degeneration	1	0.0%	0	
UVEA					
93.140	corneal endothelial pigment without PPM	1	0.0%	0	
93.710	persistent pupillary membranes, iris to iris	373	7.1%	96	9.5%
93.720	persistent pupillary membranes, iris to lens	3	0.1%	0	
93.730	persistent pupillary membranes, iris to cornea	3	0.1%	3	0.3%
93.740	persistent pupillary membranes, iris sheets	5	0.1%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	6	0.1%	9	0.9%
93.760	persistent pupillary membranes, endothelial opacity/no strands	3	0.1%	0	
93.999	uveal cysts	3	0.1%	1	0.1%
97.150	chorioretinal coloboma, congenital	0		1	0.1%
LENS					
100.200	cataract, unspecified	13	0.2%	0	
100.210	cataract. suspect not inherited/significance unknown	183	3.5%	38	3.8%
100.301	punctate cataract, anterior cortex	13	0.2%	8	0.8%
100.302	punctate cataract, posterior cortex	39	0.7%	1	0.1%
100.303	punctate cataract, equatorial cortex	5	0.1%	0	
100.304	punctate cataract, anterior sutures	3	0.1%	0	
100.305	punctate cataract, posterior sutures	13	0.2%	4	0.4%
100.306	punctate cataract, nucleus	4	0.1%	1	0.1%
100.307	punctate cataract, capsular	5	0.1%	6	0.6%
100.311	incipient cataract, anterior cortex	24	0.5%	2	0.2%
100.312	incipient cataract, posterior cortex	53	1.0%	9	0.9%
100.313	incipient cataract, equatorial cortex	12	0.2%	1	0.1%
100.314	incipient cataract, anterior sutures	4	0.1%	0	
100.315	incipient cataract, posterior sutures	13	0.2%	1	0.1%
100.316	incipient cataract, nucleus	11	0.2%	0	
100.317	incipient cataract, capsular	6	0.1%	0	
100.321	incomplete cataract, anterior cortex	0		1	0.1%
100.322	incomplete cataract, posterior cortex	0		1	0.1%
100.325	incomplete cataract, posterior sutures	0		1	0.1%
100.328	posterior suture tip opacities	3	0.1%	6	0.6%
100.330	generalized/complete cataract	7	0.1%	0	

LENS CONTINUED		1991-2013		2014-2018	
100.375	subluxation/luxation, unspecified	0		1	0.1%
100.999	*significant cataracts (summary)*	*225*	*4.3%*	*36*	*3.6%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	3	0.1%	0	
110.320	vitreal degeneration	3	0.1%	2	0.2%
FUNDUS					
97.120	coloboma	2	0.0%	0	
RETINA					
120.170	retinal dysplasia, folds	36	0.7%	2	0.2%
120.180	retinal dysplasia, geographic	5	0.1%	2	0.2%
120.310	generalized progressive retinal atrophy (PRA)	4	0.1%	0	
120.910	retinal detachment without dialysis	2	0.0%	0	
OPTIC NERVE					
130.110	micropapilla	24	0.5%	6	0.6%
130.120	optic nerve hypoplasia	12	0.2%	2	0.2%
130.150	optic disc coloboma	5	0.1%	0	
OTHER					
900.000	other, unspecified	54	1.0%	0	
900.100	other, not inherited	126	2.4%	42	4.2%
900.110	other. suspect not inherited/significance unknown	19	0.4%	1	0.1%
NORMAL					
0.000	normal globe	4552	86.4%	758	75.3%

BELGIAN TERVUREN

There are 4 varieties of Belgian Shepherd- the Groenendael, Laekenois, Malinois and Tervuren. In Europe these varieties may be interbred and are not considered genetically distinct, thus it is likely that the same genetic diseases exist in all four. In the United States the Groenendael (known as the Belgian Sheepdog), Malinois, Tervuren and Laekenois are recognized as separate breeds.

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Distichiasis	Not defined	1	Breeder option
B.	Chronic superficial keratitis/pannus	Not defined	2, 3	NO
C.	Persistent pupillary membranes - iris to iris	Not defined	1, 2	Breeder option
D.	Cataract	Not defined	2	NO
E.	Retinal atrophy - generalized	Presumed autosomal recessive	2	NO
F.	Retinal dysplasia - folds	Not defined	1, 4	Breeder option
G.	Retinal dysplasia - geographic	Not defined	1	NO
H.	Micropapilla	Not defined	2	Breeder option

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Chronic superficial keratitis/pannus

A bilateral inflammatory disease of the cornea which usually starts as a grayish haze to the ventral or ventrolateral cornea, followed by the formation of a vascularized subepithelial

growth that begins to spread toward the central cornea; pigmentation follows the vascularization. If severe, vision impairment occurs. Pannus may be associated with plasma cell infiltration of the nictitans.

C. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

D. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

In the Belgian Tervuren, cataract most often occurs as a non-progressive, triangular opacity in the posterior cortex.

E. Retinal atrophy - generalized

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. Except for X-linked PRA in the Siberian Husky, in all breeds studied to date, PRA is inherited as an autosomal recessive trait.

In the Belgian Tervuren concern has been high regarding PRA. Recently, an entire litter from known carrier background were examined with 4 of 6 individuals affected. Age of clinical onset appears to be about 4-5 yrs.

F. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

G. Retinal dysplasia - geographic

Abnormal development of the retina present at birth. Any irregularly shaped area of abnormal retinal development containing both areas of thinning and areas of elevation representing folds and retinal disorganization.

H. Micropapilla

Micropapilla refers to a small optic disc which is not associated with vision impairment. Optic nerve hypoplasia refers to a congenital defect of the optic nerve which causes blindness and abnormal pupil response in the affected eye. It may be difficult to differentiate between micropapilla and optic nerve hypoplasia on a routine (dilated) screening ophthalmoscopic exam.

References

1. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

2. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

3. Chavkin MJ, Roberts SM, Salman MD, et al. Risk factors for development of chronic superficial keratitis in dogs. *J Am Vet Med Assoc*. 1994 May 15;204:1630-1634.

4. ACVO Genetics Committee, 2002-2003 and/or Data from CERF All-Breeds Report, 2002-2003.

OCULAR DISORDERS REPORT
BELGIAN TERVUREN

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2013 11690 #	%	2014-2018 2060 #	%
GLOBE						
0.110	microphthalmia		4	0.0%	0	
10.000	glaucoma		1	0.0%	0	
EYELIDS						
21.000	entropion, unspecified		3	0.0%	0	
25.110	distichiasis		114	1.0%	6	0.3%
NASOLACRIMAL						
40.910	keratoconjunctivitis sicca		2	0.0%	0	
NICTITANS						
50.210	pannus of third eyelid		3	0.0%	5	0.2%
51.100	third eyelid cartilage anomaly		12	0.1%	9	0.4%
52.110	prolapsed gland of the third eyelid		1	0.0%	0	
CORNEA						
70.210	corneal pannus		70	0.6%	34	1.7%
70.220	pigmentary keratitis		4	0.0%	5	0.2%
70.700	corneal dystrophy		63	0.5%	13	0.6%
70.730	corneal endothelial degeneration		7	0.1%	0	
UVEA						
93.150	iris coloboma		2	0.0%	0	
93.710	persistent pupillary membranes, iris to iris		839	7.2%	245	11.9%
93.720	persistent pupillary membranes, iris to lens		12	0.1%	1	0.0%
93.730	persistent pupillary membranes, iris to cornea		5	0.0%	0	
93.740	persistent pupillary membranes, iris sheets		14	0.1%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands		16	0.1%	37	1.8%
93.810	uveal melanoma		0		2	0.1%
93.999	uveal cysts		16	0.1%	2	0.1%
LENS						
100.200	cataract, unspecified		66	0.6%	0	
100.210	cataract. suspect not inherited/significance unknown		583	5.0%	165	8.0%
100.301	punctate cataract, anterior cortex		55	0.5%	14	0.7%
100.302	punctate cataract, posterior cortex		86	0.7%	8	0.4%
100.303	punctate cataract, equatorial cortex		17	0.1%	0	
100.304	punctate cataract, anterior sutures		3	0.0%	2	0.1%
100.305	punctate cataract, posterior sutures		29	0.2%	5	0.2%
100.306	punctate cataract, nucleus		3	0.0%	2	0.1%
100.307	punctate cataract, capsular		16	0.1%	9	0.4%
100.311	incipient cataract, anterior cortex		52	0.4%	10	0.5%
100.312	incipient cataract, posterior cortex		118	1.0%	31	1.5%
100.313	incipient cataract, equatorial cortex		18	0.2%	3	0.1%
100.314	incipient cataract, anterior sutures		6	0.1%	1	0.0%
100.315	incipient cataract, posterior sutures		24	0.2%	5	0.2%
100.316	incipient cataract, nucleus		2	0.0%	3	0.1%
100.317	incipient cataract, capsular		13	0.1%	3	0.1%
100.322	incomplete cataract, posterior cortex		0		2	0.1%
100.328	posterior suture tip opacities		3	0.0%	15	0.7%

LENS CONTINUED		1991-2013		2014-2018	
100.330	generalized/complete cataract	12	0.1%	0	
100.340	resorbing/hypermature cataract	0		1	0.0%
100.375	subluxation/luxation, unspecified	1	0.0%	0	
100.999	*significant cataracts (summary)*	*520*	*4.4%*	*99*	*4.8%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	6	0.1%	7	0.3%
110.135	PHPV/PTVL	2	0.0%	1	0.0%
110.320	vitreal degeneration	27	0.2%	15	0.7%
FUNDUS					
97.110	choroidal hypoplasia	1	0.0%	0	
97.120	coloboma	2	0.0%	0	
RETINA					
120.170	retinal dysplasia, folds	40	0.3%	3	0.1%
120.180	retinal dysplasia, geographic	9	0.1%	4	0.2%
120.310	generalized progressive retinal atrophy (PRA)	23	0.2%	0	
120.910	retinal detachment without dialysis	1	0.0%	0	
120.920	retinal detachment with dialysis	0		1	0.0%
120.960	retinopathy	2	0.0%	5	0.2%
OPTIC NERVE					
130.110	micropapilla	103	0.9%	33	1.6%
130.120	optic nerve hypoplasia	89	0.8%	6	0.3%
130.150	optic disc coloboma	4	0.0%	0	
OTHER					
900.000	other, unspecified	107	0.9%	0	
900.100	other, not inherited	283	2.4%	147	7.1%
900.110	other. suspect not inherited/significance unknown	47	0.4%	3	0.1%
NORMAL					
0.000	normal globe	9869	84.4%	1402	68.1%

OCULAR DISORDERS REPORT
BERGAMASCO

There are insufficient breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the BERGAMASCO breed. Therefore, there are no conditions listed with breeding advice.

OCULAR DISORDERS REPORT
BERGAMASCO

Diagnostic Name	TOTAL DOGS EXAMINED	1991-2013 2 #	 %	2014-2018 6 #	 %
CORNEA					
70.700	corneal dystrophy	0		1	16.7%
NORMAL					
0.000	normal globe	2	100.0%	5	83.3%

OCULAR DISORDERS REPORT
BERGER DES PYRENEES

There are insufficient breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the BERGER DES PYRENEES breed. Therefore, there are no conditions listed with breeding advice.

OCULAR DISORDERS REPORT
BERGER DES PYRENEES

Diagnostic Name	TOTAL DOGS EXAMINED	1991-2013 0 #	%	2014-2018 3 #	%
OTHER					
900.100 other, not inherited		0		1	33.3%
NORMAL					
0.000 normal globe		0		2	66.7%

BERGER PICARD
(PICARDY SHEPHERD, PICARDIE)

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Distichiasis	Not defined	1	Breeder option
B.	Nictitans cartilage anomaly/eversion	Not defined	2	Breeder option
C.	Corneal dystrophy - epithelial/stromal	Not defined	2	Breeder option
D.	Persistent pupillary membranes			
	- iris to iris	Not defined	1	Breeder option
	- all other forms	Not defined	1	NO
E.	Cataract	Not defined	1	NO
F.	Retinal atrophy - generalized	Not defined	2	NO
G.	Retinal dysplasia - folds	Not defined	3	Breeder option
H.	Retinal dysplasia - geographic/ detached	Autosomal recessive	4	NO
I.	Retinopathy	Not defined	2	Breeder option

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Nictitans cartilage anomaly/eversion

A scroll-like curling of the cartilage of the third eyelid, usually everting the margin. This condition may occur in one or both eyes and may cause mild ocular irritation.

C. Corneal dystrophy- epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

D. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

E. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

F. Retinal atrophy - generalized

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality is also known as progressive retinal atrophy or PRA, and may be detected by electroretinogram (not part of a routine eye screening examination) before there are detectable funduscopic changes seen by ophthalmoscopy. There are multiple genetic types of PRA including the rod cone dysplasias described elsewhere.

G. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

H. Retinal dysplasia - geographic, detached

Abnormal development of the retina present at birth.

Retinal dysplasia - geographic: Any irregularly shaped area of abnormal retinal development containing both areas of thinning and areas of elevation representing folds and retinal disorganization.

Retinal dysplasia - detached: Severe retinal disorganization associated with separation (detachment) of the retina.

These two forms are associated with vision impairment or blindness. Retinal dysplasia is known to be inherited in many breeds. The genetic relationship among the three forms of

retinal dysplasia is not known for all breeds.

I. Retinopathy

A lesion similar to canine multifocal retinopathy has been noted in the Berger Picard. The lesions initially appear as multifocal sub-retinal fluid elevations that over time may become hyper-reflective lesions.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Berger Picard breed. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 2009 and/or Data from CERF All-Breeds Report, 2008.

2. ACVO Genetics Committee, 2013-2014 and Data from OFA All-Breeds Report, 2013-2014.

3. ACVO Genetics Committee, 2011 and/or Data from CERF All-Breeds Report, 2010.

4. ACVO Genetics Committee, 2017 and/or Data from CERF All-Breeds Report, 2016.

OCULAR DISORDERS REPORT
BERGER PICARD

		1991-2013 460		2014-2018 844	
	TOTAL DOGS EXAMINED				
Diagnostic Name		**#**	**%**	**#**	**%**
GLOBE					
0.110	microphthalmia	0		1	0.1%
EYELIDS					
25.110	distichiasis	39	8.5%	59	7.0%
NASOLACRIMAL					
40.910	keratoconjunctivitis sicca	0		2	0.2%
NICTITANS					
51.100	third eyelid cartilage anomaly	4	0.9%	23	2.7%
52.110	prolapsed gland of the third eyelid	0		1	0.1%
CORNEA					
70.700	corneal dystrophy	5	1.1%	20	2.4%
UVEA					
90.250	pigmentary uveitis	1	0.2%	0	
93.110	iris hypoplasia	0		1	0.1%
93.150	iris coloboma	0		1	0.1%
93.710	persistent pupillary membranes, iris to iris	139	30.2%	133	15.8%
93.730	persistent pupillary membranes, iris to cornea	0		1	0.1%
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		1	0.1%
93.760	persistent pupillary membranes, endothelial opacity/no strands	1	0.2%	0	
93.810	uveal melanoma	1	0.2%	0	
93.999	uveal cysts	0		7	0.8%
LENS					
100.210	cataract. suspect not inherited/significance unknown	62	13.5%	86	10.2%
100.301	punctate cataract, anterior cortex	0		3	0.4%
100.302	punctate cataract, posterior cortex	0		4	0.5%
100.304	punctate cataract, anterior sutures	0		2	0.2%
100.305	punctate cataract, posterior sutures	10	2.2%	18	2.1%
100.307	punctate cataract, capsular	1	0.2%	7	0.8%
100.311	incipient cataract, anterior cortex	1	0.2%	3	0.4%
100.312	incipient cataract, posterior cortex	1	0.2%	10	1.2%
100.313	incipient cataract, equatorial cortex	0		1	0.1%
100.314	incipient cataract, anterior sutures	1	0.2%	0	
100.315	incipient cataract, posterior sutures	5	1.1%	9	1.1%
100.316	incipient cataract, nucleus	0		2	0.2%
100.321	incomplete cataract, anterior cortex	0		2	0.2%
100.322	incomplete cataract, posterior cortex	1	0.2%	4	0.5%
100.325	incomplete cataract, posterior sutures	0		1	0.1%
100.326	incomplete cataract, nucleus	0		1	0.1%
100.328	posterior suture tip opacities	10	2.2%	73	8.6%
100.330	generalized/complete cataract	0		1	0.1%
100.999	*significant cataracts (summary)*	*20*	*4.3%*	*68*	*8.1%*

		1991-2013		2014-2018	
VITREOUS					
110.120	persistent hyaloid artery/remnant	0		9	1.1%
110.320	vitreal degeneration	1	0.2%	0	
RETINA					
120.170	retinal dysplasia, folds	110	23.9%	117	13.9%
120.180	retinal dysplasia, geographic	4	0.9%	7	0.8%
120.190	retinal dysplasia, detached	0		1	0.1%
120.310	generalized progressive retinal atrophy (PRA)	12	2.6%	15	1.8%
120.960	retinopathy	15	3.3%	42	5.0%
OPTIC NERVE					
130.110	micropapilla	0		1	0.1%
130.150	optic disc coloboma	1	0.2%	0	
OTHER					
900.000	other, unspecified	25	5.4%	0	
900.100	other, not inherited	8	1.7%	51	6.0%
900.110	other. suspect not inherited/significance unknown	6	1.3%	13	1.5%
NORMAL					
0.000	normal globe	207	45.0%	393	46.6%

BERNESE MOUNTAIN DOG

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Entropion	Not defined	1	Breeder option
B.	Ectropion	Not defined	2, 3	Breeder option
C.	Distichiasis	Not defined	4	Breeder option
D.	Persistent pupillary membranes - iris to iris	Not defined	3	Breeder option
E.	Cataract	Not defined	3, 4	NO
F.	Retinal atrophy - generalized	Not defined	1, 5	NO
G.	Systemic histiocytosis	Not defined	6-10	NO

Description and Comments

A. Entropion

A conformational defect resulting in an "in-rolling" of one or both of the eyelids which may cause ocular irritation. It is likely that entropion is influenced by several genes (polygenic) defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

B. Ectropion

A conformational defect resulting in eversion of the eyelid(s), which may cause ocular irritation due to exposure. It is likely that ectropion is influenced by several genes (polygenic) defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

C. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

D. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

E. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

F. Retinal atrophy - generalized

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. Except for X-linked PRA in the Siberian Husky, in all breeds studied to date, PRA is inherited as an autosomal recessive trait.

In the Bernese Mountain Dog, one French report found the early onset retinopathy to be functionally and electroretinographically similar to the congenital stationary night blindness (retinal dystrophy) seen in the Briard.

G. Systemic histiocytosis

An inflammatory, non-neoplastic disease arising from activated dermal Langerhans cells with an absence of infectious agents that responds to immunoregulatory drugs suggesting immune dysregulatory mechanisms. Seen as conjunctivitis, episcleritis, anterior and posterior uveitis, retinal detachments, and glaucoma. Malignant histiocytosis is a malignant histiocytic disease that is familial in the Bernese Mountain Dog with a polygenic mode of inheritance that represents up to 25% of all tumors in the breed.

References

1. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

2. ACVO Genetics Committee, 2002-2003 and/or Data from CERF All-Breeds Report, 2002-2003.

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6. Cherlie PH, Smedes SL and Feltz T. Ocular manifestations of systemic histiocytosis in a dog. *J Am Vet Med Assoc*. 1992;201:1229.

7. Moore PF and Rosin A. Malignant histiocytosis of Bernese mountain dogs. *Vet Pathol*. 1986 Jan;23:1-10.

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10. Rosin A, P Moore and Dubielzig R. Malignant histiocytosis in Bernese Mountain dogs. *J Am Vet Med Assoc*. 1986 May 1;188:1041-1045.

OCULAR DISORDERS REPORT
BERNESE MOUNTAIN DOG

Diagnostic Name		1991-2013 14505 TOTAL DOGS EXAMINED #	%	2014-2018 3605 #	%
GLOBE					
0.110	microphthalmia	7	0.0%	1	0.0%
10.000	glaucoma	1	0.0%	0	
EYELIDS					
20.160	macropalpebral fissure	25	0.2%	0	
21.000	entropion, unspecified	227	1.6%	40	1.1%
22.000	ectropion, unspecified	94	0.6%	23	0.6%
25.110	distichiasis	124	0.9%	52	1.4%
NASOLACRIMAL					
32.110	imperforate lower nasolacrimal punctum	0		1	0.0%
40.910	keratoconjunctivitis sicca	1	0.0%	0	
NICTITANS					
51.100	third eyelid cartilage anomaly	38	0.3%	5	0.1%
52.110	prolapsed gland of the third eyelid	1	0.0%	0	
CORNEA					
70.210	corneal pannus	2	0.0%	1	0.0%
70.700	corneal dystrophy	62	0.4%	6	0.2%
70.730	corneal endothelial degeneration	4	0.0%	0	
UVEA					
90.200	uveitis	1	0.0%	0	
93.110	iris hypoplasia	2	0.0%	0	
93.150	iris coloboma	9	0.1%	0	
93.710	persistent pupillary membranes, iris to iris	547	3.8%	143	4.0%
93.720	persistent pupillary membranes, iris to lens	14	0.1%	4	0.1%
93.730	persistent pupillary membranes, iris to cornea	6	0.0%	5	0.1%
93.740	persistent pupillary membranes, iris sheets	5	0.0%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	7	0.0%	24	0.7%
93.760	persistent pupillary membranes, endothelial opacity/no strands	7	0.0%	4	0.1%
93.810	uveal melanoma	1	0.0%	0	
93.999	uveal cysts	46	0.3%	11	0.3%
LENS					
100.200	cataract, unspecified	6	0.0%	0	
100.210	cataract. suspect not inherited/significance unknown	861	5.9%	199	5.5%
100.301	punctate cataract, anterior cortex	69	0.5%	23	0.6%
100.302	punctate cataract, posterior cortex	76	0.5%	15	0.4%
100.303	punctate cataract, equatorial cortex	38	0.3%	10	0.3%
100.304	punctate cataract, anterior sutures	12	0.1%	3	0.1%
100.305	punctate cataract, posterior sutures	27	0.2%	8	0.2%
100.306	punctate cataract, nucleus	15	0.1%	10	0.3%
100.307	punctate cataract, capsular	12	0.1%	11	0.3%
100.311	incipient cataract, anterior cortex	47	0.3%	15	0.4%
100.312	incipient cataract, posterior cortex	161	1.1%	23	0.6%
100.313	incipient cataract, equatorial cortex	95	0.7%	10	0.3%
100.314	incipient cataract, anterior sutures	8	0.1%	2	0.1%

LENS CONTINUED		1991-2013		2014-2018	
100.315	incipient cataract, posterior sutures	29	0.2%	1	0.0%
100.316	incipient cataract, nucleus	26	0.2%	8	0.2%
100.317	incipient cataract, capsular	42	0.3%	10	0.3%
100.321	incomplete cataract, anterior cortex	0		1	0.0%
100.322	incomplete cataract, posterior cortex	0		3	0.1%
100.323	incomplete cataract, equatorial cortex	0		2	0.1%
100.326	incomplete cataract, nucleus	1	0.0%	5	0.1%
100.327	incomplete cataract, capsular	0		3	0.1%
100.328	posterior suture tip opacities	0		8	0.2%
100.330	generalized/complete cataract	27	0.2%	2	0.1%
100.340	resorbing/hypermature cataract	0		2	0.1%
100.375	subluxation/luxation, unspecified	7	0.0%	2	0.1%
100.999	*significant cataracts (summary)*	*691*	*4.8%*	*167*	*4.6%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	20	0.1%	10	0.3%
110.135	PHPV/PTVL	8	0.1%	2	0.1%
110.320	vitreal degeneration	29	0.2%	1	0.0%
FUNDUS					
97.110	choroidal hypoplasia	1	0.0%	0	
RETINA					
120.170	retinal dysplasia, folds	32	0.2%	11	0.3%
120.180	retinal dysplasia, geographic	5	0.0%	4	0.1%
120.190	retinal dysplasia, detached	1	0.0%	2	0.1%
120.310	generalized progressive retinal atrophy (PRA)	51	0.4%	0	
120.400	retinal hemorrhage	2	0.0%	0	
120.910	retinal detachment without dialysis	3	0.0%	0	
120.920	retinal detachment with dialysis	0		1	0.0%
120.960	retinopathy	0		8	0.2%
OPTIC NERVE					
130.110	micropapilla	15	0.1%	11	0.3%
130.120	optic nerve hypoplasia	26	0.2%	6	0.2%
130.150	optic disc coloboma	20	0.1%	3	0.1%
OTHER					
900.000	other, unspecified	193	1.3%	0	
900.100	other, not inherited	495	3.4%	155	4.3%
900.110	other. suspect not inherited/significance unknown	49	0.3%	7	0.2%
NORMAL					
0.000	normal globe	12534	86.4%	2851	79.1%

BICHON FRISE

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Distichiasis	Not defined	1	Breeder option
B.	Corneal dystrophy - epithelial/stromal	Not defined	1	Breeder option
C.	Persistent pupillary membranes - iris to iris	Not defined	1, 2	Breeder option
D.	Cataract	Not defined	1, 3, 4	NO
E.	Vitreous degeneration	Not defined	5	Breeder option
F.	Retinal dysplasia - folds	Not defined	1	Breeder option

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Corneal dystrophy- epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

C. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

In the Bichon Frise, many of these strands bridge between the iris and cornea where they may be associated with corneal opacities and vision impairment.

D. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

The range in age of animals affected with cataracts in one study was 1-2 years to 9-10 years old, with the peak age of 3 years old. The cataracts involved all regions of the lens, but in age groups of 2-4 years old, the predominant regions affected were the posterior cortex, and the anterior and posterior cortices combined. The earliest abnormalities usually consisted of small punctate opacities in the paracentral posterior cortex, independent of the posterior lens sutures.

E. Vitreous degeneration

Liquefaction of the vitreous gel which may predispose to retinal detachment.

F. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

References

1. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

2. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

3. Gelatt KN, Wallace MR, Andrew SE, et al. Cataracts in the Bichon Frise. *Vet Ophthalmol*. 2003 Mar;6:3-9.

4. Schmidt GM and Vainisi SJ. Retrospective study of prophylactic random transscleral retinopexy in the Bichon Frise with cataract. *Vet Ophthalmol*. 2004 Sep-Oct;7:307-310.

5. ACVO Genetics Committee, 2008 and/or Data from CERF All-Breeds Report, 2003-2007.

OCULAR DISORDERS REPORT
BICHON FRISE

		1991-2013 9217		2014-2018 1590	
	TOTAL DOGS EXAMINED				
Diagnostic Name		**#**	**%**	**#**	**%**
GLOBE					
0.110	microphthalmia	2	0.0%	0	
EYELIDS					
20.140	ectopic cilia	2	0.0%	0	
21.000	entropion, unspecified	6	0.1%	2	0.1%
22.000	ectropion, unspecified	0		1	0.1%
25.110	distichiasis	314	3.4%	80	5.0%
NASOLACRIMAL					
32.110	imperforate lower nasolacrimal punctum	0		1	0.1%
40.910	keratoconjunctivitis sicca	2	0.0%	0	
NICTITANS					
51.100	third eyelid cartilage anomaly	1	0.0%	0	
52.110	prolapsed gland of the third eyelid	0		1	0.1%
CORNEA					
70.210	corneal pannus	2	0.0%	0	
70.220	pigmentary keratitis	2	0.0%	1	0.1%
70.700	corneal dystrophy	309	3.4%	71	4.5%
70.730	corneal endothelial degeneration	5	0.1%	2	0.1%
UVEA					
93.110	iris hypoplasia	2	0.0%	0	
93.140	corneal endothelial pigment without PPM	2	0.0%	0	
93.150	iris coloboma	4	0.0%	0	
93.710	persistent pupillary membranes, iris to iris	210	2.3%	54	3.4%
93.720	persistent pupillary membranes, iris to lens	13	0.1%	0	
93.730	persistent pupillary membranes, iris to cornea	30	0.3%	1	0.1%
93.740	persistent pupillary membranes, iris sheets	8	0.1%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		5	0.3%
93.760	persistent pupillary membranes, endothelial opacity/no strands	6	0.1%	4	0.3%
LENS					
100.200	cataract, unspecified	23	0.2%	0	
100.210	cataract. suspect not inherited/significance unknown	488	5.3%	96	6.0%
100.301	punctate cataract, anterior cortex	90	1.0%	12	0.8%
100.302	punctate cataract, posterior cortex	79	0.9%	9	0.6%
100.303	punctate cataract, equatorial cortex	11	0.1%	1	0.1%
100.304	punctate cataract, anterior sutures	8	0.1%	0	
100.305	punctate cataract, posterior sutures	34	0.4%	6	0.4%
100.306	punctate cataract, nucleus	9	0.1%	1	0.1%
100.307	punctate cataract, capsular	7	0.1%	5	0.3%
100.311	incipient cataract, anterior cortex	79	0.9%	14	0.9%
100.312	incipient cataract, posterior cortex	202	2.2%	22	1.4%
100.313	incipient cataract, equatorial cortex	31	0.3%	3	0.2%
100.314	incipient cataract, anterior sutures	2	0.0%	0	
100.315	incipient cataract, posterior sutures	44	0.5%	4	0.3%
100.316	incipient cataract, nucleus	9	0.1%	2	0.1%

LENS CONTINUED		1991-2013		2014-2018	
100.317	incipient cataract, capsular	11	0.1%	1	0.1%
100.321	incomplete cataract, anterior cortex	0		3	0.2%
100.322	incomplete cataract, posterior cortex	1	0.0%	4	0.3%
100.328	posterior suture tip opacities	0		16	1.0%
100.330	generalized/complete cataract	147	1.6%	2	0.1%
100.375	subluxation/luxation, unspecified	4	0.0%	0	
100.999	*significant cataracts (summary)*	*787*	*8.5%*	*89*	*5.6%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	18	0.2%	10	0.6%
110.135	PHPV/PTVL	3	0.0%	0	
110.200	vitritis	1	0.0%	6	0.4%
110.320	vitreal degeneration	88	1.0%	33	2.1%
FUNDUS					
97.120	coloboma	1	0.0%	0	
RETINA					
120.170	retinal dysplasia, folds	65	0.7%	5	0.3%
120.180	retinal dysplasia, geographic	3	0.0%	1	0.1%
120.310	generalized progressive retinal atrophy (PRA)	57	0.6%	2	0.1%
120.910	retinal detachment without dialysis	1	0.0%	0	
120.960	retinopathy	1	0.0%	3	0.2%
OPTIC NERVE					
130.110	micropapilla	1	0.0%	1	0.1%
130.120	optic nerve hypoplasia	1	0.0%	0	
130.150	optic disc coloboma	10	0.1%	0	
OTHER					
900.000	other, unspecified	39	0.4%	0	
900.100	other, not inherited	153	1.7%	54	3.4%
900.110	other. suspect not inherited/significance unknown	31	0.3%	1	0.1%
NORMAL					
0.000	normal globe	7662	83.1%	1156	72.7%

BIEWER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder option

Description and Comments

A. Persistent pupillary membranes (PPM)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Biewer. The conditions listed above are generally recognized to exist in the breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 2017 and/or Data from CERF/OFA All-Breeds Report, 2010-2016.

OCULAR DISORDERS REPORT
BIEWER

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2013 45 #	%	2014-2018 26 #	%
EYELIDS						
25.110	distichiasis		0		1	3.8%
UVEA						
93.710	persistent pupillary membranes, iris to iris		6	13.3%	3	11.5%
93.750	persistent pupillary membranes, lens pigment foci/no strands		1	2.2%	1	3.8%
93.760	persistent pupillary membranes, endothelial opacity/no strands		0		1	3.8%
LENS						
100.210	cataract. suspect not inherited/significance unknown		0		4	15.4%
100.302	punctate cataract, posterior cortex		0		1	3.8%
100.330	generalized/complete cataract		0		1	3.8%
100.340	resorbing/hypermature cataract		0		1	3.8%
100.999	*significant cataracts (summary)*		*0*		*3*	*11.5%*
VITREOUS						
110.120	persistent hyaloid artery/remnant		0		1	3.8%
FUNDUS						
97.110	choroidal hypoplasia		1	2.2%	0	
OPTIC NERVE						
130.150	optic disc coloboma		1	2.2%	0	
OTHER						
900.000	other, unspecified		1	2.2%	0	
NORMAL						
0.000	normal globe		41	91.1%	16	61.5%

BLACK AND TAN COONHOUND

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Persistent pupillary membranes - lens pigment foci/no strands	Not defined	1	Passes with no notation
B.	Cataract	Not defined	2	NO
C.	Retinal dysplasia - folds	Not defined	3	Breeder option

Description and Comments

A. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

B. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

C. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Black and Tan Coonhound breed. The conditions listed above are generally recognized to exist in the breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 2018 and/or Data from OFA All-Breeds Report 2013-2017.

2. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

3. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

OCULAR DISORDERS REPORT
BLACK AND TAN COONHOUND

Diagnostic Name		1991-2013 445 #	%	2014-2018 215 #	%
GLOBE					
0.110	microphthalmia	1	0.2%	0	
EYELIDS					
21.000	entropion, unspecified	3	0.7%	0	
22.000	ectropion, unspecified	3	0.7%	4	1.9%
25.110	distichiasis	5	1.1%	1	0.5%
NICTITANS					
51.100	third eyelid cartilage anomaly	2	0.4%	0	
52.110	prolapsed gland of the third eyelid	1	0.2%	0	
CORNEA					
70.210	corneal pannus	2	0.4%	0	
UVEA					
93.710	persistent pupillary membranes, iris to iris	5	1.1%	0	
93.720	persistent pupillary membranes, iris to lens	3	0.7%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	2	0.4%	6	2.8%
93.999	uveal cysts	0		1	0.5%
LENS					
100.210	cataract. suspect not inherited/significance unknown	38	8.5%	9	4.2%
100.301	punctate cataract, anterior cortex	4	0.9%	1	0.5%
100.302	punctate cataract, posterior cortex	1	0.2%	0	
100.304	punctate cataract, anterior sutures	0		3	1.4%
100.305	punctate cataract, posterior sutures	1	0.2%	0	
100.306	punctate cataract, nucleus	4	0.9%	2	0.9%
100.307	punctate cataract, capsular	1	0.2%	2	0.9%
100.311	incipient cataract, anterior cortex	1	0.2%	0	
100.312	incipient cataract, posterior cortex	5	1.1%	1	0.5%
100.314	incipient cataract, anterior sutures	1	0.2%	1	0.5%
100.316	incipient cataract, nucleus	3	0.7%	0	
100.323	incomplete cataract, equatorial cortex	0		1	0.5%
100.328	posterior suture tip opacities	0		1	0.5%
100.330	generalized/complete cataract	3	0.7%	0	
100.999	*significant cataracts (summary)*	*24*	*5.4%*	*11*	*5.1%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	0		1	0.5%
110.135	PHPV/PTVL	1	0.2%	0	
110.320	vitreal degeneration	1	0.2%	0	
FUNDUS					
97.110	choroidal hypoplasia	1	0.2%	0	
RETINA					
120.170	retinal dysplasia, folds	16	3.6%	41	19.1%
120.180	retinal dysplasia, geographic	0		1	0.5%
120.190	retinal dysplasia, detached	0		1	0.5%

	1991-2013		2014-2018	
OTHER				
900.000 other, unspecified	2	0.4%	0	
900.100 other, not inherited	12	2.7%	7	3.3%
NORMAL				
0.000 normal globe	358	80.4%	142	66.0%

BLACK RUSSIAN TERRIER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder option	
B.	Cataract	Not defined	2, 3	NO	
C.	POANV (polyneuropathy, ocular abnormalities neuronal vacuolation) - Microphthalmia - Cataracts -PPM (iris to iris)	Autosomal recessive	4	NO	RAB3GAP1: c.743delC mutation

Description and Comments

A. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

B. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

C. POANV- Polyneuropathy with ocular abnormalities and neuronal vacuolation

An autosomal recessive condition resulting in juvenile polyneuropathy that presents as laryngeal paralysis and weakness. Patients have concurrent ophthalmic abnormalities including microphthalmia, incomplete cataracts (primarily nuclear) and iris-to-iris PPMs. Neuronal vacuolation was identified on histopathology. Affected dogs were found to be homozygous for the RAB3GAP1: c.743delC mutation. Patients with this variant are not reported to survive past 6 months.

References

1. ACVO Genetics Committee, 2013-2014 and Data from OFA All-Breeds Report, 2013-2014.

2. ACVO Genetics Committee, 2007 and/or Data from CERF All-Breeds Report, 2002-2006.

3. ACVO Genetics Committee, 2008 and/or Data from CERF All-Breeds Report, 2003-2007.

4. Mhlanga-Mutangadura T, Johnson GJ, Schnabel RD, et al. A mutation in the Warburg syndrome gene, RAB3GAP1, causes a similar syndrome with polyneuropathy and neuronal vacuolation in Black Russian Terrier dogs. Neurobiology of Disease. 2016;86:75-85.

OCULAR DISORDERS REPORT
BLACK RUSSIAN TERRIER

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2013 434 #	%	2014-2018 308 #	%
EYELIDS						
21.000	entropion, unspecified		5	1.2%	3	1.0%
22.000	ectropion, unspecified		2	0.5%	2	0.6%
25.110	distichiasis		3	0.7%	5	1.6%
NICTITANS						
51.100	third eyelid cartilage anomaly		1	0.2%	0	
52.110	prolapsed gland of the third eyelid		1	0.2%	0	
CORNEA						
70.700	corneal dystrophy		1	0.2%	1	0.3%
UVEA						
93.110	iris hypoplasia		0		1	0.3%
93.150	iris coloboma		0		1	0.3%
93.710	persistent pupillary membranes, iris to iris		10	2.3%	4	1.3%
93.720	persistent pupillary membranes, iris to lens		1	0.2%	1	0.3%
93.750	persistent pupillary membranes, lens pigment foci/no strands		0		3	1.0%
93.760	persistent pupillary membranes, endothelial opacity/no strands		0		1	0.3%
93.810	uveal melanoma		0		1	0.3%
93.999	uveal cysts		3	0.7%	1	0.3%
LENS						
100.210	cataract. suspect not inherited/significance unknown		20	4.6%	23	7.5%
100.301	punctate cataract, anterior cortex		2	0.5%	5	1.6%
100.302	punctate cataract, posterior cortex		5	1.2%	2	0.6%
100.304	punctate cataract, anterior sutures		1	0.2%	0	
100.305	punctate cataract, posterior sutures		2	0.5%	0	
100.307	punctate cataract, capsular		0		1	0.3%
100.311	incipient cataract, anterior cortex		0		4	1.3%
100.312	incipient cataract, posterior cortex		8	1.8%	5	1.6%
100.315	incipient cataract, posterior sutures		1	0.2%	0	
100.316	incipient cataract, nucleus		1	0.2%	0	
100.317	incipient cataract, capsular		0		1	0.3%
100.328	posterior suture tip opacities		0		1	0.3%
100.999	*significant cataracts (summary)*		*20*	*4.6%*	*18*	*5.8%*
VITREOUS						
110.120	persistent hyaloid artery/remnant		0		1	0.3%
110.320	vitreal degeneration		1	0.2%	1	0.3%
RETINA						
120.170	retinal dysplasia, folds		0		3	1.0%
OPTIC NERVE						
130.110	micropapilla		1	0.2%	0	
OTHER						
900.000	other, unspecified		12	2.8%	0	
900.100	other, not inherited		11	2.5%	7	2.3%

OTHER CONTINUED	1991-2013	2014-2018
900.110 other. suspect not inherited/significance unknown	1 0.2%	0
NORMAL		
0.000 normal globe	387 89.2%	241 78.2%

BLOODHOUND

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Ectropion	Not defined	1, 2	Breeder option
B.	Entropion	Not defined	1-3	Breeder option
C.	Macroblepharon	Not defined	1, 2	Breeder option
D.	Prolapsed gland of the third eyelid	Not defined	1, 2	Breeder option
E.	Persistent pupillary membranes			
	- iris to iris	Not defined	4, 5	Breeder option
	- iris to cornea	Not defined	5	NO
F.	Cataract	Not defined	4	NO
G.	Retinal dysplasia - folds	Not defined	4, 5	Breeder option

Description and Comment

A. Ectropion

A conformational defect resulting in eversion of the eyelid(s), which may cause ocular irritation due to exposure. It is likely that ectropion is influenced by several genes (polygenic) defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

B. Entropion

A conformational defect resulting in an "in-rolling" of one or both of the eyelids which may cause ocular irritation. It is likely that entropion is influenced by several genes (polygenic) defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

C. Macroblepharon

Defined as an exceptionally large palpebral fissure, macroblepharon in conjunction with laxity of the lateral canthal structures may lead to lower lid ectropion and upper lid entropion. Either of these conditions may lead to severe ocular irritation.

D. Prolapsed gland of the third eyelid

Protrusion of the tear gland associated with the third eyelid. The mode of inheritance of this disorder is unknown. The exposed gland may become irritated. Commonly referred to as "cherry eye."

E. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

F. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

G. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

References

1. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

2. Barnett KC. Comparative aspects of canine hereditary eye disease. *Adv Vet Sci Comp Med*. 1976;20:39-67.

3. ACVO Genetics Committee, 2001 and/or Data from CERF All-Breeds Report, 2001.

4. ACVO Genetics Committee, 2000-2002 and/or Data from CERF All-Breeds Report, 2000-2002.

5. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

OCULAR DISORDERS REPORT
BLOODHOUND

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2013 524 #	 %	2014-2018 91 #	 %
GLOBE						
0.110	microphthalmia		1	0.2%	0	
EYELIDS						
20.160	macropalpebral fissure		75	14.3%	0	
21.000	entropion, unspecified		113	21.6%	19	20.9%
22.000	ectropion, unspecified		134	25.6%	23	25.3%
25.110	distichiasis		8	1.5%	3	3.3%
NASOLACRIMAL						
40.910	keratoconjunctivitis sicca		1	0.2%	2	2.2%
NICTITANS						
51.100	third eyelid cartilage anomaly		1	0.2%	0	
52.110	prolapsed gland of the third eyelid		6	1.1%	0	
CORNEA						
70.210	corneal pannus		5	1.0%	0	
70.220	pigmentary keratitis		2	0.4%	1	1.1%
70.730	corneal endothelial degeneration		2	0.4%	0	
UVEA						
93.710	persistent pupillary membranes, iris to iris		17	3.2%	2	2.2%
93.720	persistent pupillary membranes, iris to lens		4	0.8%	1	1.1%
93.730	persistent pupillary membranes, iris to cornea		36	6.9%	2	2.2%
93.750	persistent pupillary membranes, lens pigment foci/no strands		1	0.2%	2	2.2%
93.760	persistent pupillary membranes, endothelial opacity/no strands		1	0.2%	0	
93.999	uveal cysts		0		1	1.1%
LENS						
100.200	cataract, unspecified		1	0.2%	0	
100.210	cataract. suspect not inherited/significance unknown		13	2.5%	3	3.3%
100.301	punctate cataract, anterior cortex		10	1.9%	0	
100.302	punctate cataract, posterior cortex		1	0.2%	0	
100.306	punctate cataract, nucleus		1	0.2%	0	
100.307	punctate cataract, capsular		2	0.4%	0	
100.311	incipient cataract, anterior cortex		15	2.9%	0	
100.312	incipient cataract, posterior cortex		6	1.1%	0	
100.314	incipient cataract, anterior sutures		3	0.6%	0	
100.315	incipient cataract, posterior sutures		1	0.2%	0	
100.316	incipient cataract, nucleus		3	0.6%	1	1.1%
100.317	incipient cataract, capsular		4	0.8%	1	1.1%
100.321	incomplete cataract, anterior cortex		0		1	1.1%
100.322	incomplete cataract, posterior cortex		0		2	2.2%
100.330	generalized/complete cataract		1	0.2%	0	
100.340	resorbing/hypermature cataract		1	0.2%	0	
100.999	*significant cataracts (summary)*		*49*	*9.4%*	*5*	*5.5%*

	1991-2013		2014-2018	
VITREOUS				
110.120 persistent hyaloid artery/remnant	1	0.2%	0	
110.135 PHPV/PTVL	1	0.2%	0	
110.320 vitreal degeneration	1	0.2%	0	
RETINA				
120.170 retinal dysplasia, folds	32	6.1%	2	2.2%
120.310 generalized progressive retinal atrophy (PRA)	1	0.2%	0	
120.910 retinal detachment without dialysis	1	0.2%	0	
OPTIC NERVE				
130.150 optic disc coloboma	1	0.2%	0	
OTHER				
900.000 other, unspecified	5	1.0%	0	
900.100 other, not inherited	13	2.5%	2	2.2%
900.110 other. suspect not inherited/significance unknown	9	1.7%	0	
NORMAL				
0.000 normal globe	237	45.2%	47	51.6%

OCULAR DISORDERS REPORT
BLUE LACY

There are insufficient breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the BLUE LACY breed. Therefore, there are no conditions listed with breeding advice.

OCULAR DISORDERS REPORT
BLUE LACY

Diagnostic Name	TOTAL DOGS EXAMINED	1991-2013 2 #	% 	2014-2018 4 #	%
NORMAL					
0.000 normal globe		2	100.0%	4	100.0%

OCULAR DISORDERS REPORT
BLUE MOUNTAIN SHEPHERD

There are insufficient breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the BLUE MOUNTAIN SHEPHERD breed. Therefore, there are no conditions listed with breeding advice.

OCULAR DISORDERS REPORT
BLUE MOUNTAIN SHEPHERD

Diagnostic Name	TOTAL DOGS EXAMINED	1991-2013 0 #	%	2014-2018 1 #	%
NORMAL					
0.000 normal globe		0		1	100.0%

OCULAR DISORDERS REPORT
BLUETICK COONHOUND

There are insufficient breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the BLUETICK COONHOUND breed. Therefore, there are no conditions listed with breeding advice.

OCULAR DISORDERS REPORT
BLUETICK COONHOUND

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2013 9 #	%	2014-2018 37 #	%
EYELIDS						
22.000	ectropion, unspecified		1	11.1%	0	
UVEA						
93.710	persistent pupillary membranes, iris to iris		0		1	2.7%
93.760	persistent pupillary membranes, endothelial opacity/no strands		0		2	5.4%
LENS						
100.210	cataract. suspect not inherited/significance unknown		1	11.1%	0	
RETINA						
120.170	retinal dysplasia, folds		0		2	5.4%
120.180	retinal dysplasia, geographic		0		1	2.7%
OTHER						
900.000	other, unspecified		3	33.3%	0	
900.100	other, not inherited		0		2	5.4%
900.110	other. suspect not inherited/significance unknown		0		1	2.7%
NORMAL						
0.000	normal globe		7	77.8%	30	81.1%

BOERBOEL

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TEST
A.	Multifocal retinopathy	Autosomal recessive	1	Breeder option	Mutation in *BEST1 gene*

Description and Comments

A. Multifocal retinopathy

Canine Multifocal Retinopathy type 1 (*cmr1*) is characterized by numerous distinct (i.e. multi-focal), roughly circular patches of elevated retina (multifocal bullous retinal detachments). There may be a serous sub-retinal fluid or accumulation of sub-retinal material that produces gray-tan-pink colored lesions. These lesions, looking somewhat like blisters, vary in location and size, although typically they are present in both eyes of the affected dog.

The disease generally develops in young dogs between 11-20 weeks of age and there is minimal progression after 1 year of age. The lesions may flatten, leaving areas of retinal thinning and RPE hypertrophy, hyperplasia, and pigmentation. Discrete areas of tapetal hyper-reflectivity may be seen in areas of previous retinal and RPE detachments. Most dogs exhibit no noticeable problem with vision or electroretinographic abnormalities despite their abnormal appearing retinas.

Canine Multifocal Retinopathy type 1 is caused by a mutation in the Bestrophin 1 gene (BEST1) and is described to be recessively inherited in the Great Pyrenees, Dogue de Bordeaux, Bullmastiff, and Mastiff.

References

1. Zangerl B, Wickstrom K, Slavik J, et al. Assessment of canine BEST1 variations identifies new mutations and establishes an independent bestrophinopathy model (cmr3). *Mol Vis.* 2010;16:2791-2804.

OCULAR DISORDERS REPORT
BOERBOEL

Diagnostic Name	TOTAL DOGS EXAMINED	1991-2013 16 #	 %	2014-2018 43 #	 %
EYELIDS					
20.160	macropalpebral fissure	1	6.2%	0	
21.000	entropion, unspecified	0		1	2.3%
22.000	ectropion, unspecified	1	6.2%	0	
25.110	distichiasis	2	12.5%	1	2.3%
CORNEA					
70.220	pigmentary keratitis	0		1	2.3%
70.700	corneal dystrophy	0		1	2.3%
70.730	corneal endothelial degeneration	0		1	2.3%
UVEA					
93.710	persistent pupillary membranes, iris to iris	1	6.2%	0	
93.720	persistent pupillary membranes, iris to lens	0		1	2.3%
93.730	persistent pupillary membranes, iris to cornea	0		2	4.7%
93.760	persistent pupillary membranes, endothelial opacity/no strands	1	6.2%	1	2.3%
LENS					
100.210	cataract. suspect not inherited/significance unknown	1	6.2%	2	4.7%
100.302	punctate cataract, posterior cortex	0		1	2.3%
100.312	incipient cataract, posterior cortex	0		1	2.3%
100.315	incipient cataract, posterior sutures	0		1	2.3%
100.328	posterior suture tip opacities	0		1	2.3%
100.999	*significant cataracts (summary)*	*0*		*3*	*7.0%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	0		1	2.3%
RETINA					
120.170	retinal dysplasia, folds	0		4	9.3%
120.180	retinal dysplasia, geographic	1	6.2%	0	
OTHER					
900.100	other, not inherited	0		1	2.3%
NORMAL					
0.000	normal globe	10	62.5%	32	74.4%

BOLOGNESE

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Distichiasis	Not defined	1	Breeder option
B.	Corneal dystrophy - epithelial/stromal	Not defined	2	Breeder option
C.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder option
D.	Cataract	Not defined	3	NO
E.	Vitreous Degeneration	Not defined	4	Breeder Option

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Corneal Dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

C. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

D. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

E. Vitreous degeneration

A liquefaction of the vitreous gel which may predispose to retinal detachment. This is a significant problem in the Whippet.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Bolognese breed. The conditions listed above are generally recognized to exist in the breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

2. ACVO Genetics Committee, 2013-2014 and Data from OFA All-Breeds Report, 2013-2014.

3. ACVO Genetics Committee, 2015 and Data from OFA All-Breeds Report, 2013-2014.

4. ACVO Genetics Committee, 2017 and Data from OFA/CERF All-Breeds Report, 2010-2016.

OCULAR DISORDERS REPORT
BOLOGNESE

Diagnostic Name		1991-2013 TOTAL DOGS EXAMINED 619 #	%	2014-2018 187 #	%
EYELIDS					
21.000	entropion, unspecified	3	0.5%	0	
25.110	distichiasis	105	17.0%	4	2.1%
NASOLACRIMAL					
32.110	imperforate lower nasolacrimal punctum	1	0.2%	1	0.5%
40.910	keratoconjunctivitis sicca	2	0.3%	0	
NICTITANS					
52.110	prolapsed gland of the third eyelid	2	0.3%	0	
CORNEA					
70.700	corneal dystrophy	11	1.8%	4	2.1%
UVEA					
93.710	persistent pupillary membranes, iris to iris	92	14.9%	26	13.9%
93.730	persistent pupillary membranes, iris to cornea	6	1.0%	0	
93.760	persistent pupillary membranes, endothelial opacity/no strands	4	0.6%	0	
LENS					
100.210	cataract. suspect not inherited/significance unknown	18	2.9%	2	1.1%
100.305	punctate cataract, posterior sutures	1	0.2%	0	
100.311	incipient cataract, anterior cortex	2	0.3%	0	
100.312	incipient cataract, posterior cortex	2	0.3%	0	
100.313	incipient cataract, equatorial cortex	2	0.3%	1	0.5%
100.314	incipient cataract, anterior sutures	0		1	0.5%
100.315	incipient cataract, posterior sutures	7	1.1%	0	
100.317	incipient cataract, capsular	1	0.2%	0	
100.330	generalized/complete cataract	4	0.6%	0	
100.999	*significant cataracts (summary)*	*19*	*3.1%*	*2*	*1.1%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	0		1	0.5%
110.135	PHPV/PTVL	0		1	0.5%
110.200	vitritis	1	0.2%	1	0.5%
110.320	vitreal degeneration	11	1.8%	1	0.5%
RETINA					
120.170	retinal dysplasia, folds	6	1.0%	0	
120.180	retinal dysplasia, geographic	0		1	0.5%
120.190	retinal dysplasia, detached	1	0.2%	0	
120.310	generalized progressive retinal atrophy (PRA)	1	0.2%	0	
120.910	retinal detachment without dialysis	1	0.2%	0	
OPTIC NERVE					
130.110	micropapilla	1	0.2%	0	
OTHER					
900.000	other, unspecified	19	3.1%	0	
900.100	other, not inherited	20	3.2%	4	2.1%

OTHER CONTINUED	1991-2013	2014-2018
900.110 other. suspect not inherited/significance unknown	4 0.6%	0
NORMAL		
0.000 normal globe	443 71.6%	141 75.4%

BORDER COLLIE

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Distichiasis	Not defined	1	Breeder option	
B.	Corneal dystrophy - epithelial/stromal	Not defined	1	Breeder option	
C.	Persistent pupillary membranes - iris to iris - all other forms	 Not defined Not defined	 2, 3 3	 Breeder option NO	
D.	Cataract	Not defined	2	NO	
E.	Lens luxation	Autosomal recessive	4, 11	NO	Mutation in the *ADAMTS17* gene
F.	Vitreous degeneration	Not defined	5	Breeder option	
G.	Retinal atrophy - generalized	Suggested X-linked	2, 6, 7	NO	
H.	Retinal dysplasia - folds	Not defined	2	Breeder option	
I.	Choroidal hypoplasia (Collie Eye Anomaly) - optic Nerve coloboma - retinal detachment - retinal hemorrhage - staphyloma/coloboma	Autosomal recessive	8-10	NO	Mutation in the *NHEJ1* gene

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Corneal Dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

C. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

D. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

E. Lens luxation

Partial (subluxation) or complete displacement of the lens from the normal anatomic site behind the pupil. Lens luxation not associated with trauma or inflammation is presumed to be inherited. Lens luxation may result in elevated intraocular pressure (glaucoma), causing vision impairment or blindness.

F. Vitreous degeneration

Liquefaction of the vitreous gel which may predispose to retinal detachment.

G. Retinal atrophy - generalized

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

H. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

I. Choroidal hypoplasia (Collie Eye Anomaly)
- Staphyloma/coloboma
- Retinal detachment
- Retinal hemorrhage
- Optic nerve coloboma

A spectrum of malformations present at birth and ranging from inadequate development of the choroid (choroidal hypoplasia) to defects of the choroid, sclera, and/or optic nerve (coloboma/staphyloma) to complete retinal detachment (with or without hemorrhage). Mildly affected animals will have no detectable vision deficit.

This disorder is collectively referred to as "Collie Eye Anomaly." The choroidal hypoplasia component is caused by a 7799 base pair deletion with the gene *NHEJ1.* The mutation is a recessive trait. A DNA test is available and is diagnostic only for the choroidal hypoplasia component of CEA. For colobomas to develop, an additional mutation in a second gene has to be present; that gene is still unknown.

Historical Note:

Central progressive retinal atrophy was previously a condition listed for this breed. However as the condition is no longer identified in the breed, the condition has been removed. Central progressive retinal atrophy was a progressive retinal degeneration in which photoreceptor death occurred secondary to disease of the underlying pigment epithelium. Progression was slow and some animals never lost vision. CPRA occurred in England, but was uncommon elsewhere.

References

1. ACVO Genetics Committee, 2007 and/or Data from CERF All-Breeds Report, 2002-2006.

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3. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

4. Foster SJ, Curtis R, Barnett KC. Primary lens luxation in the Border Collie. *J Small Anim Pract*. 1986;27:1-6.

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7. Vilboux T, Chaudieu G, Jeannin P, et al. Progressive retinal atrophy in the Border Collie: a new XLPRA. *BMC Vet Res*. 2008;4:10.

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9. Parker HG, Kukekova AV, Akey DT, et al. Breed relationships facilitate fine-mapping studies: a 7.8-kb deletion cosegregates with Collie eye anomaly across multiple dog breeds. *Gen Res*. 2007;17:1562-1571.

10. Lowe JK, Kukekova AV, Kirkness EF, et al. Linkage mapping of the primary disease locus for collie eye anomaly. *Genomics*. 2003;82:86-95.

11. Gould D, Pettitt L, McLaughlin B, et al. ADAMTS17 mutation associated with primary lens luxation is widespread among breeds. *Veterinary Ophthalmology* 2011;14:378-384.

OCULAR DISORDERS REPORT
BORDER COLLIE

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2013 24204 #	%	2014-2018 3254 #	%
GLOBE						
0.110	microphthalmia		12	0.0%	1	0.0%
10.000	glaucoma		0		1	0.0%
EYELIDS						
21.000	entropion, unspecified		2	0.0%	0	
25.110	distichiasis		109	0.5%	24	0.7%
NICTITANS						
51.100	third eyelid cartilage anomaly		2	0.0%	5	0.2%
CORNEA						
70.210	corneal pannus		16	0.1%	6	0.2%
70.220	pigmentary keratitis		0		1	0.0%
70.700	corneal dystrophy		181	0.7%	56	1.7%
70.730	corneal endothelial degeneration		4	0.0%	1	0.0%
UVEA						
90.200	uveitis		0		1	0.0%
93.110	iris hypoplasia		1	0.0%	1	0.0%
93.140	corneal endothelial pigment without PPM		2	0.0%	0	
93.150	iris coloboma		8	0.0%	0	
93.710	persistent pupillary membranes, iris to iris		1489	6.2%	234	7.2%
93.720	persistent pupillary membranes, iris to lens		30	0.1%	6	0.2%
93.730	persistent pupillary membranes, iris to cornea		33	0.1%	2	0.1%
93.740	persistent pupillary membranes, iris sheets		14	0.1%	1	0.0%
93.750	persistent pupillary membranes, lens pigment foci/no strands		6	0.0%	6	0.2%
93.760	persistent pupillary membranes, endothelial opacity/no strands		3	0.0%	1	0.0%
93.810	uveal melanoma		0		1	0.0%
93.999	uveal cysts		9	0.0%	3	0.1%
97.150	chorioretinal coloboma, congenital		1	0.0%	2	0.1%
LENS						
100.200	cataract, unspecified		57	0.2%	0	
100.210	cataract. suspect not inherited/significance unknown		1092	4.5%	210	6.5%
100.301	punctate cataract, anterior cortex		101	0.4%	19	0.6%
100.302	punctate cataract, posterior cortex		58	0.2%	8	0.2%
100.303	punctate cataract, equatorial cortex		43	0.2%	8	0.2%
100.304	punctate cataract, anterior sutures		5	0.0%	1	0.0%
100.305	punctate cataract, posterior sutures		98	0.4%	45	1.4%
100.306	punctate cataract, nucleus		24	0.1%	8	0.2%
100.307	punctate cataract, capsular		23	0.1%	13	0.4%
100.311	incipient cataract, anterior cortex		132	0.5%	14	0.4%
100.312	incipient cataract, posterior cortex		93	0.4%	17	0.5%
100.313	incipient cataract, equatorial cortex		105	0.4%	24	0.7%
100.314	incipient cataract, anterior sutures		12	0.0%	0	
100.315	incipient cataract, posterior sutures		50	0.2%	12	0.4%
100.316	incipient cataract, nucleus		25	0.1%	10	0.3%
100.317	incipient cataract, capsular		23	0.1%	5	0.2%
100.321	incomplete cataract, anterior cortex		1	0.0%	7	0.2%

LENS CONTINUED		1991-2013		2014-2018	
100.322	incomplete cataract, posterior cortex	1	0.0%	2	0.1%
100.323	incomplete cataract, equatorial cortex	1	0.0%	3	0.1%
100.326	incomplete cataract, nucleus	0		2	0.1%
100.327	incomplete cataract, capsular	0		1	0.0%
100.328	posterior suture tip opacities	12	0.0%	82	2.5%
100.330	generalized/complete cataract	28	0.1%	2	0.1%
100.340	resorbing/hypermature cataract	0		1	0.0%
100.375	subluxation/luxation, unspecified	14	0.1%	0	
100.999	*significant cataracts (summary)*	*880*	*3.6%*	*202*	*6.2%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	63	0.3%	5	0.2%
110.135	PHPV/PTVL	18	0.1%	2	0.1%
110.200	vitritis	1	0.0%	7	0.2%
110.320	vitreal degeneration	151	0.6%	24	0.7%
FUNDUS					
97.110	choroidal hypoplasia	417	1.7%	44	1.4%
97.120	coloboma	48	0.2%	0	
RETINA					
120.170	retinal dysplasia, folds	188	0.8%	20	0.6%
120.180	retinal dysplasia, geographic	15	0.1%	1	0.0%
120.310	generalized progressive retinal atrophy (PRA)	220	0.9%	17	0.5%
120.400	retinal hemorrhage	6	0.0%	0	
120.910	retinal detachment without dialysis	18	0.1%	0	
120.920	retinal detachment with dialysis	0		1	0.0%
120.960	retinopathy	3	0.0%	20	0.6%
OPTIC NERVE					
130.110	micropapilla	16	0.1%	7	0.2%
130.120	optic nerve hypoplasia	18	0.1%	1	0.0%
130.150	optic disc coloboma	89	0.4%	8	0.2%
OTHER					
900.000	other, unspecified	214	0.9%	0	
900.100	other, not inherited	644	2.7%	184	5.7%
900.110	other. suspect not inherited/significance unknown	91	0.4%	2	0.1%
NORMAL					
0.000	normal globe	20392	84.3%	2354	72.3%

BORDER TERRIER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Distichiasis	Not defined	1	Breeder option	
B.	Persistent pupillary membranes - iris to iris	Not defined	2, 3	Breeder option	
C.	Cataract	Not defined	4, 5	NO	Mutation in the *HSF4* gene
D.	Vitreous degeneration	Not defined	5	Breeder option	

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established, although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

C. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

The condition is inherited as an autosomal recessive mutation in the HSF4 gene (*HSF4-1*). A DNA test is available.

D. Vitreous degeneration

Liquefaction of the vitreous gel which may predispose to retinal detachment.

References

1. ACVO Genetics Committee, 2007 and/or Data from CERF All-Breeds Report, 2002-2006.

2. ACVO Genetics Committee, 2002-2003 and/or Data from CERF All-Breeds Report, 2002-2003.

3. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

4. Mellersh CS, Pettitt L, Forman OP, et al. Identification of mutations in HSF4 in dogs of three different breeds with hereditary cataracts. *Vet Ophthalmol*. 2006;9:369-378.

5. ACVO Genetics Committee, 2000-2002 and/or Data from CERF All-Breeds Report, 2000-2002.

OCULAR DISORDERS REPORT
BORDER TERRIER

		1991-2013 5138		2014-2018 1784	
	TOTAL DOGS EXAMINED				
Diagnostic Name		**#**	**%**	**#**	**%**
EYELIDS					
21.000	entropion, unspecified	3	0.1%	0	
25.110	distichiasis	39	0.8%	11	0.6%
NASOLACRIMAL					
32.110	imperforate lower nasolacrimal punctum	0		1	0.1%
NICTITANS					
52.110	prolapsed gland of the third eyelid	1	0.0%	0	
CORNEA					
70.700	corneal dystrophy	11	0.2%	3	0.2%
UVEA					
93.140	corneal endothelial pigment without PPM	1	0.0%	0	
93.710	persistent pupillary membranes, iris to iris	115	2.2%	83	4.7%
93.720	persistent pupillary membranes, iris to lens	1	0.0%	0	
93.730	persistent pupillary membranes, iris to cornea	3	0.1%	0	
93.740	persistent pupillary membranes, iris sheets	2	0.0%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	1	0.0%	1	0.1%
93.760	persistent pupillary membranes, endothelial opacity/no strands	1	0.0%	0	
93.999	uveal cysts	1	0.0%	0	
LENS					
100.200	cataract, unspecified	9	0.2%	0	
100.210	cataract. suspect not inherited/significance unknown	269	5.2%	196	11.0%
100.301	punctate cataract, anterior cortex	25	0.5%	14	0.8%
100.302	punctate cataract, posterior cortex	18	0.4%	4	0.2%
100.303	punctate cataract, equatorial cortex	15	0.3%	5	0.3%
100.304	punctate cataract, anterior sutures	2	0.0%	1	0.1%
100.305	punctate cataract, posterior sutures	10	0.2%	17	1.0%
100.306	punctate cataract, nucleus	5	0.1%	0	
100.307	punctate cataract, capsular	4	0.1%	5	0.3%
100.311	incipient cataract, anterior cortex	49	1.0%	20	1.1%
100.312	incipient cataract, posterior cortex	42	0.8%	16	0.9%
100.313	incipient cataract, equatorial cortex	57	1.1%	24	1.3%
100.314	incipient cataract, anterior sutures	2	0.0%	2	0.1%
100.315	incipient cataract, posterior sutures	11	0.2%	8	0.4%
100.316	incipient cataract, nucleus	13	0.3%	0	
100.317	incipient cataract, capsular	5	0.1%	5	0.3%
100.321	incomplete cataract, anterior cortex	1	0.0%	7	0.4%
100.322	incomplete cataract, posterior cortex	1	0.0%	9	0.5%
100.323	incomplete cataract, equatorial cortex	0		4	0.2%
100.326	incomplete cataract, nucleus	0		1	0.1%
100.327	incomplete cataract, capsular	0		1	0.1%
100.328	posterior suture tip opacities	3	0.1%	79	4.4%
100.330	generalized/complete cataract	17	0.3%	5	0.3%
100.340	resorbing/hypermature cataract	1	0.0%	2	0.1%
100.375	subluxation/luxation, unspecified	1	0.0%	0	
100.999	*significant cataracts (summary)*	*287*	*5.6%*	*150*	*8.4%*

		1991-2013		2014-2018	
VITREOUS					
110.120	persistent hyaloid artery/remnant	4	0.1%	5	0.3%
110.200	vitritis	1	0.0%	9	0.5%
110.320	vitreal degeneration	47	0.9%	23	1.3%
FUNDUS					
97.110	choroidal hypoplasia	1	0.0%	0	
97.120	coloboma	1	0.0%	0	
RETINA					
120.170	retinal dysplasia, folds	11	0.2%	4	0.2%
120.180	retinal dysplasia, geographic	7	0.1%	1	0.1%
120.310	generalized progressive retinal atrophy (PRA)	11	0.2%	2	0.1%
120.910	retinal detachment without dialysis	1	0.0%	0	
OPTIC NERVE					
130.120	optic nerve hypoplasia	0		1	0.1%
OTHER					
900.000	other, unspecified	56	1.1%	0	
900.100	other, not inherited	131	2.5%	93	5.2%
900.110	other. suspect not inherited/significance unknown	11	0.2%	6	0.3%
NORMAL					
0.000	normal globe	4663	90.8%	1322	74.1%

BORZOI

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Corneal dystrophy - epithelial/stromal	Not defined	1	Breeder option
B.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder option
C.	Cataract	Not defined	2	NO
D.	Optic nerve hypoplasia	Not defined	1	NO
E.	Retinopathy	Not defined	3	Breeder option
F.	Retinal degeneration	Not defined	4	NO
G.	Micropapilla	Not defined	1	Breeder option

Description and Comments

A. Corneal Dystrophy- epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

B. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

C. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

D. Optic nerve hypoplasia

A congenital defect of the optic nerve which causes blindness and abnormal pupil response in the affected eye. May be unable to differentiate from micropapilla on a routine (dilated)

screening ophthalmoscopic exam.

E. Retinopathy

Patchy focal unilateral or bilateral hyper reflective tapetal lesions most frequently peripheral but occasionally central around a pigmented spot, usually non progressive. Not usually present prior to 3 months of age but usually present by 18 months of age.

F. Retinal degeneration

A unilateral or bilateral retinal disease that affects young and adult Borzoi and which can be progressive. When bilateral, the ophthalmoscopic lesions are often asymmetrical, particularly in the early stages of the disease. Fundus examination shows initially single or multiple focal retinal lesions that appear active (local infiltrative inflammation or granulation) or inactive. The lesions can progress resulting in widespread retinal atrophy. The end-stage ophthalmoscopic lesions vary and may appear indistinguishable from PRA, or may be more characteristic of an inflammatory retinopathy. The asymmetry of the fundus abnormalities and the presence of inflammatory lesions in the retina and choroid help to differentiate this disorder from PRA. The mode of inheritance of this disease is not known; however, studies of different families suggest that it is possibly inherited. An intriguing aspect of the disease has been the preponderance of affected males compared to females. This has been confirmed in a recent unpublished survey.

G. Micropapilla

Micropapilla refers to a small optic disc which is not associated with vision impairment. Optic nerve hypoplasia refers to a congenital defect of the optic nerve which causes blindness and abnormal pupil response in the affected eye. It may be difficult to differentiate between micropapilla and optic nerve hypoplasia on a routine (dilated) screening ophthalmoscopic exam.

References

1. ACVO Genetics Committee, 2002-2003 and/or Data from CERF All-Breeds Report, 2002-2003.

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3. Storey ES, Grahn BH and Alcorn J. Multifocal chorioretinal lesions in Borzoi dogs. *Vet Ophthalmol*. 2005 Sep-Oct;8:337-347.

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OCULAR DISORDERS REPORT
BORZOI

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2013 2940 #	%	2014-2018 929 #	%
GLOBE						
0.110	microphthalmia		6	0.2%	1	0.1%
EYELIDS						
20.160	macropalpebral fissure		1	0.0%	0	
25.110	distichiasis		8	0.3%	3	0.3%
NICTITANS						
50.210	pannus of third eyelid		0		1	0.1%
51.100	third eyelid cartilage anomaly		0		2	0.2%
CORNEA						
70.210	corneal pannus		16	0.5%	1	0.1%
70.220	pigmentary keratitis		0		1	0.1%
70.700	corneal dystrophy		15	0.5%	1	0.1%
70.730	corneal endothelial degeneration		1	0.0%	0	
UVEA						
93.710	persistent pupillary membranes, iris to iris		65	2.2%	15	1.6%
93.720	persistent pupillary membranes, iris to lens		6	0.2%	0	
93.730	persistent pupillary membranes, iris to cornea		11	0.4%	0	
93.740	persistent pupillary membranes, iris sheets		1	0.0%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands		0		3	0.3%
93.760	persistent pupillary membranes, endothelial opacity/no strands		1	0.0%	1	0.1%
93.810	uveal melanoma		0		3	0.3%
93.999	uveal cysts		5	0.2%	5	0.5%
LENS						
100.200	cataract, unspecified		2	0.1%	0	
100.210	cataract. suspect not inherited/significance unknown		91	3.1%	28	3.0%
100.301	punctate cataract, anterior cortex		5	0.2%	2	0.2%
100.302	punctate cataract, posterior cortex		9	0.3%	2	0.2%
100.304	punctate cataract, anterior sutures		2	0.1%	0	
100.305	punctate cataract, posterior sutures		6	0.2%	4	0.4%
100.306	punctate cataract, nucleus		1	0.0%	0	
100.307	punctate cataract, capsular		4	0.1%	0	
100.311	incipient cataract, anterior cortex		9	0.3%	3	0.3%
100.312	incipient cataract, posterior cortex		14	0.5%	5	0.5%
100.313	incipient cataract, equatorial cortex		2	0.1%	2	0.2%
100.314	incipient cataract, anterior sutures		2	0.1%	0	
100.315	incipient cataract, posterior sutures		1	0.0%	0	
100.316	incipient cataract, nucleus		1	0.0%	0	
100.317	incipient cataract, capsular		4	0.1%	3	0.3%
100.324	incomplete cataract, anterior sutures		0		1	0.1%
100.328	posterior suture tip opacities		0		8	0.9%
100.330	generalized/complete cataract		7	0.2%	1	0.1%
100.340	resorbing/hypermature cataract		0		1	0.1%
100.375	subluxation/luxation, unspecified		4	0.1%	0	
100.999	*significant cataracts (summary)*		*69*	*2.3%*	*24*	*2.6%*

		1991-2013		2014-2018	
VITREOUS					
110.120	persistent hyaloid artery/remnant	9	0.3%	5	0.5%
110.135	PHPV/PTVL	10	0.3%	1	0.1%
110.200	vitritis	0		2	0.2%
110.320	vitreal degeneration	9	0.3%	2	0.2%
RETINA					
120.170	retinal dysplasia, folds	7	0.2%	3	0.3%
120.180	retinal dysplasia, geographic	8	0.3%	1	0.1%
120.190	retinal dysplasia, detached	1	0.0%	0	
120.310	generalized progressive retinal atrophy (PRA)	25	0.9%	2	0.2%
120.400	retinal hemorrhage	2	0.1%	0	
120.910	retinal detachment without dialysis	5	0.2%	0	
120.920	retinal detachment with dialysis	1	0.0%	1	0.1%
120.960	retinopathy	6	0.2%	28	3.0%
OPTIC NERVE					
130.110	micropapilla	10	0.3%	4	0.4%
130.120	optic nerve hypoplasia	14	0.5%	2	0.2%
130.150	optic disc coloboma	3	0.1%	1	0.1%
OTHER					
900.000	other, unspecified	44	1.5%	0	
900.100	other, not inherited	120	4.1%	68	7.3%
900.110	other. suspect not inherited/significance unknown	28	1.0%	1	0.1%
NORMAL					
0.000	normal globe	2581	87.8%	752	80.9%

BOSTON TERRIER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Glaucoma	Not defined	1-3	NO	
B.	Distichiasis	Not defined	1	Breeder option	
C.	Imperforate lacrimal punctum	Not defined	4	Breeder option	
D.	Corneal dystrophy - epithelial/stromal	Not defined	1	Breeder option	
E.	Corneal dystrophy - endothelial	Not defined	1, 5	NO	
F.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder option	
G.	Cataract	Autosomal recessive	1, 7-11	NO	Mutation in the *HSF4* gene (*HSF4-1*)
H.	Vitreous degeneration	Not defined	6, 12	Breeder option	

Description and Comments

A. Glaucoma

Glaucoma is characterized by an elevation of intraocular pressure (IOP) which, when sustained, causes intraocular damage resulting in blindness. The elevated intraocular pressure occurs because the fluid cannot leave through the iridocorneal angle. Diagnosis and classification of glaucoma requires measurement of the IOP (tonometry) and examination of the iridocorneal angle (gonioscopy). Neither of these tests are part of a routine screening exam for certification.

B. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

C. Imperforate lacrimal punctum

A developmental anomaly resulting in failure of opening of the lacrimal duct located at the medial lid margins. The lower punctum is more frequently affected. This defect usually results in epiphora, an overflow of tears onto the face.

D. Corneal dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral

E. Corneal dystrophy – endothelial

Corneal endothelial dystrophy is an abnormal loss of the inner lining of the cornea that causes progressive fluid retention (edema). With time the edema results in keratitis and decreased vision. This usually does not occur until the animal is older.

In the Boston Terrier, this is a primary degenerative endothelial disease leading to progressive and permanent corneal edema. It is not known if this disease is an inherited disorder. There is no sex predilection. The condition is observed in older dogs, 6 to 13 years of age with a mean of 9.5 years. The corneal edema starts asymptomatically in the dorsal temporal corneal quadrant of one eye and slowly progresses medially, eventually involving the entire cornea. Typically, it becomes bilateral. In the later stages, discomfort, intracorneal bullae with subsequent ulceration and keratoconus may develop.

F. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally during the first three months of life. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

G. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

The Boston Terrier has at least two distinct forms of inherited cataract. One type has an onset before 6 months of age with rapid progression to complete opacity prior to 2 years old. The early onset cataract is inherited as an autosomal recessive mutation in the *HSF4* gene (*HSF4-1*). A DNA test is available. A second type of cataract occurs after 4-5 years of age with variable progression. The genetic mutation responsible for this cataract is not yet known.

H. Vitreous degeneration

Liquefaction of the vitreous gel which may predispose to retinal detachment.

References

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OCULAR DISORDERS REPORT
BOSTON TERRIER

		1991-2013 12076		2014-2018 3589	
	TOTAL DOGS EXAMINED				
Diagnostic Name		#	%	#	%
GLOBE					
0.110	microphthalmia	2	0.0%	2	0.1%
10.000	glaucoma	1	0.0%	0	
EYELIDS					
20.140	ectopic cilia	5	0.0%	0	
20.160	macropalpebral fissure	12	0.1%	0	
21.000	entropion, unspecified	29	0.2%	15	0.4%
22.000	ectropion, unspecified	2	0.0%	0	
25.110	distichiasis	404	3.3%	132	3.7%
NASOLACRIMAL					
32.110	imperforate lower nasolacrimal punctum	18	0.1%	49	1.4%
40.910	keratoconjunctivitis sicca	7	0.1%	7	0.2%
NICTITANS					
50.210	pannus of third eyelid	0		2	0.1%
51.100	third eyelid cartilage anomaly	1	0.0%	0	
52.110	prolapsed gland of the third eyelid	8	0.1%	3	0.1%
CORNEA					
70.210	corneal pannus	0		1	0.0%
70.220	pigmentary keratitis	15	0.1%	6	0.2%
70.700	corneal dystrophy	283	2.3%	74	2.1%
70.730	corneal endothelial degeneration	24	0.2%	3	0.1%
UVEA					
93.110	iris hypoplasia	5	0.0%	2	0.1%
93.150	iris coloboma	7	0.1%	1	0.0%
93.710	persistent pupillary membranes, iris to iris	422	3.5%	178	5.0%
93.720	persistent pupillary membranes, iris to lens	10	0.1%	4	0.1%
93.730	persistent pupillary membranes, iris to cornea	6	0.0%	1	0.0%
93.740	persistent pupillary membranes, iris sheets	8	0.1%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		1	0.0%
93.810	uveal melanoma	1	0.0%	0	
93.999	uveal cysts	25	0.2%	13	0.4%
LENS					
100.200	cataract, unspecified	81	0.7%	0	
100.210	cataract. suspect not inherited/significance unknown	269	2.2%	93	2.6%
100.301	punctate cataract, anterior cortex	135	1.1%	55	1.5%
100.302	punctate cataract, posterior cortex	41	0.3%	15	0.4%
100.303	punctate cataract, equatorial cortex	57	0.5%	26	0.7%
100.304	punctate cataract, anterior sutures	24	0.2%	19	0.5%
100.305	punctate cataract, posterior sutures	15	0.1%	14	0.4%
100.306	punctate cataract, nucleus	7	0.1%	3	0.1%
100.307	punctate cataract, capsular	9	0.1%	26	0.7%
100.311	incipient cataract, anterior cortex	571	4.7%	123	3.4%
100.312	incipient cataract, posterior cortex	150	1.2%	19	0.5%
100.313	incipient cataract, equatorial cortex	270	2.2%	42	1.2%
100.314	incipient cataract, anterior sutures	71	0.6%	22	0.6%

LENS CONTINUED		1991-2013		2014-2018	
100.315	incipient cataract, posterior sutures	33	0.3%	5	0.1%
100.316	incipient cataract, nucleus	16	0.1%	5	0.1%
100.317	incipient cataract, capsular	13	0.1%	5	0.1%
100.321	incomplete cataract, anterior cortex	4	0.0%	53	1.5%
100.322	incomplete cataract, posterior cortex	3	0.0%	19	0.5%
100.323	incomplete cataract, equatorial cortex	4	0.0%	17	0.5%
100.324	incomplete cataract, anterior sutures	1	0.0%	2	0.1%
100.325	incomplete cataract, posterior sutures	0		1	0.0%
100.326	incomplete cataract, nucleus	0		2	0.1%
100.328	posterior suture tip opacities	2	0.0%	13	0.4%
100.330	generalized/complete cataract	88	0.7%	12	0.3%
100.340	resorbing/hypermature cataract	0		1	0.0%
100.375	subluxation/luxation, unspecified	12	0.1%	5	0.1%
100.999	*significant cataracts (summary)*	*1593*	*13.2%*	*486*	*13.5%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	41	0.3%	15	0.4%
110.135	PHPV/PTVL	7	0.1%	4	0.1%
110.200	vitritis	1	0.0%	10	0.3%
110.320	vitreal degeneration	166	1.4%	26	0.7%
FUNDUS					
97.110	choroidal hypoplasia	2	0.0%	1	0.0%
RETINA					
120.170	retinal dysplasia, folds	33	0.3%	4	0.1%
120.180	retinal dysplasia, geographic	12	0.1%	3	0.1%
120.190	retinal dysplasia, detached	4	0.0%	0	
120.310	generalized progressive retinal atrophy (PRA)	11	0.1%	0	
120.400	retinal hemorrhage	3	0.0%	0	
120.910	retinal detachment without dialysis	1	0.0%	0	
120.920	retinal detachment with dialysis	1	0.0%	0	
120.960	retinopathy	1	0.0%	3	0.1%
OPTIC NERVE					
130.110	micropapilla	1	0.0%	0	
130.120	optic nerve hypoplasia	2	0.0%	0	
130.150	optic disc coloboma	0		1	0.0%
OTHER					
900.000	other, unspecified	165	1.4%	0	
900.100	other, not inherited	390	3.2%	213	5.9%
900.110	other. suspect not inherited/significance unknown	65	0.5%	7	0.2%
NORMAL					
0.000	normal globe	9952	82.4%	2570	71.6%

BOUVIER DES FLANDRES

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Glaucoma	Not defined	1-3	NO
B.	Entropion	Not defined	4	Breeder option
C.	Distichiasis	Not defined	5	Breeder option
D.	Corneal dystrophy - epithelial/stromal	Not defined	6	Breeder option
E.	Persistent pupillary membranes - iris to iris - lens pigment foci/no strands	 Not defined Not defined	 1, 4 7	 Breeder option Passes with no notation
F.	Cataract	Not defined	1	NO
G.	Vitreous degeneration	Not defined	6	Breeder option
H.	Persistent hyperplastic primary vitreous/Persistent hyperplastic tunica vasculosa lentis (PHPV/PHTVL)	Not defined	1, 8	NO
I.	Retinal dysplasia - folds	Not defined	5	Breeder option

Description and Comments

A. Glaucoma

Glaucoma is characterized by an elevation of intraocular pressure (IOP) which, when sustained, causes intraocular damage resulting in blindness. The elevated intraocular pressure occurs because the fluid cannot leave through the iridocorneal angle. Diagnosis and classification of glaucoma requires measurement of the IOP (tonometry) and examination of the iridocorneal angle (gonioscopy). Neither of these tests are part of a routine screening exam for certification.

In this breed, primary glaucoma is associated with narrowed iridocorneal angles and various degrees of congenital angle malformations varying from mild to severe. Dysplastic pectinate ligaments and subsequent narrowed angles are similar to those described in the Basset

Hound and American and English Cocker Spaniels. The occurrence of glaucoma is related to the most severe abnormalities of the pectinate ligaments. The relationship between glaucoma development and the anomaly of the pectinate ligament is not clear.

A recent study evaluated risk factors for development of glaucoma in the Bouvier des Flandres. A narrow angle with dysplastic pectinate ligaments on gonioscopy and/or presence of a narrow or closed ciliary cleft on high resolution ultrasound were associated with development of primary glaucoma in the breed.

B. Entropion

A conformational defect resulting in an "in-rolling" of one or both of the eyelids which may cause ocular irritation. It is likely that entropion is influenced by several genes (polygenic), defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

C. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised

D. Corneal Dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

E. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

F. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

G. Vitreous degeneration

Liquefaction of the vitreous gel which may predispose to retinal detachment.

H. Persistent hyperplastic primary vitreous (PHPV)/Persistent hyperplastic tunica vasculosa lentis (PHTVL)

Persistent hyperplastic primary vitreous is a congenital defect resulting from abnormalities in the development and regression of the hyaloid artery (the primary vitreous) and the interaction of this blood vessel with the posterior lens capsule/cortex during embryogenesis. This condition is often associated with persistent hyperplastic tunica vasculosa lentis which results from failure of regression of the embryologic vascular network which surrounds the developing lens.

In the Bouvier des Flandres, the condition is associated with retinal dysplasia and detachment, optic nerve hypoplasia, lenticonus, cataract and congenital blindness.

I. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

References

1. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

2. van der Linde-Sipman JS. Dysplasia of the pectinate ligament and primary glaucoma in the Bouvier des Flandres dog. *Vet Pathol*. 1987;24:201-206.

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4. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

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6. ACVO Genetics Committee, 2007 and/or Data from CERF All-Breeds Report, 2002-2006.

7. ACVO Genetics Committee, 2017 and/or Data from CERF/OFA All-Breeds Report, 2010-2016.

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OCULAR DISORDERS REPORT
BOUVIER DES FLANDRES

		1991-2013		2014-2018	
	TOTAL DOGS EXAMINED	4626		944	
Diagnostic Name		#	%	#	%
GLOBE					
10.000	glaucoma	1	0.0%	1	0.1%
EYELIDS					
20.160	macropalpebral fissure	1	0.0%	0	
21.000	entropion, unspecified	27	0.6%	3	0.3%
22.000	ectropion, unspecified	6	0.1%	0	
25.110	distichiasis	40	0.9%	6	0.6%
CORNEA					
70.210	corneal pannus	1	0.0%	0	
70.220	pigmentary keratitis	1	0.0%	1	0.1%
70.700	corneal dystrophy	27	0.6%	6	0.6%
70.730	corneal endothelial degeneration	4	0.1%	0	
UVEA					
93.110	iris hypoplasia	0		1	0.1%
93.710	persistent pupillary membranes, iris to iris	384	8.3%	80	8.5%
93.720	persistent pupillary membranes, iris to lens	11	0.2%	0	
93.730	persistent pupillary membranes, iris to cornea	6	0.1%	0	
93.740	persistent pupillary membranes, iris sheets	6	0.1%	2	0.2%
93.750	persistent pupillary membranes, lens pigment foci/no strands	9	0.2%	16	1.7%
93.760	persistent pupillary membranes, endothelial opacity/no strands	2	0.0%	0	
93.810	uveal melanoma	1	0.0%	0	
93.999	uveal cysts	12	0.3%	6	0.6%
LENS					
100.200	cataract, unspecified	5	0.1%	0	
100.210	cataract. suspect not inherited/significance unknown	365	7.9%	120	12.7%
100.301	punctate cataract, anterior cortex	27	0.6%	11	1.2%
100.302	punctate cataract, posterior cortex	36	0.8%	6	0.6%
100.303	punctate cataract, equatorial cortex	4	0.1%	2	0.2%
100.304	punctate cataract, anterior sutures	5	0.1%	3	0.3%
100.305	punctate cataract, posterior sutures	27	0.6%	8	0.8%
100.306	punctate cataract, nucleus	9	0.2%	2	0.2%
100.307	punctate cataract, capsular	18	0.4%	5	0.5%
100.311	incipient cataract, anterior cortex	14	0.3%	7	0.7%
100.312	incipient cataract, posterior cortex	94	2.0%	9	1.0%
100.313	incipient cataract, equatorial cortex	20	0.4%	3	0.3%
100.314	incipient cataract, anterior sutures	0		1	0.1%
100.315	incipient cataract, posterior sutures	23	0.5%	4	0.4%
100.316	incipient cataract, nucleus	31	0.7%	3	0.3%
100.317	incipient cataract, capsular	9	0.2%	3	0.3%
100.321	incomplete cataract, anterior cortex	0		2	0.2%
100.322	incomplete cataract, posterior cortex	1	0.0%	2	0.2%
100.326	incomplete cataract, nucleus	0		1	0.1%
100.328	posterior suture tip opacities	8	0.2%	40	4.2%
100.330	generalized/complete cataract	31	0.7%	0	
100.375	subluxation/luxation, unspecified	2	0.0%	0	
100.999	*significant cataracts (summary)*	*354*	*7.7%*	*72*	*7.6%*

		1991-2013		2014-2018	
VITREOUS					
110.120	persistent hyaloid artery/remnant	7	0.2%	5	0.5%
110.135	PHPV/PTVL	6	0.1%	0	
110.200	vitritis	0		1	0.1%
110.320	vitreal degeneration	10	0.2%	3	0.3%
RETINA					
120.170	retinal dysplasia, folds	32	0.7%	5	0.5%
120.180	retinal dysplasia, geographic	2	0.0%	1	0.1%
120.310	generalized progressive retinal atrophy (PRA)	13	0.3%	1	0.1%
120.960	retinopathy	0		1	0.1%
OPTIC NERVE					
130.110	micropapilla	1	0.0%	2	0.2%
130.120	optic nerve hypoplasia	1	0.0%	0	
130.150	optic disc coloboma	3	0.1%	0	
OTHER					
900.000	other, unspecified	64	1.4%	0	
900.100	other, not inherited	151	3.3%	48	5.1%
900.110	other. suspect not inherited/significance unknown	106	2.3%	2	0.2%
NORMAL					
0.000	normal globe	3648	78.9%	632	66.9%

BOXER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Distichiasis	Not defined	1	Breeder option
B.	Ectopic cilia	Not defined	2	Breeder option
C.	Ectropion	Not defined	1	Breeder option
D.	Eury/Macroblepharon	Not defined	3, 4	Breeder option
E.	Corneal dystrophy - epithelial/stromal	Not defined	1	Breeder option
F.	Corneal dystrophy - epithelial erosion	Not defined	1, 5-7	Breeder option
G.	Persistent pupillary membranes			
	- iris to iris	Not defined	2	Breeder option
	- iris to cornea	Not defined	8	NO
H.	Cataract	Not defined	1	NO
I.	Vitreous degeneration	Not defined	9	Breeder option

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

In the Boxer, because there is significant clinical disease associated with the abnormal hairs, breeding affected animals should be discouraged.

B. Ectopic cilia

Hair emerging through the eyelid conjunctiva. Ectopic cilia occur more frequently in younger dogs and cause discomfort and corneal disease.

C. Ectropion

A conformational defect resulting in eversion of the eyelid(s), which may cause ocular irritation due to exposure. It is likely that ectropion is influenced by several genes (polygenic) defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

D. Eury/Macroblepharon

Defined as an exceptionally large palpebral fissure, macroblepharon in conjunction with laxity of the lateral canthal structures may lead to lower lid ectropion and upper lid entropion. Either of these conditions may lead to severe ocular irritation.

E. Corneal dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

F. Corneal dystrophy - epithelial erosion

A general group of corneal ulcerative conditions (e.g. erosions, indolent or persistent ulcers, epithelial bonding defects) is recognized as a common problem in older Boxers (as well as other older animals). It has been commonly referred to as Boxer corneal ulceration. Animals that are affected are usually 7-8 years of age or older. The ulceration can be a very difficult lesion to heal, and it is often recurrent. The chronic form stimulates eventual scarring, with vascularization, fibrosis and pigmentation of the lesion site. The lesion can cause vision impairment.

G. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur

H. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

I. Vitreous degeneration

Liquefaction of the vitreous gel which may predispose to retinal detachment.

References

1. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

2. ACVO Genetics Committee, 2006 and/or Data from CERF All-Breeds Report, 2001-2005.

3. ACVO Genetics Committee, 2000-2002 and/or Data from CERF All-Breeds Report, 2000-2002.

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8. ACVO Genetics Committee, 2016-2017 and/or Data from OFA All-Breeds Report, 2016.

9. ACVO Genetics Committee, 2013-2014 and/or Data from OFA All-Breeds Report, 2013-2014.

OCULAR DISORDERS REPORT
BOXER

		1991-2013		2014-2018	
	TOTAL DOGS EXAMINED	1585		264	
Diagnostic Name		#	%	#	%
GLOBE					
0.110	microphthalmia	5	0.3%	0	
EYELIDS					
20.140	ectopic cilia	3	0.2%	0	
20.160	macropalpebral fissure	9	0.6%	0	
21.000	entropion, unspecified	2	0.1%	5	1.9%
22.000	ectropion, unspecified	60	3.8%	10	3.8%
25.110	distichiasis	180	11.4%	44	16.7%
NASOLACRIMAL					
32.110	imperforate lower nasolacrimal punctum	0		1	0.4%
CORNEA					
70.210	corneal pannus	1	0.1%	0	
70.220	pigmentary keratitis	1	0.1%	0	
70.700	corneal dystrophy	131	8.3%	20	7.6%
70.730	corneal endothelial degeneration	2	0.1%	1	0.4%
UVEA					
93.150	iris coloboma	1	0.1%	0	
93.710	persistent pupillary membranes, iris to iris	4	0.3%	0	
93.720	persistent pupillary membranes, iris to lens	3	0.2%	0	
93.730	persistent pupillary membranes, iris to cornea	7	0.4%	5	1.9%
93.740	persistent pupillary membranes, iris sheets	1	0.1%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	1	0.1%	4	1.5%
93.760	persistent pupillary membranes, endothelial opacity/no strands	1	0.1%	3	1.1%
93.999	uveal cysts	1	0.1%	1	0.4%
LENS					
100.200	cataract, unspecified	4	0.3%	0	
100.210	cataract. suspect not inherited/significance unknown	37	2.3%	12	4.5%
100.301	punctate cataract, anterior cortex	2	0.1%	0	
100.303	punctate cataract, equatorial cortex	2	0.1%	0	
100.304	punctate cataract, anterior sutures	3	0.2%	0	
100.305	punctate cataract, posterior sutures	1	0.1%	1	0.4%
100.306	punctate cataract, nucleus	1	0.1%	0	
100.307	punctate cataract, capsular	2	0.1%	0	
100.311	incipient cataract, anterior cortex	14	0.9%	4	1.5%
100.312	incipient cataract, posterior cortex	2	0.1%	0	
100.313	incipient cataract, equatorial cortex	7	0.4%	0	
100.314	incipient cataract, anterior sutures	2	0.1%	0	
100.315	incipient cataract, posterior sutures	2	0.1%	0	
100.316	incipient cataract, nucleus	2	0.1%	1	0.4%
100.317	incipient cataract, capsular	0		2	0.8%
100.321	incomplete cataract, anterior cortex	0		2	0.8%
100.326	incomplete cataract, nucleus	0		1	0.4%
100.328	posterior suture tip opacities	1	0.1%	2	0.8%
100.330	generalized/complete cataract	7	0.4%	0	
100.375	subluxation/luxation, unspecified	2	0.1%	0	

LENS CONTINUED	1991-2013		2014-2018	
100.999 significant cataracts (summary)	*51*	*3.2%*	*11*	*4.2%*
VITREOUS				
110.120 persistent hyaloid artery/remnant	2	0.1%	1	0.4%
110.135 PHPV/PTVL	1	0.1%	0	
110.320 vitreal degeneration	10	0.6%	2	0.8%
RETINA				
120.170 retinal dysplasia, folds	5	0.3%	0	
120.180 retinal dysplasia, geographic	0		2	0.8%
120.310 generalized progressive retinal atrophy (PRA)	3	0.2%	0	
120.400 retinal hemorrhage	1	0.1%	0	
120.910 retinal detachment without dialysis	1	0.1%	0	
OPTIC NERVE				
130.110 micropapilla	1	0.1%	0	
130.120 optic nerve hypoplasia	1	0.1%	0	
130.150 optic disc coloboma	2	0.1%	1	0.4%
OTHER				
900.000 other, unspecified	13	0.8%	0	
900.100 other, not inherited	44	2.8%	15	5.7%
900.110 other. suspect not inherited/significance unknown	10	0.6%	1	0.4%
NORMAL				
0.000 normal globe	1176	74.2%	166	62.9%

BOYKIN SPANIEL

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Distichiasis	Not defined	1	Breeder option	
B.	Corneal dystrophy - epithelial/stromal	Not defined	1	Breeder option	
C.	Persistent pupillary membranes - iris to iris - lens pigment foci/no strands	 Not defined Not defined	 2 3	 Breeder option Passes with no notation	
D.	Cataract	Not defined	1	NO	
E.	Persistent hyaloid artery	Not defined	2	Breeder option	
F.	Retinal atrophy - generalized	Not defined	1	NO	
G.	Retinal dysplasia - folds	Not defined	1	Breeder option	
H.	Choroidal hypoplasia (Collie Eye Anomaly) - staphyloma/coloboma - retinal detachment - retinal hemorrhage - optic nerve coloboma	Autosomal recessive	4-6	NO	Mutation in the *NHEJ1 gene*

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established, although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Corneal dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

C. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

D. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

E. Persistent hyaloid artery (PHA)

Congenital defect resulting from abnormalities in the development and regression of the hyaloid artery. The blood vessel remnant can be present in the vitreous as a small patent vascular strand (PHA) or as a non-vascular strand that appears gray-white (persistent hyaloid remnant).

F. Retinal atrophy - generalized

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram before it is apparent clinically. In most breeds studied to date, retinal atrophy is recessively inherited.

G. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

H. Choroidal hypoplasia (Collie Eye Anomaly)
- Staphyloma/coloboma
- Retinal detachment
- Retinal hemorrhage
- Optic nerve coloboma

A spectrum of malformations present at birth and ranging from inadequate development of the choroid (choroidal hypoplasia) to defects of the choroid, sclera, and/or optic nerve (coloboma/staphyloma) to complete retinal detachment (with or without hemorrhage). Mildly

affected animals will have no detectable vision deficit.

This disorder is collectively referred to as "Collie Eye Anomaly." The choroidal hypoplasia component is caused by a 7799 base pair deletion with the gene *NHEJ1.* The mutation is a recessive trait. A DNA test is available and is diagnostic only for the choroidal hypoplasia component of CEA. For colobomas to develop, an additional mutation in a second gene has to be present; that gene is still unknown.

References

1. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

2. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

3. ACVO Genetics Committee, 2018 and/or Data from OFA All-Breeds Report 2013-2017.

4. ACVO Genetics Committee, 2007 and/or Data from CERF All-Breeds Report, 2002-2006.

5. ACVO Genetics Committee, 2008 and/or Data from CERF All-Breeds Report, 2003-2007.

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OCULAR DISORDERS REPORT
BOYKIN SPANIEL

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2013 2803 #	%	2014-2018 1723 #	%
GLOBE						
0.110	microphthalmia		1	0.0%	0	
EYELIDS						
20.160	macropalpebral fissure		2	0.1%	0	
21.000	entropion, unspecified		1	0.0%	0	
25.110	distichiasis		370	13.2%	232	13.5%
NASOLACRIMAL						
32.110	imperforate lower nasolacrimal punctum		0		2	0.1%
NICTITANS						
51.100	third eyelid cartilage anomaly		1	0.0%	1	0.1%
52.110	prolapsed gland of the third eyelid		1	0.0%	0	
CORNEA						
70.210	corneal pannus		1	0.0%	0	
70.220	pigmentary keratitis		1	0.0%	3	0.2%
70.700	corneal dystrophy		49	1.7%	10	0.6%
70.730	corneal endothelial degeneration		1	0.0%	0	
UVEA						
93.110	iris hypoplasia		0		4	0.2%
93.150	iris coloboma		1	0.0%	0	
93.710	persistent pupillary membranes, iris to iris		56	2.0%	64	3.7%
93.720	persistent pupillary membranes, iris to lens		2	0.1%	0	
93.730	persistent pupillary membranes, iris to cornea		5	0.2%	0	
93.740	persistent pupillary membranes, iris sheets		2	0.1%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands		6	0.2%	23	1.3%
93.999	uveal cysts		1	0.0%	0	
97.150	chorioretinal coloboma, congenital		0		2	0.1%
LENS						
100.200	cataract, unspecified		7	0.2%	0	
100.210	cataract. suspect not inherited/significance unknown		161	5.7%	135	7.8%
100.301	punctate cataract, anterior cortex		14	0.5%	10	0.6%
100.302	punctate cataract, posterior cortex		37	1.3%	12	0.7%
100.303	punctate cataract, equatorial cortex		7	0.2%	0	
100.304	punctate cataract, anterior sutures		3	0.1%	3	0.2%
100.305	punctate cataract, posterior sutures		14	0.5%	11	0.6%
100.306	punctate cataract, nucleus		9	0.3%	8	0.5%
100.307	punctate cataract, capsular		6	0.2%	11	0.6%
100.311	incipient cataract, anterior cortex		15	0.5%	8	0.5%
100.312	incipient cataract, posterior cortex		33	1.2%	33	1.9%
100.313	incipient cataract, equatorial cortex		6	0.2%	3	0.2%
100.314	incipient cataract, anterior sutures		0		1	0.1%
100.315	incipient cataract, posterior sutures		4	0.1%	3	0.2%
100.316	incipient cataract, nucleus		9	0.3%	4	0.2%
100.317	incipient cataract, capsular		5	0.2%	11	0.6%
100.321	incomplete cataract, anterior cortex		0		2	0.1%
100.322	incomplete cataract, posterior cortex		0		1	0.1%

LENS CONTINUED		1991-2013		2014-2018	
100.323	incomplete cataract, equatorial cortex	0		3	0.2%
100.327	incomplete cataract, capsular	0		1	0.1%
100.328	posterior suture tip opacities	1	0.0%	21	1.2%
100.330	generalized/complete cataract	10	0.4%	1	0.1%
100.999	*significant cataracts (summary)*	*179*	*6.4%*	*126*	*7.3%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	16	0.6%	36	2.1%
110.135	PHPV/PTVL	3	0.1%	2	0.1%
110.320	vitreal degeneration	5	0.2%	5	0.3%
FUNDUS					
97.110	choroidal hypoplasia	33	1.2%	21	1.2%
97.120	coloboma	1	0.0%	0	
RETINA					
120.170	retinal dysplasia, folds	59	2.1%	18	1.0%
120.180	retinal dysplasia, geographic	9	0.3%	0	
120.190	retinal dysplasia, detached	1	0.0%	1	0.1%
120.310	generalized progressive retinal atrophy (PRA)	30	1.1%	1	0.1%
120.400	retinal hemorrhage	2	0.1%	0	
120.910	retinal detachment without dialysis	2	0.1%	0	
120.920	retinal detachment with dialysis	0		1	0.1%
120.960	retinopathy	4	0.1%	11	0.6%
OPTIC NERVE					
130.110	micropapilla	1	0.0%	0	
130.120	optic nerve hypoplasia	4	0.1%	0	
130.150	optic disc coloboma	14	0.5%	20	1.2%
OTHER					
900.000	other, unspecified	73	2.6%	0	
900.100	other, not inherited	94	3.4%	89	5.2%
900.110	other. suspect not inherited/significance unknown	8	0.3%	9	0.5%
NORMAL					
0.000	normal globe	2173	77.5%	1104	64.1%

OCULAR DISORDERS REPORT
BOZ SHEPHERD

There are insufficient breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the BOZ SHEPHERD breed. Therefore, there are no conditions listed with breeding advice.

OCULAR DISORDERS REPORT
BOZ SHEPHERD

Diagnostic Name	TOTAL DOGS EXAMINED	1991-2013 0 #	%	2014-2018 1 #	%
NORMAL					
0.000 normal globe		0		1	100.0%

BRACCO ITALIANO

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Distichiasis	Not defined	1	Breeder option
B.	Cataract	Not defined	2	NO
C.	Retinal dysplasia - folds	Not defined	3	Breeder option

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

C. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

References

There are no references providing detailed descriptions of hereditary conditions of the Bracco Italiano breed. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 2013-2014 and Data from OFA All-Breeds Report, 2013-2014.

2. ACVO Genetics Committee, 2009 and/or Data from CERF All-Breeds Report, 2008.

3. ACVO Genetics Committee, 2006 and/or Data from CERF All-Breeds Report, 2001-2005.

OCULAR DISORDERS REPORT
BRACCO ITALIANO

Diagnostic Name		1991-2013 TOTAL DOGS EXAMINED 76 #	 %	2014-2018 88 #	 %
EYELIDS					
20.160	macropalpebral fissure	1	1.3%	0	
21.000	entropion, unspecified	4	5.3%	4	4.5%
25.110	distichiasis	7	9.2%	10	11.4%
NICTITANS					
51.100	third eyelid cartilage anomaly	1	1.3%	1	1.1%
52.110	prolapsed gland of the third eyelid	1	1.3%	0	
UVEA					
93.710	persistent pupillary membranes, iris to iris	2	2.6%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		1	1.1%
LENS					
100.210	cataract. suspect not inherited/significance unknown	7	9.2%	5	5.7%
100.301	punctate cataract, anterior cortex	2	2.6%	0	
100.302	punctate cataract, posterior cortex	2	2.6%	1	1.1%
100.311	incipient cataract, anterior cortex	1	1.3%	2	2.3%
100.312	incipient cataract, posterior cortex	5	6.6%	4	4.5%
100.313	incipient cataract, equatorial cortex	1	1.3%	3	3.4%
100.316	incipient cataract, nucleus	2	2.6%	0	
100.317	incipient cataract, capsular	0		2	2.3%
100.328	posterior suture tip opacities	1	1.3%	1	1.1%
100.999	*significant cataracts (summary)*	*13*	*17.1%*	*12*	*13.6%*
VITREOUS					
110.135	PHPV/PTVL	0		2	2.3%
110.320	vitreal degeneration	0		2	2.3%
RETINA					
120.170	retinal dysplasia, folds	6	7.9%	3	3.4%
120.960	retinopathy	0		2	2.3%
OTHER					
900.000	other, unspecified	2	2.6%	0	
900.100	other, not inherited	3	3.9%	4	4.5%
NORMAL					
0.000	normal globe	49	64.5%	50	56.8%

OCULAR DISORDERS REPORT
BRAQUE D'AUVERGNE

There are insufficient breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the BRAQUE D'AUVERGNE breed. Therefore, there are no conditions listed with breeding advice.

OCULAR DISORDERS REPORT
BRAQUE D'AUVERGNE

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2013 3 #	%	2014-2018 36 #	%
GLOBE						
0.110	microphthalmia		0		1	2.8%
UVEA						
93.710	persistent pupillary membranes, iris to iris		0		5	13.9%
93.720	persistent pupillary membranes, iris to lens		0		1	2.8%
93.730	persistent pupillary membranes, iris to cornea		0		1	2.8%
LENS						
100.210	cataract. suspect not inherited/significance unknown		0		7	19.4%
100.303	punctate cataract, equatorial cortex		0		1	2.8%
100.312	incipient cataract, posterior cortex		0		1	2.8%
100.317	incipient cataract, capsular		0		1	2.8%
100.999	*significant cataracts (summary)*		*0*		*3*	*8.3%*
RETINA						
120.170	retinal dysplasia, folds		0		1	2.8%
OTHER						
900.100	other, not inherited		0		3	8.3%
900.110	other. suspect not inherited/significance unknown		0		1	2.8%
NORMAL						
0.000	normal globe		3	100.0%	19	52.8%

OCULAR DISORDERS REPORT
BRAQUE DU BOURBONNAIS

There are insufficient breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the BRAQUE DU BOURBONNAIS breed. Therefore, there are no conditions listed with breeding advice.

OCULAR DISORDERS REPORT
BRAQUE DU BOURBONNAIS

Diagnostic Name	TOTAL DOGS EXAMINED	1991-2013 6 #	% 	2014-2018 0 #	%
NORMAL					
0.000 normal globe		6	100.0%	0	

OCULAR DISORDERS REPORT
BRAQUE FRANCAIS PYRENEES

There are insufficient breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the BRAQUE FRANCAIS PYRENEES breed. Therefore, there are no conditions listed with breeding advice.

OCULAR DISORDERS REPORT
BRAQUE FRANCAIS PYRENEES

Diagnostic Name	TOTAL DOGS EXAMINED	1991-2013 3 #	 %	2014-2018 2 #	 %
NORMAL					
0.000 normal globe		2	66.7%	2	100.0%

BRAQUE FRANCAIS

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Cataract	Not defined	1	NO

Description and Comments

A. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Braque Francais breed. The conditions listed above are generally recognized to exist in the breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 2017 and/or Data from CERF/OFA All-Breeds Report, 2010-2016.

OCULAR DISORDERS REPORT
BRAQUE FRANCAIS

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2013 7 #	%	2014-2018 59 #	%
EYELIDS						
25.110	distichiasis		0		2	3.4%
UVEA						
93.710	persistent pupillary membranes, iris to iris		0		1	1.7%
93.750	persistent pupillary membranes, lens pigment foci/no strands		0		2	3.4%
LENS						
100.210	cataract. suspect not inherited/significance unknown		1	14.3%	5	8.5%
100.312	incipient cataract, posterior cortex		0		1	1.7%
100.316	incipient cataract, nucleus		0		1	1.7%
100.322	incomplete cataract, posterior cortex		0		1	1.7%
100.999	*significant cataracts (summary)*		*0*		*3*	*5.1%*
OTHER						
900.100	other, not inherited		1	14.3%	6	10.2%
NORMAL						
0.000	normal globe		6	85.7%	43	72.9%

BRAZILIAN TERRIER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Multifocal retinopathy	Autosomal recessive	1	Breeder option	Mutation in the *BEST1* gene

Description and Comments

A. Multifocal retinopathy

Canine Multifocal Retinopathy type 1 (cmr1) is characterized by numerous distinct (i.e. multi-focal), roughly circular patches of elevated retina (multifocal bullous retinal detachments). There may be a serous subretinal fluid, or accumulation of subretinal material that produces gray-tan-pink colored lesions. These lesions, looking somewhat like blisters, vary in location and size, although typically they are present in both eyes of the affected dog.

The disease generally develops in young dogs between 11-20 weeks of age and there is minimal progression after 1 year of age. The lesions may flatten, leaving areas of retinal thinning and RPE hypertrophy, hyperplasia, and pigmentation. Discrete areas of tapetal hyper-reflectivity may be seen in areas of previous retinal and RPE detachments. Most dogs exhibit no noticeable problem with vision or electroretinographic abnormalities despite their abnormal appearing retinas.

Canine Multifocal Retinopathy type 1 is caused by a mutation in the Bestrophin 1 gene (BEST1) and is described to be recessively inherited in the Great Pyrenees, Dogue de Bordeaux, Bullmastiff, and Mastiff. A DNA test is available.

References

There are no breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the Brazilian Terrier. The condition listed above is currently noted solely due to the availability of a genetic test for the disease.

1. Zangerl B, Wickstrom K, Slavik J, et al. Assessment of canine BEST1 variations identifies new mutations and establishes an independent bestrophinopathy model (cmr3). *Mol Vis*. 2010;16:2791-2804.

BRIARD

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Corneal dystrophy - epithelial/stromal	Not defined	1	Breeder option	
B.	Persistent pupillary membranes - iris to iris - lens pigment foci/no strands	Not defined Not defined	2 3	Breeder option Passes with no notation	
C.	Cataract	Not defined	4	NO	
D.	Retinal atrophy - generalized	Not defined	1	NO	
E.	Retinal dystrophy formerly Congenital stationary night blindness (*CSNB*)	Autosomal recessive	1, 5-10	NO	Mutation in the *RPE65* gene

Description and Comments

A. Corneal dystrophy- epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

B. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

C. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane,

persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

D. Retinal atrophy - generalized

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

In the Briard, early fundus abnormalities usually appear after 4 years of age. The electroretinogram (ERG) shows marked functional abnormalities indicative of a progressive rod-cone degeneration. The age for early diagnosis by ERG has not been established but should be possible in dogs over 2 years of age.

E. Retinal dystrophy formerly Congenital stationary night blindness (*CSNB*)

A non-progressive retinal function defect characterized primarily by night blindness; day vision is normal to severely compromised. CSNB is an autosomal recessive trait caused by a mutation in the RPE65 gene. The condition is detected by 5-6 weeks of age, after the postnatal maturation of the retina is completed. Nystagmus is present in some dogs, particularly in those having night blindness and severely compromised day vision. Ophthalmoscopic examination shows no abnormalities. Abnormalities in serum lipids (mild hypercholesterolemia) and elevated arachidonic acid have been noted in some animals. The ERG results are specific and diagnostic for the disorder. ERG testing is essential to distinguish this disorder from more central visual pathway defects which may appear clinically similar.

The gene mutation RPE65 has been identified. This is the same mutation as causes Leber's congenital amaurosis, also sometimes called juvenile retinitis pigmentosa (RP), in humans. A DNA test is available.

Historical Note:

Central progressive retinal atrophy was previously a condition listed for this breed. However as the condition is no longer identified in the breed, the condition has been removed. Central progressive retinal atrophy was a progressive retinal degeneration in which photoreceptor death occurred secondary to disease of the underlying pigment epithelium. Progression was slow and some animals never lost vision. CPRA occurred in England, but was uncommon elsewhere.

References

1. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

2. ACVO Genetics Committee, 2006 and/or Data from CERF All-Breeds Report, 2001-2005.

3. ACVO Genetics Committee, 2017 and/or Data from OFA All-Breeds Report, 2015-2016.

4. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

5. Narfstrom K. Retinal dystrophy or 'congenital stationary night blindness' in the Briard dog. *Vet Ophthalmol*. 1999;2:75-76.

6. Narfstrom K, Wrigstad A, Nilsson SE. The Briard dog: a new animal model of congenital stationary night blindness. *Br J Ophthalmol*. 1989;73:750-756.

7. Veske A, Nilsson SE, Narfstrom K, et al. Retinal dystrophy of Swedish Briard/Briard-Beagle dogs is due to a 4-bp deletion in RPE65. *Genomics*. 1999;57:57-61.

8. Wrigstad A, Narfstrom K, Nilsson SE. Slowly progressive changes of the retina and retinal pigment epithelium in Briard dogs with hereditary retinal dystrophy. A morphological study. *Doc Ophthalmol.* 1994;87:337-354.

9. Lightfoot RM, Cabral L, Gooch L, et al. Retinal pigment epithelial dystrophy in Briard dogs. *Res Vet Sci*. 1996;60:17-23.

10. Aguirre GD, Baldwin V, Pearce-Kelling S, et al. Congenital stationary night blindness in the dog: common mutation in the RPE65 gene indicates founder effect. *Mol Vis*. 1998;4:23.

OCULAR DISORDERS REPORT
BRIARD

		1991-2013 2098		2014-2018 273	
	TOTAL DOGS EXAMINED				
Diagnostic Name		**#**	**%**	**#**	**%**
GLOBE					
10.000	glaucoma	1	0.0%	0	
EYELIDS					
20.140	ectopic cilia	1	0.0%	0	
21.000	entropion, unspecified	1	0.0%	0	
25.110	distichiasis	9	0.4%	0	
NASOLACRIMAL					
32.110	imperforate lower nasolacrimal punctum	2	0.1%	0	
NICTITANS					
51.100	third eyelid cartilage anomaly	2	0.1%	0	
52.110	prolapsed gland of the third eyelid	2	0.1%	0	
CORNEA					
70.210	corneal pannus	1	0.0%	0	
70.700	corneal dystrophy	26	1.2%	8	2.9%
UVEA					
93.710	persistent pupillary membranes, iris to iris	17	0.8%	12	4.4%
93.720	persistent pupillary membranes, iris to lens	2	0.1%	1	0.4%
93.730	persistent pupillary membranes, iris to cornea	2	0.1%	0	
93.740	persistent pupillary membranes, iris sheets	2	0.1%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	5	0.2%	6	2.2%
93.999	uveal cysts	10	0.5%	0	
LENS					
100.200	cataract, unspecified	9	0.4%	0	
100.210	cataract. suspect not inherited/significance unknown	65	3.1%	11	4.0%
100.301	punctate cataract, anterior cortex	6	0.3%	0	
100.302	punctate cataract, posterior cortex	1	0.0%	0	
100.303	punctate cataract, equatorial cortex	0		1	0.4%
100.305	punctate cataract, posterior sutures	2	0.1%	2	0.7%
100.306	punctate cataract, nucleus	5	0.2%	0	
100.307	punctate cataract, capsular	3	0.1%	2	0.7%
100.311	incipient cataract, anterior cortex	6	0.3%	0	
100.312	incipient cataract, posterior cortex	9	0.4%	0	
100.313	incipient cataract, equatorial cortex	2	0.1%	0	
100.315	incipient cataract, posterior sutures	1	0.0%	0	
100.316	incipient cataract, nucleus	2	0.1%	2	0.7%
100.317	incipient cataract, capsular	2	0.1%	0	
100.323	incomplete cataract, equatorial cortex	1	0.0%	0	
100.328	posterior suture tip opacities	0		3	1.1%
100.330	generalized/complete cataract	3	0.1%	0	
100.999	*significant cataracts (summary)*	*52*	*2.5%*	*7*	*2.6%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	1	0.0%	0	
110.135	PHPV/PTVL	3	0.1%	0	
110.320	vitreal degeneration	2	0.1%	0	

	1991-2013		2014-2018	
FUNDUS				
97.120 coloboma	1	0.0%	0	
RETINA				
120.170 retinal dysplasia, folds	7	0.3%	0	
120.180 retinal dysplasia, geographic	1	0.0%	0	
120.310 generalized progressive retinal atrophy (PRA)	1	0.0%	0	
120.400 retinal hemorrhage	1	0.0%	0	
120.910 retinal detachment without dialysis	2	0.1%	0	
OPTIC NERVE				
130.120 optic nerve hypoplasia	1	0.0%	0	
130.150 optic disc coloboma	3	0.1%	0	
OTHER				
900.000 other, unspecified	37	1.8%	0	
900.100 other, not inherited	66	3.1%	12	4.4%
900.110 other. suspect not inherited/significance unknown	16	0.8%	0	
NORMAL				
0.000 normal globe	1935	92.2%	225	82.4%

BRITTANY

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Distichiasis	Not defined	1	Breeder option
B.	Persistent pupillary membrane			
	- iris to iris	Not defined	2	Breeder option
	- lens pigment foci/no strands	Not defined	3	Passes with no notation
C.	Cataract	Not defined	4	NO
D.	Vitreous degeneration	Not defined	5	Breeder option
E.	Retinal dysplasia - folds	Not defined	5	Breeder option
F.	Retinal dysplasia - geographic	Not defined	6	NO

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Persistent pupillary membrane (PPM)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

C. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume

cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

The exact frequency and significance of cataracts in the Brittany is not known, although it is probably low.

D. Vitreous degeneration

Liquefaction of the vitreous gel which may predispose to retinal detachment.

E. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

F. Retinal dysplasia - geographic

Abnormal development of the retina present at birth. Any irregularly shaped area of abnormal retinal development containing both areas of thinning and areas of elevation representing folds and retinal disorganization.

References

There are no references providing detailed descriptions of hereditary conditions of the Brittany breed. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 2002-2003 and/or Data from CERF All-Breeds Report, 2002-2003.

2. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

3. ACVO Genetics Committee, 2017 and/or Data from OFA All-Breeds Report, 2015-2016.

4. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

5. ACVO Genetics Committee, 2006 and/or Data from CERF All-Breeds Report, 2001-2005.

6. ACVO Genetics Committee, 2008 and/or Data from CERF All-Breeds Report, 2003-2007.

OCULAR DISORDERS REPORT
BRITTANY

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2013 1973 #	 %	2014-2018 771 #	 %
EYELIDS						
25.110	distichiasis		48	2.4%	15	1.9%
NASOLACRIMAL						
40.910	keratoconjunctivitis sicca		1	0.1%	0	
NICTITANS						
52.110	prolapsed gland of the third eyelid		2	0.1%	0	
CORNEA						
70.700	corneal dystrophy		5	0.3%	1	0.1%
70.730	corneal endothelial degeneration		3	0.2%	0	
UVEA						
93.710	persistent pupillary membranes, iris to iris		31	1.6%	14	1.8%
93.720	persistent pupillary membranes, iris to lens		2	0.1%	1	0.1%
93.750	persistent pupillary membranes, lens pigment foci/no strands		4	0.2%	17	2.2%
93.999	uveal cysts		1	0.1%	0	
LENS						
100.200	cataract, unspecified		10	0.5%	0	
100.210	cataract. suspect not inherited/significance unknown		83	4.2%	40	5.2%
100.301	punctate cataract, anterior cortex		10	0.5%	5	0.6%
100.302	punctate cataract, posterior cortex		25	1.3%	5	0.6%
100.303	punctate cataract, equatorial cortex		2	0.1%	1	0.1%
100.304	punctate cataract, anterior sutures		1	0.1%	0	
100.305	punctate cataract, posterior sutures		5	0.3%	1	0.1%
100.306	punctate cataract, nucleus		1	0.1%	2	0.3%
100.307	punctate cataract, capsular		8	0.4%	4	0.5%
100.311	incipient cataract, anterior cortex		10	0.5%	1	0.1%
100.312	incipient cataract, posterior cortex		32	1.6%	16	2.1%
100.313	incipient cataract, equatorial cortex		12	0.6%	1	0.1%
100.314	incipient cataract, anterior sutures		2	0.1%	0	
100.315	incipient cataract, posterior sutures		8	0.4%	1	0.1%
100.316	incipient cataract, nucleus		6	0.3%	2	0.3%
100.317	incipient cataract, capsular		4	0.2%	2	0.3%
100.321	incomplete cataract, anterior cortex		0		1	0.1%
100.322	incomplete cataract, posterior cortex		1	0.1%	0	
100.323	incomplete cataract, equatorial cortex		1	0.1%	0	
100.327	incomplete cataract, capsular		1	0.1%	3	0.4%
100.328	posterior suture tip opacities		0		3	0.4%
100.330	generalized/complete cataract		4	0.2%	0	
100.340	resorbing/hypermature cataract		0		1	0.1%
100.375	subluxation/luxation, unspecified		3	0.2%	1	0.1%
100.999	*significant cataracts (summary)*		*143*	*7.2%*	*46*	*6.0%*
VITREOUS						
110.120	persistent hyaloid artery/remnant		1	0.1%	5	0.6%
110.135	PHPV/PTVL		1	0.1%	0	
110.200	vitritis		0		1	0.1%
110.320	vitreal degeneration		12	0.6%	5	0.6%

		1991-2013		2014-2018	
RETINA					
120.170	retinal dysplasia, folds	7	0.4%	1	0.1%
120.180	retinal dysplasia, geographic	6	0.3%	2	0.3%
120.310	generalized progressive retinal atrophy (PRA)	21	1.1%	0	
120.910	retinal detachment without dialysis	1	0.1%	0	
120.920	retinal detachment with dialysis	1	0.1%	0	
120.960	retinopathy	1	0.1%	1	0.1%
OPTIC NERVE					
130.110	micropapilla	1	0.1%	0	
130.120	optic nerve hypoplasia	1	0.1%	0	
130.150	optic disc coloboma	1	0.1%	0	
OTHER					
900.000	other, unspecified	17	0.9%	0	
900.100	other, not inherited	63	3.2%	31	4.0%
900.110	other. suspect not inherited/significance unknown	8	0.4%	1	0.1%
NORMAL					
0.000	normal globe	1723	87.3%	615	79.8%

BRUSSELS GRIFFON

	DISORDER	INHERITANCE	REFERENCES	BREEDING ADVICE
A.	Exposure keratopathy syndrome/ Macroblepharon	Not defined	1	Breeder option
B.	Distichiasis	Not defined	2, 3	Breeder option
C.	Persistent pupillary membranes			
	- iris to iris	Not defined	1, 3	Breeder option
	- lens pigment foci/no strands	Not defined	4	Passes with no notation
D.	Cataract	Not defined	1	NO
E.	Lens luxation	Autosomal recessive	2, 3	NO
F.	Persistent hyaloid artery	Not defined	3	Breeder option
G.	Vitreous degeneration	Not defined	1, 5-6	Breeder option
H.	Retinal atrophy - generalized	Not defined	2, 3	NO
I.	Retinal dysplasia - folds	Not defined	4	Breeder option
	- geographic	Not defined	6	NO
J.	Optic nerve coloboma	Not defined	1	NO

Description and Comments

A. Exposure keratopathy syndrome/macroblepharon

A condition characterized by variable degrees of superficial vascularization, fibrosis and/or pigmentation of the cornea. May be associated with excessive exposure/irritation of the globe due to shallow orbits, lower eyelid medial entropion, lagophthalmos and macropalpebral fissure.

B. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong

recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

C. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

D. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

E. Lens luxation

Partial (subluxation) or complete displacement of the lens from the normal anatomic site behind the pupil. Lens luxation not associated with trauma or inflammation is presumed to be inherited. Lens luxation may result in elevated intraocular pressure (glaucoma) causing vision impairment or blindness.

F. Persistent hyaloid artery (PHA)

Congenital defect resulting from abnormalities in the development and regression of the hyaloid artery. The blood vessel remnant can be present in the vitreous as a small patent vascular strand (PHA) or as a non-vascular strand that appears gray-white (persistent hyaloid remnant).

G. Vitreous degeneration

Liquefaction of the vitreous gel which may predispose to retinal detachment.

H. Retinal atrophy - generalized

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as Progressive Retinal Atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. Except for X-linked PRA in the Siberian Husky, in all breeds studied to date, PRA is inherited as an autosomal recessive trait.

I. Retinal dysplasia - geographic

Abnormal development of the retina present at birth. Any irregularly shaped area of abnormal retinal development containing both areas of thinning and areas of elevation representing folds and retinal disorganization.

J. Optic nerve coloboma

A congenital cavity in the optic nerve which, if large, may cause blindness or vision impairment.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Brussels Griffon breed. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

2. ACVO Genetics Committee, 2002-2003 and/or Data from CERF All-Breeds Report, 2002-2003.

3. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

4. ACVO Genetics Committee, 2017 and/or Data from OFA All-Breeds Report, 2015-2016.

5. ACVO Genetics Committee, 2007 and/or Data from CERF All-Breeds Report, 2002-2006.

6. ACVO Genetics Committee, 2008 and/or Data from CERF All-Breeds Report, 2003-2007.

OCULAR DISORDERS REPORT
BRUSSELS GRIFFON

		1991-2013		2014-2018	
	TOTAL DOGS EXAMINED	1234		341	
Diagnostic Name		#	%	#	%
EYELIDS					
20.140	ectopic cilia	8	0.6%	0	
21.000	entropion, unspecified	3	0.2%	3	0.9%
25.110	distichiasis	28	2.3%	7	2.1%
NASOLACRIMAL					
40.910	keratoconjunctivitis sicca	2	0.2%	1	0.3%
CORNEA					
70.210	corneal pannus	1	0.1%	0	
70.220	pigmentary keratitis	17	1.4%	9	2.6%
70.700	corneal dystrophy	10	0.8%	0	
UVEA					
93.110	iris hypoplasia	2	0.2%	0	
93.710	persistent pupillary membranes, iris to iris	94	7.6%	47	13.8%
93.720	persistent pupillary membranes, iris to lens	1	0.1%	0	
93.730	persistent pupillary membranes, iris to cornea	2	0.2%	0	
93.740	persistent pupillary membranes, iris sheets	1	0.1%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	4	0.3%	11	3.2%
93.760	persistent pupillary membranes, endothelial opacity/no strands	3	0.2%	1	0.3%
93.999	uveal cysts	2	0.2%	0	
97.150	chorioretinal coloboma, congenital	1	0.1%	0	
LENS					
100.200	cataract, unspecified	8	0.6%	0	
100.210	cataract. suspect not inherited/significance unknown	48	3.9%	11	3.2%
100.301	punctate cataract, anterior cortex	22	1.8%	2	0.6%
100.302	punctate cataract, posterior cortex	10	0.8%	2	0.6%
100.303	punctate cataract, equatorial cortex	4	0.3%	1	0.3%
100.304	punctate cataract, anterior sutures	3	0.2%	0	
100.305	punctate cataract, posterior sutures	1	0.1%	0	
100.307	punctate cataract, capsular	4	0.3%	0	
100.311	incipient cataract, anterior cortex	75	6.1%	7	2.1%
100.312	incipient cataract, posterior cortex	32	2.6%	4	1.2%
100.313	incipient cataract, equatorial cortex	42	3.4%	2	0.6%
100.314	incipient cataract, anterior sutures	7	0.6%	0	
100.315	incipient cataract, posterior sutures	5	0.4%	0	
100.316	incipient cataract, nucleus	5	0.4%	0	
100.317	incipient cataract, capsular	2	0.2%	0	
100.321	incomplete cataract, anterior cortex	0		3	0.9%
100.322	incomplete cataract, posterior cortex	0		1	0.3%
100.330	generalized/complete cataract	29	2.4%	0	
100.375	subluxation/luxation, unspecified	8	0.6%	0	
100.999	*significant cataracts (summary)*	*249*	*20.2%*	*22*	*6.5%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	8	0.6%	2	0.6%
110.135	PHPV/PTVL	2	0.2%	0	
110.200	vitritis	4	0.3%	17	5.0%

VITREOUS CONTINUED		1991-2013		2014-2018	
110.320	vitreal degeneration	303	24.6%	30	8.8%
FUNDUS					
97.110	choroidal hypoplasia	2	0.2%	0	
97.120	coloboma	2	0.2%	0	
RETINA					
120.170	retinal dysplasia, folds	13	1.1%	19	5.6%
120.180	retinal dysplasia, geographic	13	1.1%	2	0.6%
120.190	retinal dysplasia, detached	1	0.1%	1	0.3%
120.310	generalized progressive retinal atrophy (PRA)	23	1.9%	0	
120.400	retinal hemorrhage	2	0.2%	0	
120.910	retinal detachment without dialysis	2	0.2%	0	
120.960	retinopathy	0		1	0.3%
OPTIC NERVE					
130.120	optic nerve hypoplasia	2	0.2%	1	0.3%
130.150	optic disc coloboma	18	1.5%	1	0.3%
OTHER					
900.000	other, unspecified	26	2.1%	0	
900.100	other, not inherited	28	2.3%	17	5.0%
900.110	other. suspect not inherited/significance unknown	12	1.0%	4	1.2%
NORMAL					
0.000	normal globe	754	61.1%	202	59.2%

BULL TERRIER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Persistent pupillary membranes			
	- iris to iris	Not defined	1, 2	Breeder Option
	- iris to cornea	Not defined	2	NO
B.	Cataract	Not defined	1	NO

Description and Comments

A. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

B. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

References

There are no references providing detailed descriptions of hereditary conditions of the Bull Terrier breed. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 2000-2002 and/or Data from CERF All-Breeds Report, 2000-2002.

2. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

OCULAR DISORDERS REPORT
BULL TERRIER

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2013 237 #	 %	2014-2018 18 #	 %
GLOBE						
0.110	microphthalmia		3	1.3%	0	
EYELIDS						
21.000	entropion, unspecified		2	0.8%	0	
22.000	ectropion, unspecified		1	0.4%	0	
25.110	distichiasis		5	2.1%	0	
CORNEA						
70.700	corneal dystrophy		1	0.4%	0	
70.730	corneal endothelial degeneration		5	2.1%	0	
UVEA						
93.710	persistent pupillary membranes, iris to iris		8	3.4%	0	
93.720	persistent pupillary membranes, iris to lens		4	1.7%	0	
93.730	persistent pupillary membranes, iris to cornea		11	4.6%	1	5.6%
93.740	persistent pupillary membranes, iris sheets		1	0.4%	0	
93.760	persistent pupillary membranes, endothelial opacity/no strands		1	0.4%	0	
LENS						
100.210	cataract. suspect not inherited/significance unknown		6	2.5%	0	
100.301	punctate cataract, anterior cortex		2	0.8%	1	5.6%
100.302	punctate cataract, posterior cortex		2	0.8%	0	
100.303	punctate cataract, equatorial cortex		2	0.8%	0	
100.304	punctate cataract, anterior sutures		1	0.4%	0	
100.306	punctate cataract, nucleus		1	0.4%	0	
100.307	punctate cataract, capsular		1	0.4%	0	
100.311	incipient cataract, anterior cortex		1	0.4%	0	
100.312	incipient cataract, posterior cortex		1	0.4%	0	
100.313	incipient cataract, equatorial cortex		2	0.8%	2	11.1%
100.314	incipient cataract, anterior sutures		1	0.4%	0	
100.315	incipient cataract, posterior sutures		1	0.4%	0	
100.330	generalized/complete cataract		3	1.3%	0	
100.375	subluxation/luxation, unspecified		7	3.0%	0	
100.999	*significant cataracts (summary)*		*18*	*7.6%*	*3*	*16.7%*
VITREOUS						
110.320	vitreal degeneration		4	1.7%	1	5.6%
RETINA						
120.170	retinal dysplasia, folds		1	0.4%	0	
120.180	retinal dysplasia, geographic		0		1	5.6%
120.310	generalized progressive retinal atrophy (PRA)		1	0.4%	0	
120.910	retinal detachment without dialysis		2	0.8%	0	
OPTIC NERVE						
130.110	micropapilla		2	0.8%	1	5.6%
130.120	optic nerve hypoplasia		3	1.3%	0	

	1991-2013	2014-2018
OTHER		
900.000 other, unspecified	5 2.1%	0
900.100 other, not inherited	8 3.4%	0
900.110 other. suspect not inherited/significance unknown	3 1.3%	0
NORMAL		
0.000 normal globe	187 78.9%	13 72.2%

BULLDOG

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Keratoconjunctivitis sicca	Not defined	1, 7, 8	NO	
B.	Entropion	Not defined	1, 3	Breeder option	
C.	Ectropion	Not defined	1	Breeder option	
D.	Distichiasis	Not defined	1	Breeder option	
E.	Ectopic cilia	Not defined	1	Breeder option	
F.	Eury/Macroblepharon	Not defined	1	Breeder option	
G.	Prolapsed gland of third eyelid	Not defined	1, 4-6	Breeder option	
H.	Exposure/Pigmentary Keratitis	Not defined	2	Breeder option	
I.	Corneal dystrophy – epithelial/stromal	Not defined	9	Breeder option	
J.	Secondary keratitis - chronic	Not defined	2	Breeder option	
K.	Uveal cysts	Not defined	2	Breeder option	
L.	Persistent pupillary membranes - iris to iris	Not defined	10	Breeder option	
M.	Cataract	Not defined	1	NO	
N.	Retinal dysplasia - folds	Not defined	1	Breeder option	
O.	Multifocal retinopathy - *cmr1*	Autosomal recessive	11, 12	Breeder option	Mutation in the *BEST1* gene

Description and Comments

A. Keratoconjunctivitis sicca

An abnormality of the tear film, most commonly a deficiency of the aqueous portion, although the mucin and/or lipid layers may be affected; results in ocular irritation and/or vision impairment.

B. Entropion

A conformational defect resulting in an "in-rolling" of one or both of the eyelids which may cause ocular irritation. It is likely that entropion is influenced by several genes (polygenic), defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

C. Ectropion

A conformational defect resulting in eversion of the eyelids which may cause ocular irritation due to exposure. It is likely that ectropion is influenced by several genes (polygenic) defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

In the Bulldog, ectropion is associated with an exceptionally large palpebral fissure and laxity of the canthal structures. Central lower lid ectropion is often associated with entropion of the adjacent lid. This causes severe ocular irritation.

D. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

In the Bulldog, these abnormal eyelashes may be associated with significant clinical disease and breeding of affected animals should be discouraged.

E. Ectopic cilia

Hair emerging through the eyelid conjunctiva. Ectopic cilia occur more frequently in younger dogs and cause discomfort and corneal disease.

F. Eury/Macroblepharon

Macroblepharon is defined as an exceptionally large palpebral fissure, macroblepharon in conjunction with laxity of the lateral canthal structures may lead to lower lid ectropion and upper lid entropion.

G. Prolapse of the gland of the third eyelid

Protrusion of the tear gland associated with the third eyelid. The mode of inheritance of this disorder is unknown. The exposed gland may become irritated and severe chronic inflammation or keratoconjunctivitis sicca/dry eye syndrome may ensue. Commonly referred to as "cherry eye."

Bulldogs were overrepresented in a study of prolapsed gland of the third eyelid. In the study, 100% of the prolapsed glands in Bulldogs occurred before 1 year of age. Bulldogs were also more likely to develop bilateral prolapsed glands that occurred either simultaneously with the first prolapse or with a short time interval between prolapses.

H. Exposure/pigmentary keratitis

A condition characterized by variable degrees of superficial vascularization, fibrosis and/or pigmentation of the cornea. May be associated with excessive exposure/irritation of the globe due to shallow orbits, lower eyelid medial entropion, lagophthalmos and macropalpebral fissure.

I. Corneal Dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

J. Secondary keratitis - chronic

A specific designation does not exist on the CAER form for this condition. We ask examiners to mark other – unlisted conditions suspected as inherited. Then in the comments box please write secondary keratitis – chronic.

A condition characterized by variable degrees of superficial vascularization, fibrosis and/or pigmentation of the cornea. Often associated with entropion or a combination of entropion and ectropion.

K. Uveal cysts

Fluid filled sacs arising from the posterior surface of the iris, to which they may remain attached or break free and float into the anterior chamber. Usually occur in mature dogs.

This disorder may be observed in any breed but retriever breeds tend to be predisposed. There is usually no effect on vision unless the cysts are heavily clustered and impinge on the pupillary area. Less frequently, the cysts may rupture and adhere to the cornea or anterior lens capsule. Multiple cysts may occlude the iridocorneal angle and cause glaucoma.

L. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

M. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

N. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

O. Multifocal Retinopathy

A specific designation does not exist on the CAER form for this condition. We ask examiners to mark other – unlisted conditions suspected as inherited. Then in the comments box please write multifocal retinopathy.

Canine Multifocal Retinopathy type 1 (cmr1) is characterized by numerous distinct (i.e. multifocal), roughly circular patches of elevated retina (multifocal bullous retinal detachments). There may be a serous subretinal fluid, or accumulation of subretinal material that produces gray-tan-pink colored lesions. These lesions, looking somewhat like blisters, vary in location and size, although typically they are present in both eyes of the affected dog. The disease generally develops in young dogs between 11-20 weeks of age and there is minimal progression after 1 year of age. The lesions may flatten, leaving areas of retinal thinning and RPE hypertrophy, hyperplasia, and pigmentation. Discrete areas of tapetal hyper-reflectivity may be seen in areas of previous retinal and RPE detachments. Most dogs exhibit no noticeable problem with vision or electroretinographic abnormalities despite their abnormal appearing retinas. Canine Multifocal Retinopathy type 1 is caused by a mutation in the Bestrophin 1 gene (*BEST1*) and is described to be recessively inherited in the Great Pyrenees, Dogue de Bordeaux, Bullmastiff, and Mastiff. A DNA test is available.

References

1. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

2. ACVO Genetics Committee, 2016 and/or Data from CERF/OFA All-Breeds Report, 2010-2015.

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12. Donner J, Kaukonen M, Anderson H et al. Genetic panel screening of nearly 100 mutations reveals new insights into the breed distribution of risk variants for canine hereditary disorders. PLOS One Aug 2016 11 (8): 1-18.

OCULAR DISORDERS REPORT
BULLDOG

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2013 912 #	%	2014-2018 542 #	%
GLOBE						
0.110	microphthalmia		1	0.1%	0	
EYELIDS						
20.140	ectopic cilia		6	0.7%	6	1.1%
20.160	macropalpebral fissure		16	1.8%	0	
21.000	entropion, unspecified		134	14.7%	78	14.4%
22.000	ectropion, unspecified		50	5.5%	25	4.6%
25.110	distichiasis		192	21.1%	148	27.3%
NASOLACRIMAL						
32.110	imperforate lower nasolacrimal punctum		1	0.1%	5	0.9%
40.910	keratoconjunctivitis sicca		2	0.2%	7	1.3%
NICTITANS						
52.110	prolapsed gland of the third eyelid		15	1.6%	8	1.5%
CORNEA						
70.210	corneal pannus		9	1.0%	3	0.6%
70.220	pigmentary keratitis		20	2.2%	10	1.8%
70.700	corneal dystrophy		7	0.8%	4	0.7%
UVEA						
93.710	persistent pupillary membranes, iris to iris		6	0.7%	7	1.3%
93.730	persistent pupillary membranes, iris to cornea		1	0.1%	0	
93.740	persistent pupillary membranes, iris sheets		2	0.2%	0	
93.760	persistent pupillary membranes, endothelial opacity/no strands		1	0.1%	0	
93.999	uveal cysts		7	0.8%	5	0.9%
LENS						
100.200	cataract, unspecified		1	0.1%	0	
100.210	cataract. suspect not inherited/significance unknown		25	2.7%	10	1.8%
100.301	punctate cataract, anterior cortex		3	0.3%	1	0.2%
100.302	punctate cataract, posterior cortex		2	0.2%	0	
100.303	punctate cataract, equatorial cortex		0		1	0.2%
100.305	punctate cataract, posterior sutures		1	0.1%	1	0.2%
100.306	punctate cataract, nucleus		0		1	0.2%
100.311	incipient cataract, anterior cortex		4	0.4%	1	0.2%
100.312	incipient cataract, posterior cortex		2	0.2%	0	
100.313	incipient cataract, equatorial cortex		3	0.3%	1	0.2%
100.314	incipient cataract, anterior sutures		1	0.1%	0	
100.316	incipient cataract, nucleus		2	0.2%	2	0.4%
100.317	incipient cataract, capsular		1	0.1%	0	
100.328	posterior suture tip opacities		2	0.2%	4	0.7%
100.330	generalized/complete cataract		5	0.5%	0	
100.375	subluxation/luxation, unspecified		2	0.2%	1	0.2%
100.999	*significant cataracts (summary)*		*25*	*2.7%*	*8*	*1.5%*

		1991-2013		2014-2018	
VITREOUS					
110.120	persistent hyaloid artery/remnant	1	0.1%	0	
110.320	vitreal degeneration	2	0.2%	0	
RETINA					
120.170	retinal dysplasia, folds	59	6.5%	25	4.6%
120.180	retinal dysplasia, geographic	3	0.3%	1	0.2%
120.190	retinal dysplasia, detached	2	0.2%	0	
120.960	retinopathy	1	0.1%	0	
OTHER					
900.000	other, unspecified	7	0.8%	0	
900.100	other, not inherited	41	4.5%	45	8.3%
900.110	other. suspect not inherited/significance unknown	10	1.1%	4	0.7%
NORMAL					
0.000	normal globe	563	61.7%	256	47.2%

BULLMASTIFF

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Glaucoma	Not defined	1	NO	
B.	Entropion	Not defined	1	Breeder option	
C.	Ectropion	Not defined	2	Breeder option	
D.	Eury/Macroblepharon	Not defined	2	Breeder option	
E.	Distichiasis	Not defined	1	Breeder option	
F.	Persistent pupillary membranes - iris to iris - lens pigment foci/no strands	 Not defined Not defined	 1 3	 Breeder option Passes with no notation	
G.	Cataract	Not defined	1	NO	
H.	Retinal atrophy - generalized	Autosomal dominant	4	NO	Mutation in the *RHO* gene
I.	Retinal dysplasia - folds	Not defined	1	Breeder option	
J.	Multifocal retinopathy - *cmr1*	Autosomal recessive	5	Breeder option	Mutation in the *BEST1* gene
K.	Optic nerve hypoplasia	Not defined	2	NO	
L.	Micropapilla	Not defined	2	Breeder option	

Description and Comments

A. Glaucoma

Glaucoma is characterized by an elevation of intraocular pressure (IOP) which, when sustained, causes intraocular damage resulting in blindness. The elevated intraocular pressure occurs because the fluid cannot leave through the iridocorneal angle. Diagnosis and classification of glaucoma requires measurement of the IOP (tonometry) and examination of the iridocorneal angle (gonioscopy). Neither of these tests are part of

a routine screening exam for certification.

B. Entropion

A conformational defect resulting in an "in-rolling" of one or both of the eyelids which may cause ocular irritation. It is likely that entropion is influenced by several genes (polygenic) defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

In the Bullmastiff, the palpebral fissures may become vertical and/or shaped like a "pagoda." Entropion in the Bullmastiff is severe and may require multiple surgical corrections.

C. Ectropion

A conformational defect resulting in eversion (rolling-out) of the eyelids, which may cause ocular irritation due to exposure. It is likely that ectropion is influenced by several genes (polygenic), defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

D. Eury/Macroblepharon

Defined as an exceptionally large palpebral fissure, macroblepharon in conjunction with laxity of the lateral canthal structures may lead to lower lid ectropion and upper lid entropion. Either of these conditions may lead to severe ocular irritation.

E. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

F. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and is therefore not noted on the certificate.

G. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

H Retinal atrophy - generalized

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. PRA in the Bullmastiff is inherited as an autosomal dominant trait. A DNA test is available.

I. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

J. Multifocal retinopathy

Canine Multifocal Retinopathy type 1 (*cmr1*) is characterized by numerous distinct (i.e. multifocal), roughly circular patches of elevated retina (multifocal bullous retinal detachments). There may be a serous sub-retinal fluid, or accumulation of sub-retinal material that produces gray-tan-pink colored lesions. These lesions, looking somewhat like blisters, vary in location and size, although typically they are present in both eyes of the affected dog.

The disease generally develops in young dogs between 11-20 weeks of age and there is minimal progression after 1 year of age. The lesions may flatten, leaving areas of retinal thinning and RPE hypertrophy, hyperplasia, and pigmentation. Discrete areas of tapetal hyper-reflectivity may be seen in areas of previous retinal and RPE detachments. Most dogs exhibit no noticeable problem with vision or electroretinographic abnormalities despite their abnormal appearing retinas.

Canine Multifocal Retinopathy type 1 is caused by a mutation in the Bestrophin 1 gene (*BEST1*) and is described to be recessively inherited in the Great Pyrenees, Dogue de Bordeaux, Bullmastiff, and Mastiff.

K. Optic nerve hypoplasia

A congenital defect of the optic nerve which causes blindness and abnormal pupil response in the affected eye. May be unable to differentiate from micropapilla on a

routine (dilated) screening ophthalmoscopic exam.

L. Micropapilla

Micropapilla refers to a small optic disc, which is not associated with vision impairment. Optic nerve hypoplasia refers to a congenital defect of the optic nerve, which causes blindness and abnormal pupil response in the affected eye. It may be difficult to differentiate between micropapilla and optic nerve hypoplasia on a routine (dilated) screening ophthalmoscopic exam.

References

1. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

2. ACVO Genetics Committee, 2000-2002 and/or Data from CERF All-Breeds Report, 2000-2002.

3. ACVO Genetics Committee, 2017 and/or Data from OFA All-Breeds Report, 2015-2016

4. Kijas JW, Cideciyan AV, Aleman TS, et al. Naturally occurring rhodopsin mutation in the dog causes retinal dysfunction and degeneration mimicking human dominant retinitis pigmentosa. *Proc Natl Acad Sci U S A*. 2002 Apr 30;99:6328-6333.

5. Guziewicz KE, Zangerl B, Lindauer SJ, et al. Bestrophin gene mutations cause canine multifocal retinopathy: a novel animal model for best disease. *Invest Ophthalmol Vis Sci.* 2007 May;48:1959-1967.

OCULAR DISORDERS REPORT
BULLMASTIFF

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2013 1377 #	%	2014-2018 661 #	%
GLOBE						
0.110	microphthalmia		4	0.3%	1	0.2%
EYELIDS						
20.160	macropalpebral fissure		16	1.2%	0	
21.000	entropion, unspecified		87	6.3%	27	4.1%
22.000	ectropion, unspecified		23	1.7%	9	1.4%
25.110	distichiasis		35	2.5%	20	3.0%
NICTITANS						
51.100	third eyelid cartilage anomaly		1	0.1%	2	0.3%
52.110	prolapsed gland of the third eyelid		1	0.1%	0	
CORNEA						
70.210	corneal pannus		2	0.1%	0	
70.220	pigmentary keratitis		3	0.2%	2	0.3%
70.700	corneal dystrophy		2	0.1%	1	0.2%
70.730	corneal endothelial degeneration		1	0.1%	0	
UVEA						
93.140	corneal endothelial pigment without PPM		1	0.1%	0	
93.150	iris coloboma		2	0.1%	2	0.3%
93.710	persistent pupillary membranes, iris to iris		33	2.4%	54	8.2%
93.720	persistent pupillary membranes, iris to lens		9	0.7%	1	0.2%
93.730	persistent pupillary membranes, iris to cornea		20	1.5%	7	1.1%
93.740	persistent pupillary membranes, iris sheets		1	0.1%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands		3	0.2%	4	0.6%
93.760	persistent pupillary membranes, endothelial opacity/no strands		1	0.1%	6	0.9%
93.999	uveal cysts		7	0.5%	3	0.5%
97.150	chorioretinal coloboma, congenital		0		1	0.2%
LENS						
100.200	cataract, unspecified		1	0.1%	0	
100.210	cataract. suspect not inherited/significance unknown		45	3.3%	18	2.7%
100.301	punctate cataract, anterior cortex		5	0.4%	1	0.2%
100.302	punctate cataract, posterior cortex		3	0.2%	2	0.3%
100.303	punctate cataract, equatorial cortex		1	0.1%	0	
100.305	punctate cataract, posterior sutures		0		2	0.3%
100.307	punctate cataract, capsular		2	0.1%	0	
100.311	incipient cataract, anterior cortex		8	0.6%	4	0.6%
100.312	incipient cataract, posterior cortex		11	0.8%	4	0.6%
100.313	incipient cataract, equatorial cortex		7	0.5%	4	0.6%
100.315	incipient cataract, posterior sutures		1	0.1%	1	0.2%
100.316	incipient cataract, nucleus		4	0.3%	0	
100.321	incomplete cataract, anterior cortex		1	0.1%	0	
100.322	incomplete cataract, posterior cortex		1	0.1%	3	0.5%
100.323	incomplete cataract, equatorial cortex		1	0.1%	0	
100.326	incomplete cataract, nucleus		0		1	0.2%
100.328	posterior suture tip opacities		0		3	0.5%
100.330	generalized/complete cataract		7	0.5%	1	0.2%

LENS CONTINUED	1991-2013		2014-2018	
100.999 significant cataracts (summary)	*53*	*3.8%*	*23*	*3.5%*
VITREOUS				
110.120 persistent hyaloid artery/remnant	0		1	0.2%
110.135 PHPV/PTVL	0		1	0.2%
110.320 vitreal degeneration	3	0.2%	0	
RETINA				
120.170 retinal dysplasia, folds	71	5.2%	30	4.5%
120.180 retinal dysplasia, geographic	3	0.2%	0	
120.310 generalized progressive retinal atrophy (PRA)	3	0.2%	0	
120.960 retinopathy	2	0.1%	5	0.8%
OPTIC NERVE				
130.110 micropapilla	3	0.2%	5	0.8%
130.120 optic nerve hypoplasia	6	0.4%	1	0.2%
130.150 optic disc coloboma	1	0.1%	1	0.2%
OTHER				
900.000 other, unspecified	25	1.8%	0	
900.100 other, not inherited	44	3.2%	20	3.0%
900.110 other. suspect not inherited/significance unknown	13	0.9%	0	
NORMAL				
0.000 normal globe	1065	77.3%	472	71.4%

OCULAR DISORDERS REPORT
CA DE BOU

There are insufficient breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the CA DE BOU breed. Therefore, there are no conditions listed with breeding advice.

OCULAR DISORDERS REPORT
CA DE BOU

Diagnostic Name	TOTAL DOGS EXAMINED	1991-2013 0 #	%	2014-2018 1 #	%
NORMAL					
0.000 normal globe		0		1	100.0%

CAIRN TERRIER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Ocular melanosis with and without glaucoma	Presumed autosomal dominant	1-3	NO
B.	Persistent pupillary membranes			
	- iris to iris	Not defined	4, 5	Breeder option
	- lens pigment foci/no strands	Not defined	6	Passes with no notation
C.	Cataract	Not defined	1	NO
D.	Vitreous degeneration	Not defined	6	Breeder option
E.	Persistent hyaloid artery	Not defined	6	Breeder option

Description and Comments

A. Ocular melanosis with and without glaucoma
(Previously ocular melanosis with secondary glaucoma, previously pigmentary glaucoma)

A proliferation of melanocytes within the uveal tract associated with an elevation in intraocular pressure. Obstruction of the aqueous outflow pathways occurs resulting in glaucoma. This condition has been identified most commonly in the Cairn Terrier. The condition is familial but the exact mode of inheritance is unknown (pedigree anaylsis has ruled out a sex-linked disorder). In the Cairn Terrier, the disease is very slowly progressive and blindness ultimately results. Some dogs develop episodes of anterior uveitis associated with the shedding of large amounts of pigment from the iris surface. There is a long pre-glaucomatous phase of the disease in which diagnosis of the condition is possible. Age of onset varies from 2-14 years.

B. Persistent pupillary membranes (PPM)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

C. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

D. Vitreous degeneration

A liquefaction of the vitreous gel which may predispose to retinal detachment.

E. Persistent hyaloid artery (PHA)

Congenital defect resulting from abnormalities in the development and regression of the hyaloid artery. The blood vessel remnant can be present in the vitreous as a small patent vascular strand (PHA) or as a non-vascular strand that appears gray-white (persistent hyaloid remnant).

References

1. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

2. ACVO Genetics Committee, 2000-2002 and/or Data from CERF All-Breeds Report, 2000-2002.

3. Petersen-Jones SM, Forcier J, Mentzer AL. Ocular melanosis in the Cairn Terrier: clinical description and investigation of mode of inheritance. *Vet Ophthalmol*. 2007;10 Suppl 1:63-69.

4. ACVO Genetics Committee, 2002-2003 and/or Data from CERF All-Breeds Report, 2002-2003.

5. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

6. ACVO Genetics Committee, 2016 and/or Data from CERF/OFA All-Breeds Report, 2010-2015.

OCULAR DISORDERS REPORT
CAIRN TERRIER

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2013 3512 #	%	2014-2018 924 #	%
GLOBE						
0.110	microphthalmia		1	0.0%	1	0.1%
10.000	glaucoma		3	0.1%	0	
EYELIDS						
25.110	distichiasis		15	0.4%	4	0.4%
NASOLACRIMAL						
32.110	imperforate lower nasolacrimal punctum		0		1	0.1%
40.910	keratoconjunctivitis sicca		5	0.1%	3	0.3%
NICTITANS						
51.100	third eyelid cartilage anomaly		1	0.0%	0	
52.110	prolapsed gland of the third eyelid		1	0.0%	0	
CORNEA						
70.210	corneal pannus		1	0.0%	0	
70.220	pigmentary keratitis		7	0.2%	0	
70.700	corneal dystrophy		23	0.7%	6	0.6%
70.730	corneal endothelial degeneration		3	0.1%	0	
UVEA						
93.140	corneal endothelial pigment without PPM		1	0.0%	0	
93.150	iris coloboma		1	0.0%	1	0.1%
93.710	persistent pupillary membranes, iris to iris		268	7.6%	145	15.7%
93.720	persistent pupillary membranes, iris to lens		8	0.2%	7	0.8%
93.730	persistent pupillary membranes, iris to cornea		5	0.1%	0	
93.740	persistent pupillary membranes, iris sheets		2	0.1%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands		13	0.4%	36	3.9%
93.760	persistent pupillary membranes, endothelial opacity/no strands		4	0.1%	9	1.0%
93.810	uveal melanoma		0		2	0.2%
93.930	ocular melanocytosis		9	0.3%	0	
93.999	uveal cysts		1	0.0%	0	
LENS						
100.200	cataract, unspecified		11	0.3%	0	
100.210	cataract. suspect not inherited/significance unknown		178	5.1%	97	10.5%
100.301	punctate cataract, anterior cortex		21	0.6%	18	1.9%
100.302	punctate cataract, posterior cortex		21	0.6%	10	1.1%
100.303	punctate cataract, equatorial cortex		13	0.4%	1	0.1%
100.305	punctate cataract, posterior sutures		5	0.1%	0	
100.306	punctate cataract, nucleus		1	0.0%	0	
100.307	punctate cataract, capsular		5	0.1%	6	0.6%
100.311	incipient cataract, anterior cortex		32	0.9%	6	0.6%
100.312	incipient cataract, posterior cortex		58	1.7%	3	0.3%
100.313	incipient cataract, equatorial cortex		27	0.8%	4	0.4%
100.315	incipient cataract, posterior sutures		10	0.3%	0	
100.316	incipient cataract, nucleus		2	0.1%	3	0.3%
100.317	incipient cataract, capsular		5	0.1%	0	
100.321	incomplete cataract, anterior cortex		5	0.1%	7	0.8%

LENS CONTINUED		1991-2013		2014-2018	
100.322	incomplete cataract, posterior cortex	5	0.1%	7	0.8%
100.323	incomplete cataract, equatorial cortex	1	0.0%	2	0.2%
100.326	incomplete cataract, nucleus	1	0.0%	2	0.2%
100.328	posterior suture tip opacities	0		2	0.2%
100.330	generalized/complete cataract	28	0.8%	5	0.5%
100.340	resorbing/hypermature cataract	1	0.0%	3	0.3%
100.375	subluxation/luxation, unspecified	1	0.0%	1	0.1%
100.999	*significant cataracts (summary)*	*252*	*7.2%*	*77*	*8.3%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	26	0.7%	27	2.9%
110.135	PHPV/PTVL	6	0.2%	0	
110.320	vitreal degeneration	40	1.1%	18	1.9%
FUNDUS					
97.110	choroidal hypoplasia	2	0.1%	0	
97.120	coloboma	1	0.0%	0	
RETINA					
120.170	retinal dysplasia, folds	19	0.5%	2	0.2%
120.180	retinal dysplasia, geographic	6	0.2%	3	0.3%
120.310	generalized progressive retinal atrophy (PRA)	22	0.6%	1	0.1%
120.960	retinopathy	0		1	0.1%
OPTIC NERVE					
130.110	micropapilla	3	0.1%	0	
130.120	optic nerve hypoplasia	8	0.2%	0	
130.150	optic disc coloboma	11	0.3%	0	
OTHER					
900.000	other, unspecified	76	2.2%	0	
900.100	other, not inherited	127	3.6%	43	4.7%
900.110	other. suspect not inherited/significance unknown	90	2.6%	9	1.0%
NORMAL					
0.000	normal globe	2802	79.8%	541	58.5%

CANAAN DOG

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Distichiasis	Not defined	1	Breeder option
B.	Persistent pupillary membranes - iris to iris	Not defined	2	Breeder option
C.	Cataract	Not defined	2, 3	NO

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

C. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

References

There are no references providing detailed descriptions of hereditary conditions of the Canaan Dog breed. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 2006 and/or Data from CERF All-Breeds Report, 2001-2005.

2. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

3. ACVO Genetics Committee, 2000-2002 and/or Data from CERF All-Breeds Report, 2000-2002.

OCULAR DISORDERS REPORT
CANAAN DOG

Diagnostic Name		1991-2013 453 #	1991-2013 453 %	2014-2018 114 #	2014-2018 114 %
EYELIDS					
25.110	distichiasis	13	2.9%	3	2.6%
CORNEA					
70.700	corneal dystrophy	3	0.7%	2	1.8%
UVEA					
93.710	persistent pupillary membranes, iris to iris	17	3.8%	5	4.4%
93.740	persistent pupillary membranes, iris sheets	1	0.2%	0	
93.999	uveal cysts	2	0.4%	0	
LENS					
100.210	cataract. suspect not inherited/significance unknown	17	3.8%	3	2.6%
100.302	punctate cataract, posterior cortex	2	0.4%	0	
100.303	punctate cataract, equatorial cortex	1	0.2%	0	
100.304	punctate cataract, anterior sutures	1	0.2%	0	
100.306	punctate cataract, nucleus	3	0.7%	0	
100.307	punctate cataract, capsular	0		1	0.9%
100.311	incipient cataract, anterior cortex	2	0.4%	1	0.9%
100.312	incipient cataract, posterior cortex	7	1.5%	0	
100.314	incipient cataract, anterior sutures	1	0.2%	0	
100.315	incipient cataract, posterior sutures	1	0.2%	0	
100.316	incipient cataract, nucleus	12	2.6%	0	
100.322	incomplete cataract, posterior cortex	0		1	0.9%
100.323	incomplete cataract, equatorial cortex	0		1	0.9%
100.328	posterior suture tip opacities	0		1	0.9%
100.330	generalized/complete cataract	13	2.9%	0	
100.999	*significant cataracts (summary)*	*43*	*9.5%*	*4*	*3.5%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	0		1	0.9%
FUNDUS					
97.110	choroidal hypoplasia	1	0.2%	1	0.9%
RETINA					
120.170	retinal dysplasia, folds	2	0.4%	0	
120.310	generalized progressive retinal atrophy (PRA)	9	2.0%	0	
OTHER					
900.000	other, unspecified	6	1.3%	0	
900.100	other, not inherited	19	4.2%	5	4.4%
NORMAL					
0.000	normal globe	372	82.1%	91	79.8%

CANADIAN ESKIMO DOG

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder option

Description and Comments

A. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Canadian Eskimo Dog breed. The conditions listed above are generally recognized to exist in the breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 2017 and/or Data from CERF/OFA All-Breeds Report, 2010-2016.

OCULAR DISORDERS REPORT
CANADIAN ESKIMO DOG

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2013 4 #	 %	2014-2018 41 #	 %
CORNEA						
70.700	corneal dystrophy		0		1	2.4%
UVEA						
93.710	persistent pupillary membranes, iris to iris		2	50.0%	7	17.1%
LENS						
100.302	punctate cataract, posterior cortex		0		1	2.4%
100.307	punctate cataract, capsular		1	25.0%	0	
100.999	*significant cataracts (summary)*		*1*	*25.0%*	*1*	*2.4%*
VITREOUS						
110.120	persistent hyaloid artery/remnant		1	25.0%	0	
RETINA						
120.180	retinal dysplasia, geographic		1	25.0%	0	
OTHER						
900.100	other, not inherited		1	25.0%	1	2.4%
NORMAL						
0.000	normal globe		2	50.0%	32	78.0%

CANE CORSO

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Entropion	Not defined	1, 2	Breeder option	
B.	Ectropion	Not defined	1, 2	Breeder option	
C.	Eury/Macroblepharon	Not defined	1	Breeder option	
D.	Distichiasis	Not defined	2	Breeder option	
E.	Prolapsed gland of the third eyelid	Not defined	1	Breeder option	
F.	Nictitans cartilage anomaly/eversion	Not defined	1	Breeder option	
G.	Cataract	Not defined	1, 2	NO	
H.	Multifocal retinopathy - *cmr1*	Autosomal recessive	3, 4	Breeder option	Mutation in the *BEST1* gene
I.	Neuronal ceroid lipofuscinosis	Autosomal recessive	5	NO	

Description and Comments

A. Entropion

A conformational defect resulting in an "in-rolling" of one or both of the eyelids which may cause ocular irritation. It is likely that entropion is influenced by several genes (polygenic), defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull. Entropion in the Mastiff is severe and may require multiple surgical corrections.

B. Ectropion

A conformational defect resulting in eversion of the eyelids, which may cause ocular irritation due to exposure. It is likely that ectropion is influenced by several genes (polygenic), defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

C. Macroblepharon

Defined as an exceptionally large palpebral fissure, macroblepharon in conjunction with laxity of the lateral canthal structures may lead to lower lid ectropion and upper lid entropion. Either of these conditions may lead to severe ocular irritation.

D. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

E. Nictitans cartilage anomaly/eversion

A scroll-like curling of the cartilage of the third eyelid, usually everting the margin. This condition may occur in one or both eyes and may cause mild ocular irritation.

F. Prolapsed gland of the third eyelid

Protrusion of the tear gland associated with the third eyelid. The mode of inheritance of this disorder is unknown. The exposed gland may become irritated. Commonly referred to as "cherry eye."

G. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

H. Multifocal retinopathy

Canine Multifocal Retinopathy type 1 (*cmr1*) is characterized by numerous distinct (i.e. multi-focal), roughly circular patches of elevated retina (multifocal bullous retinal detachments). There may be a serous subretinal fluid, or accumulation of subretinal material that produces gray-tan-pink colored lesions. These lesions, looking somewhat like blisters, vary in location and size, although typically they are present in both eyes of the affected dog.

The disease generally develops in young dogs between 11-20 weeks of age and there is minimal progression after 1 year of age. The lesions may flatten, leaving areas of retinal thinning and RPE hypertrophy, hyperplasia, and pigmentation. Discrete areas of tapetal hyper-reflectivity may be seen in areas of previous retinal and RPE detachments. Most dogs exhibit no noticeable problem with vision or electroretinographic abnormalities despite their abnormal appearing retinas.

Canine Multifocal Retinopathy type 1 is caused by a mutation in the Bestrophin 1 gene

(*BEST1*) and is described to be recessively inherited in the Great Pyrenees, Dogue de Bordeaux, Bullmastiff, and Mastiff. A DNA test is available.

I. Neuronal ceroid lipofuscinosis

An inherited disease of man and animals characterized by the accumulation of lipopigment in various tissues of the body including the eye. It results in progressive neurologic disease including blindness. (Also called Batten's disease.)

References

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OCULAR DISORDERS REPORT
CANE CORSO

Diagnostic Name	TOTAL DOGS EXAMINED	1991-2013 63 #	1991-2013 63 %	2014-2018 156 #	2014-2018 156 %
EYELIDS					
21.000	entropion, unspecified	2	3.2%	3	1.9%
22.000	ectropion, unspecified	5	7.9%	8	5.1%
25.110	distichiasis	3	4.8%	6	3.8%
NICTITANS					
51.100	third eyelid cartilage anomaly	1	1.6%	0	
52.110	prolapsed gland of the third eyelid	2	3.2%	1	0.6%
CORNEA					
70.700	corneal dystrophy	1	1.6%	0	
UVEA					
93.710	persistent pupillary membranes, iris to iris	2	3.2%	1	0.6%
93.750	persistent pupillary membranes, lens pigment foci/no strands	1	1.6%	1	0.6%
93.999	uveal cysts	1	1.6%	2	1.3%
LENS					
100.210	cataract. suspect not inherited/significance unknown	2	3.2%	5	3.2%
100.301	punctate cataract, anterior cortex	1	1.6%	0	
100.302	punctate cataract, posterior cortex	1	1.6%	2	1.3%
100.305	punctate cataract, posterior sutures	0		1	0.6%
100.328	posterior suture tip opacities	0		1	0.6%
100.330	generalized/complete cataract	1	1.6%	0	
100.999	*significant cataracts (summary)*	*3*	*4.8%*	*3*	*1.9%*
VITREOUS					
110.135	PHPV/PTVL	1	1.6%	0	
RETINA					
120.170	retinal dysplasia, folds	0		1	0.6%
120.960	retinopathy	1	1.6%	0	
OTHER					
900.000	other, unspecified	1	1.6%	0	
900.100	other, not inherited	0		2	1.3%
900.110	other. suspect not inherited/significance unknown	0		1	0.6%
NORMAL					
0.000	normal globe	49	77.8%	127	81.4%

OCULAR DISORDERS REPORT
CAO DE CASTRO LABOREIRO

There are insufficient breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the CAO DE CASTRO LABOREIRO breed. Therefore, there are no conditions listed with breeding advice.

OCULAR DISORDERS REPORT
CAO DE CASTRO LABOREIRO

Diagnostic Name	TOTAL DOGS EXAMINED	1991-2013 0 #	%	2014-2018 1 #	%
NORMAL					
0.000 normal globe		0		1	100.0%

CARDIGAN WELSH CORGI

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Distichiasis	Not defined	1	Breeder option	
B.	Persistent pupillary membranes - iris to iris	Not defined	2	Breeder option	
C.	Cataract	Not defined	1	NO	
D.	Retinal atrophy - rod-cone dysplasia type 3 (*rcd3*)	Presumed autosomal recessive	1, 3-5	NO	Mutation in the *PDE6A* gene

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin that may cause ocular irritation. Distichiasis may occur any time in the life of the dog. It is difficult to make a strong recommendation about breeding dogs with this entity. The hereditary basis is not known although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

C. Cataract

Lens opacity which may affect one or both eyes and may involve the lens partially or completely. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membranes, persistent hyaloid, or nutritional deficiencies.

D. Retinal atrophy - rod-cone dysplasia type 3 (*rcd3*)

PRA in the Cardigan Welsh Corgi is an autosomal recessive trait caused by a one base pair deletion in the gene encoding the alpha subunit of cyclic GMP phosphodiesterase (rcd3). PRA begins early in life with clinical signs of night blindness and a lack of rod ERG responses is seen at 6-8 weeks of age. Dogs are completely blind by 2-3 years of age when ophthalmoscopic signs are first visible. The mutation is found in the *PDE6A* gene. A DNA test is available.

Historical Note:

Central progressive retinal atrophy was previously a condition listed for this breed. However as the condition is no longer identified in the breed, the condition has been removed. Central progressive retinal atrophy was a progressive retinal degeneration in which photoreceptor death occurred secondary to disease of the underlying pigment epithelium. Progression was slow and some animals never lost vision. CPRA occurred in England, but was uncommon elsewhere.

References

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OCULAR DISORDERS REPORT
CARDIGAN WELSH CORGI

		1991-2013		2014-2018	
	TOTAL DOGS EXAMINED	3425		617	
Diagnostic Name		#	%	#	%
GLOBE					
0.110	microphthalmia	2	0.1%	0	
EYELIDS					
25.110	distichiasis	129	3.8%	21	3.4%
NASOLACRIMAL					
32.110	imperforate lower nasolacrimal punctum	0		1	0.2%
CORNEA					
70.700	corneal dystrophy	14	0.4%	3	0.5%
70.730	corneal endothelial degeneration	2	0.1%	0	
UVEA					
93.110	iris hypoplasia	0		1	0.2%
93.150	iris coloboma	1	0.0%	0	
93.710	persistent pupillary membranes, iris to iris	101	2.9%	18	2.9%
93.720	persistent pupillary membranes, iris to lens	3	0.1%	1	0.2%
93.730	persistent pupillary membranes, iris to cornea	9	0.3%	0	
93.740	persistent pupillary membranes, iris sheets	1	0.0%	0	
93.810	uveal melanoma	0		1	0.2%
LENS					
100.200	cataract, unspecified	15	0.4%	0	
100.210	cataract. suspect not inherited/significance unknown	99	2.9%	32	5.2%
100.301	punctate cataract, anterior cortex	10	0.3%	1	0.2%
100.302	punctate cataract, posterior cortex	11	0.3%	0	
100.303	punctate cataract, equatorial cortex	10	0.3%	4	0.6%
100.304	punctate cataract, anterior sutures	2	0.1%	0	
100.305	punctate cataract, posterior sutures	2	0.1%	2	0.3%
100.306	punctate cataract, nucleus	2	0.1%	0	
100.311	incipient cataract, anterior cortex	32	0.9%	2	0.3%
100.312	incipient cataract, posterior cortex	17	0.5%	2	0.3%
100.313	incipient cataract, equatorial cortex	13	0.4%	3	0.5%
100.314	incipient cataract, anterior sutures	3	0.1%	1	0.2%
100.315	incipient cataract, posterior sutures	2	0.1%	1	0.2%
100.316	incipient cataract, nucleus	7	0.2%	1	0.2%
100.317	incipient cataract, capsular	2	0.1%	1	0.2%
100.321	incomplete cataract, anterior cortex	0		1	0.2%
100.322	incomplete cataract, posterior cortex	0		1	0.2%
100.328	posterior suture tip opacities	1	0.0%	2	0.3%
100.330	generalized/complete cataract	8	0.2%	0	
100.340	resorbing/hypermature cataract	0		1	0.2%
100.999	*significant cataracts (summary)*	*136*	*4.0%*	*21*	*3.4%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	4	0.1%	1	0.2%
110.200	vitritis	0		2	0.3%
110.320	vitreal degeneration	7	0.2%	1	0.2%

		1991-2013		2014-2018	
FUNDUS					
97.110	choroidal hypoplasia	3	0.1%	0	
97.120	coloboma	2	0.1%	0	
RETINA					
120.170	retinal dysplasia, folds	24	0.7%	1	0.2%
120.180	retinal dysplasia, geographic	6	0.2%	0	
120.310	generalized progressive retinal atrophy (PRA)	9	0.3%	0	
120.400	retinal hemorrhage	1	0.0%	0	
120.910	retinal detachment without dialysis	2	0.1%	0	
120.960	retinopathy	0		1	0.2%
OPTIC NERVE					
130.120	optic nerve hypoplasia	3	0.1%	0	
OTHER					
900.000	other, unspecified	16	0.5%	0	
900.100	other, not inherited	41	1.2%	15	2.4%
900.110	other. suspect not inherited/significance unknown	9	0.3%	0	
NORMAL					
0.000	normal globe	3029	88.4%	506	82.0%

OCULAR DISORDERS REPORT
CAROLINA DOG

There are insufficient breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the CAROLINA DOG breed. Therefore, there are no conditions listed with breeding advice.

OCULAR DISORDERS REPORT
CAROLINA DOG

Diagnostic Name	TOTAL DOGS EXAMINED	1991-2013 0 # %	2014-2018 2 # %
NORMAL			
0.000 normal globe		0	2 100.0%

OCULAR DISORDERS REPORT
CATALAN SHEEPDOG

There are insufficient breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the CATALAN SHEEPDOG breed. Therefore, there are no conditions listed with breeding advice.

OCULAR DISORDERS REPORT
CATALAN SHEEPDOG

Diagnostic Name	TOTAL DOGS EXAMINED	1991-2013 0 # %	2014-2018 2 # %
UVEA			
93.150 iris coloboma		0	2 100.0%

OCULAR DISORDERS REPORT
CAUCASIAN SHEPHERD

There are insufficient breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the CAUCASIAN SHEPHERD breed. Therefore, there are no conditions listed with breeding advice.

OCULAR DISORDERS REPORT
CAUCASIAN MTN DOG

Diagnostic Name	TOTAL DOGS EXAMINED	1991-2013 4 # %	2014-2018 11 # %
EYELIDS			
21.000	entropion, unspecified	0	1 9.1%
UVEA			
93.710	persistent pupillary membranes, iris to iris	0	2 18.2%
LENS			
100.311	incipient cataract, anterior cortex	0	1 9.1%
100.312	incipient cataract, posterior cortex	0	1 9.1%
100.313	incipient cataract, equatorial cortex	0	1 9.1%
100.999	*significant cataracts (summary)*	*0*	*3 27.3%*
NORMAL			
0.000	normal globe	4 100.0%	7 63.6%

CAVALIER KING CHARLES SPANIEL

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Microphthalmia with multiple ocular defects	Not defined	1, 2	NO
B.	Keratoconjunctivitis sicca	Not defined	3	NO
C.	Congenital KCS and ichthyosiform dermatosis	Autosomal recessive	4, 5	NO
D.	Entropion	Not defined	6	Breeder option
E.	Distichiasis	Not defined	1	Breeder option
F.	Corneal dystrophy - epithelial/stromal	Not defined	1, 7	Breeder option
G.	Exposure/pigmentary keratitis	Not defined	1	Breeder option
H.	Persistent pupillary membranes - iris to iris	Not defined	8	Breeder option
I.	Cataract	Not defined	1, 9	NO
J.	Vitreous degeneration	Not defined	6	Breeder option
K.	Retinal dysplasia - folds	Not defined	1	Breeder option
L.	Retinal dysplasia - geographic/detached	Not defined	1	NO

Description and Comments

A. Microphthalmia with multiple ocular defects

Microphthalmia is a congenital defect characterized by a small eye often associated with other ocular malformations, including defects of the cornea, anterior chamber, lens and/or retina.

B. Keratoconjunctivitis sicca (KCS)

An abnormality of the tear film, most commonly a deficiency of the aqueous portion, although the mucin and/or lipid layers may be affected; results in ocular irritation and/or vision impairment.

C. Congenital KCS and ichthyosiform dermatosis

A syndrome in which dogs are born with severe to absolute keratoconjunctivitis sicca (KCS) which is poorly responsive to lacrimostimulant treatment. Co-morbid congenital dermatopathy affecting haircoat, skin and footpads is severe and requires intensive life-long care. Clinical signs are so devastating that affected dogs are often euthanized.

D. Entropion

A conformational defect resulting in an "in-rolling" of one or both of the eyelids which may cause ocular irritation. It is likely that entropion is influenced by several genes (polygenic), defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

E. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

F. Corneal dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral. In the Cavalier King Charles Spaniel, lesions are circular or semicircular central crystalline deposits in the anterior corneal stroma that appear between 2 and 5 years of age. It may be associated with exophthalmos and lagophthalmos common in these dogs.

G. Exposure/pigmentary keratitis

A condition characterized by variable degrees of superficial vascularization, fibrosis and/or pigmentation of the cornea. May be associated with excessive exposure/irritation of the globe due to shallow orbits, lower eyelid medial entropion, lagophthalmos and macropalpebral fissure.

H. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

I. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

In the Cavalier King Charles Spaniel, onset is at an early age (less than 6 months), affecting the cortex and nucleus with rapid progression to complete cataract, resulting in blindness.

J. Vitreous degeneration

Liquefaction of the vitreous gel which may predispose to retinal detachment.

K. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

L. Retinal dysplasia – geographic/detached

Abnormal development of the retina present at birth.

Retinal dysplasia - geographic: Any irregularly shaped area of abnormal retinal development containing both areas of thinning and areas of elevation representing folds and retinal disorganization.

Retinal dysplasia - detached: Severe retinal disorganization associated with separation (detachment) of the retina.

These two forms are associated with vision impairment or blindness. Retinal dysplasia is known to be inherited in many breeds. The genetic relationship among the three forms of retinal dysplasia is not known for all breeds.

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OCULAR DISORDERS REPORT
CAVALIER KING CHARLES SPANIEL

		1991-2013 43668		2014-2018 15736	
	TOTAL DOGS EXAMINED				
Diagnostic Name		#	%	#	%
GLOBE					
0.110	microphthalmia	63	0.1%	28	0.2%
10.000	glaucoma	3	0.0%	0	
EYELIDS					
20.140	ectopic cilia	3	0.0%	1	0.0%
20.160	macropalpebral fissure	126	0.3%	0	
21.000	entropion, unspecified	184	0.4%	44	0.3%
22.000	ectropion, unspecified	8	0.0%	3	0.0%
25.110	distichiasis	3979	9.1%	1398	8.9%
NASOLACRIMAL					
32.110	imperforate lower nasolacrimal punctum	5	0.0%	55	0.3%
40.910	keratoconjunctivitis sicca	59	0.1%	53	0.3%
NICTITANS					
50.210	pannus of third eyelid	1	0.0%	0	
51.100	third eyelid cartilage anomaly	6	0.0%	0	
52.110	prolapsed gland of the third eyelid	18	0.0%	2	0.0%
CORNEA					
70.210	corneal pannus	14	0.0%	3	0.0%
70.220	pigmentary keratitis	195	0.4%	124	0.8%
70.700	corneal dystrophy	3836	8.8%	1359	8.6%
70.730	corneal endothelial degeneration	44	0.1%	16	0.1%
UVEA					
93.110	iris hypoplasia	1	0.0%	6	0.0%
93.140	corneal endothelial pigment without PPM	7	0.0%	0	
93.150	iris coloboma	4	0.0%	0	
93.710	persistent pupillary membranes, iris to iris	453	1.0%	197	1.3%
93.720	persistent pupillary membranes, iris to lens	34	0.1%	4	0.0%
93.730	persistent pupillary membranes, iris to cornea	29	0.1%	6	0.0%
93.740	persistent pupillary membranes, iris sheets	44	0.1%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	20	0.0%	32	0.2%
93.760	persistent pupillary membranes, endothelial opacity/no strands	9	0.0%	2	0.0%
93.999	uveal cysts	20	0.0%	7	0.0%
97.150	chorioretinal coloboma, congenital	0		8	0.1%
LENS					
100.200	cataract, unspecified	57	0.1%	0	
100.210	cataract. suspect not inherited/significance unknown	1617	3.7%	531	3.4%
100.301	punctate cataract, anterior cortex	225	0.5%	102	0.6%
100.302	punctate cataract, posterior cortex	101	0.2%	37	0.2%
100.303	punctate cataract, equatorial cortex	73	0.2%	30	0.2%
100.304	punctate cataract, anterior sutures	32	0.1%	20	0.1%
100.305	punctate cataract, posterior sutures	90	0.2%	44	0.3%
100.306	punctate cataract, nucleus	98	0.2%	39	0.2%
100.307	punctate cataract, capsular	34	0.1%	27	0.2%
100.311	incipient cataract, anterior cortex	319	0.7%	110	0.7%

LENS CONTINUED		1991-2013		2014-2018	
100.312	incipient cataract, posterior cortex	235	0.5%	74	0.5%
100.313	incipient cataract, equatorial cortex	137	0.3%	34	0.2%
100.314	incipient cataract, anterior sutures	25	0.1%	5	0.0%
100.315	incipient cataract, posterior sutures	69	0.2%	19	0.1%
100.316	incipient cataract, nucleus	198	0.5%	53	0.3%
100.317	incipient cataract, capsular	55	0.1%	10	0.1%
100.321	incomplete cataract, anterior cortex	8	0.0%	32	0.2%
100.322	incomplete cataract, posterior cortex	13	0.0%	47	0.3%
100.323	incomplete cataract, equatorial cortex	3	0.0%	8	0.1%
100.325	incomplete cataract, posterior sutures	1	0.0%	4	0.0%
100.326	incomplete cataract, nucleus	6	0.0%	25	0.2%
100.327	incomplete cataract, capsular	2	0.0%	11	0.1%
100.328	posterior suture tip opacities	21	0.0%	86	0.5%
100.330	generalized/complete cataract	210	0.5%	14	0.1%
100.340	resorbing/hypermature cataract	2	0.0%	8	0.1%
100.375	subluxation/luxation, unspecified	13	0.0%	3	0.0%
100.999	*significant cataracts (summary)*	*1993*	*4.6%*	*753*	*4.8%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	73	0.2%	29	0.2%
110.135	PHPV/PTVL	29	0.1%	4	0.0%
110.200	vitritis	3	0.0%	10	0.1%
110.320	vitreal degeneration	194	0.4%	78	0.5%
FUNDUS					
97.110	choroidal hypoplasia	8	0.0%	1	0.0%
97.120	coloboma	4	0.0%	0	
RETINA					
120.170	retinal dysplasia, folds	3341	7.7%	640	4.1%
120.180	retinal dysplasia, geographic	1348	3.1%	286	1.8%
120.190	retinal dysplasia, detached	145	0.3%	30	0.2%
120.310	generalized progressive retinal atrophy (PRA)	140	0.3%	23	0.1%
120.400	retinal hemorrhage	6	0.0%	0	
120.910	retinal detachment without dialysis	20	0.0%	0	
120.920	retinal detachment with dialysis	1	0.0%	2	0.0%
120.960	retinopathy	14	0.0%	27	0.2%
OPTIC NERVE					
130.110	micropapilla	21	0.0%	7	0.0%
130.120	optic nerve hypoplasia	12	0.0%	3	0.0%
130.150	optic disc coloboma	15	0.0%	24	0.2%
OTHER					
900.000	other, unspecified	596	1.4%	0	
900.100	other, not inherited	1262	2.9%	704	4.5%
900.110	other. suspect not inherited/significance unknown	179	0.4%	53	0.3%
NORMAL					
0.000	normal globe	32161	73.6%	10485	66.6%

OCULAR DISORDERS REPORT
CENTRAL ASIAN SHEPHERD

There are insufficient breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the CENTRAL ASIAN SHEPHERD breed. Therefore, there are no conditions listed with breeding advice.

OCULAR DISORDERS REPORT
CENTRAL ASIAN SHEPHERD DOG

Diagnostic Name	TOTAL DOGS EXAMINED	1991-2013 3 #	%	2014-2018 5 #	%
UVEA					
93.710	persistent pupillary membranes, iris to iris	0		2	40.0%
LENS					
100.210	cataract. suspect not inherited/significance unknown	1	33.3%	1	20.0%
100.328	posterior suture tip opacities	0		1	20.0%
NORMAL					
0.000	normal globe	2	66.7%	2	40.0%

CESKY TERRIER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Distichiasis	Not defined	1	Breeder option
B.	Corneal dystrophy - epithelial/stromal	Not defined	2, 3	Breeder option

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Corneal Dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Cesky Terrier breed. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 2002-2003 and/or Data from CERF All-Breeds Report, 2002-2003.

2. ACVO Genetics Committee, 2007 and/or Data from CERF All-Breeds Report, 2002-2006.

3. ACVO Genetics Committee, 2008 and/or Data from CERF All-Breeds Report, 2003-2007.

OCULAR DISORDERS REPORT
CESKY TERRIER

Diagnostic Name		1991-2013 TOTAL DOGS EXAMINED 105 #	 %	2014-2018 24 #	 %
EYELIDS					
25.110	distichiasis	18	17.1%	1	4.2%
NASOLACRIMAL					
32.110	imperforate lower nasolacrimal punctum	1	1.0%	0	
CORNEA					
70.700	corneal dystrophy	8	7.6%	0	
UVEA					
93.710	persistent pupillary membranes, iris to iris	2	1.9%	2	8.3%
93.750	persistent pupillary membranes, lens pigment foci/no strands	1	1.0%	0	
97.150	chorioretinal coloboma, congenital	0		1	4.2%
LENS					
100.200	cataract, unspecified	1	1.0%	0	
100.210	cataract. suspect not inherited/significance unknown	1	1.0%	0	
100.301	punctate cataract, anterior cortex	1	1.0%	0	
100.307	punctate cataract, capsular	2	1.9%	0	
100.311	incipient cataract, anterior cortex	1	1.0%	0	
100.312	incipient cataract, posterior cortex	1	1.0%	0	
100.999	*significant cataracts (summary)*	*6*	*5.7%*	*0*	
FUNDUS					
97.110	choroidal hypoplasia	0		1	4.2%
RETINA					
120.170	retinal dysplasia, folds	8	7.6%	0	
120.910	retinal detachment without dialysis	1	1.0%	0	
OPTIC NERVE					
130.110	micropapilla	1	1.0%	0	
OTHER					
900.000	other, unspecified	1	1.0%	0	
900.100	other, not inherited	4	3.8%	1	4.2%
NORMAL					
0.000	normal globe	71	67.6%	19	79.2%

OCULAR DISORDERS REPORT
CHART POLSKI

There are insufficient breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the CHART POLSKI breed. Therefore, there are no conditions listed with breeding advice.

OCULAR DISORDERS REPORT
CHART POLSKI

Diagnostic Name	TOTAL DOGS EXAMINED	1991-2013 5 #	%	2014-2018 6 #	%
EYELIDS					
25.110	distichiasis	0		1	16.7%
UVEA					
93.710	persistent pupillary membranes, iris to iris	0		1	16.7%
LENS					
100.210	cataract. suspect not inherited/significance unknown	1	20.0%	0	
VITREOUS					
110.200	vitritis	0		1	16.7%
FUNDUS					
97.110	choroidal hypoplasia	1	20.0%	1	16.7%
OPTIC NERVE					
130.150	optic disc coloboma	1	20.0%	0	
OTHER					
900.000	other, unspecified	3	60.0%	0	
NORMAL					
0.000	normal globe	1	20.0%	3	50.0%

CHESAPEAKE BAY RETRIEVER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Entropion	Not defined	1	Breeder option	
B.	Distichiasis	Not defined	1	Breeder option	
C.	Persistent pupillary membranes				
	- iris to iris	Not defined	1-3	Breeder option	
	- lens pigment foci/no strands	Not defined	4	Passes with no notation	
D.	Cataract	Presumed incomplete dominant	1, 5	NO	
E.	Vitreous degeneration	Not defined	6	Breeder option	
F.	Retinal atrophy - generalized (*prcd*)	Autosomal recessive	1, 7	NO	Mutation in the *prcd* gene
G.	Retinal dysplasia - folds	Not defined	1	Breeder option	
H.	Retinal dysplasia - geographic/detached	Not defined	1	NO	

Description and Comments

A. Entropion

A conformational defect resulting in "in-rolling" of one or both of the eyelids which may cause ocular irritation. It is likely that entropion is influenced by several genes (polygenic), defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull. Selection should be directed against entropion and toward a head conformation that minimizes or eliminates the likelihood of the defect.

B. Distichiasis

Eyelashes abnormally located in the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established, although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When

diagnosed, distichiasis should be recorded; breeding discretion is advised.

C. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

D. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

Hereditary cataracts have been described in the Chesapeake Bay Retriever and affect the young adult dog. They appear as posterior cortical, axial, triangular opacities and the Y suture tips can be affected in both the anterior and posterior cortices. Extension of the cataract into the posterior cortex and progression to impair vision can occur. An autosomal dominant inheritance with incomplete penetrance has been proposed; however, the genetics have not been completely defined and additional studies will be required.

E. Vitreous degeneration

Liquefaction of the vitreous gel which may predispose to retinal detachment.

F. Retinal atrophy - generalized (*prcd*)

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

Studies have shown that the principal form of PRA in the Chesapeake Bay Retriever is *prcd* which is a late-onset form of PRA inherited as autosomal recessive. The mutation is allelic to that present in Miniature Poodles, Labrador Retrievers, English and American Cocker Spaniels and others. The locus is termed the progressive rod-cone degeneration (*prcd*) gene and at least 30+ breeds are affected. In most affected dogs to date, the disease is recognized clinically in dogs 3-6 years of age or older. This photoreceptor degeneration is characterized by slow death of visual cells following their normal development. The disease begins clinically with signs of night blindness followed by day blindness. A DNA test is available. It is important to note than in all breeds in which a molecular diagnostic test for the disease is available, it is possible to have dogs diagnosed clinically as affected, yet the DNA test results are normal. This suggests that other genetic causes of PRA exist or that the diagnosed affected dog has an acquired disease that mimics the inherited disorder.

A second, less common form of PRA is also present in the Chesapeake Bay Retriever with

ophthalmoscopic abnormalities characteristic of mid-stage disease found in dogs between 8-12 months of age. The lesions are progressive and end-stage lesions are evident by 2-3 years of age. A DNA test is available.

G. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

H. Retinal dysplasia - geographic/detached

Abnormal development of the retina present at birth.

Retinal dysplasia - geographic: Any irregularly shaped area of abnormal retinal development containing both areas of thinning and areas of elevation representing folds and retinal disorganization.

Retinal dysplasia - detached: Severe retinal disorganization associated with separation (detachment) of the retina.

These two forms are associated with vision impairment or blindness. Retinal dysplasia is known to be inherited in many breeds. The genetic relationship among the three forms of retinal dysplasia is not known for all breeds.

References

1. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

2. ACVO Genetics Committee, 2002-2003 and/or Data from CERF All-Breeds Report, 2002-2003.

3. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

4. ACVO Genetics Committee, 2017 and/or Data from CERF/OFA All-Breeds Report, 2010-2016.

5. Gelatt KN. Cataracts in Chesapeake Bay retrievers. *J Am Vet Med Assoc*. 1979;175:1176-1178.

6. ACVO Genetics Committee, 2018 and/or Data from OFA All-Breeds Report 2013-2017.

7. Zangerl B, Goldstein O, Philp AR, et al. Identical mutation in a novel retinal gene causes progressive rod-cone degeneration in dogs and retinitis pigmentosa in humans. *Genomics*. 2006;88:551-563.

OCULAR DISORDERS REPORT
CHESAPEAKE BAY RETRIEVER

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2013 11781 #	%	2014-2018 2188 #	%
GLOBE						
0.110	microphthalmia		7	0.1%	0	
10.000	glaucoma		3	0.0%	1	0.0%
EYELIDS						
20.140	ectopic cilia		1	0.0%	1	0.0%
20.160	macropalpebral fissure		3	0.0%	0	
21.000	entropion, unspecified		51	0.4%	5	0.2%
22.000	ectropion, unspecified		7	0.1%	0	
25.110	distichiasis		847	7.2%	185	8.5%
NASOLACRIMAL						
32.110	imperforate lower nasolacrimal punctum		0		1	0.0%
NICTITANS						
51.100	third eyelid cartilage anomaly		2	0.0%	1	0.0%
52.110	prolapsed gland of the third eyelid		2	0.0%	0	
CORNEA						
70.210	corneal pannus		1	0.0%	0	
70.700	corneal dystrophy		70	0.6%	16	0.7%
70.730	corneal endothelial degeneration		1	0.0%	0	
UVEA						
93.150	iris coloboma		1	0.0%	0	
93.710	persistent pupillary membranes, iris to iris		199	1.7%	55	2.5%
93.720	persistent pupillary membranes, iris to lens		11	0.1%	0	
93.730	persistent pupillary membranes, iris to cornea		3	0.0%	0	
93.740	persistent pupillary membranes, iris sheets		14	0.1%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands		24	0.2%	45	2.1%
93.760	persistent pupillary membranes, endothelial opacity/no strands		4	0.0%	0	
93.810	uveal melanoma		0		1	0.0%
93.999	uveal cysts		19	0.2%	13	0.6%
LENS						
100.200	cataract, unspecified		74	0.6%	0	
100.210	cataract. suspect not inherited/significance unknown		483	4.1%	121	5.5%
100.301	punctate cataract, anterior cortex		41	0.3%	11	0.5%
100.302	punctate cataract, posterior cortex		104	0.9%	22	1.0%
100.303	punctate cataract, equatorial cortex		33	0.3%	6	0.3%
100.304	punctate cataract, anterior sutures		8	0.1%	5	0.2%
100.305	punctate cataract, posterior sutures		38	0.3%	4	0.2%
100.306	punctate cataract, nucleus		7	0.1%	3	0.1%
100.307	punctate cataract, capsular		15	0.1%	14	0.6%
100.311	incipient cataract, anterior cortex		51	0.4%	13	0.6%
100.312	incipient cataract, posterior cortex		206	1.7%	36	1.6%
100.313	incipient cataract, equatorial cortex		50	0.4%	8	0.4%
100.314	incipient cataract, anterior sutures		6	0.1%	1	0.0%
100.315	incipient cataract, posterior sutures		40	0.3%	11	0.5%
100.316	incipient cataract, nucleus		17	0.1%	2	0.1%

LENS CONTINUED		1991-2013		2014-2018	
100.317	incipient cataract, capsular	20	0.2%	6	0.3%
100.321	incomplete cataract, anterior cortex	0		1	0.0%
100.322	incomplete cataract, posterior cortex	1	0.0%	3	0.1%
100.325	incomplete cataract, posterior sutures	1	0.0%	2	0.1%
100.326	incomplete cataract, nucleus	0		1	0.0%
100.328	posterior suture tip opacities	4	0.0%	12	0.5%
100.330	generalized/complete cataract	43	0.4%	0	
100.375	subluxation/luxation, unspecified	6	0.1%	2	0.1%
100.999	*significant cataracts (summary)*	*755*	*6.4%*	*149*	*6.8%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	19	0.2%	2	0.1%
110.135	PHPV/PTVL	10	0.1%	0	
110.200	vitritis	5	0.0%	21	1.0%
110.320	vitreal degeneration	70	0.6%	11	0.5%
FUNDUS					
97.110	choroidal hypoplasia	3	0.0%	0	
RETINA					
120.170	retinal dysplasia, folds	77	0.7%	9	0.4%
120.180	retinal dysplasia, geographic	48	0.4%	5	0.2%
120.190	retinal dysplasia, detached	1	0.0%	2	0.1%
120.310	generalized progressive retinal atrophy (PRA)	87	0.7%	8	0.4%
120.400	retinal hemorrhage	1	0.0%	0	
120.910	retinal detachment without dialysis	1	0.0%	0	
120.960	retinopathy	0		10	0.5%
OPTIC NERVE					
130.110	micropapilla	1	0.0%	0	
130.120	optic nerve hypoplasia	2	0.0%	0	
130.150	optic disc coloboma	2	0.0%	0	
OTHER					
900.000	other, unspecified	127	1.1%	0	
900.100	other, not inherited	352	3.0%	146	6.7%
900.110	other. suspect not inherited/significance unknown	52	0.4%	10	0.5%
NORMAL					
0.000	normal globe	9759	82.8%	1543	70.5%

CHIHUAHUA

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TEST AVAILABLE
A.	Distichiasis	Not defined	1	Breeder option	
B.	Corneal dystrophy - endothelial	Not defined	2, 3	NO	
C.	Persistent pupillary membranes - iris to iris	Not defined	2, 4	Breeder option	
D.	Cataract	Not defined	2	NO	
E.	Vitreous degeneration	Not defined	2	Breeder option	
F.	Retinal atrophy generalized (*prcd*)	Autosomal recessive	5, 6	NO	Mutation in the *prcd* gene

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Corneal dystrophy - endothelial

An abnormal loss of the inner lining of the cornea that causes progressive fluid retention (edema). With time the edema results in keratitis and decreased vision. This usually does not occur until the animal is older.

In the Chihuahua, this is a primary degenerative endothelial disease leading to progressive and permanent corneal edema. It is suspected to be a heritable disorder. There is no sex predilection. The condition is observed in older dogs, 6 to 13 years of age with a mean of 9.5 years. The corneal edema starts asymptomatically in the dorsal temporal corneal quadrant of one eye and slowly progresses medially, eventually involving the entire cornea. Typically, it becomes bilateral. In the later stages, discomfort, intracorneal bullae with subsequent ulceration and keratoconus may develop.

Histologically, the primary endothelial disease appears slightly different from the clinically similar disorder of the Boston Terrier.

C. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

D. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

E. Vitreous degeneration

A liquefaction of the vitreous gel which may predispose to retinal detachment.

F. Retinal atrophy - generalized *(prcd)*

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as Progressive Retinal Atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

Studies have shown that the principal form of PRA in the Chihuahua is *prcd* which is a late-onset form of PRA inherited as autosomal recessive. The mutation is allelic to that present in Miniature Poodles, Labrador Retrievers, English and American Cocker Spaniels and others. The locus is termed the progressive rod-cone degeneration (*prcd*) gene and at least 30+ breeds are affected. In most affected dogs to date, the disease is recognized clinically in dogs 3-6 years of age or older. This photoreceptor degeneration is characterized by slow death of visual cells following their normal development. The disease begins clinically with signs of night blindness followed by day blindness. A DNA test is available.

References

1. ACVO Genetics Committee, 2011 and/or Data from CERF All-Breeds Report, 2010.

2. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

3. Martin CL and Dice PF. Corneal endothelial dystrophy in the dog. *J Am Anim Hosp Assoc.* 1982;18:327.

4. ACVO Genetics Committee, 2016 and/or Data from CERF/OFA All-Breeds Report, 2010- 2015.

5. Hyama M, Tada N, Mitsui H, et al. Real-time PCR genotyping in assay for canine progressive rod-cone degeneration and mutant allele frequency in Toy Poodles, Chihuahuas, and Miniature Dachshunds in Japan. J Vet Med Sci 2016; 78(3): 481.

6. Downs LM, Hitti R, Pregnolato S, et al. Genetic screening for PRA-associated mutations in multiple dog breeds shows that PRA is heterogeneous within and between breeds. *Vet Ophthalmol*. 2014;17:126-130.

OCULAR DISORDERS REPORT
CHIHUAHUA

		1991-2013		2014-2018	
	TOTAL DOGS EXAMINED	**1209**		**882**	
Diagnostic Name		**#**	**%**	**#**	**%**
EYELIDS					
20.140	ectopic cilia	1	0.1%	0	
21.000	entropion, unspecified	3	0.2%	1	0.1%
25.110	distichiasis	56	4.6%	43	4.9%
NASOLACRIMAL					
32.110	imperforate lower nasolacrimal punctum	0		5	0.6%
40.910	keratoconjunctivitis sicca	1	0.1%	2	0.2%
NICTITANS					
52.110	prolapsed gland of the third eyelid	1	0.1%	4	0.5%
CORNEA					
70.220	pigmentary keratitis	0		5	0.6%
70.700	corneal dystrophy	3	0.2%	3	0.3%
70.730	corneal endothelial degeneration	4	0.3%	4	0.5%
UVEA					
93.710	persistent pupillary membranes, iris to iris	85	7.0%	62	7.0%
93.720	persistent pupillary membranes, iris to lens	3	0.2%	1	0.1%
93.730	persistent pupillary membranes, iris to cornea	2	0.2%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	5	0.4%	3	0.3%
93.760	persistent pupillary membranes, endothelial opacity/no strands	2	0.2%	0	
LENS					
100.200	cataract, unspecified	3	0.2%	0	
100.210	cataract. suspect not inherited/significance unknown	35	2.9%	18	2.0%
100.301	punctate cataract, anterior cortex	7	0.6%	5	0.6%
100.303	punctate cataract, equatorial cortex	2	0.2%	0	
100.304	punctate cataract, anterior sutures	1	0.1%	0	
100.305	punctate cataract, posterior sutures	2	0.2%	1	0.1%
100.306	punctate cataract, nucleus	0		1	0.1%
100.307	punctate cataract, capsular	0		2	0.2%
100.311	incipient cataract, anterior cortex	21	1.7%	10	1.1%
100.312	incipient cataract, posterior cortex	13	1.1%	6	0.7%
100.313	incipient cataract, equatorial cortex	5	0.4%	3	0.3%
100.314	incipient cataract, anterior sutures	1	0.1%	0	
100.315	incipient cataract, posterior sutures	1	0.1%	1	0.1%
100.316	incipient cataract, nucleus	6	0.5%	2	0.2%
100.317	incipient cataract, capsular	1	0.1%	2	0.2%
100.321	incomplete cataract, anterior cortex	1	0.1%	4	0.5%
100.325	incomplete cataract, posterior sutures	0		1	0.1%
100.326	incomplete cataract, nucleus	0		3	0.3%
100.328	posterior suture tip opacities	0		2	0.2%
100.330	generalized/complete cataract	12	1.0%	0	
100.375	subluxation/luxation, unspecified	1	0.1%	1	0.1%
100.999	*significant cataracts (summary)*	*76*	*6.3%*	*41*	*4.6%*

		1991-2013		2014-2018	
VITREOUS					
110.120	persistent hyaloid artery/remnant	1	0.1%	1	0.1%
110.135	PHPV/PTVL	1	0.1%	1	0.1%
110.200	vitritis	1	0.1%	11	1.2%
110.320	vitreal degeneration	51	4.2%	17	1.9%
FUNDUS					
97.110	choroidal hypoplasia	1	0.1%	0	
RETINA					
120.170	retinal dysplasia, folds	6	0.5%	2	0.2%
120.180	retinal dysplasia, geographic	3	0.2%	0	
120.310	generalized progressive retinal atrophy (PRA)	10	0.8%	2	0.2%
120.960	retinopathy	1	0.1%	0	
OPTIC NERVE					
130.110	micropapilla	1	0.1%	0	
130.150	optic disc coloboma	1	0.1%	0	
OTHER					
900.000	other, unspecified	21	1.7%	0	
900.100	other, not inherited	28	2.3%	41	4.6%
900.110	other. suspect not inherited/significance unknown	3	0.2%	3	0.3%
NORMAL					
0.000	normal globe	1001	82.8%	674	76.4%

CHINESE CRESTED

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Distichiasis	Not defined	1	Breeder option	
B.	Persistent pupillary membranes - iris to iris	Not defined	2, 3	Breeder option	
C.	Cataract	Not defined	4	NO	
D.	Lens luxation	Autosomal recessive	5, 6	NO	Mutation in the *ADAMTS17 gene*
E.	Vitreous degeneration	Not defined	3, 6, 7, 8	Breeder option	
F.	Retinal atrophy - generalized (*prcd*)	Autosomal recessive	3, 8, 9	NO	Mutation in the *prcd* gene
G.	Retinal atrophy - rod-cone dysplasia type 3 (rcd3)	Presumed autosomal recessive	8	NO	Mutation in the PDE6A gene
H.	Ceroid lipofuscinosis	Not defined	9	NO	

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

C. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

D. Lens luxation

Partial (subluxation) or complete displacement of the lens from its normal anatomic site behind the pupil. Lens luxation not associated with trauma or inflammation is presumed to be inherited. Lens luxation may result in elevated intraocular pressure (glaucoma) causing vision impairment or blindness. A mutation in *ADAMTS17* has been associated with primary lens luxation. A DNA test is available.

E. Vitreous degeneration

Liquefaction of the vitreous gel which may predispose to retinal detachment.

F. Retinal atrophy - generalized *(prcd)*

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as Progressive Retinal Atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

Studies have shown that the principal form of PRA in the Chinese Crested is *prcd* which is a late-onset form of PRA inherited as autosomal recessive. The mutation is allelic to that present in Miniature Poodles, Labrador Retrievers, English and American Cocker Spaniels and others. The locus is termed the progressive rod-cone degeneration (*prcd*) gene and at least 30+ breeds are affected. In most affected dogs to date, the disease is recognized clinically in dogs 3-6 years of age or older. This photoreceptor degeneration is characterized by slow death of visual cells following their normal development. The disease begins clinically with signs of night blindness followed by day blindness. A DNA test is available.

In the Chinese Crested, a second, but very infrequency type of PRA has been identified that is caused by the mutation in the *PDE6A* gene that causes PRA in Cardigan Welsh Corgis. However, most cases of PRA that test normal for the *prcd* gene defect likely results from a gene defect that is still to be identified.

G. Retinal atrophy - rod-cone dysplasia type 3 (*rcd3*)

PRA in the Chinese Crested is an autosomal recessive trait caused by a one base pair deletion in the gene encoding the alpha subunit of cyclic GMP phosphodiesterase (rcd3). PRA begins early in life with clinical signs of night blindness and a lack of rod ERG responses is seen at 6-8 weeks of age. Dogs are completely blind by 2-3 years of age when ophthalmoscopic signs are first visible. The mutation is found in the *PDE6A* gene. A DNA test is available.

H. Ceroid lipofuscinosis

An inherited disease of humans and animals characterized by the accumulation of lipopigment in various tissues of the body including the eye. It results in progressive neurologic disease including blindness. (Also called Batten's disease)

References

1. ACVO Genetics Committee, 2016 and/or Data from CERF/OFA All-Breeds Report, 2010-2015.

2. ACVO Genetics Committee, 2000-2002 and/or Data from CERF All-Breeds Report, 2000-2002.

3. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

4. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

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8. Downs LM, Hitti R, Pregnolato S, et al. Genetic screening for PRA-associated mutations in multiple dog breeds shows that PRA is heterogeneous within and between breeds. *Vet Ophthalmol*. 2014;17:126-130.

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OCULAR DISORDERS REPORT
CHINESE CRESTED

Diagnostic Name		1991-2013 TOTAL DOGS EXAMINED 6093 #	%	2014-2018 754 #	%
GLOBE					
0.110	microphthalmia	4	0.1%	0	
10.000	glaucoma	2	0.0%	0	
EYELIDS					
20.140	ectopic cilia	1	0.0%	1	0.1%
21.000	entropion, unspecified	4	0.1%	0	
25.110	distichiasis	31	0.5%	11	1.5%
NASOLACRIMAL					
32.110	imperforate lower nasolacrimal punctum	1	0.0%	4	0.5%
40.910	keratoconjunctivitis sicca	18	0.3%	0	
NICTITANS					
52.110	prolapsed gland of the third eyelid	3	0.0%	0	
CORNEA					
70.210	corneal pannus	5	0.1%	0	
70.220	pigmentary keratitis	6	0.1%	2	0.3%
70.700	corneal dystrophy	33	0.5%	4	0.5%
70.730	corneal endothelial degeneration	2	0.0%	1	0.1%
UVEA					
93.110	iris hypoplasia	4	0.1%	1	0.1%
93.150	iris coloboma	1	0.0%	1	0.1%
93.710	persistent pupillary membranes, iris to iris	149	2.4%	30	4.0%
93.720	persistent pupillary membranes, iris to lens	10	0.2%	1	0.1%
93.730	persistent pupillary membranes, iris to cornea	10	0.2%	0	
93.740	persistent pupillary membranes, iris sheets	5	0.1%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	2	0.0%	1	0.1%
93.760	persistent pupillary membranes, endothelial opacity/no strands	2	0.0%	1	0.1%
93.999	uveal cysts	4	0.1%	0	
LENS					
100.210	cataract. suspect not inherited/significance unknown	143	2.3%	22	2.9%
100.301	punctate cataract, anterior cortex	26	0.4%	9	1.2%
100.302	punctate cataract, posterior cortex	17	0.3%	1	0.1%
100.303	punctate cataract, equatorial cortex	12	0.2%	2	0.3%
100.304	punctate cataract, anterior sutures	2	0.0%	1	0.1%
100.305	punctate cataract, posterior sutures	4	0.1%	3	0.4%
100.306	punctate cataract, nucleus	8	0.1%	1	0.1%
100.307	punctate cataract, capsular	5	0.1%	3	0.4%
100.311	incipient cataract, anterior cortex	41	0.7%	1	0.1%
100.312	incipient cataract, posterior cortex	30	0.5%	0	
100.313	incipient cataract, equatorial cortex	28	0.5%	2	0.3%
100.314	incipient cataract, anterior sutures	2	0.0%	0	
100.315	incipient cataract, posterior sutures	4	0.1%	2	0.3%
100.316	incipient cataract, nucleus	5	0.1%	0	
100.317	incipient cataract, capsular	1	0.0%	1	0.1%
100.321	incomplete cataract, anterior cortex	1	0.0%	2	0.3%

LENS CONTINUED		1991-2013		2014-2018	
100.322	incomplete cataract, posterior cortex	1	0.0%	3	0.4%
100.323	incomplete cataract, equatorial cortex	0		1	0.1%
100.326	incomplete cataract, nucleus	0		1	0.1%
100.327	incomplete cataract, capsular	0		1	0.1%
100.328	posterior suture tip opacities	2	0.0%	2	0.3%
100.330	generalized/complete cataract	25	0.4%	2	0.3%
100.340	resorbing/hypermature cataract	0		1	0.1%
100.375	subluxation/luxation, unspecified	24	0.4%	5	0.7%
100.999	*significant cataracts (summary)*	*212*	*3.5%*	*37*	*4.9%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	6	0.1%	1	0.1%
110.135	PHPV/PTVL	2	0.0%	0	
110.200	vitritis	10	0.2%	30	4.0%
110.320	vitreal degeneration	708	11.6%	50	6.6%
FUNDUS					
97.110	choroidal hypoplasia	3	0.0%	0	
97.120	coloboma	2	0.0%	0	
RETINA					
120.170	retinal dysplasia, folds	30	0.5%	3	0.4%
120.180	retinal dysplasia, geographic	6	0.1%	0	
120.190	retinal dysplasia, detached	2	0.0%	0	
120.310	generalized progressive retinal atrophy (PRA)	93	1.5%	5	0.7%
120.400	retinal hemorrhage	4	0.1%	0	
120.910	retinal detachment without dialysis	8	0.1%	0	
120.960	retinopathy	0		2	0.3%
OPTIC NERVE					
130.110	micropapilla	4	0.1%	0	
130.120	optic nerve hypoplasia	13	0.2%	0	
130.150	optic disc coloboma	8	0.1%	0	
OTHER					
900.000	other, unspecified	68	1.1%	0	
900.100	other, not inherited	163	2.7%	27	3.6%
900.110	other. suspect not inherited/significance unknown	20	0.3%	0	
NORMAL					
0.000	normal globe	5205	85.4%	577	76.5%

CHINESE FOO DOG

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Lens luxation	Autosomal recessive	1	NO	Mutation in the *ADAMTS17* gene

Description and Comments

A. Lens luxation

Partial (subluxation) or complete displacement of the lens from the normal anatomic site behind the pupil. Lens luxation not associated with trauma or inflammation is presumed to be inherited. Lens luxation may result in elevated intraocular pressure (glaucoma), causing vision impairment or blindness. A mutation in *ADAMTS17* has been associated with primary lens luxation. A DNA test is available.

References

There are no breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the Chinese Foo Dog. The condition listed above is currently noted solely due to the availability of a genetic test for the disease.

1. Gould D, Pettitt L, McLaughlin B, et al. ADAMTS17 mutation associated with primary lens luxation is widespread among breeds. *Vet Ophthalmol*. 2011; 14: 378-384.

CHINESE SHAR-PEI

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Glaucoma – POAG	Autosomal recessive	1	NO	Mutation in the *ADAMTS17* gene
B.	Entropion	Not defined	2-6	NO	
C.	Prolapsed gland of third eyelid	Not defined	2	Breeder option	
D.	Corneal dystrophy - epithelial/stromal	Not defined	2-4	Breeder option	
E.	Persistent pupillary membranes - iris to iris	Not defined	7	Breeder option	
F.	Cataract	Not defined	2	NO	
G.	Lens luxation	Autosomal recessive	2, 8	NO	Mutation in the *ADAMTS17* gene
H.	Retinal atrophy - generalized	Not defined	2	NO	
I.	Secondary keratitis - chronic	Not defined	7	Breeder option	

Description and Comments

A. Glaucoma

Glaucoma is characterized by an elevation of intraocular pressure (IOP) which, when sustained, causes intraocular damage resulting in blindness. The elevated IOP occurs because the fluid cannot leave through the iridocorneal angle. Diagnosis and classification of glaucoma requires measurement of the intraocular pressure (tonometry) and examination of the iridocorneal angle (gonioscopy). Neither of these tests is part of a routine breed eye screening exam.

A 6 base pair deletion in exon 22 of *ADAMTS17* has been found in some affected Chinese Shar-Pei. Results supported phenotype is an autosomal recessive trait. A genetic test is available.

B. Entropion

A conformational defect resulting in an "in-rolling" of one or both of the eyelids which may cause ocular irritation. It is likely that entropion is influenced by several genes (polygenic), defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

The condition is a particularly severe problem in the Chinese Shar-Pei and is compounded by breeder selection for facial conformation with heavy skin folds which encourages formation of entropion.

C. Prolapsed gland of the third eyelid

This condition, which is often referred to as "cherry eye," represents a protrusion of the glandular portion of the third eyelid. The mode of inheritance of this disorder is unknown. Exposure of the gland may cause ocular irritation and be associated with decreased tears (Keratoconjunctivitis sicca).

D. Corneal dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

E. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

F. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

G. Lens luxation

Partial (subluxation) or complete displacement of the lens from the normal anatomic site behind the pupil. Lens luxation not associated with trauma or inflammation is presumed to be inherited. Lens luxation may result in elevated intraocular pressure (glaucoma) causing vision impairment or blindness.

A 6 base pair deletion in exon 22 of *ADAMTS17* has been found in some affected Chinese Shar-Pei. Results supported phenotype is an autosomal recessive trait. A genetic test is available.

H. Retinal atrophy - generalized

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. PRA is inherited as an autosomal recessive trait in most breeds.

I. Secondary keratitis - chronic

A specific designation does not exist on the CAER form for this condition. We ask examiners to mark other – unlisted conditions suspected as inherited. Then in the comments box please write secondary keratitis – chronic.

A condition characterized by variable degrees of superficial vascularization, fibrosis and/or pigmentation of the cornea. Often associated with entropion or a combination of entropion and ectropion.

References

1. Oliver, JAC, Rustidge S, Pettit L, et al. Evaluation of ADAMTS17 in Chinese Shar-Pei with primary open-angle glaucoma, primary lens luxation, or both. *Am J Vet Res.* 2018 Jan; 79(1): 98-106.

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7. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

8. Lazarus JA, Pickett JP, Champagne ES. Primary lens luxation in the Chinese Shar-Pei: clinical and hereditary characteristics. *Vet Ophthalmol*. 1998;1:101-107.

OCULAR DISORDERS REPORT
CHINESE SHAR-PEI

Diagnostic Name		1991-2013 548 #	1991-2013 548 %	2014-2018 100 #	2014-2018 100 %
GLOBE					
0.110	microphthalmia	1	0.2%	1	1.0%
EYELIDS					
21.000	entropion, unspecified	276	50.4%	42	42.0%
22.000	ectropion, unspecified	11	2.0%	1	1.0%
25.110	distichiasis	3	0.5%	0	
NICTITANS					
51.100	third eyelid cartilage anomaly	1	0.2%	1	1.0%
52.110	prolapsed gland of the third eyelid	2	0.4%	1	1.0%
CORNEA					
70.210	corneal pannus	29	5.3%	0	
70.220	pigmentary keratitis	8	1.5%	5	5.0%
70.700	corneal dystrophy	4	0.7%	0	
70.730	corneal endothelial degeneration	6	1.1%	1	1.0%
UVEA					
93.710	persistent pupillary membranes, iris to iris	15	2.7%	1	1.0%
93.720	persistent pupillary membranes, iris to lens	5	0.9%	0	
93.730	persistent pupillary membranes, iris to cornea	5	0.9%	3	3.0%
93.750	persistent pupillary membranes, lens pigment foci/no strands	2	0.4%	2	2.0%
93.760	persistent pupillary membranes, endothelial opacity/no strands	1	0.2%	0	
93.810	uveal melanoma	1	0.2%	0	
LENS					
100.200	cataract, unspecified	4	0.7%	0	
100.210	cataract. suspect not inherited/significance unknown	13	2.4%	2	2.0%
100.301	punctate cataract, anterior cortex	1	0.2%	1	1.0%
100.302	punctate cataract, posterior cortex	1	0.2%	0	
100.305	punctate cataract, posterior sutures	2	0.4%	0	
100.306	punctate cataract, nucleus	0		1	1.0%
100.307	punctate cataract, capsular	1	0.2%	0	
100.311	incipient cataract, anterior cortex	2	0.4%	0	
100.312	incipient cataract, posterior cortex	5	0.9%	1	1.0%
100.313	incipient cataract, equatorial cortex	0		1	1.0%
100.314	incipient cataract, anterior sutures	1	0.2%	0	
100.315	incipient cataract, posterior sutures	2	0.4%	0	
100.316	incipient cataract, nucleus	1	0.2%	0	
100.330	generalized/complete cataract	2	0.4%	0	
100.375	subluxation/luxation, unspecified	9	1.6%	0	
100.999	*significant cataracts (summary)*	*22*	*4.0%*	*4*	*4.0%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	1	0.2%	0	
110.320	vitreal degeneration	1	0.2%	0	

		1991-2013		2014-2018	
RETINA					
120.170	retinal dysplasia, folds	4	0.7%	0	
120.180	retinal dysplasia, geographic	1	0.2%	0	
120.310	generalized progressive retinal atrophy (PRA)	2	0.4%	0	
120.910	retinal detachment without dialysis	1	0.2%	0	
OPTIC NERVE					
130.120	optic nerve hypoplasia	1	0.2%	0	
OTHER					
900.000	other, unspecified	9	1.6%	0	
900.100	other, not inherited	15	2.7%	6	6.0%
900.110	other. suspect not inherited/significance unknown	19	3.5%	3	3.0%
NORMAL					
0.000	normal globe	263	48.0%	45	45.0%

OCULAR DISORDERS REPORT
CHINOOK HYBRID

There are insufficient breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the CHINOOK HYBRID breed. Therefore, there are no conditions listed with breeding advice.

OCULAR DISORDERS REPORT
CHINOOK HYBRID

Diagnostic Name	TOTAL DOGS EXAMINED	1991-2013 2 #	 %	2014-2018 2 #	 %
LENS					
100.210	cataract. suspect not inherited/significance unknown	1	50.0%	0	
NORMAL					
0.000	normal globe	1	50.0%	2	100.0%

CHINOOK

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Persistent pupillary membranes	Not defined	1	Breeder option
	- iris to iris	Not defined	1	Breeder option
B.	Cataract	Not defined	1	NO
C.	Vitreous degeneration	Not defined	2, 3	Breeder option
D.	Retinal dysplasia - folds	Not defined	1	Breeder option

Description and Comments

A. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

B. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

C. Vitreous degeneration

Liquefaction of the vitreous gel which may predispose to retinal detachment.

D. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Chinook breed. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

2. ACVO Genetics Committee, 2006 and/or Data from CERF All-Breeds Report, 2001-2005.

3. ACVO Genetics Committee, 2009 and/or Data from CERF All-Breeds Report, 2008.

OCULAR DISORDERS REPORT
CHINOOK

Diagnostic Name		1991-2013 TOTAL DOGS EXAMINED 1246 #	 %	2014-2018 340 #	 %
EYELIDS					
20.140	ectopic cilia	1	0.1%	0	
25.110	distichiasis	5	0.4%	0	
NASOLACRIMAL					
40.910	keratoconjunctivitis sicca	1	0.1%	0	
NICTITANS					
51.100	third eyelid cartilage anomaly	2	0.2%	2	0.6%
CORNEA					
70.700	corneal dystrophy	2	0.2%	0	
70.730	corneal endothelial degeneration	1	0.1%	0	
UVEA					
93.710	persistent pupillary membranes, iris to iris	83	6.7%	12	3.5%
93.720	persistent pupillary membranes, iris to lens	2	0.2%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		2	0.6%
93.760	persistent pupillary membranes, endothelial opacity/no strands	1	0.1%	0	
93.810	uveal melanoma	0		1	0.3%
LENS					
100.200	cataract, unspecified	2	0.2%	0	
100.210	cataract. suspect not inherited/significance unknown	68	5.5%	18	5.3%
100.301	punctate cataract, anterior cortex	5	0.4%	2	0.6%
100.302	punctate cataract, posterior cortex	1	0.1%	1	0.3%
100.303	punctate cataract, equatorial cortex	0		1	0.3%
100.305	punctate cataract, posterior sutures	2	0.2%	0	
100.306	punctate cataract, nucleus	5	0.4%	2	0.6%
100.311	incipient cataract, anterior cortex	8	0.6%	2	0.6%
100.312	incipient cataract, posterior cortex	15	1.2%	2	0.6%
100.313	incipient cataract, equatorial cortex	7	0.6%	1	0.3%
100.314	incipient cataract, anterior sutures	1	0.1%	0	
100.315	incipient cataract, posterior sutures	8	0.6%	1	0.3%
100.316	incipient cataract, nucleus	6	0.5%	2	0.6%
100.317	incipient cataract, capsular	4	0.3%	1	0.3%
100.321	incomplete cataract, anterior cortex	0		1	0.3%
100.322	incomplete cataract, posterior cortex	1	0.1%	2	0.6%
100.328	posterior suture tip opacities	1	0.1%	4	1.2%
100.330	generalized/complete cataract	9	0.7%	1	0.3%
100.375	subluxation/luxation, unspecified	0		1	0.3%
100.999	*significant cataracts (summary)*	*74*	*5.9%*	*19*	*5.6%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	2	0.2%	0	
110.320	vitreal degeneration	15	1.2%	4	1.2%
FUNDUS					
97.110	choroidal hypoplasia	0		1	0.3%

		1991-2013		2014-2018	
RETINA					
120.170	retinal dysplasia, folds	61	4.9%	4	1.2%
120.180	retinal dysplasia, geographic	1	0.1%	0	
120.310	generalized progressive retinal atrophy (PRA)	1	0.1%	0	
120.920	retinal detachment with dialysis	0		1	0.3%
OTHER					
900.000	other, unspecified	19	1.5%	0	
900.100	other, not inherited	44	3.5%	13	3.8%
900.110	other. suspect not inherited/significance unknown	2	0.2%	0	
NORMAL					
0.000	normal globe	1055	84.7%	272	80.0%

CHOW CHOW

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Glaucoma	Autosomal recessive	1-3	NO
B.	Entropion	Not defined	1	NO
C.	Ectropion	Not defined	4	Breeder option
D.	Corneal dystrophy - endothelial	Not defined	1	NO
E.	Persistent pupillary membranes			
	- iris to iris	Not defined	1, 5	Breeder option
	- iris to lens	Not defined	6	NO
	- iris to cornea	Not defined	6	NO
	- lens pigment foci/no strands	Not defined	7	Passes with no notation
F.	Cataract	Not defined	1, 8	NO
G.	Secondary keratitis – chronic	Not defined	4, 9	Breeder option

DESCRIPTION AND COMMENTS

A. Glaucoma

Glaucoma is characterized by an elevation of intraocular pressure (IOP) which, when sustained, causes intraocular damage resulting in blindness. The elevated intraocular pressure occurs because the fluid cannot leave through the iridocorneal angle. Diagnosis and classification of glaucoma requires measurement of the IOP (tonometry) and examination of the iridocorneal angle (gonioscopy). Neither of these tests are part of a routine screening exam for certification.

Age of onset in the Chow Chow appears to be anywhere between 3-6 years of age and has been observed as a bilateral condition. Gonioscopy has shown extremely narrow iridocorneal angles and in many regions no evidence of trabecular meshwork.

B. Entropion

A conformational defect resulting in an "in-rolling" of one or both of the eyelids which may cause ocular irritation. It is likely that entropion is influenced by several genes (polygenic), defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

Entropion in the Chow Chow has been observed for decades and is definitely related to the amount of skin covering the head and face. Because of the conformation admired by both fanciers and the judges, it is doubtful that we will see a significant change in the incidence of entropion as folds are, in many cases, desired by these individuals. Entropion requires surgical correction in the Chow Chow to return comfort and decrease chances for vision loss.

C. Ectropion

A conformational defect resulting in eversion of the eyelids, which may cause ocular irritation due to exposure. It is likely that ectropion is influenced by several genes (polygenic) defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

D. Corneal dystrophy - endothelial

Corneal endothelial dystrophy is an abnormal loss of the inner lining of the cornea that causes progressive fluid retention (edema). With time the edema results in keratitis and decreased vision. This usually does not occur until the animal is older.

E. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Major PPM's have been observed in the Chow Chow. Many ophthalmologists have observed puppies so severely affected that they are temporarily or permanently blind. The blindness is due to adherence of the membranes to the cornea and/or lens.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

F. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

In the Chow Chow, the only reported cataract is congenital. The clinical appearance is

variable, ranging from small nuclear or capsular opacities to generalized opacity. The central lens (nucleus) is most consistently affected with variable involvement of the peripheral lens (cortex). Concurrent ocular anomalies may include entropion, microphthalmia, persistent pupillary membranes, and retinal folds, although any direct relationship of these latter conditions to the cataract is unclear.

G. Secondary keratitis - chronic

A specific designation does not exist on the CAER form for this condition. We ask examiners to mark other - unlisted conditions suspected as inherited. Then in the comments box please write secondary keratitis - chronic.

A condition characterized by variable degrees of superficial vascularization, fibrosis and/or pigmentation of the cornea. Often associated with entropion or a combination of entropion and ectropion.

References

1. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

2. Gelatt KN, MacKay EO. Prevalence of the breed-related glaucomas in pure-bred dogs in North America. *Vet Ophthalmol*. 2004;7:97-111.

3. Corcaran KA, Koch SA. Primary glaucoma in the Chow chows. *Prog Vet Comp Ophthal*. 1994;4:193-197.

4. ACVO Genetics Committee, 2008 and/or Data from CERF All-Breeds Report, 2003-2007.

5. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

6. ACVO Genetics Committee, 2009 and/or Data from CERF All-Breeds Report, 2008.

7. ACVO Genetics Committee, 2017 and/or Data from Cerf All-Breeds Report, 2010-2016.

8. Collins BK, Collier LL, Johnson GS, et al. Familial cataracts and concurrent ocular anomalies in chow chows. *J Am Vet Med Assoc*. 1992;200:1485-1491.

9. ACVO Genetics Committee, 2007 and/or Data from CERF All-Breeds Report, 2002-2006.

OCULAR DISORDERS REPORT
CHOW CHOW

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2013 1196 #	 %	2014-2018 259 #	 %
GLOBE						
0.110	microphthalmia		4	0.3%	0	
EYELIDS						
20.160	macropalpebral fissure		3	0.3%	0	
21.000	entropion, unspecified		337	28.2%	50	19.3%
22.000	ectropion, unspecified		20	1.7%	5	1.9%
25.110	distichiasis		7	0.6%	2	0.8%
NASOLACRIMAL						
40.910	keratoconjunctivitis sicca		0		2	0.8%
CORNEA						
70.210	corneal pannus		9	0.8%	0	
70.220	pigmentary keratitis		22	1.8%	4	1.5%
70.700	corneal dystrophy		8	0.7%	2	0.8%
70.730	corneal endothelial degeneration		17	1.4%	0	
UVEA						
93.140	corneal endothelial pigment without PPM		5	0.4%	0	
93.710	persistent pupillary membranes, iris to iris		425	35.5%	81	31.3%
93.720	persistent pupillary membranes, iris to lens		17	1.4%	1	0.4%
93.730	persistent pupillary membranes, iris to cornea		54	4.5%	7	2.7%
93.740	persistent pupillary membranes, iris sheets		8	0.7%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands		9	0.8%	8	3.1%
93.760	persistent pupillary membranes, endothelial opacity/no strands		1	0.1%	5	1.9%
LENS						
100.210	cataract. suspect not inherited/significance unknown		27	2.3%	5	1.9%
100.301	punctate cataract, anterior cortex		2	0.2%	0	
100.302	punctate cataract, posterior cortex		5	0.4%	0	
100.303	punctate cataract, equatorial cortex		2	0.2%	0	
100.305	punctate cataract, posterior sutures		1	0.1%	0	
100.306	punctate cataract, nucleus		1	0.1%	1	0.4%
100.307	punctate cataract, capsular		1	0.1%	0	
100.311	incipient cataract, anterior cortex		5	0.4%	0	
100.312	incipient cataract, posterior cortex		9	0.8%	0	
100.315	incipient cataract, posterior sutures		1	0.1%	0	
100.316	incipient cataract, nucleus		3	0.3%	0	
100.326	incomplete cataract, nucleus		0		1	0.4%
100.328	posterior suture tip opacities		0		2	0.8%
100.330	generalized/complete cataract		1	0.1%	0	
100.999	*significant cataracts (summary)*		*31*	*2.6%*	*2*	*0.8%*
VITREOUS						
110.120	persistent hyaloid artery/remnant		4	0.3%	1	0.4%
110.320	vitreal degeneration		2	0.2%	1	0.4%

		1991-2013		2014-2018	
RETINA					
120.170	retinal dysplasia, folds	2	0.2%	0	
120.180	retinal dysplasia, geographic	1	0.1%	0	
120.190	retinal dysplasia, detached	1	0.1%	0	
120.310	generalized progressive retinal atrophy (PRA)	7	0.6%	1	0.4%
OPTIC NERVE					
130.120	optic nerve hypoplasia	1	0.1%	0	
OTHER					
900.000	other, unspecified	17	1.4%	0	
900.100	other, not inherited	24	2.0%	9	3.5%
900.110	other. suspect not inherited/significance unknown	15	1.3%	0	
NORMAL					
0.000	normal globe	539	45.1%	109	42.1%

OCULAR DISORDERS REPORT
CIRNECO DELL ETNA

There are insufficient breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the CIRNECO DELL ETNA breed. Therefore, there are no conditions listed with breeding advice.

OCULAR DISORDERS REPORT
CIRNECO DELL ETNA

Diagnostic Name	TOTAL DOGS EXAMINED	1991-2013 10 #	%	2014-2018 40 #	%
EYELIDS					
25.110	distichiasis	0		2	5.0%
UVEA					
93.710	persistent pupillary membranes, iris to iris	0		1	2.5%
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		1	2.5%
LENS					
100.210	cataract. suspect not inherited/significance unknown	0		2	5.0%
100.307	punctate cataract, capsular	0		1	2.5%
100.999	*significant cataracts (summary)*	*0*		*1*	*2.5%*
OTHER					
900.100	other, not inherited	0		2	5.0%
NORMAL					
0.000	normal globe	10	100.0%	33	82.5%

CLUMBER SPANIEL

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Microphthalmia	Not defined	1	NO
B.	Keratoconjunctivitis sicca	Not defined	1, 2	NO
C.	Entropion	Not defined	1, 3	Breeder option
D.	Ectropion	Not defined	1	Breeder option
E.	Distichiasis	Not defined	1	Breeder option
F.	Persistent pupillary membranes - iris to iris	Not defined	1, 4	Breeder option
G.	Cataract	Not defined	1	NO
H.	Retinal dysplasia - folds	Not defined	1	Breeder option
I.	Secondary keratitis - chronic	Not defined	1	Breeder option

Description and Comments

A. Microphthalmia

Microphthalmia is a congenital defect characterized by a small eye often associated with defects of the cornea, iris (coloboma), anterior chamber, lens (cataract) and/or retina.

An association has been made between partial albinism, multiple ocular defects (especially microphthalmia) and deafness in a number of canine breeds including the Collie. From these reports it appears that a predominantly white hair coat is associated with a higher incidence of ocular defects.

B. Keratoconjunctivitis sicca

An abnormality of the tear film, most commonly a deficiency of the aqueous portion, although the mucin and/or lipid layers may be affected; results in ocular irritation and/or vision impairment.

C. Entropion

A conformational defect resulting in "in-rolling" of one or both of the eyelids, which may

cause ocular irritation. It is likely that entropion is influenced by several genes (polygenic), defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

D. Ectropion

A conformational defect resulting in eversion of the eyelids, which may cause ocular irritation. It is likely that ectropion is influenced by several genes (polygenic), defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

E. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established, although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

F. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

G. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

H. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

I. Secondary keratitis - chronic

A specific designation does not exist on the CAER form for this condition. We ask examiners to mark other – unlisted conditions suspected as inherited. Then in the comments box please write secondary keratitis – chronic.

A condition characterized by variable degrees of superficial vascularization, fibrosis and/or pigmentation of the cornea. Often associated with entropion or a combination of entropion and ectropion.

References

1. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

2. ACVO Genetics Committee, 2008 and/or Data from CERF All-Breeds Report, 2003-2007.

3. Hodgman SFJ. Abnormalities and defects in pedigree dogs: I. An investigation into the existence of abnormalities in pedigree dogs in British Isles. *J Small Anim Pract*. 1963;4:447-456.

4. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

OCULAR DISORDERS REPORT
CLUMBER SPANIEL

Diagnostic Name		1991-2013 TOTAL DOGS EXAMINED 2573 #	 %	2014-2018 276 #	 %
GLOBE					
0.110	microphthalmia	6	0.2%	0	
EYELIDS					
20.140	ectopic cilia	1	0.0%	0	
20.160	macropalpebral fissure	167	6.5%	0	
21.000	entropion, unspecified	548	21.3%	66	23.9%
22.000	ectropion, unspecified	413	16.1%	42	15.2%
25.110	distichiasis	181	7.0%	30	10.9%
NASOLACRIMAL					
32.110	imperforate lower nasolacrimal punctum	3	0.1%	2	0.7%
40.910	keratoconjunctivitis sicca	17	0.7%	3	1.1%
NICTITANS					
52.110	prolapsed gland of the third eyelid	1	0.0%	0	
CORNEA					
70.210	corneal pannus	13	0.5%	0	
70.220	pigmentary keratitis	11	0.4%	1	0.4%
70.700	corneal dystrophy	5	0.2%	0	
UVEA					
93.710	persistent pupillary membranes, iris to iris	60	2.3%	9	3.3%
93.720	persistent pupillary membranes, iris to lens	2	0.1%	0	
93.730	persistent pupillary membranes, iris to cornea	6	0.2%	0	
93.740	persistent pupillary membranes, iris sheets	1	0.0%	0	
93.760	persistent pupillary membranes, endothelial opacity/no strands	2	0.1%	0	
LENS					
100.200	cataract, unspecified	15	0.6%	0	
100.210	cataract. suspect not inherited/significance unknown	85	3.3%	11	4.0%
100.301	punctate cataract, anterior cortex	20	0.8%	2	0.7%
100.302	punctate cataract, posterior cortex	26	1.0%	3	1.1%
100.303	punctate cataract, equatorial cortex	5	0.2%	0	
100.304	punctate cataract, anterior sutures	1	0.0%	0	
100.305	punctate cataract, posterior sutures	15	0.6%	3	1.1%
100.306	punctate cataract, nucleus	5	0.2%	1	0.4%
100.307	punctate cataract, capsular	1	0.0%	0	
100.311	incipient cataract, anterior cortex	15	0.6%	0	
100.312	incipient cataract, posterior cortex	41	1.6%	1	0.4%
100.313	incipient cataract, equatorial cortex	7	0.3%	0	
100.314	incipient cataract, anterior sutures	2	0.1%	0	
100.315	incipient cataract, posterior sutures	12	0.5%	4	1.4%
100.316	incipient cataract, nucleus	7	0.3%	0	
100.317	incipient cataract, capsular	5	0.2%	0	
100.322	incomplete cataract, posterior cortex	0		2	0.7%
100.323	incomplete cataract, equatorial cortex	0		1	0.4%
100.326	incomplete cataract, nucleus	0		1	0.4%
100.328	posterior suture tip opacities	2	0.1%	3	1.1%

LENS CONTINUED		1991-2013		2014-2018	
100.330	generalized/complete cataract	5	0.2%	0	
100.999	*significant cataracts (summary)*	*182*	*7.1%*	*18*	*6.5%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	6	0.2%	0	
110.135	PHPV/PTVL	3	0.1%	0	
FUNDUS					
97.110	choroidal hypoplasia	2	0.1%	0	
97.120	coloboma	3	0.1%	0	
RETINA					
120.170	retinal dysplasia, folds	177	6.9%	6	2.2%
120.180	retinal dysplasia, geographic	7	0.3%	3	1.1%
120.190	retinal dysplasia, detached	0		1	0.4%
120.310	generalized progressive retinal atrophy (PRA)	15	0.6%	0	
120.910	retinal detachment without dialysis	1	0.0%	0	
120.960	retinopathy	1	0.0%	0	
OPTIC NERVE					
130.150	optic disc coloboma	2	0.1%	0	
OTHER					
900.000	other, unspecified	25	1.0%	0	
900.100	other, not inherited	62	2.4%	11	4.0%
900.110	other. suspect not inherited/significance unknown	21	0.8%	3	1.1%
NORMAL					
0.000	normal globe	1384	53.8%	119	43.1%

COCKER SPANIEL

(*American)

*The official breed name is Cocker Spaniel. The designation "American" has been used to avoid confusion and emphasize the distinction from the English Cocker Spaniel breed.

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Keratoconjunctivitis sicca	Not defined	1, 2	NO	
B.	Glaucoma	Not defined	1, 3, 4	NO	
C.	Entropion	Not defined	1	Breeder option	
D.	Ectropion	Not defined	1	Breeder option	
E.	Distichiasis	Not defined	1, 2, 5, 6	Breeder option	
F.	Eury/Macroblepharon	Not defined	1	Breeder option	
G.	Imperforate lacrimal punctum	Not defined	1	Breeder option	
H.	Prolapsed gland of the third eyelid	Not defined	1, 7	Breeder option	
I.	Corneal dystrophy - epithelial/stromal	Not defined	1	Breeder option	
J.	Corneal dystrophy - posterior polymorphous	Not defined	1	Breeder option	
K.	Persistent pupillary membranes - iris to iris	Not defined	8	Breeder option	
L.	Cataract	Presumed autosomal recessive	1, 2, 9-12	NO	
M.	Retinal atrophy - generalized (*prcd*)	Autosomal recessive	1, 13-15	NO	Mutation in the *prcd* gene
N.	Retinal dysplasia - folds	Not defined	1, 16	Breeder option	

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
O.	Retinal dysplasia-geographic/detached	Not defined	1, 16	NO	
P.	Secondary keratitis - chronic	Not defined	1, 17	Breeder option	

Description and Comments

A. Keratoconjunctivitis sicca

An abnormality of the tear film, most commonly a deficiency of the aqueous portion, although the mucin and/or lipid layers may be affected; results in ocular irritation and/or vision impairment.

B. Glaucoma

An elevation of intraocular pressure (IOP) which, when sustained, causes intraocular damage resulting in blindness. The elevated IOP occurs because the fluid cannot leave through the iridocorneal angle. Diagnosis and classification of glaucoma requires measurement of IOP (tonometry) and examination of the iridocorneal angle (gonioscopy). Neither of these tests is part of a routine breed eye screening exam.

C. Entropion

A conformational defect resulting in an "in-rolling" of one or both of the eyelids which may cause ocular irritation. It is likely that entropion is influenced by several genes (polygenic), defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

D. Ectropion

A conformational defect resulting in eversion of the eyelids, which may cause ocular irritation due to exposure. It is likely that ectropion is influenced by several genes (polygenic) defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

E. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

F. Eury/Macroblepharon

A specific designation does not exist on the CAER form for this condition. We ask examiners to mark other - unlisted conditions suspected as inherited. Then in the comments box please write eury/macroblepharon.

Macroblepharon is defined as an exceptionally large palpebral fissure, macroblepharon in conjunction with laxity of the lateral canthal structures may lead to lower lid ectropion and upper lid entropion.

G. Imperforate lacrimal punctum

A developmental anomaly resulting in failure of opening of the lacrimal duct adjacent to the eye. The lower punctum is more frequently affected. This defect usually results in epiphora, an overflow of tears onto the face.

H. Prolapsed gland of the third eyelid

Protrusion of the tear gland associated with the third eyelid. The mode of inheritance of this disorder is unknown. The exposed gland may become irritated. Commonly referred to as "cherry eye."

I. Corneal dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

J. Corneal dystrophy - posterior polymorphous

Posterior polymorphous dystrophy appears as multifocal, non-pigmented, vesicular to linear posterior corneal opacities at the level of the corneal endothelium. The condition is bilateral and has been seen in dogs from 1-7 years of age. Progression of the dystrophy is limited, and there is no treatment. It differs from endothelial dystrophy by an absence of corneal edema. Corneal endothelial cells distant from the corneal opacities are normal.

K. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

L. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

In this breed, the onset of cataract may occur at an early age (less than 2 years) with rapid progression to maturity and associated with significant lens-induced inflammation.

M. Retinal atrophy - generalized (*prcd*)

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

Studies have shown that the principal form of PRA in the Cocker Spaniel is *prcd* which is a late-onset form of PRA inherited as autosomal recessive. The mutation is allelic to that present in Miniature Poodles, Labrador Retrievers, English Cocker Spaniels and others. The locus is termed the progressive rod-cone degeneration (*prcd*) gene and at least 30+ breeds are affected. In most affected dogs to date, the disease is recognized clinically in dogs 3-6 years of age or older. This photoreceptor degeneration is characterized by slow death of visual cells following their normal development. The disease begins clinically with signs of night blindness followed by day blindness. A DNA test is available.

N. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

O. Retinal dysplasia - geographic, detached

Abnormal development of the retina present at birth.

Retinal dysplasia - geographic: Any irregularly shaped area of abnormal retinal development containing both areas of thinning and areas of elevation representing folds and retinal disorganization.

Retinal dysplasia - detached: Severe retinal disorganization associated with separation (detachment) of the retina.

These two forms are associated with vision impairment or blindness. Retinal dysplasia is known to be inherited in many breeds. The genetic relationship among the three forms of retinal dysplasia is not known for all breeds.

P. Secondary keratitis - chronic

A specific designation does not exist on the CAER form for this condition. We ask examiners to mark other - unlisted conditions suspected as inherited. Then in the comments box please write secondary keratitis - chronic.

A condition characterized by variable degrees of superficial vascularization, fibrosis and/or

pigmentation of the cornea. Often associated with entropion or a combination of entropion and ectropion

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OCULAR DISORDERS REPORT
COCKER SPANIEL

		1991-2013		2014-2018	
	TOTAL DOGS EXAMINED	54254		6935	
Diagnostic Name		#	%	#	%
GLOBE					
0.110	microphthalmia	34	0.1%	2	0.0%
10.000	glaucoma	32	0.1%	5	0.1%
EYELIDS					
20.110	eyelid dermoid	2	0.0%	0	
20.140	ectopic cilia	55	0.1%	1	0.0%
20.160	macropalpebral fissure	179	0.3%	0	
21.000	entropion, unspecified	151	0.3%	9	0.1%
22.000	ectropion, unspecified	949	1.7%	57	0.8%
25.110	distichiasis	27405	50.5%	3303	47.6%
NASOLACRIMAL					
32.110	imperforate lower nasolacrimal punctum	394	0.7%	220	3.2%
40.910	keratoconjunctivitis sicca	305	0.6%	105	1.5%
NICTITANS					
50.210	pannus of third eyelid	0		1	0.0%
51.100	third eyelid cartilage anomaly	8	0.0%	0	
52.110	prolapsed gland of the third eyelid	210	0.4%	21	0.3%
CORNEA					
70.210	corneal pannus	497	0.9%	1	0.0%
70.220	pigmentary keratitis	431	0.8%	138	2.0%
70.700	corneal dystrophy	1512	2.8%	162	2.3%
70.730	corneal endothelial degeneration	36	0.1%	7	0.1%
UVEA					
90.250	pigmentary uveitis	1	0.0%	0	
93.110	iris hypoplasia	3	0.0%	1	0.0%
93.140	corneal endothelial pigment without PPM	2	0.0%	0	
93.150	iris coloboma	6	0.0%	3	0.0%
93.710	persistent pupillary membranes, iris to iris	150	0.3%	29	0.4%
93.720	persistent pupillary membranes, iris to lens	30	0.1%	2	0.0%
93.730	persistent pupillary membranes, iris to cornea	35	0.1%	0	
93.740	persistent pupillary membranes, iris sheets	28	0.1%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	22	0.0%	37	0.5%
93.760	persistent pupillary membranes, endothelial opacity/no strands	4	0.0%	3	0.0%
93.810	uveal melanoma	1	0.0%	0	
93.999	uveal cysts	20	0.0%	3	0.0%
97.150	chorioretinal coloboma, congenital	0		6	0.1%
LENS					
100.200	cataract, unspecified	1023	1.9%	0	
100.210	cataract. suspect not inherited/significance unknown	3142	5.8%	509	7.3%
100.301	punctate cataract, anterior cortex	882	1.6%	138	2.0%
100.302	punctate cataract, posterior cortex	508	0.9%	64	0.9%
100.303	punctate cataract, equatorial cortex	133	0.2%	23	0.3%
100.304	punctate cataract, anterior sutures	126	0.2%	16	0.2%
100.305	punctate cataract, posterior sutures	176	0.3%	42	0.6%

LENS CONTINUED		1991-2013		2014-2018	
100.306	punctate cataract, nucleus	72	0.1%	10	0.1%
100.307	punctate cataract, capsular	50	0.1%	23	0.3%
100.311	incipient cataract, anterior cortex	981	1.8%	149	2.1%
100.312	incipient cataract, posterior cortex	1154	2.1%	135	1.9%
100.313	incipient cataract, equatorial cortex	297	0.5%	43	0.6%
100.314	incipient cataract, anterior sutures	103	0.2%	6	0.1%
100.315	incipient cataract, posterior sutures	178	0.3%	17	0.2%
100.316	incipient cataract, nucleus	183	0.3%	20	0.3%
100.317	incipient cataract, capsular	70	0.1%	30	0.4%
100.321	incomplete cataract, anterior cortex	18	0.0%	75	1.1%
100.322	incomplete cataract, posterior cortex	17	0.0%	75	1.1%
100.323	incomplete cataract, equatorial cortex	2	0.0%	17	0.2%
100.324	incomplete cataract, anterior sutures	1	0.0%	2	0.0%
100.325	incomplete cataract, posterior sutures	1	0.0%	4	0.1%
100.326	incomplete cataract, nucleus	1	0.0%	23	0.3%
100.327	incomplete cataract, capsular	0		3	0.0%
100.328	posterior suture tip opacities	6	0.0%	56	0.8%
100.330	generalized/complete cataract	989	1.8%	64	0.9%
100.340	resorbing/hypermature cataract	6	0.0%	24	0.3%
100.375	subluxation/luxation, unspecified	66	0.1%	21	0.3%
100.999	*significant cataracts (summary)*	*6971*	*12.8%*	*1003*	*14.5%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	35	0.1%	12	0.2%
110.135	PHPV/PTVL	9	0.0%	0	
110.200	vitritis	0		9	0.1%
110.320	vitreal degeneration	140	0.3%	24	0.3%
FUNDUS					
97.110	choroidal hypoplasia	32	0.1%	1	0.0%
97.120	coloboma	14	0.0%	0	
RETINA					
120.170	retinal dysplasia, folds	6595	12.2%	420	6.1%
120.180	retinal dysplasia, geographic	162	0.3%	10	0.1%
120.190	retinal dysplasia, detached	9	0.0%	0	
120.310	generalized progressive retinal atrophy (PRA)	454	0.8%	14	0.2%
120.400	retinal hemorrhage	7	0.0%	0	
120.910	retinal detachment without dialysis	14	0.0%	0	
120.960	retinopathy	11	0.0%	27	0.4%
OPTIC NERVE					
130.110	micropapilla	4	0.0%	0	
130.120	optic nerve hypoplasia	10	0.0%	0	
130.150	optic disc coloboma	106	0.2%	7	0.1%
OTHER					
900.000	other, unspecified	451	0.8%	0	
900.100	other, not inherited	1103	2.0%	386	5.6%
900.110	other. suspect not inherited/significance unknown	642	1.2%	28	0.4%

	1991-2013	2014-2018
NORMAL		
0.000 normal globe	22542 41.5%	2414 34.8%

COLLIE

(Rough and Smooth varieties)

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Microphthalmia	Not defined	1, 2	NO	
B.	Distichiasis	Not defined	1	Breeder option	
C.	Corneal dystrophy - epithelial/stromal	Not defined	3	Breeder option	
D.	Persistent pupillary membranes - iris to iris - iris to lens	 Not defined Not defined	 1, 3 4	 Breeder option NO	
E.	Cataract	Not defined	1	NO	
F.	Persistent hyaloid artery	Not defined	5	Breeder option	
G.	Retinal atrophy - generalized	Not defined	1	NO	
H.	Retinal atrophy- Rod/cone dysplasia type 2- (*rcd2*)	Autosomal recessive	6-9	NO	Mutation in the *RD3* gene
I.	Retinal dysplasia - folds	Not defined	1	Breeder option	
J.	Choroidal hypoplasia (Collie Eye Anomaly) - staphyloma/coloboma - retinal detachment - retinal hemorrhage - optic nerve coloboma	Autosomal recessive	1, 10-34	NO	Mutation in the *NHEJ1* gene
K.	Stationary night blindness	Presumed autosomal recessive	35	NO	
L.	Proliferative keratoconjunctivitis	Not defined	1, 36, 37	Breeder option	

Description and Comments

A. Microphthalmia

Microphthalmia is a congenital defect characterized by a small eye often associated with defects of the cornea, iris (coloboma), anterior chamber, lens (cataract) and/or retina.

An association has been made between partial albinism, multiple ocular defects (especially microphthalmia) and deafness in a number of canine breeds including the Collie. From these reports it appears that a predominantly white hair coat is associated with a higher incidence of ocular defects.

B. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. In the Collie, because there is significant clinical disease associated with the abnormal hairs, breeding of affected animals should be discouraged.

C. Corneal dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

D. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

In the Collie, this is a particularly serious problem noted frequently on routine screening examination. The majority of persistent pupillary membranes identified on routine screening examinations include iris sheets, and bridging from the iris to cornea and the iris to lens. These may result in vision impairment.

E. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

F. Persistent hyaloid artery (PHA)

Congenital defect resulting from abnormalities in the development and regression of the hyaloid artery. The blood vessel remnant can be present in the vitreous as a small patent vascular strand (PHA) or as a non-vascular strand that appears gray-white (persistent hyaloid remnant).

G. Retinal atrophy - generalized

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. PRA is inherited as an autosomal recessive trait in most breeds. In the Collie, the rod/cone degeneration occurs very rarely and in those cases has not been caused by any of the known genetic mutations.

H. Retinal atrophy - Rod-cone dysplasia type 2- (*rcd2*)

An inherited retinal disease characterized by abortive or abnormal development of rods and cones. The disease can be detected histologically by 6 weeks. Clinical night blindness is observed as early as 6 weeks with total blindness by 1 year of age. It may be diagnosed as early as 24 days with an ERG. Histologically the disease can be detected by 6 weeks. This form of retinal dysplasia is clinically similar to, but genetically distinct from that seen in the Irish Setter. This condition is caused by an insertion in *RD3.* A DNA test is available.

I. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

J. Choroidal hypoplasia (Collie Eye Anomaly)
- staphyloma/coloboma
- retinal detachment
- retinal hemorrhage
- optic nerve coloboma

A spectrum of malformations present at birth and ranging from inadequate development of the choroid (choroidal hypoplasia) to defects of the choroid, sclera, and/or optic nerve (coloboma/staphyloma) to complete retinal detachment (with or without hemorrhage). Mildly affected animals will have no detectable vision deficit.

This disorder is collectively referred to as "Collie Eye Anomaly." The choroidal hypoplasia component is caused by a 7799 base pair deletion with the gene *NHEJ1.* The mutation is a recessive trait. A DNA test is available and is diagnostic only for the choroidal hypoplasia component of CEA. For colobomas to develop, an additional mutation in a second gene has to be present; that gene is still unknown.

A DNA test is available and may not be predictive of all populations. As the genotype-phenotype correlation is complex, and not always straightforward, one should refer to http://www.optigen.com/opt9_coloboma_res.html for a summary and more details of the molecular studies of CEA.

K. Stationary night blindness

An inherited defect in vision in which rod function is markedly abnormal or absent, but cone function is either normal or minimally affected. The condition does not progress to complete blindness, and there is no ophthalmoscopic evidence of retinal degeneration. Definitive diagnosis requires electroretinography. Only a single case has been reported in the literature.

L. Proliferative keratoconjunctivitis

An acquired condition characterized by a progressive, pink, fleshy mass involving the cornea, raised bands of inflammatory tissue on the anterior aspect of the nictitating membrane, and conjunctivitis. The condition is most likely immune-mediated but affects Collies more frequently than other breeds.

Historical Note:

Central progressive retinal atrophy was previously a condition listed for this breed. However as the condition is no longer identified in the breed, the condition has been removed. Central progressive retinal atrophy was a progressive retinal degeneration in which photoreceptor death occurred secondary to disease of the underlying pigment epithelium. Progression was slow and some animals never lost vision. CPRA occurred in England, but was uncommon elsewhere.

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OCULAR DISORDERS REPORT
COLLIE

		1991-2013		2014-2018	
	TOTAL DOGS EXAMINED	51865		9030	
Diagnostic Name		#	%	#	%
GLOBE					
0.110	microphthalmia	777	1.5%	261	2.9%
10.000	glaucoma	7	0.0%	0	
EYELIDS					
20.110	eyelid dermoid	1	0.0%	0	
20.140	ectopic cilia	5	0.0%	0	
20.160	macropalpebral fissure	1	0.0%	0	
21.000	entropion, unspecified	52	0.1%	6	0.1%
22.000	ectropion, unspecified	8	0.0%	0	
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51.100	third eyelid cartilage anomaly	1	0.0%	12	0.1%
52.110	prolapsed gland of the third eyelid	2	0.0%	0	
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70.210	corneal pannus	2	0.0%	1	0.0%
70.220	pigmentary keratitis	7	0.0%	1	0.0%
70.700	corneal dystrophy	363	0.7%	56	0.6%
70.730	corneal endothelial degeneration	12	0.0%	0	
UVEA					
90.250	pigmentary uveitis	1	0.0%	0	
93.110	iris hypoplasia	2	0.0%	7	0.1%
93.140	corneal endothelial pigment without PPM	1	0.0%	0	
93.150	iris coloboma	23	0.0%	1	0.0%
93.710	persistent pupillary membranes, iris to iris	7897	15.2%	2469	27.3%
93.720	persistent pupillary membranes, iris to lens	377	0.7%	157	1.7%
93.730	persistent pupillary membranes, iris to cornea	118	0.2%	13	0.1%
93.740	persistent pupillary membranes, iris sheets	64	0.1%	3	0.0%
93.750	persistent pupillary membranes, lens pigment foci/no strands	12	0.0%	36	0.4%
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93.999	uveal cysts	19	0.0%	9	0.1%
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100.200	cataract, unspecified	114	0.2%	0	
100.210	cataract. suspect not inherited/significance unknown	462	0.9%	123	1.4%
100.301	punctate cataract, anterior cortex	76	0.1%	9	0.1%
100.302	punctate cataract, posterior cortex	22	0.0%	3	0.0%
100.303	punctate cataract, equatorial cortex	5	0.0%	0	
100.304	punctate cataract, anterior sutures	25	0.0%	4	0.0%
100.305	punctate cataract, posterior sutures	16	0.0%	7	0.1%
100.306	punctate cataract, nucleus	108	0.2%	43	0.5%

LENS CONTINUED		1991-2013		2014-2018	
100.307	punctate cataract, capsular	24	0.0%	11	0.1%
100.311	incipient cataract, anterior cortex	83	0.2%	18	0.2%
100.312	incipient cataract, posterior cortex	103	0.2%	6	0.1%
100.313	incipient cataract, equatorial cortex	35	0.1%	4	0.0%
100.314	incipient cataract, anterior sutures	31	0.1%	9	0.1%
100.315	incipient cataract, posterior sutures	21	0.0%	5	0.1%
100.316	incipient cataract, nucleus	130	0.3%	18	0.2%
100.317	incipient cataract, capsular	23	0.0%	7	0.1%
100.321	incomplete cataract, anterior cortex	1	0.0%	1	0.0%
100.322	incomplete cataract, posterior cortex	0		2	0.0%
100.326	incomplete cataract, nucleus	0		6	0.1%
100.327	incomplete cataract, capsular	0		1	0.0%
100.328	posterior suture tip opacities	0		6	0.1%
100.330	generalized/complete cataract	48	0.1%	1	0.0%
100.375	subluxation/luxation, unspecified	7	0.0%	2	0.0%
100.999	*significant cataracts (summary)*	*865*	*1.7%*	*155*	*1.7%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	346	0.7%	53	0.6%
110.135	PHPV/PTVL	44	0.1%	7	0.1%
110.320	vitreal degeneration	46	0.1%	2	0.0%
FUNDUS					
97.110	choroidal hypoplasia	35205	67.9%	6750	74.8%
97.120	coloboma	2298	4.4%	0	
RETINA					
120.170	retinal dysplasia, folds	3409	6.6%	788	8.7%
120.180	retinal dysplasia, geographic	55	0.1%	5	0.1%
120.190	retinal dysplasia, detached	74	0.1%	32	0.4%
120.310	generalized progressive retinal atrophy (PRA)	813	1.6%	2	0.0%
120.400	retinal hemorrhage	105	0.2%	0	
120.910	retinal detachment without dialysis	823	1.6%	0	
120.920	retinal detachment with dialysis	23	0.0%	118	1.3%
120.960	retinopathy	1	0.0%	0	
OPTIC NERVE					
130.110	micropapilla	115	0.2%	53	0.6%
130.120	optic nerve hypoplasia	221	0.4%	33	0.4%
130.150	optic disc coloboma	4026	7.8%	851	9.4%
OTHER					
900.000	other, unspecified	132	0.3%	0	
900.100	other, not inherited	273	0.5%	72	0.8%
900.110	other. suspect not inherited/significance unknown	560	1.1%	29	0.3%
NORMAL					
0.000	normal globe	13603	26.2%	1508	16.7%

COTON DE TULEAR

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Distichiasis	Not defined	1	Breeder option	
B.	Corneal dystrophy - epithelial/stromal	Not defined	2	Breeder option	
C.	Persistent pupillary membranes - iris to iris	Not defined	2	Breeder option	
D.	Cataract	Not defined	2	NO	
E.	Vitreous degeneration	Not defined	2	Breeder option	
F.	Retinal atrophy - generalized (*prcd*)	Not defined	3	NO	Mutation in the *prcd* gene
G.	Multifocal retinopathy - *cmr2*	Autosomal recessive	4, 5	Breeder Option	Mutation in the *BEST1* gene
H.	Retinal dysplasia - folds	Presumed autosomal recessive	3	Breeder option	

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established, although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Corneal dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

C. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

D. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

E. Vitreous degeneration

Liquefaction of the vitreous gel which may predispose to retinal detachment.

F. Retinal atrophy - generalized (*prcd*)

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as Progressive Retinal Atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

Studies have shown that the principal form of PRA in the Coton de Tulear is *prcd* which is a late-onset form of PRA inherited as autosomal recessive. The mutation is allelic to that present in Miniature Poodles, Labrador Retrievers, English and American Cocker Spaniels and others. The locus is termed the progressive rod-cone degeneration (*prcd*) gene and at least 30+ breeds are affected. In most affected dogs to date, the disease is recognized clinically in dogs 3-6 years of age or older. This photoreceptor degeneration is characterized by slow death of visual cells following their normal development. The disease begins clinically with signs of night blindness followed by day blindness. A DNA test is available.

G. Multifocal retinopathy – cmr2

Canine Multifocal Retinopathy type 2 (cmr2) is characterized by numerous distinct (i.e. multi-focal), roughly circular patches of elevated retina (multifocal bullous retinal detachments). There is typically a serous sub-retinal fluid in the Coton de Tulear, although there may be accumulation of sub-retinal material that produces gray-tan-pink colored lesions. These lesions, looking somewhat like blisters, vary in location and size, although typically they are present in both eyes of the affected dog.

The disease generally develops in young dogs between 15 weeks to 1 year of age. The lesions typically remain static in size and color beyond 1 year of age. The bullae appear to gradually lose the serous sub-retinal fluid after 4-5 years of age. Discrete areas of tapetal hyper-reflectivity might also be seen. Most dogs exhibit no noticeable problem with vision despite their abnormal appearing retinas. Electroretinograms reveal significant differences in

photopic flickers in affected dogs.

Canine Multifocal Retinopathy type 2 is caused by a mutation in the Bestrophin 1 gene (*BEST1*) and is described to be recessively inherited in the Coton du Tulear. A DNA test is available.

H. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding or bullae that may be single or multiple. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

References

1. ACVO Genetics Committee, 2007 and/or Data from CERF All-Breeds Report, 2002-2006.

2. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

3. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

4. Guziewicz KE, Zangerl B, Lindauer SJ, et al. Bestrophin gene mutations cause canine multifocal retinopathy: a novel animal model for best disease. *Invest Ophthalmol Vis Sci*. 2007;48:1959-1967.

5. Grahn BH, Sandmeyer LL, Breaux C. Retinopathy of Coton de Tulear dogs: clinical manifestations, electroretinographic, ultrasonographic, fluorescein and indocyanine green angiographic, and optical coherence tomographic findings. *Vet Ophthalmol*. 2008;11:242-249.

OCULAR DISORDERS REPORT
COTON DE TULEAR

		1991-2013 4625		2014-2018 932	
	TOTAL DOGS EXAMINED				
Diagnostic Name		**#**	**%**	**#**	**%**
GLOBE					
0.110	microphthalmia	1	0.0%	0	
EYELIDS					
20.140	ectopic cilia	1	0.0%	0	
21.000	entropion, unspecified	4	0.1%	0	
25.110	distichiasis	42	0.9%	6	0.6%
NASOLACRIMAL					
32.110	imperforate lower nasolacrimal punctum	1	0.0%	4	0.4%
40.910	keratoconjunctivitis sicca	1	0.0%	0	
NICTITANS					
52.110	prolapsed gland of the third eyelid	13	0.3%	8	0.9%
CORNEA					
70.220	pigmentary keratitis	1	0.0%	0	
70.700	corneal dystrophy	45	1.0%	13	1.4%
70.730	corneal endothelial degeneration	1	0.0%	0	
UVEA					
93.110	iris hypoplasia	2	0.0%	0	
93.150	iris coloboma	2	0.0%	0	
93.710	persistent pupillary membranes, iris to iris	388	8.4%	83	8.9%
93.720	persistent pupillary membranes, iris to lens	8	0.2%	1	0.1%
93.730	persistent pupillary membranes, iris to cornea	6	0.1%	0	
93.740	persistent pupillary membranes, iris sheets	1	0.0%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	1	0.0%	1	0.1%
93.760	persistent pupillary membranes, endothelial opacity/no strands	7	0.2%	1	0.1%
93.999	uveal cysts	4	0.1%	0	
97.150	chorioretinal coloboma, congenital	0		1	0.1%
LENS					
100.210	cataract. suspect not inherited/significance unknown	145	3.1%	57	6.1%
100.301	punctate cataract, anterior cortex	8	0.2%	1	0.1%
100.302	punctate cataract, posterior cortex	4	0.1%	0	
100.303	punctate cataract, equatorial cortex	3	0.1%	0	
100.305	punctate cataract, posterior sutures	7	0.2%	5	0.5%
100.306	punctate cataract, nucleus	2	0.0%	0	
100.307	punctate cataract, capsular	3	0.1%	5	0.5%
100.311	incipient cataract, anterior cortex	13	0.3%	2	0.2%
100.312	incipient cataract, posterior cortex	14	0.3%	3	0.3%
100.313	incipient cataract, equatorial cortex	10	0.2%	0	
100.314	incipient cataract, anterior sutures	2	0.0%	1	0.1%
100.315	incipient cataract, posterior sutures	2	0.0%	4	0.4%
100.316	incipient cataract, nucleus	4	0.1%	1	0.1%
100.317	incipient cataract, capsular	5	0.1%	1	0.1%
100.321	incomplete cataract, anterior cortex	0		1	0.1%
100.328	posterior suture tip opacities	1	0.0%	20	2.1%
100.330	generalized/complete cataract	7	0.2%	0	

LENS CONTINUED		1991-2013		2014-2018	
100.340	resorbing/hypermature cataract	0		1	0.1%
100.375	subluxation/luxation, unspecified	1	0.0%	0	
100.999	*significant cataracts (summary)*	*84*	*1.8%*	*25*	*2.7%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	3	0.1%	5	0.5%
110.135	PHPV/PTVL	1	0.0%	0	
110.200	vitritis	1	0.0%	1	0.1%
110.320	vitreal degeneration	44	1.0%	10	1.1%
FUNDUS					
97.110	choroidal hypoplasia	1	0.0%	0	
RETINA					
120.170	retinal dysplasia, folds	19	0.4%	2	0.2%
120.180	retinal dysplasia, geographic	10	0.2%	1	0.1%
120.190	retinal dysplasia, detached	3	0.1%	0	
120.310	generalized progressive retinal atrophy (PRA)	29	0.6%	5	0.5%
120.370	multifocal retinopathy	2	0.0%	0	
120.910	retinal detachment without dialysis	1	0.0%	0	
120.960	retinopathy	1	0.0%	0	
OPTIC NERVE					
130.110	micropapilla	3	0.1%	0	
130.120	optic nerve hypoplasia	2	0.0%	0	
130.150	optic disc coloboma	1	0.0%	0	
OTHER					
900.000	other, unspecified	44	1.0%	0	
900.100	other, not inherited	158	3.4%	37	4.0%
900.110	other. suspect not inherited/significance unknown	29	0.6%	3	0.3%
NORMAL					
0.000	normal globe	3997	86.4%	711	76.3%

CURLY-COATED RETRIEVER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Distichiasis	Not defined	1	Breeder option
B.	Corneal dystrophy - epithelial/stromal	Not defined	1	Breeder option
C.	Persistent pupillary membranes			
	- iris to iris	Not defined	2	Breeder option
	- lens pigment foci/no strands	Not defined	3	Passes with no notation
D.	Cataract	Not defined	1, 4	NO
E.	Vitreous degeneration	Not defined	5, 6	Breeder option
F.	Choroidal hypoplasia	Not defined	7	NO
G.	Optic nerve coloboma	Not defined	7	NO
H.	Retinal dysplasia - folds	Not defined	7	Breeder option

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established, although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Corneal dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

C. Persistent pupillary membrane (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

D. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

In the Curly-Coated Retriever the following cataracts have been reported:

1. **Anterior cortical subcapsular cataract:** Anterior subcapsular striate cortical cataracts usually occur bilaterally, slowly progress and usually occur between 5-8 years of age.

2. **Posterior subcapsular cataract:** Posterior polar subcapsular opacities occur at 2-4 years of age and progress slowly.

E. Vitreous degeneration

Liquefaction of the vitreous gel which may predispose to retinal detachment.

F. Choroidal hypoplasia

Inadequate development of the choroid present at birth and non-progressive. This condition is more commonly identified in the Collie breed where it is a manifestation of "Collie Eye Anomaly."

G. Optic nerve coloboma

A congenital cavity in the optic nerve which, if large, may cause blindness or vision impairment.

H. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

References

1. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

2. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

3. ACVO Genetics Committee, 2017 and/or Data from CERF/OFA All-Breeds Report, 2010-2016.

4. Barnett KC. Comparative aspects of canine hereditary eye disease. *Adv Vet Sci Comp Med.* 1976;20:39-67.

5. ACVO Genetics Committee, 2006 and/or Data from CERF All-Breeds Report, 2001-2005.

6. ACVO Genetics Committee, 2009 and/or Data from CERF All-Breeds Report, 2008.

7. ACVO Genetics Committee, 2002-2003 and/or Data from CERF All-Breeds Report, 2002-2003.

OCULAR DISORDERS REPORT
CURLY-COATED RETRIEVER

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2013 1798 #	%	2014-2018 223 #	%
GLOBE						
0.110	microphthalmia		1	0.1%	0	
EYELIDS						
20.140	ectopic cilia		4	0.2%	0	
21.000	entropion, unspecified		11	0.6%	0	
22.000	ectropion, unspecified		1	0.1%	2	0.9%
25.110	distichiasis		139	7.7%	17	7.6%
NICTITANS						
51.100	third eyelid cartilage anomaly		1	0.1%	2	0.9%
52.110	prolapsed gland of the third eyelid		1	0.1%	0	
CORNEA						
70.700	corneal dystrophy		13	0.7%	1	0.4%
70.730	corneal endothelial degeneration		1	0.1%	0	
UVEA						
90.250	pigmentary uveitis		1	0.1%	0	
93.710	persistent pupillary membranes, iris to iris		66	3.7%	13	5.8%
93.720	persistent pupillary membranes, iris to lens		4	0.2%	0	
93.730	persistent pupillary membranes, iris to cornea		5	0.3%	0	
93.740	persistent pupillary membranes, iris sheets		2	0.1%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands		6	0.3%	13	5.8%
93.760	persistent pupillary membranes, endothelial opacity/no strands		1	0.1%	0	
93.999	uveal cysts		1	0.1%	0	
LENS						
100.200	cataract, unspecified		19	1.1%	0	
100.210	cataract. suspect not inherited/significance unknown		94	5.2%	33	14.8%
100.301	punctate cataract, anterior cortex		11	0.6%	2	0.9%
100.302	punctate cataract, posterior cortex		11	0.6%	2	0.9%
100.303	punctate cataract, equatorial cortex		2	0.1%	1	0.4%
100.304	punctate cataract, anterior sutures		1	0.1%	0	
100.305	punctate cataract, posterior sutures		8	0.4%	9	4.0%
100.307	punctate cataract, capsular		7	0.4%	1	0.4%
100.311	incipient cataract, anterior cortex		11	0.6%	0	
100.312	incipient cataract, posterior cortex		11	0.6%	2	0.9%
100.313	incipient cataract, equatorial cortex		10	0.6%	1	0.4%
100.314	incipient cataract, anterior sutures		1	0.1%	0	
100.315	incipient cataract, posterior sutures		4	0.2%	2	0.9%
100.316	incipient cataract, nucleus		3	0.2%	0	
100.317	incipient cataract, capsular		3	0.2%	0	
100.328	posterior suture tip opacities		0		20	9.0%
100.375	subluxation/luxation, unspecified		3	0.2%	0	
100.999	*significant cataracts (summary)*		*102*	*5.7%*	*20*	*9.0%*
VITREOUS						
110.120	persistent hyaloid artery/remnant		1	0.1%	2	0.9%
110.320	vitreal degeneration		20	1.1%	0	

		1991-2013		2014-2018	
FUNDUS					
97.110	choroidal hypoplasia	13	0.7%	0	
RETINA					
120.170	retinal dysplasia, folds	15	0.8%	6	2.7%
120.180	retinal dysplasia, geographic	3	0.2%	0	
120.310	generalized progressive retinal atrophy (PRA)	11	0.6%	1	0.4%
120.960	retinopathy	0		1	0.4%
OPTIC NERVE					
130.110	micropapilla	0		1	0.4%
130.120	optic nerve hypoplasia	3	0.2%	0	
130.150	optic disc coloboma	13	0.7%	0	
OTHER					
900.000	other, unspecified	16	0.9%	0	
900.100	other, not inherited	36	2.0%	15	6.7%
900.110	other. suspect not inherited/significance unknown	14	0.8%	1	0.4%
NORMAL					
0.000	normal globe	1465	81.5%	131	58.7%

OCULAR DISORDERS REPORT
CZECHOSLOVAKIAN VLCAK

There are insufficient breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the CZECHOSLOVAKIAN VLCAK breed. Therefore, there are no conditions listed with breeding advice.

OCULAR DISORDERS REPORT
CZECHOSLOVAKIAN WOLFDOG

Diagnostic Name		1991-2013 TOTAL DOGS EXAMINED 4 #	 %	2014-2018 31 #	 %
NASOLACRIMAL					
32.110	imperforate lower nasolacrimal punctum	0		2	6.5%
UVEA					
93.999	uveal cysts	0		2	6.5%
LENS					
100.210	cataract. suspect not inherited/significance unknown	0		3	9.7%
RETINA					
120.170	retinal dysplasia, folds	1	25.0%	0	
OPTIC NERVE					
130.110	micropapilla	0		1	3.2%
OTHER					
900.000	other, unspecified	1	25.0%	0	
900.100	other, not inherited	0		2	6.5%
NORMAL					
0.000	normal globe	12	300.0%	24	77.4%

DACHSHUND

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Microphthalmia and multiple ocular defects	Not defined	1-3	NO	
B.	Distichiasis	Not defined	1	Breeder option	
C.	Chronic superficial keratitis/pannus	Presumed autosomal recessive	1, 4	NO	
D.	Punctate keratitis	Not defined		NO	
E.	Corneal dystrophy - epithelial/stromal	Not defined	1, 5	Breeder option	
F.	Corneal dystrophy - endothelial	Not defined	1, 5, 6	NO	
G.	Iris coloboma	Not defined	7	NO	
H.	Persistent pupillary membranes				
	- iris to iris	Not defined	7, 8	Breeder option	
	- iris to cornea	Not defined	8	NO	
	- iris to lens	Not defined	9	NO	
	- lens pigment foci/no strands	Not defined	10	Passes with no notation	
I.	Cataract	Not defined	1	NO	
J.	Persistent hyaloid artery	Not defined	8, 11	Breeder option	
K.	Retinal atrophy - generalized (*crd1)*	Autosomal recessive	14, 21	NO	Mutation in the *NPHP4* gene
L.	Retinopathy - associated with ceroid lipufuscinosis	Autosomal recessive	24, 25	NO	Mutation in the *TPP1* gene

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
M.	Retinal dysplasia - folds	Not defined	7, 8	Breeder option	
N.	Coloboma/staphyloma (Smooth standard only)	Not defined	26	NO	
O.	Optic nerve coloboma	Not defined	1	NO	
P.	Optic nerve hypoplasia	Not defined	8	NO	
Q.	Micropapilla	Not defined	1, 8	Breeder option	
R.	Dermoid	Not defined	1, 27	Breeder option	
S.	Uveodermatologic syndrome	Not defined	28	NO	

Description and Comments

A. Microphthalmia and multiple ocular anomalies

Microphthalmia is a congenital defect characterized by a small eye often with associated defects of the cornea, anterior chamber, lens and/or retina.

An association has been made between partial albinism, multiple ocular defects (especially microphthalmia) and deafness in a number of canine breeds including the Dachshund. From these reports it appears that a predominantly white hair coat is associated with a higher incidence of ocular defects.

B. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established, although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

C. Chronic superficial keratitis/pannus

A bilateral disease of the cornea which usually starts as a grayish haze to the ventral or ventrolateral cornea, followed by the formation of a vascularized sub-epithelial growth that begins to spread toward the central cornea; pigmentation follows the vascularization. If severe, vision impairment occurs. Pannus may be associated with plasma cell infiltration of the nictitans.

D. Punctate keratitis

Focal circular rings usually affecting the central sub-epithelial and/or anterior portion of the cornea. There often is an associated dry eye with corneal erosions. The mode of inheritance is unknown.

E. Corneal dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

F. Corneal dystrophy - endothelial

An abnormal loss of the inner lining of the cornea that causes progressive fluid retention (edema). With time the edema results in keratitis and decreased vision.

G. Iris coloboma

A coloboma is a congenital defect which may affect the iris, choroid or optic disc. Iris colobomas are seen as notches in the pupillary margin.

H. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

I. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

J. Persistent hyaloid artery (PHA)

Congenital defect resulting from abnormalities in the development and regression of the hyaloid artery. The blood vessel remnant can be present in the vitreous as a small patent vascular strand (PHA) or as a non-vascular strand that appears gray-white (persistent hyaloid remnant).

K. Retinal atrophy - generalized

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram before it is apparent clinically.

In Miniature Dachshunds there is a recessively inherited disorder caused by a 44 base pair insertion in the *RPGRIP1* gene. The insertion presumably truncates the protein and its major C-terminal RPGR binding domain. The resulting disease is called cone-rod dystrophy 1 (crd1) as the salient clinical abnormalities are a cone ERG dysfunction which does not correlate with photopic vision defects. The onset of the disease is variable, and is influenced by a second modifier locus which also is located on canine chromosome 15. Dogs homozygous for both defects have retinal abnormalities on ophthalmoscopy before 1-2 years of age. Dogs homozygous only for the *RPGRIP* insertion may have a late onset (>6 years) retinal degeneration diagnosed by ophthalmoscopy. Although the *RPGRIP1* molecular defect can be identified by means of a DNA test, questions have been raised about its validity given the poor genotype-phenotype correlation. A DNA test is available.

In a previous study using an inbred research colony, a 44-nucleotide insertion (ins44) in exon 2 of RPGRIP1 was associated with retinal degeneration. Despite concordance of ins44 with retinal degeneration, evidence indicate that there was phenotype-genotype discordance within the miniature long-haired dachshunds that were not directly related to the experimental colony as not all dogs that were homozygous for ins44 were developing early onset retinal degeneration, but were developing retinal degeneration at a much later stage or not at all. In this investigation MAP9 deletion associated with early retinal degeneration onset was identified. Given the new genome assembly, the nominal title is CanFam3.1MAP9 corrected. Deletion was confirmed in early onset retinal degeneration cases and not late onset retinal degeneration cases, there is a variable age of onset and demonstrate the interaction of two independent loci that contribute to the phenotype. This study has shown that RPGRIP1 ins44/ins44 dogs with early onset retinal degeneration has several polymorphisms in MAP9, some of them potentially harmful, when compared with MAP9 in late onset retinal degeneration dogs. Detection of the presence or absence of MAP early onset retinal degeneration by qPCR can be used to specify early onset or late onset status for ins44 homozygotes. The story, however, is not as straightforward as suggested by the Forman et al. 2016 paper. Unpublished work by K. Miyadera and G. Aguirre in a research colony in which one of the founders originated from a MLHD at the Animal Health Trust finds that dogs that are homozygous for the RPGRIP1 ins 44 and the newly identified MAP9 deletion still do not show early-onset retinal degeneration. This suggests that there probably is a third genetic locus that interacts with MAP9 and RPGRIP1 in determining the age of disease onset and severity of the phenotype. Regardless, the identification of the MAP9 deletion is a major finding that will help unravel the complex genetics of this retinal disorder.

L. Retinopathy associated with ceroid lipufuscinosis

Progressive, multifocal serous retinal detachments first appear in Longhaired Dachshunds with late infantile neuronal ceroid lipofuscinosis at age 5-10 months. Late infantile ceroid neuronal lipofuscinosis in Miniature Dachshunds is a fatal, autosomal recessive, inherited lysosomal storage disease characterized by progressive neurodegeneration. The disease results from a defect in the *TPP1* (Tripeptidyl peptidase) gene. Inheritance of the retinopathy is linked to the gene causing late infantile neuronal ceroid lipofuscinosis.

M. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

N. Coloboma/staphyloma

A coloboma is a congenital defect which may affect the iris, choroid or optic disc. Iris colobomas are seen as notches in the pupillary margin. Scleral ectasia is defined as a congenital thinning and secondary distention of the sclera; when lined by uveal tissue it is called a staphyloma. These may be anteriorly located, apparent as a bulge beneath the upper eyelid or posteriorly located, requiring visualization with an ophthalmoscope. These conditions may or may not be genetically related to the same anomalies seen associated with microphthalmia (entity "A" above).

O. Optic nerve coloboma

A congenital cavity in the optic nerve which, if large, may cause blindness or vision impairment.

P. Optic nerve hypoplasia

Optic nerve hypoplasia refers to a congenital defect of the optic nerve which causes blindness and abnormal pupil response in the affected eye. May be difficult to differentiate between micropapilla and optic nerve hypoplasia on a routine (dilated) screening ophthalmoscopic exam.

Q. Micropapilla

Micropapilla refers to a small optic disc which is not associated with vision impairment. Optic nerve hypoplasia refers to a congenital defect of the optic nerve which causes blindness and abnormal pupil response in the affected eye. It may be difficult to differentiate between micropapilla and optic nerve hypoplasia on a routine (dilated) screening ophthalmoscopic exam.

R. Dermoid

A dermoid is a focal area of normal epidermal tissue (skin) that forms in an abnormal location (usually the cornea, conjunctiva or eyelid). The lesion generally causes discomfort to the affected animal.

S. Uveodermatologic syndrome

Uveodermatologic syndrome in the Dachshund bears many similarities to a condition in people called Vogt-Koyanagi-Harada (or VKH) syndrome. Thus, the condition in dogs is often referred to as VKH or VKH-like syndrome. It is an immune-mediated disease in which pigmented cells (melanocytes) in the eye and in the skin are destroyed by white blood cells (lymphocytes). The first clinical signs are usually inflammation of the intraocular structures (or uveitis) in both eyes. Adhesions between the iris and lens (posterior synechia) and the peripheral iris and cornea (peripheral anterior synechia) develop rapidly. Other complications include cataract development, retinal degeneration, retinal separation or detachment, optic disc atrophy and secondary glaucoma. The uveitis is very difficult to control medically and ultimately results in blindness in most affected dogs. Whitening of the hair (poliosis) and skin (vitiligo) may also be noted in advanced cases. The genetics of this condition are unclear, but some genetic predisposition is indicated by the higher prevalence of this disorder in Dachshunds compared with other dog breeds. Affected dogs are generally young, ranging in age between 1½ to 4 years.

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OCULAR DISORDERS REPORT
DACHSHUND

		1991-2013 5746		2014-2018 1153	
	TOTAL DOGS EXAMINED				
Diagnostic Name		**#**	**%**	**#**	**%**
GLOBE					
0.110	microphthalmia	19	0.3%	5	0.4%
10.000	glaucoma	2	0.0%	0	
EYELIDS					
21.000	entropion, unspecified	6	0.1%	1	0.1%
25.110	distichiasis	342	6.0%	91	7.9%
NASOLACRIMAL					
32.110	imperforate lower nasolacrimal punctum	1	0.0%	1	0.1%
40.910	keratoconjunctivitis sicca	2	0.0%	3	0.3%
NICTITANS					
50.210	pannus of third eyelid	0		1	0.1%
51.100	third eyelid cartilage anomaly	2	0.0%	0	
52.110	prolapsed gland of the third eyelid	8	0.1%	1	0.1%
CORNEA					
70.210	corneal pannus	3	0.1%	0	
70.700	corneal dystrophy	30	0.5%	5	0.4%
70.730	corneal endothelial degeneration	9	0.2%	0	
UVEA					
93.110	iris hypoplasia	5	0.1%	5	0.4%
93.150	iris coloboma	24	0.4%	1	0.1%
93.710	persistent pupillary membranes, iris to iris	233	4.1%	63	5.5%
93.720	persistent pupillary membranes, iris to lens	24	0.4%	2	0.2%
93.730	persistent pupillary membranes, iris to cornea	27	0.5%	4	0.3%
93.740	persistent pupillary membranes, iris sheets	4	0.1%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	47	0.8%	67	5.8%
93.760	persistent pupillary membranes, endothelial opacity/no strands	7	0.1%	7	0.6%
93.999	uveal cysts	4	0.1%	0	
97.150	chorioretinal coloboma, congenital	0		2	0.2%
LENS					
100.200	cataract, unspecified	43	0.7%	0	
100.210	cataract. suspect not inherited/significance unknown	236	4.1%	46	4.0%
100.301	punctate cataract, anterior cortex	26	0.5%	5	0.4%
100.302	punctate cataract, posterior cortex	13	0.2%	4	0.3%
100.303	punctate cataract, equatorial cortex	9	0.2%	2	0.2%
100.304	punctate cataract, anterior sutures	4	0.1%	0	
100.305	punctate cataract, posterior sutures	9	0.2%	3	0.3%
100.306	punctate cataract, nucleus	6	0.1%	3	0.3%
100.307	punctate cataract, capsular	10	0.2%	3	0.3%
100.311	incipient cataract, anterior cortex	46	0.8%	4	0.3%
100.312	incipient cataract, posterior cortex	20	0.3%	3	0.3%
100.313	incipient cataract, equatorial cortex	14	0.2%	1	0.1%
100.314	incipient cataract, anterior sutures	2	0.0%	0	
100.315	incipient cataract, posterior sutures	18	0.3%	0	
100.316	incipient cataract, nucleus	6	0.1%	3	0.3%

LENS CONTINUED		1991-2013		2014-2018	
100.317	incipient cataract, capsular	7	0.1%	1	0.1%
100.321	incomplete cataract, anterior cortex	0		3	0.3%
100.322	incomplete cataract, posterior cortex	0		1	0.1%
100.324	incomplete cataract, anterior sutures	0		1	0.1%
100.328	posterior suture tip opacities	1	0.0%	4	0.3%
100.330	generalized/complete cataract	36	0.6%	5	0.4%
100.340	resorbing/hypermature cataract	1	0.0%	2	0.2%
100.375	subluxation/luxation, unspecified	5	0.1%	4	0.3%
100.999	*significant cataracts (summary)*	*270*	*4.7%*	*44*	*3.8%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	37	0.6%	2	0.2%
110.135	PHPV/PTVL	15	0.3%	0	
110.200	vitritis	0		1	0.1%
110.320	vitreal degeneration	33	0.6%	7	0.6%
FUNDUS					
97.110	choroidal hypoplasia	5	0.1%	2	0.2%
97.120	coloboma	14	0.2%	0	
RETINA					
120.170	retinal dysplasia, folds	47	0.8%	12	1.0%
120.180	retinal dysplasia, geographic	7	0.1%	0	
120.190	retinal dysplasia, detached	1	0.0%	0	
120.310	generalized progressive retinal atrophy (PRA)	114	2.0%	13	1.1%
120.400	retinal hemorrhage	1	0.0%	0	
120.910	retinal detachment without dialysis	5	0.1%	0	
120.920	retinal detachment with dialysis	0		2	0.2%
120.960	retinopathy	1	0.0%	1	0.1%
OPTIC NERVE					
130.110	micropapilla	15	0.3%	7	0.6%
130.120	optic nerve hypoplasia	37	0.6%	3	0.3%
130.150	optic disc coloboma	24	0.4%	2	0.2%
OTHER					
900.000	other, unspecified	89	1.5%	0	
900.100	other, not inherited	211	3.7%	68	5.9%
900.110	other. suspect not inherited/significance unknown	50	0.9%	5	0.4%
NORMAL					
0.000	normal globe	4538	79.0%	793	68.8%

DALMATIAN

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Glaucoma	Not defined	1-3	NO
B.	Entropion	Not defined		Breeder option
C.	Distichiasis	Not defined	4	Breeder option
D.	Corneal dystrophy - epithelial/stromal	Not defined	4	Breeder option
E.	Iris hypoplasia	Not defined	5	Breeder option
F.	Iris coloboma	Not defined	6	NO
G.	Iris sphincter dysplasia	Not defined	7	Breeder option
H.	Persistent pupillary membranes - iris to iris	Not defined	6	Breeder option
I.	Cataract	Not defined	1, 2	NO
J.	Vitreous degeneration	Not defined	8	Breeder option
K.	Retinal dysplasia - folds	Not defined	6	Breeder option
L.	Dermoid	Not defined	1, 2	Breeder option

It is recommended that this breed be examined prior to pharmacological dilation to best facilitate identification of iris hypoplasia/sphincter dysplasia.

Description and Comments

A. Glaucoma

Glaucoma is characterized by an elevation of intraocular pressure which, when sustained, causes intraocular damage resulting in blindness. The elevated intraocular pressure occurs because the fluid cannot leave through the iridocorneal angle. Diagnosis and classification of glaucoma requires measurement of the intraocular pressure (tonometry) and examination of the iridocorneal angle (gonioscopy). Neither of these tests is part of a routine breed eye screening exam.

B. Entropion

A conformational defect resulting in an "in-rolling" of one or both of the eyelids which may cause ocular irritation. It is likely that entropion is influenced by several genes (polygenic), defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull. In the Dalmatian, entropion normally involves the lower lid.

C. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established, although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

D. Corneal dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

E. Iris Hypoplasia

A congenital abnormality in iris development usually characterized by a reduced quantity of tissue identified as partial-thickness defect in iris tissue. Full-thickness iris hypoplasia is rare and should be recorded as an iris coloboma on the OFA form.

F. Iris coloboma

An abnormality in the development of the iris which may present as a minor notching of the pupillary margin, a hole in the iris or complete absence of iridal development. The relationship of iris coloboma to other ocular abnormalities in this breed has not been determined.

G. Iris sphincter dysplasia (ISD)

Defective development of the iris, or part of the iris, resulting in an immature state. ISD is the result of poorly developed iris sphincter muscles. The pupils of dogs with ISD do not properly contract in bright light. Dogs usually are uncomfortable and often squint in sunlight. The disorder exposes the interior of the eye to ultraviolet light that may potentially cause serious vision problems, such as cataracts or retinal damage, as dogs age.

H. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

I. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

J. Vitreous degeneration

A liquefaction of the vitreous gel which may predispose to retinal detachment.

K. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

L. Dermoid

A patch of skin, usually located on the cornea; its presence usually causes ocular irritation and if large can affect vision.

This abnormal development of the cornea has been observed so extensively in some Dalmatian dogs that little corneal tissue remains visible. It has been observed both unilaterally and bilaterally and in more than one dog in a litter on occasion. Surgical correction in most patients helps to return comfort and improve vision.

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OCULAR DISORDERS REPORT
DALMATIAN

		1991-2013		2014-2018	
	TOTAL DOGS EXAMINED	2384		1002	
Diagnostic Name		#	%	#	%
GLOBE					
0.110	microphthalmia	1	0.0%	0	
EYELIDS					
20.140	ectopic cilia	1	0.0%	0	
21.000	entropion, unspecified	5	0.2%	0	
22.000	ectropion, unspecified	1	0.0%	0	
25.110	distichiasis	111	4.7%	50	5.0%
NASOLACRIMAL					
32.110	imperforate lower nasolacrimal punctum	1	0.0%	1	0.1%
NICTITANS					
52.110	prolapsed gland of the third eyelid	1	0.0%	0	
CORNEA					
70.210	corneal pannus	1	0.0%	0	
70.700	corneal dystrophy	68	2.9%	20	2.0%
70.730	corneal endothelial degeneration	2	0.1%	0	
UVEA					
93.110	iris hypoplasia	48	2.0%	28	2.8%
93.150	iris coloboma	12	0.5%	4	0.4%
93.710	persistent pupillary membranes, iris to iris	19	0.8%	9	0.9%
93.720	persistent pupillary membranes, iris to lens	2	0.1%	1	0.1%
93.730	persistent pupillary membranes, iris to cornea	5	0.2%	1	0.1%
93.740	persistent pupillary membranes, iris sheets	1	0.0%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		3	0.3%
93.999	uveal cysts	3	0.1%	0	
97.150	chorioretinal coloboma, congenital	0		1	0.1%
LENS					
100.110	microphakia, congenital	0		1	0.1%
100.200	cataract, unspecified	1	0.0%	0	
100.210	cataract. suspect not inherited/significance unknown	40	1.7%	27	2.7%
100.301	punctate cataract, anterior cortex	6	0.3%	4	0.4%
100.302	punctate cataract, posterior cortex	4	0.2%	2	0.2%
100.303	punctate cataract, equatorial cortex	5	0.2%	4	0.4%
100.305	punctate cataract, posterior sutures	0		1	0.1%
100.306	punctate cataract, nucleus	2	0.1%	1	0.1%
100.307	punctate cataract, capsular	1	0.0%	0	
100.311	incipient cataract, anterior cortex	14	0.6%	8	0.8%
100.312	incipient cataract, posterior cortex	11	0.5%	1	0.1%
100.313	incipient cataract, equatorial cortex	10	0.4%	3	0.3%
100.314	incipient cataract, anterior sutures	3	0.1%	0	
100.315	incipient cataract, posterior sutures	1	0.0%	0	
100.316	incipient cataract, nucleus	5	0.2%	1	0.1%
100.317	incipient cataract, capsular	2	0.1%	1	0.1%
100.321	incomplete cataract, anterior cortex	1	0.0%	4	0.4%
100.322	incomplete cataract, posterior cortex	1	0.0%	3	0.3%
100.323	incomplete cataract, equatorial cortex	0		1	0.1%

LENS CONTINUED		1991-2013		2014-2018	
100.327	incomplete cataract, capsular	0		1	0.1%
100.328	posterior suture tip opacities	0		1	0.1%
100.330	generalized/complete cataract	6	0.3%	0	
100.340	resorbing/hypermature cataract	0		1	0.1%
100.375	subluxation/luxation, unspecified	4	0.2%	0	
100.999	*significant cataracts (summary)*	*73*	*3.1%*	*36*	*3.6%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	0		3	0.3%
110.135	PHPV/PTVL	2	0.1%	0	
110.200	vitritis	0		3	0.3%
110.320	vitreal degeneration	25	1.0%	3	0.3%
FUNDUS					
97.110	choroidal hypoplasia	1	0.0%	0	
RETINA					
120.170	retinal dysplasia, folds	12	0.5%	4	0.4%
120.310	generalized progressive retinal atrophy (PRA)	5	0.2%	2	0.2%
120.400	retinal hemorrhage	1	0.0%	0	
120.910	retinal detachment without dialysis	1	0.0%	0	
120.960	retinopathy	0		3	0.3%
OPTIC NERVE					
130.110	micropapilla	1	0.0%	1	0.1%
OTHER					
900.000	other, unspecified	43	1.8%	0	
900.100	other, not inherited	106	4.4%	44	4.4%
900.110	other. suspect not inherited/significance unknown	74	3.1%	3	0.3%
NORMAL					
0.000	normal globe	1990	83.5%	801	79.9%

DANDIE DINMONT TERRIER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Glaucoma	Not defined	1, 2	NO
B.	Distichiasis	Not defined	3	Breeder option
C.	Persistent pupillary membranes - iris to iris	Not defined	4	Breeder option
D.	Cataract	Not defined	3	NO

Description and Comments

A. Glaucoma

Glaucoma is an elevation of intraocular pressure (IOP) which, when sustained, causes intraocular damage resulting in blindness. The elevated IOP occurs because the fluid cannot leave through the iridocorneal angle. Diagnosis and classification of glaucoma requires measurement of IOP (tonometry) and examination of the iridocorneal angle (gonioscopy). Neither of these tests is part of a routine breed eye screening exam.

In the Dandie Dinmont terrier a 9.5 Mb susceptibility locus has been identified on canine chromosome 8. The definitive mutation has not been determined. A genetic test is not yet available.

B. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

C. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

D. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are

complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

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OCULAR DISORDERS REPORT
DANDIE DINMONT TERRIER

Diagnostic Name		1991-2013 TOTAL DOGS EXAMINED 242 #	 %	2014-2018 37 #	 %
GLOBE					
0.110	microphthalmia	1	0.4%	0	
10.000	glaucoma	1	0.4%	0	
EYELIDS					
25.110	distichiasis	18	7.4%	3	8.1%
CORNEA					
70.700	corneal dystrophy	6	2.5%	0	
UVEA					
93.710	persistent pupillary membranes, iris to iris	24	9.9%	3	8.1%
93.720	persistent pupillary membranes, iris to lens	1	0.4%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	1	0.4%	4	10.8%
93.999	uveal cysts	2	0.8%	0	
LENS					
100.200	cataract, unspecified	4	1.7%	0	
100.210	cataract. suspect not inherited/significance unknown	26	10.7%	3	8.1%
100.301	punctate cataract, anterior cortex	1	0.4%	2	5.4%
100.302	punctate cataract, posterior cortex	3	1.2%	0	
100.305	punctate cataract, posterior sutures	1	0.4%	0	
100.307	punctate cataract, capsular	3	1.2%	0	
100.311	incipient cataract, anterior cortex	2	0.8%	3	8.1%
100.312	incipient cataract, posterior cortex	1	0.4%	0	
100.330	generalized/complete cataract	5	2.1%	0	
100.375	subluxation/luxation, unspecified	1	0.4%	0	
100.999	*significant cataracts (summary)*	*20*	*8.3%*	*5*	*13.5%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	3	1.2%	0	
OTHER					
900.000	other, unspecified	6	2.5%	0	
900.100	other, not inherited	7	2.9%	6	16.2%
900.110	other. suspect not inherited/significance unknown	1	0.4%	0	
NORMAL					
0.000	normal globe	167	69.0%	20	54.1%

OCULAR DISORDERS REPORT
DANISH BROHOLMER

There are insufficient breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the DANISH BROHOLMER breed. Therefore, there are no conditions listed with breeding advice.

OCULAR DISORDERS REPORT
DANISH BROHOLMER

Diagnostic Name	1991-2013 TOTAL DOGS EXAMINED 3 # %	2014-2018 0 # %
NORMAL		
0.000 normal globe	3 100.0%	0

OCULAR DISORDERS REPORT
DANISH SWEDISH FARMDOG

There are insufficient breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the DANISH SWEDISH FARMDOG breed. Therefore, there are no conditions listed with breeding advice.

OCULAR DISORDERS REPORT
DANISH SWEDISH FARMDOG

Diagnostic Name	TOTAL DOGS EXAMINED	1991-2013 2 #	%	2014-2018 39 #	%
UVEA					
93.710	persistent pupillary membranes, iris to iris	0		3	7.7%
LENS					
100.316	incipient cataract, nucleus	0		1	2.6%
100.999	*significant cataracts (summary)*	*0*		*1*	*2.6%*
OTHER					
900.100	other, not inherited	0		1	2.6%
900.110	other. suspect not inherited/significance unknown	0		1	2.6%
NORMAL					
0.000	normal globe	2	100.0%	34	87.2%

DOBERMAN PINSCHER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Microphthalmia with multiple ocular defects	Not defined	1-5	NO
B.	Distichiasis	Not defined	1	Breeder option
C.	Persistent pupillary membranes			
	- iris to iris	Not defined	1-6	Breeder option
	- lens pigment foci/no strands	Not defined	7	Passes with no notation
	- iris to lens	Not defined	6	NO
D.	Cataract	Not defined	1	NO
E.	Persistent hyperplastic primary vitreous/ Persistent hyperplastic tunica vasculosa lentis (PHPV/PHTVL)	Presumed dominant/ incomplete penetrance	1, 8-16	NO
F.	Retinal dysplasia - folds	Not defined	1	Breeder option
G.	Ligneous conjunctivitis	Not defined	17	NO

Description and Comments

A. Microphthalmia with multiple ocular defects

Microphthalmia is a congenital defect characterized by a small eye often associated with defects of the cornea, iris (coloboma), anterior chamber, lens (cataract) and/or retina (retinal dysplasia). Note that this syndrome is distinct from "E," PHPV/PHTVL, which may also be associated with microphthalmia.

B. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time. It is difficult to make a strong recommendation with regards to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded and breeding discretion is advised.

C. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

D. Cataract

Lens opacity which may affect one or both eyes and may involve the lens partially or completely. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membranes, persistent hyaloid, or nutritional deficiencies.

Cataracts have been infrequently observed in the Doberman Pinscher and there is no specific location attributed to cataracts within the Doberman lens. Most cataracts are bilateral, usually observed within the first two years of life, and may cause significant vision loss.

E. Persistent hyperplastic primary vitreous (PHPV)/Persistent hyperplastic tunica vasculosa lentis (PHTVL)

Persistent hyperplastic primary vitreous is a congenital defect resulting from abnormalities in the development and regression of the hyaloid artery (the primary vitreous) and the interaction of this blood vessel with the posterior lens capsule/cortex during embryogenesis. This condition is often associated with persistent hyperplastic tunica vasculosa lentis which results from failure of regression of the embryologic vascular network which surrounds the developing lens.

The condition in the Doberman includes a spectrum of malformations ranging from spots of pigment on the posterior surface of the lens to posterior lenticonus, cataract and a dense fibrous plaque on the posterior surface of the lens. In the more severe forms, partial or complete vision impairment occurs. PHPV has been extensively studied in the Doberman in Europe. This disorder has been observed occasionally in the Doberman in the United States.

F. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

G. Ligneous conjunctivitis

A rare type of conjunctivitis characterized by the formation of thick membranes covering conjunctiva of the nictitans and eyelids of affected dogs. This condition has been diagnosed in four unrelated Doberman Pinschers, three of which had life-threatening systemic disease. Ligneous conjunctivitis has also been reported in one Yorkshire Terrier.

References

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OCULAR DISORDERS REPORT
DOBERMAN PINSCHER

Diagnostic Name	TOTAL DOGS EXAMINED	1991-2013 4812 #	%	2014-2018 1250 #	%
GLOBE					
0.110	microphthalmia	7	0.1%	0	
EYELIDS					
20.140	ectopic cilia	1	0.0%	0	
21.000	entropion, unspecified	6	0.1%	1	0.1%
22.000	ectropion, unspecified	1	0.0%	0	
25.110	distichiasis	81	1.7%	20	1.6%
NASOLACRIMAL					
40.910	keratoconjunctivitis sicca	1	0.0%	1	0.1%
NICTITANS					
51.100	third eyelid cartilage anomaly	5	0.1%	3	0.2%
52.110	prolapsed gland of the third eyelid	7	0.1%	0	
CORNEA					
70.700	corneal dystrophy	10	0.2%	0	
70.730	corneal endothelial degeneration	4	0.1%	0	
UVEA					
93.110	iris hypoplasia	1	0.0%	0	
93.140	corneal endothelial pigment without PPM	2	0.0%	0	
93.150	iris coloboma	1	0.0%	0	
93.710	persistent pupillary membranes, iris to iris	105	2.2%	25	2.0%
93.720	persistent pupillary membranes, iris to lens	33	0.7%	2	0.2%
93.730	persistent pupillary membranes, iris to cornea	8	0.2%	2	0.2%
93.740	persistent pupillary membranes, iris sheets	4	0.1%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	35	0.7%	129	10.3%
93.760	persistent pupillary membranes, endothelial opacity/no strands	2	0.0%	4	0.3%
93.810	uveal melanoma	3	0.1%	1	0.1%
93.999	uveal cysts	6	0.1%	7	0.6%
LENS					
100.200	cataract, unspecified	32	0.7%	0	
100.210	cataract. suspect not inherited/significance unknown	254	5.3%	71	5.7%
100.301	punctate cataract, anterior cortex	14	0.3%	3	0.2%
100.302	punctate cataract, posterior cortex	4	0.1%	1	0.1%
100.303	punctate cataract, equatorial cortex	1	0.0%	0	
100.304	punctate cataract, anterior sutures	3	0.1%	1	0.1%
100.305	punctate cataract, posterior sutures	10	0.2%	0	
100.306	punctate cataract, nucleus	6	0.1%	3	0.2%
100.307	punctate cataract, capsular	14	0.3%	2	0.2%
100.311	incipient cataract, anterior cortex	8	0.2%	3	0.2%
100.312	incipient cataract, posterior cortex	17	0.4%	2	0.2%
100.313	incipient cataract, equatorial cortex	7	0.1%	3	0.2%
100.315	incipient cataract, posterior sutures	8	0.2%	0	
100.316	incipient cataract, nucleus	14	0.3%	5	0.4%
100.317	incipient cataract, capsular	9	0.2%	4	0.3%
100.321	incomplete cataract, anterior cortex	0		2	0.2%

LENS CONTINUED		1991-2013		2014-2018	
100.322	incomplete cataract, posterior cortex	0		2	0.2%
100.326	incomplete cataract, nucleus	0		1	0.1%
100.328	posterior suture tip opacities	0		6	0.5%
100.330	generalized/complete cataract	14	0.3%	1	0.1%
100.375	subluxation/luxation, unspecified	2	0.0%	2	0.2%
100.999	*significant cataracts (summary)*	*161*	*3.3%*	*33*	*2.6%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	15	0.3%	7	0.6%
110.135	PHPV/PTVL	40	0.8%	11	0.9%
110.200	vitritis	0		1	0.1%
110.320	vitreal degeneration	9	0.2%	1	0.1%
FUNDUS					
97.110	choroidal hypoplasia	2	0.0%	0	
97.120	coloboma	1	0.0%	0	
RETINA					
120.170	retinal dysplasia, folds	90	1.9%	9	0.7%
120.180	retinal dysplasia, geographic	12	0.2%	0	
120.310	generalized progressive retinal atrophy (PRA)	12	0.2%	0	
120.910	retinal detachment without dialysis	2	0.0%	0	
120.960	retinopathy	1	0.0%	0	
OPTIC NERVE					
130.120	optic nerve hypoplasia	3	0.1%	0	
OTHER					
900.000	other, unspecified	57	1.2%	0	
900.100	other, not inherited	178	3.7%	79	6.3%
900.110	other. suspect not inherited/significance unknown	43	0.9%	12	1.0%
NORMAL					
0.000	normal globe	4103	85.3%	903	72.2%
SCLERA					
80.810	limbal melanoma	0		1	0.1%

DOGUE DE BORDEAUX

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Distichiasis	Not defined	1	Breeder option	
B.	Entropion	Not defined	2	Breeder option	
C.	Ectropion	Not defined	3	Breeder option	
D.	Eury/Macroblepharon	Not defined	2	Breeder option	
E.	Persistent pupillary membranes - iris to iris	Not defined	4	Breeder option	
F.	Cataract	Not defined	1	NO	
G.	Multifocal retinopathy - *cmr1*	Autosomal recessive	5	Breeder option	Mutation in the *BEST1* gene

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Entropion

A conformational defect resulting in an "in-rolling" of one or both of the eyelids which may cause ocular irritation. It is likely that entropion is influenced by several genes (polygenic), defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull. Entropion in the Mastiff is severe and may require multiple surgical corrections.

C. Ectropion

A conformational defect resulting in eversion of the eyelids, which may cause ocular irritation due to exposure. It is likely that ectropion is influenced by several genes (polygenic), defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

D. Eury/Macroblepharon

Defined as an exceptionally large palpebral fissure, macroblepharon in conjunction with laxity of the lateral canthal structures may lead to lower lid ectropion and upper lid entropion. Either of these conditions may lead to severe ocular irritation.

E. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

F. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

G. Multifocal retinopathy

Canine Multifocal Retinopathy type 1 (cmr1) is characterized by numerous distinct (i.e. multi-focal), roughly circular patches of elevated retina (multifocal bullous retinal detachments). There may be a serous subretinal fluid, or accumulation of subretinal material that produces gray-tan-pink colored lesions. These lesions, looking somewhat like blisters, vary in location and size, although typically they are present in both eyes of the affected dog.

The disease generally develops in young dogs between 11-20 weeks of age and there is minimal progression after 1 year of age. The lesions may flatten, leaving areas of retinal thinning and RPE hypertrophy, hyperplasia, and pigmentation. Discrete areas of tapetal hyper-reflectivity may be seen in areas of previous retinal and RPE detachments. Most dogs exhibit no noticeable problem with vision or electroretinographic abnormalities despite their abnormal appearing retinas.

Canine Multifocal Retinopathy type 1 is caused by a mutation in the Bestrophin 1 gene (*BEST1*) and is described to be recessively inherited in the Great Pyrenees, Dogue de Bordeaux, Bullmastiff, and Mastiff. A DNA test is available.

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2. ACVO Genetics Committee, 2016 and/or Data from CERF/OFA All-Breeds Report, 2010-2015

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OCULAR DISORDERS REPORT
DOGUE DE BORDEAUX

Diagnostic Name		1991-2013 TOTAL DOGS EXAMINED 265 #	%	2014-2018 83 #	%
EYELIDS					
20.160	macropalpebral fissure	9	3.4%	0	
21.000	entropion, unspecified	13	4.9%	9	10.8%
22.000	ectropion, unspecified	28	10.6%	12	14.5%
25.110	distichiasis	25	9.4%	10	12.0%
NICTITANS					
52.110	prolapsed gland of the third eyelid	1	0.4%	0	
CORNEA					
70.700	corneal dystrophy	5	1.9%	4	4.8%
70.730	corneal endothelial degeneration	0		1	1.2%
UVEA					
93.710	persistent pupillary membranes, iris to iris	10	3.8%	6	7.2%
93.720	persistent pupillary membranes, iris to lens	1	0.4%	0	
93.730	persistent pupillary membranes, iris to cornea	4	1.5%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	4	1.5%	1	1.2%
93.760	persistent pupillary membranes, endothelial opacity/no strands	0		1	1.2%
93.999	uveal cysts	2	0.8%	3	3.6%
LENS					
100.210	cataract. suspect not inherited/significance unknown	8	3.0%	1	1.2%
100.301	punctate cataract, anterior cortex	0		2	2.4%
100.306	punctate cataract, nucleus	3	1.1%	0	
100.311	incipient cataract, anterior cortex	1	0.4%	0	
100.316	incipient cataract, nucleus	1	0.4%	1	1.2%
100.999	*significant cataracts (summary)*	*5*	*1.9%*	*3*	*3.6%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	1	0.4%	0	
RETINA					
120.170	retinal dysplasia, folds	5	1.9%	1	1.2%
120.960	retinopathy	0		1	1.2%
OTHER					
900.000	other, unspecified	6	2.3%	0	
900.100	other, not inherited	11	4.2%	5	6.0%
900.110	other. suspect not inherited/significance unknown	2	0.8%	0	
NORMAL					
0.000	normal globe	187	70.6%	44	53.0%

OCULAR DISORDERS REPORT
DRENTSCHE PATRIJSHOND

There are insufficient breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the DRENTSCHE PATRIJSHOND breed. Therefore, there are no conditions listed with breeding advice.

OCULAR DISORDERS REPORT
DRENTSCHE PATRIJSHOND

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2013 6 #	%	2014-2018 14 #	%
UVEA						
93.750	persistent pupillary membranes, lens pigment foci/no strands		0		1	7.1%
LENS						
100.210	cataract. suspect not inherited/significance unknown		1	16.7%	0	
100.306	punctate cataract, nucleus		0		1	7.1%
100.999	*significant cataracts (summary)*		*0*		*1*	*7.1%*
OTHER						
900.100	other, not inherited		2	33.3%	0	
NORMAL						
0.000	normal globe		4	66.7%	12	85.7%

DUTCH SHEPHERD

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Cataract	Not defined	1	NO

Description and Comments

A. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Dutch Shepherd breed. The conditions listed above are generally recognized to exist in the breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 2017 and/or Data from CERF/OFA All-Breeds Report, 2010-2016.

OCULAR DISORDERS REPORT
DUTCH SHEPHERD

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2013 37 #	 %	2014-2018 55 #	 %
EYELIDS						
25.110	distichiasis		3	8.1%	0	
CORNEA						
70.700	corneal dystrophy		1	2.7%	1	1.8%
UVEA						
93.750	persistent pupillary membranes, lens pigment foci/no strands		2	5.4%	0	
LENS						
100.210	cataract. suspect not inherited/significance unknown		4	10.8%	8	14.5%
100.301	punctate cataract, anterior cortex		1	2.7%	1	1.8%
100.303	punctate cataract, equatorial cortex		0		2	3.6%
100.304	punctate cataract, anterior sutures		1	2.7%	0	
100.306	punctate cataract, nucleus		0		2	3.6%
100.307	punctate cataract, capsular		0		2	3.6%
100.311	incipient cataract, anterior cortex		1	2.7%	0	
100.312	incipient cataract, posterior cortex		1	2.7%	0	
100.313	incipient cataract, equatorial cortex		1	2.7%	1	1.8%
100.999	*significant cataracts (summary)*		*5*	*13.5%*	*8*	*14.5%*
RETINA						
120.310	generalized progressive retinal atrophy (PRA)		1	2.7%	0	
OTHER						
900.000	other, unspecified		3	8.1%	0	
900.100	other, not inherited		1	2.7%	4	7.3%
900.110	other. suspect not inherited/significance unknown		0		1	1.8%
NORMAL						
0.000	normal globe		31	83.8%	40	72.7%

OCULAR DISORDERS REPORT
ECT LANDSEER

There are insufficient breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the ECT LANDSEER breed. Therefore, there are no conditions listed with breeding advice.

OCULAR DISORDERS REPORT
ECT LANDSEER

Diagnostic Name	TOTAL DOGS EXAMINED	1991-2013 0 #	%	2014-2018 1 #	%
NORMAL					
0.000 normal globe		0		1	100.0%

ENGLISH COCKER SPANIEL

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Keratoconjunctivitis sicca	Not defined	1	NO	
B.	Glaucoma	Not defined	2-4	NO	
C.	Ectropion	Not defined	2	Breeder option	
D.	Distichiasis	Not defined	2, 4, 5	Breeder option	
E.	Corneal dystrophy - epithelial/stromal	Not defined	6	Breeder option	
F.	Persistent pupillary membranes				
	- iris to iris	Not defined	2, 6,7	Breeder option	
	- iris to cornea	Not defined	7, 8	NO	
	- lens pigment foci/no strands	Not defined	9	Passes with no notation	
G.	Cataract	Not defined	2, 7, 10-12	NO	
H.	Retinal atrophy - generalized (*prcd*)	Autosomal recessive	2, 13-15	NO	Mutation in the *prcd* gene
I.	Central progressive retinal atrophy	Not defined	16-18	NO	
J.	Retinal dysplasia - folds	Presumed autosomal recessive	2, 19	Breeder option	

Description and Comments

A. Keratoconjunctivitis sicca (KCS)

An abnormality of the tear film, most commonly a deficiency of the aqueous portion, although the mucin and/or lipid layers may be affected; results in ocular irritation and/or vision impairment.

B. Glaucoma

Glaucoma is characterized by an elevation of intraocular pressure (IOP) which, when sustained, causes intraocular damage resulting in blindness. The elevated intraocular pressure occurs because the fluid cannot leave through the iridocorneal angle. Diagnosis and classification of glaucoma requires measurement of the IOP (tonometry) and examination of the iridocorneal angle (gonioscopy). Neither of these tests is part of a routine screening exam for certification.

Glaucoma in the English Cocker Spaniel is recognized in England. The frequency and significance of this disease in the breed in the United States is not known, but is probably low.

C. Ectropion

A conformational defect resulting in eversion of the eyelids which may cause ocular irritation. It is likely that ectropion is influenced by several genes (polygenic) defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

D. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established, although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

E. Corneal dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral. In the English Cocker Spaniel, lesions are circular or semicircular central crystalline deposits in the anterior corneal stroma that appear between 2 and 5 years of age. It may be associated with exophthalmos and lagophthalmos common in these dogs.

F. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

In the English Cocker Spaniel, this is a particularly serious problem as the majority of PPMs identified on routine screening examination bridge from the iris to the cornea and are associated with corneal opacities which may result in vision impairment.

Lens pigment foci/no strands is considered an insignificant finding and therefore is not noted on the certificate.

G. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

Congenital cataracts have been reported in Red Cocker Spaniels, presumably English Cocker Spaniels, in Denmark. The cataracts affected the anterior capsule; in some cases the cortex and/or nucleus were opaque. Associated findings in some dogs were persistent pupillary membrane (PPM) and/or microphthalmia. It is likely that these cataracts are part of a syndrome characterized by multiple congenital ocular anomalies. The condition is familial, but a specific mode of inheritance has not been defined.

H. Retinal atrophy - generalized (*prcd*)

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

Studies have shown that the principal form of PRA in the English Cocker Spaniel is *prcd* which is a late-onset form of PRA inherited as autosomal recessive. The mutation is allelic to that present in Miniature Poodles, Labrador Retrievers, and American Cocker Spaniels and others. The locus is termed the progressive rod-cone degeneration (*prcd*) gene and at least 30+ breeds are affected. In most affected dogs to date, the disease is recognized clinically in dogs 3-6 years of age or older. However, in the English Cocker Spaniel, the phenotype can be very variable in the age of onset. This photoreceptor degeneration is characterized by slow death of visual cells following their normal development. The disease begins clinically with signs of night blindness followed by day blindness. A DNA test is available.

Other forms of retinal degeneration that are not *prcd* are recognized in the breed. The currently available genetic test will not detect these other forms of PRA.

I. Central progressive retinal atrophy (CPRA)

A progressive retinal degeneration in which photoreceptor degeneration occurs secondary to disease of the underlying pigment epithelium. Progression is slow and some animals may never lose vision. CPRA is a frequent occurrence in England, but is uncommon elsewhere.

CPRA is characterized by the appearance of brown spots and patches primarily in the tapetal fundus and retinal degeneration. These areas are created by an accumulation of autofluorescent lipopigment within the retinal pigment epithelium cells. These changes are consistent with retinal changes observed in Vitamin E deficiency. Neurologic signs including ataxia and proprioceptive deficits have also been identified in affected dogs.

In the English Cocker Spaniel, retinal lesions of CPRA have been related to an underlying abnormal metabolism of Vitamin E resulting in a systemic deficiency.

J. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

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OCULAR DISORDERS REPORT
ENGLISH COCKER SPANIEL

		1991-2013 10556		2014-2018 1029	
	TOTAL DOGS EXAMINED				
Diagnostic Name		**#**	**%**	**#**	**%**
GLOBE					
0.110	microphthalmia	14	0.1%	0	
10.000	glaucoma	1	0.0%	0	
EYELIDS					
20.110	eyelid dermoid	1	0.0%	0	
20.140	ectopic cilia	6	0.1%	0	
20.160	macropalpebral fissure	3	0.0%	0	
21.000	entropion, unspecified	43	0.4%	6	0.6%
22.000	ectropion, unspecified	94	0.9%	3	0.3%
25.110	distichiasis	1891	17.9%	167	16.2%
NASOLACRIMAL					
32.110	imperforate lower nasolacrimal punctum	15	0.1%	9	0.9%
40.910	keratoconjunctivitis sicca	12	0.1%	0	
NICTITANS					
52.110	prolapsed gland of the third eyelid	6	0.1%	0	
CORNEA					
70.210	corneal pannus	10	0.1%	0	
70.220	pigmentary keratitis	10	0.1%	1	0.1%
70.700	corneal dystrophy	92	0.9%	9	0.9%
70.730	corneal endothelial degeneration	37	0.4%	0	
UVEA					
90.250	pigmentary uveitis	1	0.0%	0	
93.140	corneal endothelial pigment without PPM	6	0.1%	0	
93.150	iris coloboma	2	0.0%	0	
93.710	persistent pupillary membranes, iris to iris	126	1.2%	27	2.6%
93.720	persistent pupillary membranes, iris to lens	40	0.4%	3	0.3%
93.730	persistent pupillary membranes, iris to cornea	183	1.7%	5	0.5%
93.740	persistent pupillary membranes, iris sheets	10	0.1%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	19	0.2%	42	4.1%
93.760	persistent pupillary membranes, endothelial opacity/no strands	14	0.1%	7	0.7%
93.999	uveal cysts	5	0.0%	0	
LENS					
100.200	cataract, unspecified	172	1.6%	0	
100.210	cataract. suspect not inherited/significance unknown	642	6.1%	73	7.1%
100.301	punctate cataract, anterior cortex	94	0.9%	6	0.6%
100.302	punctate cataract, posterior cortex	49	0.5%	2	0.2%
100.303	punctate cataract, equatorial cortex	19	0.2%	0	
100.304	punctate cataract, anterior sutures	11	0.1%	1	0.1%
100.305	punctate cataract, posterior sutures	30	0.3%	1	0.1%
100.306	punctate cataract, nucleus	21	0.2%	3	0.3%
100.307	punctate cataract, capsular	7	0.1%	4	0.4%
100.311	incipient cataract, anterior cortex	127	1.2%	4	0.4%
100.312	incipient cataract, posterior cortex	130	1.2%	6	0.6%
100.313	incipient cataract, equatorial cortex	84	0.8%	3	0.3%

LENS CONTINUED		1991-2013		2014-2018	
100.314	incipient cataract, anterior sutures	8	0.1%	0	
100.315	incipient cataract, posterior sutures	24	0.2%	2	0.2%
100.316	incipient cataract, nucleus	58	0.5%	3	0.3%
100.317	incipient cataract, capsular	14	0.1%	4	0.4%
100.321	incomplete cataract, anterior cortex	0		5	0.5%
100.322	incomplete cataract, posterior cortex	1	0.0%	4	0.4%
100.323	incomplete cataract, equatorial cortex	0		5	0.5%
100.326	incomplete cataract, nucleus	0		3	0.3%
100.327	incomplete cataract, capsular	0		1	0.1%
100.328	posterior suture tip opacities	0		6	0.6%
100.330	generalized/complete cataract	99	0.9%	2	0.2%
100.375	subluxation/luxation, unspecified	8	0.1%	1	0.1%
100.999	*significant cataracts (summary)*	*948*	*9.0%*	*59*	*5.7%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	6	0.1%	5	0.5%
110.135	PHPV/PTVL	4	0.0%	0	
110.320	vitreal degeneration	24	0.2%	3	0.3%
RETINA					
120.170	retinal dysplasia, folds	154	1.5%	17	1.7%
120.180	retinal dysplasia, geographic	12	0.1%	4	0.4%
120.190	retinal dysplasia, detached	2	0.0%	0	
120.310	generalized progressive retinal atrophy (PRA)	423	4.0%	1	0.1%
120.400	retinal hemorrhage	3	0.0%	0	
120.960	retinopathy	2	0.0%	1	0.1%
OPTIC NERVE					
130.110	micropapilla	2	0.0%	0	
130.120	optic nerve hypoplasia	2	0.0%	0	
130.150	optic disc coloboma	15	0.1%	0	
OTHER					
900.000	other, unspecified	47	0.4%	0	
900.100	other, not inherited	252	2.4%	66	6.4%
900.110	other. suspect not inherited/significance unknown	120	1.1%	1	0.1%
NORMAL					
0.000	normal globe	7191	68.1%	636	61.8%

OCULAR DISORDERS REPORT
ENGLISH COONHOUND

There are insufficient breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the ENGLISH COONHOUND breed. Therefore, there are no conditions listed with breeding advice.

OCULAR DISORDERS REPORT
ENGLISH COONHOUND

Diagnostic Name	TOTAL DOGS EXAMINED	1991-2013 0 #	%	2014-2018 1 #	%
NORMAL					
0.000 normal globe		0		1	100.0%

OCULAR DISORDERS REPORT
ENGLISH FOXHOUND

There are insufficient breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the ENGLISH FOXHOUND breed. Therefore, there are no conditions listed with breeding advice.

OCULAR DISORDERS REPORT
ENGLISH FOXHOUND

Diagnostic Name	TOTAL DOGS EXAMINED	1991-2013 0 #	%	2014-2018 3 #	%
OTHER					
900.100	other, not inherited	0		1	33.3%
NORMAL					
0.000	normal globe	0		2	66.7%

OCULAR DISORDERS REPORT
ENGLISH JACK RUSSELL TERRIER

There are insufficient breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the ENGLISH JACK RUSSELL TERRIER breed. Therefore, there are no conditions listed with breeding advice.

OCULAR DISORDERS REPORT
ENGLISH JACK RUSSELL TERRIER

Diagnostic Name	TOTAL DOGS EXAMINED	1991-2013 1 # %	2014-2018 1 # %
NORMAL			
0.000 normal globe		1 100.0%	1 100.0%

ENGLISH SETTER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Distichiasis	Not defined	1	Breeder option	
B.	Persistent pupillary membranes				
	- iris to iris	Not defined	1, 2	Breeder option	
	- iris to cornea	Not defined	1	NO	
C.	Cataract	Not defined	1	NO	
D.	Retinal atrophy - generalized	Presumed autosomal recessive	1, 3	NO	
E.	Retinal atrophy - rod-cone dysplasia recessive type 1 (*rcd4*)	Autosomal recessive	4	NO	Mutation in the *C2orf71* gene
F.	Retinal dysplasia				
	- folds	Not defined	1	Breeder option	
	- geographic	Not defined	5	NO	
G.	Ceroid lipofuscinosis	Autosomal recessive	6-10	NO	Mutation in the *CLN8* gene

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of the dog. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal.

B. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

C. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

D. Retinal atrophy – generalized

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. Except for X-linked PRA in the Siberian Husky, in all breeds studied to date, PRA is inherited as an autosomal recessive trait.

E. Rod-cone dysplasia, type 4 (*rcd4*)

A form of PRA identified in the Gordon and Irish Setter breeds. Clinical night blindness is observed on average as late as 10 years of age and progresses to total blindness. This form of PRA has been referred to as late-onset PRA (LOPRA). The disorder is caused by a mutation present in the *C2orf71* gene. A DNA test is available that will unequivocally identify genetically normal, affected and carrier dogs. The test is accurate only for this mutation and will not identify other forms of PRA.

F. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

Retinal dysplasia - geographic

Any irregularly shaped area of abnormal retinal development containing both areas of thinning and areas of elevation representing folds and areas of retinal disorganization. This form may be associated with vision impairment.

G. Ceroid lipofuscinosis

An inherited disease of humans and animals characterized by the accumulation of lipopigment in various tissues of the body including the eye. It results in progressive neurologic disease including blindness. (Also called Batten's Disease.) A DNA test is available.

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OCULAR DISORDERS REPORT
ENGLISH SETTER

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2013 1663 #	1991-2013 1663 %	2014-2018 131 #	2014-2018 131 %
EYELIDS						
21.000	entropion, unspecified		8	0.5%	3	2.3%
22.000	ectropion, unspecified		3	0.2%	0	
25.110	distichiasis		69	4.1%	2	1.5%
NICTITANS						
52.110	prolapsed gland of the third eyelid		2	0.1%	0	
CORNEA						
70.700	corneal dystrophy		13	0.8%	1	0.8%
70.730	corneal endothelial degeneration		3	0.2%	0	
UVEA						
93.710	persistent pupillary membranes, iris to iris		63	3.8%	5	3.8%
93.720	persistent pupillary membranes, iris to lens		5	0.3%	0	
93.730	persistent pupillary membranes, iris to cornea		7	0.4%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands		0		1	0.8%
93.810	uveal melanoma		0		1	0.8%
93.999	uveal cysts		1	0.1%	0	
LENS						
100.200	cataract, unspecified		5	0.3%	0	
100.210	cataract. suspect not inherited/significance unknown		62	3.7%	4	3.1%
100.301	punctate cataract, anterior cortex		5	0.3%	1	0.8%
100.302	punctate cataract, posterior cortex		10	0.6%	0	
100.305	punctate cataract, posterior sutures		1	0.1%	2	1.5%
100.306	punctate cataract, nucleus		2	0.1%	0	
100.307	punctate cataract, capsular		2	0.1%	0	
100.311	incipient cataract, anterior cortex		5	0.3%	0	
100.312	incipient cataract, posterior cortex		8	0.5%	0	
100.313	incipient cataract, equatorial cortex		1	0.1%	0	
100.315	incipient cataract, posterior sutures		1	0.1%	1	0.8%
100.316	incipient cataract, nucleus		1	0.1%	1	0.8%
100.317	incipient cataract, capsular		2	0.1%	0	
100.321	incomplete cataract, anterior cortex		0		1	0.8%
100.322	incomplete cataract, posterior cortex		0		2	1.5%
100.328	posterior suture tip opacities		0		4	3.1%
100.330	generalized/complete cataract		3	0.2%	1	0.8%
100.375	subluxation/luxation, unspecified		1	0.1%	0	
100.999	*significant cataracts (summary)*		*46*	*2.8%*	*9*	*6.9%*
VITREOUS						
110.120	persistent hyaloid artery/remnant		7	0.4%	0	
110.135	PHPV/PTVL		1	0.1%	0	
110.320	vitreal degeneration		4	0.2%	0	
RETINA						
120.170	retinal dysplasia, folds		35	2.1%	2	1.5%
120.180	retinal dysplasia, geographic		15	0.9%	0	
120.190	retinal dysplasia, detached		1	0.1%	0	
120.310	generalized progressive retinal atrophy (PRA)		21	1.3%	1	0.8%

	1991-2013		2014-2018	
OPTIC NERVE				
130.110 micropapilla	1	0.1%	0	
130.120 optic nerve hypoplasia	1	0.1%	0	
OTHER				
900.000 other, unspecified	6	0.4%	0	
900.100 other, not inherited	53	3.2%	1	0.8%
900.110 other. suspect not inherited/significance unknown	4	0.2%	0	
NORMAL				
0.000 normal globe	1400	84.2%	107	81.7%

ENGLISH SHEPHERD

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Cataract	Not defined	1	NO	
B.	Retinal atrophy - generalized (*prcd*)	Autosomal recessive	2	NO	Mutation in the *prcd* gene
C.	Choroidal hypoplasia (Collie Eye Anomaly) - optic nerve coloboma - retinal detachment - retinal hemorrhage - staphyloma/coloboma	Autosomal recessive	3, 4, 5	NO	Mutation in the *NHEJ1* gene

Description and Comments

A. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

B. Retinal atrophy - generalized (*prcd*)

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

Studies have shown that the principal form of PRA in the English Shepherd is *prcd* which is a late-onset form of PRA inherited as autosomal recessive. The mutation is allelic to that present in Miniature Poodles, Labrador Retrievers, English and American Cocker Spaniels and others. The locus is termed the progressive rod-cone degeneration (*prcd*) gene and at least 30+ breeds are affected. In most affected dogs to date, the disease is recognized clinically in dogs 3-6 years of age or older. This photoreceptor degeneration is characterized by slow death of visual cells following their normal development. The disease begins clinically with signs of night blindness followed by day blindness. A DNA test is available.

C. Choroidal hypoplasia (Collie Eye Anomaly)
- staphyloma/coloboma
- retinal detachment
- retinal hemorrhage
- optic nerve coloboma

A spectrum of malformations present at birth and ranging from inadequate development of the choroid (choroidal hypoplasia) to defects of the choroid, sclera, and/or optic nerve (coloboma/staphyloma) to complete retinal detachment (with or without hemorrhage). Mildly affected animals will have no detectable vision deficit.

This disorder is collectively referred to as "Collie Eye Anomaly." The choroidal hypoplasia component is caused by a 7799 base pair deletion with the gene *NHEJ1.* The mutation is a recessive trait. A DNA test is available and is diagnostic only for the choroidal hypoplasia component of CEA. For colobomas to develop, an additional mutation in a second gene has to be present; that gene is still unknown.

References

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OCULAR DISORDERS REPORT
ENGLISH SHEPHERD

Diagnostic Name		1991-2013 TOTAL DOGS EXAMINED 103 #	 %	2014-2018 38 #	 %
GLOBE					
0.110	microphthalmia	2	1.9%	0	
EYELIDS					
21.000	entropion, unspecified	5	4.9%	0	
CORNEA					
70.210	corneal pannus	1	1.0%	0	
70.700	corneal dystrophy	1	1.0%	0	
UVEA					
93.710	persistent pupillary membranes, iris to iris	5	4.9%	1	2.6%
93.720	persistent pupillary membranes, iris to lens	1	1.0%	0	
LENS					
100.210	cataract. suspect not inherited/significance unknown	2	1.9%	1	2.6%
100.301	punctate cataract, anterior cortex	2	1.9%	0	
100.306	punctate cataract, nucleus	0		1	2.6%
100.315	incipient cataract, posterior sutures	1	1.0%	0	
100.317	incipient cataract, capsular	1	1.0%	0	
100.321	incomplete cataract, anterior cortex	2	1.9%	0	
100.322	incomplete cataract, posterior cortex	2	1.9%	1	2.6%
100.330	generalized/complete cataract	3	2.9%	1	2.6%
100.999	*significant cataracts (summary)*	*11*	*10.7%*	*3*	*7.9%*
RETINA					
120.170	retinal dysplasia, folds	2	1.9%	0	
OTHER					
900.100	other, not inherited	6	5.8%	8	21.1%
NORMAL					
0.000	normal globe	84	81.6%	26	68.4%

ENGLISH SPRINGER SPANIEL

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Entropion	Not defined	1	Breeder option	
B.	Distichiasis	Not defined	2	Breeder option	
C.	Corneal dystrophy - epithelial/stromal	Not defined	1	Breeder option	
D.	Persistent pupillary membranes				
	- iris to iris	Not defined	1, 3	Breeder option	
	- iris to lens	Not defined	3	NO	
	- lens pigment foci/no strands	Not defined	4	Passes with no notation	
E.	Cataract	Not defined		NO	
F.	Persistent hyaloid artery	Not defined	5, 6	Breeder option	
G.	Vitreous degeneration	Not defined	7	Breeder option	
H.	Retinal atrophy - generalized	Not defined	8	NO	
I.	Retinal atrophy - *cord-1*	Autosomal recessive	9	NO	Mutation in the *RPGRIP1* gene
J.	Retinal dysplasia - folds	Presumed autosomal recessive	1, 10-12, 15	NO	
K.	Retinal dysplasia - geographic/ detached	Autosomal recessive	1, 10-12	NO	
L.	Refractive error	Not defined	13, 14	Breeder option	

Description and Comments

A. Entropion

A conformational defect resulting in an "in-rolling" of one or both of the eyelids which may cause ocular irritation. It is likely that entropion is influenced by several genes (polygenic), defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull. In the English Springer Spaniel this usually involves the lower lateral lid margin.

B. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

C. Corneal dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

D. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted

E. Cataract

Lens opacity which may affect one or both eyes and may involve the lens partially or completely. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membranes, persistent hyaloid, or nutritional deficiencies.

Cataract in the English Springer Spaniel is reported to be a familial trait usually involving the posterior subcapsular region of the lens that progresses slowly.

F. Persistent hyaloid artery (PHA)

Congenital defect resulting from abnormalities in the development and regression of the hyaloid artery. The blood vessel remnant can be present in the vitreous as a small patent vascular strand (PHA) or as a non-vascular strand that appears gray-white (persistent hyaloid remnant).

G. Vitreous degeneration

Liquefaction of the vitreous gel which may predispose to retinal detachment.

H. Retinal atrophy - generalized

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. PRA is inherited as an autosomal recessive trait in most breeds.

I. Retinal atrophy - *cord-1*

Cord-1 PRA in the English Springer Spaniel has an onset of clinical signs at 2 to 9 years of age leading to blindness in most affected dogs. *Cord1* PRA in the English Springer Spaniel has been described as beginning with increased granularity of the fundus or tiny hyporeflective brown or grey patches in the far peripheral tapetum. Over time, these abnormalities become more diffuse with mottling over much of the tapetum. Vessel attenuation accompanies the more diffuse changes. In advanced cases, there is generalized tapetal hyperreflectivity and vessel attenuation. Pedigree analysis has shown cord-1 in the English Springer Spaniel to be an autosomal recessive trait. A mutation in the *RPGRIP1* gene in cone-rod dystrophy (*cord1*) was found through genetic testing to be associated with one form of PRA in English Springer Spaniels, but not all clinically affected dogs have the *RPGRIP1* mutation, implying that other mutations have yet to be identified. A DNA test is available. The test is accurate only for this mutation and will not identify other forms of PRA. Not all dogs homozygous for the *RPGRIP1* genotype demonstrate the phenotype clinically.

J. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

The relationship between folds and geographic/detached lesions has been a topic of dispute for many years. It is the consensus of the English Springer Spaniel Field Trial Association Heritable Defects Committee (the parent breed club in the United States) that none of the forms of retinal dysplasia are desirable in a breeding animal.

K. Retinal dysplasia - geographic, detached

Abnormal development of the retina present at birth.

Retinal dysplasia - geographic: Any irregularly shaped area of abnormal retinal development containing both areas of thinning and areas of elevation representing folds and retinal disorganization.
Retinal dysplasia - detached: Severe retinal disorganization associated with separation (detachment) of the retina.

These two forms are associated with vision impairment or blindness. Retinal dysplasia is known to be inherited in many breeds. The genetic relationship among the three forms of retinal dysplasia is not known for all breeds.

Retinal dysplasia with multiple ocular defects - A syndrome of retinal dysplasia in association with other ocular defects has been reported in English Springer Spaniels. Congenital lenticular abnormalities include colobomata, microphakia and subluxation. Glaucoma and buphthalmos are frequent. The prognosis for vision and comfort in affected eyes is guarded to poor.

L. Refractive Myopia

A condition of the eye where the light that comes in does not directly focus on the retina but in front of it. In common terminology, "near-sighted." This condition has been shown to have a genetic component in English Springer Spaniels, although the exact mode of inheritance has not been determined.

References

1. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.
2. ACVO Genetics Committee, 2002-2003 and/or Data from CERF All-Breeds Report, 2002-2003.
3. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.
4. ACVO Genetics Committee, 2016 and/or Data from OFA All-Breeds Report, 2010-2016.
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12. Toole DO. Retinal dysplasia in English Springer Spaniel dogs: Light microscopy of the postnatal lesions. *Veterinary pathology*. 1983;20:298-311.

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14. Kubai MA, Labelle AL, Hamor RE, et al. Heritability of lenticular myopia in English Springer Spaniels. *Invest Ophthalmol Vis Sci*. 2013;54:7324-7328.

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OCULAR DISORDERS REPORT
ENGLISH SPRINGER SPANIEL

		1991-2013 42701		2014-2018 8595	
TOTAL DOGS EXAMINED					
Diagnostic Name		#	%	#	%
GLOBE					
0.110	microphthalmia	24	0.1%	4	0.0%
10.000	glaucoma	5	0.0%	2	0.0%
EYELIDS					
20.110	eyelid dermoid	2	0.0%	0	
20.160	macropalpebral fissure	3	0.0%	0	
21.000	entropion, unspecified	254	0.6%	49	0.6%
22.000	ectropion, unspecified	55	0.1%	4	0.0%
25.110	distichiasis	353	0.8%	52	0.6%
NASOLACRIMAL					
32.110	imperforate lower nasolacrimal punctum	2	0.0%	9	0.1%
40.910	keratoconjunctivitis sicca	9	0.0%	2	0.0%
NICTITANS					
51.100	third eyelid cartilage anomaly	0		1	0.0%
52.110	prolapsed gland of the third eyelid	8	0.0%	0	
CORNEA					
70.210	corneal pannus	5	0.0%	2	0.0%
70.220	pigmentary keratitis	3	0.0%	1	0.0%
70.700	corneal dystrophy	524	1.2%	111	1.3%
70.730	corneal endothelial degeneration	12	0.0%	1	0.0%
UVEA					
93.110	iris hypoplasia	6	0.0%	8	0.1%
93.140	corneal endothelial pigment without PPM	4	0.0%	0	
93.150	iris coloboma	27	0.1%	4	0.0%
93.710	persistent pupillary membranes, iris to iris	3134	7.3%	764	8.9%
93.720	persistent pupillary membranes, iris to lens	107	0.3%	16	0.2%
93.730	persistent pupillary membranes, iris to cornea	86	0.2%	4	0.0%
93.740	persistent pupillary membranes, iris sheets	48	0.1%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	34	0.1%	69	0.8%
93.760	persistent pupillary membranes, endothelial opacity/no strands	15	0.0%	1	0.0%
93.810	uveal melanoma	2	0.0%	0	
93.999	uveal cysts	14	0.0%	7	0.1%
97.150	chorioretinal coloboma, congenital	0		1	0.0%
LENS					
100.200	cataract, unspecified	97	0.2%	0	
100.210	cataract. suspect not inherited/significance unknown	1056	2.5%	233	2.7%
100.301	punctate cataract, anterior cortex	130	0.3%	34	0.4%
100.302	punctate cataract, posterior cortex	88	0.2%	21	0.2%
100.303	punctate cataract, equatorial cortex	46	0.1%	6	0.1%
100.304	punctate cataract, anterior sutures	18	0.0%	2	0.0%
100.305	punctate cataract, posterior sutures	75	0.2%	14	0.2%
100.306	punctate cataract, nucleus	31	0.1%	3	0.0%
100.307	punctate cataract, capsular	28	0.1%	15	0.2%
100.311	incipient cataract, anterior cortex	171	0.4%	37	0.4%

LENS CONTINUED		1991-2013		2014-2018	
100.312	incipient cataract, posterior cortex	169	0.4%	44	0.5%
100.313	incipient cataract, equatorial cortex	85	0.2%	16	0.2%
100.314	incipient cataract, anterior sutures	23	0.1%	2	0.0%
100.315	incipient cataract, posterior sutures	41	0.1%	1	0.0%
100.316	incipient cataract, nucleus	60	0.1%	12	0.1%
100.317	incipient cataract, capsular	27	0.1%	8	0.1%
100.321	incomplete cataract, anterior cortex	1	0.0%	5	0.1%
100.322	incomplete cataract, posterior cortex	0		9	0.1%
100.323	incomplete cataract, equatorial cortex	0		1	0.0%
100.326	incomplete cataract, nucleus	0		4	0.0%
100.327	incomplete cataract, capsular	2	0.0%	3	0.0%
100.328	posterior suture tip opacities	3	0.0%	22	0.3%
100.330	generalized/complete cataract	84	0.2%	7	0.1%
100.375	subluxation/luxation, unspecified	25	0.1%	4	0.0%
100.999	*significant cataracts (summary)*	*1176*	*2.8%*	*244*	*2.8%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	201	0.5%	66	0.8%
110.135	PHPV/PTVL	38	0.1%	4	0.0%
110.200	vitritis	1	0.0%	2	0.0%
110.320	vitreal degeneration	169	0.4%	61	0.7%
FUNDUS					
97.110	choroidal hypoplasia	4	0.0%	0	
97.120	coloboma	5	0.0%	0	
RETINA					
120.170	retinal dysplasia, folds	1761	4.1%	227	2.6%
120.180	retinal dysplasia, geographic	686	1.6%	60	0.7%
120.190	retinal dysplasia, detached	114	0.3%	14	0.2%
120.310	generalized progressive retinal atrophy (PRA)	461	1.1%	34	0.4%
120.400	retinal hemorrhage	8	0.0%	0	
120.910	retinal detachment without dialysis	57	0.1%	0	
120.920	retinal detachment with dialysis	1	0.0%	1	0.0%
120.960	retinopathy	10	0.0%	13	0.2%
OPTIC NERVE					
130.110	micropapilla	8	0.0%	5	0.1%
130.120	optic nerve hypoplasia	6	0.0%	3	0.0%
130.150	optic disc coloboma	13	0.0%	0	
OTHER					
900.000	other, unspecified	336	0.8%	0	
900.100	other, not inherited	792	1.9%	266	3.1%
900.110	other. suspect not inherited/significance unknown	210	0.5%	12	0.1%
NORMAL					
0.000	normal globe	35361	82.8%	6648	77.3%

ENGLISH TOY SPANIEL

(King Charles, Prince Charles, Ruby, Blenheim)

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Entropion	Not defined	1	Breeder option
B.	Eury/macroblepharon	Not defined	2	Breeder option
C.	Distichiasis	Not defined	1	Breeder option
D.	Corneal dystrophy - epithelial/stromal	Not defined	1	Breeder option
E.	Exposure/pigmentary keratitis	Not defined	3	Breeder option
F.	Persistent pupillary membranes - iris to iris	Not defined	4	Breeder option
G.	Cataract	Not defined	1	NO
H.	Persistent hyperplastic primary vitreous /Persistent hyperplastic tunica vasculosa lentis (PHPV/PHTVL)	Presumed dominant/ incomplete penetrance	1	NO
I.	Persistent hyaloid artery	Not defined	1	Breeder option
J.	Vitreous degeneration	Not defined	5	Breeder option
K.	Retinal dysplasia - folds	Presumed autosomal recessive	1	Breeder option

Description and Comments

A. Entropion

A conformational defect resulting in "in-rolling" of one or both of the eyelids which may cause ocular irritation. It is likely that entropion is influenced by several genes (polygenic), defining the skin and other structures, which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

B. Eury/Macroblepharon

Defined as an exceptionally large palpebral fissure, macroblepharon in conjunction with laxity of the lateral canthal structures may lead to lower lid ectropion and upper lid entropion. Either of these conditions may lead to severe ocular irritation. This condition is no longer listed on the CAER form. Please mark other conditions suspected as inherited and describe in the comments section.

C. Distichiasis

Eyelashes abnormally located on the eyelid margin, which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established, although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

D. Corneal dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

E. Exposure/Pigmentary keratitis

A condition characterized by variable degrees of superficial vascularization, fibrosis and/or pigmentation of the cornea. May be associated with excessive exposure/irritation of the globe due to shallow orbits, lower eyelid medial entropion, lagophthalmos and macropalpebral fissure.

F. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

G. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

Onset of cataract in the English Toy Spaniel is at an early age (less than 6 months), affecting the cortex and nucleus with rapid progression to complete cataract, resulting in blindness.

H. Persistent hyperplastic primary vitreous (PHPV)/Persistent hyperplastic tunica vasculosa lentis (PHTVL)

Persistent hyperplastic primary vitreous is a congenital defect resulting from abnormalities in the development and regression of the hyaloid artery (the primary vitreous) and the interaction of this blood vessel with the posterior lens capsule/cortex during embryogenesis. This condition is often associated with persistent hyperplastic tunica vasculosa lentis which results from failure of regression of the embryologic vascular network which surrounds the developing lens.

I. Persistent hyaloid artery (PHA)

A congenital defect resulting from abnormalities in the development and regression of the hyaloid artery. The blood vessel remnant can be present in the vitreous as a small vascular strand (PHA**)** or as a non-vascular strand that appears gray-white (persistent hyaloid remnant).

J. Vitreous degeneration

Liquefaction of the vitreous gel, which may predispose to retinal detachment.

K. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

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References

There are no references providing detailed descriptions of hereditary ocular conditions of the English Toy Spaniel breed. The conditions listed above are generally recognized to exist in the breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

2. ACVO Genetics Committee, 2008 and/or Data from CERF All-Breeds Report, 2003-2007.

3. ACVO Genetics Committee, 2007 and/or Data from CERF All-Breeds Report, 2002-2006.

4. ACVO Genetics Committee, 2013-2014 and Data from OFA All-Breeds Report, 2013-2014.

5. ACVO Genetics Committee, 2009 and/or Data from CERF All-Breeds Report, 2008.

OCULAR DISORDERS REPORT
ENGLISH TOY SPANIEL

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2013 832 #	 %	2014-2018 455 #	 %
GLOBE						
0.110	microphthalmia		3	0.4%	2	0.4%
EYELIDS						
20.140	ectopic cilia		1	0.1%	0	
20.160	macropalpebral fissure		10	1.2%	0	
21.000	entropion, unspecified		54	6.5%	5	1.1%
22.000	ectropion, unspecified		3	0.4%	0	
25.110	distichiasis		91	10.9%	47	10.3%
NASOLACRIMAL						
40.910	keratoconjunctivitis sicca		1	0.1%	1	0.2%
NICTITANS						
52.110	prolapsed gland of the third eyelid		2	0.2%	0	
CORNEA						
70.210	corneal pannus		1	0.1%	0	
70.220	pigmentary keratitis		16	1.9%	6	1.3%
70.700	corneal dystrophy		100	12.0%	77	16.9%
70.730	corneal endothelial degeneration		3	0.4%	2	0.4%
UVEA						
93.710	persistent pupillary membranes, iris to iris		6	0.7%	7	1.5%
93.720	persistent pupillary membranes, iris to lens		0		2	0.4%
93.730	persistent pupillary membranes, iris to cornea		1	0.1%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands		1	0.1%	5	1.1%
93.760	persistent pupillary membranes, endothelial opacity/no strands		0		1	0.2%
93.999	uveal cysts		0		2	0.4%
LENS						
100.200	cataract, unspecified		10	1.2%	0	
100.210	cataract. suspect not inherited/significance unknown		37	4.4%	35	7.7%
100.301	punctate cataract, anterior cortex		2	0.2%	7	1.5%
100.302	punctate cataract, posterior cortex		11	1.3%	6	1.3%
100.303	punctate cataract, equatorial cortex		1	0.1%	1	0.2%
100.305	punctate cataract, posterior sutures		3	0.4%	3	0.7%
100.306	punctate cataract, nucleus		2	0.2%	1	0.2%
100.307	punctate cataract, capsular		7	0.8%	14	3.1%
100.311	incipient cataract, anterior cortex		19	2.3%	7	1.5%
100.312	incipient cataract, posterior cortex		19	2.3%	4	0.9%
100.313	incipient cataract, equatorial cortex		2	0.2%	2	0.4%
100.315	incipient cataract, posterior sutures		1	0.1%	0	
100.316	incipient cataract, nucleus		8	1.0%	5	1.1%
100.317	incipient cataract, capsular		11	1.3%	3	0.7%
100.321	incomplete cataract, anterior cortex		3	0.4%	3	0.7%
100.322	incomplete cataract, posterior cortex		1	0.1%	7	1.5%
100.323	incomplete cataract, equatorial cortex		1	0.1%	2	0.4%
100.326	incomplete cataract, nucleus		0		6	1.3%
100.327	incomplete cataract, capsular		0		2	0.4%

LENS CONTINUED		1991-2013		2014-2018	
100.328	posterior suture tip opacities	0		3	0.7%
100.330	generalized/complete cataract	16	1.9%	5	1.1%
100.340	resorbing/hypermature cataract	0		3	0.7%
100.999	*significant cataracts (summary)*	*117*	*14.1%*	*81*	*17.8%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	43	5.2%	67	14.7%
110.135	PHPV/PTVL	9	1.1%	6	1.3%
110.320	vitreal degeneration	16	1.9%	5	1.1%
RETINA					
120.170	retinal dysplasia, folds	49	5.9%	15	3.3%
120.180	retinal dysplasia, geographic	3	0.4%	5	1.1%
120.190	retinal dysplasia, detached	1	0.1%	1	0.2%
120.310	generalized progressive retinal atrophy (PRA)	6	0.7%	1	0.2%
120.920	retinal detachment with dialysis	0		1	0.2%
OPTIC NERVE					
130.110	micropapilla	1	0.1%	0	
130.150	optic disc coloboma	1	0.1%	0	
OTHER					
900.000	other, unspecified	55	6.6%	0	
900.100	other, not inherited	44	5.3%	43	9.5%
900.110	other. suspect not inherited/significance unknown	13	1.6%	4	0.9%
NORMAL					
0.000	normal globe	457	54.9%	184	40.4%

ENTLEBUCHER MOUNTAIN DOG

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Glaucoma	Not defined	1	NO	
B.	Distichiasis	Not defined	2	Breeder option	
C.	Corneal dystrophy - epithelial/stromal	Not defined	2	Breeder option	
D.	Persistent pupillary membranes - iris to iris - lens pigment foci/no strands	Not defined Not defined	3, 4 5	Breeder option Passes with no notation	
E.	Cataract	Presumed autosomal recessive	1, 6, 7	NO	
F.	Retinal atrophy - generalized (*prcd*)	Autosomal recessive	1, 7-9	NO	Mutation in the *prcd* gene
G.	Retinal dysplasia - folds	Not defined	10	Breeder option	

Description and Comments

A. Glaucoma

Glaucoma is an elevation of intraocular pressure (IOP) which, when sustained, causes intraocular damage resulting in blindness. The elevated IOP occurs because the fluid cannot leave through the iridocorneal angle. Diagnosis and classification of glaucoma requires measurement of IOP (tonometry) and examination of the iridocorneal angle (gonioscopy). Neither of these tests are part of a routine breed eye screening exam.

B. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

C. Corneal dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

D. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore is not noted on the certificate.

E. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

Cataracts in the Entlebucher Mountain Dog generally become evident in young to middle-aged dogs (5.5 +/- 2.6 years). The opacities typically begin in the posterior subcapsular/capsular polar region along the suture lines as early as 1-2 years of age. Most dogs are affected with bilaterally symmetrical cataracts, which may or may not progress. Pedigree analysis suggests an autosomal recessive mode of inheritance.

F. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

G. Retinal atrophy - generalized *(prcd)*

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

Studies have shown that the principal form of PRA in the Entlebucher Mountain Dog is *prcd* which is a late-onset form of PRA inherited as autosomal recessive. The mutation is allelic to that present in Miniature Poodles, Labrador Retrievers, English and American Cocker Spaniels and others. The locus is termed the progressive rod-cone degeneration (*prcd*) gene and at least 30+ breeds are affected. In most affected dogs to date, the disease is

recognized clinically in dogs 3-6 years of age or older. This photoreceptor degeneration is characterized by slow death of visual cells following their normal development. The disease begins clinically with signs of night blindness followed by day blindness. A DNA test is available.

References

1. Spiess BM. [Inherited eye diseases in the Entlebucher Mountain Dog]. *Schweizer Archiv fur Tierheilkunde*. 1994;136:105-110. Vererbte Augenkrankheiten beim Entlebucher Sennenhund.

2. Koch SA. Cataracts in interrelated Old English Sheepdogs. *J Am Vet Med Assoc*. 1972;160:299-301.

3. Gelatt KN, Samuelson DA, Barrie KP, et al. Biometry and clinical characteristics of congenital cataracts and microphthalmia in the Miniature Schnauzer. *J Am Vet Med Assoc*. 1983;183:99-102.

4. ACVO Genetics Committee, 2006 and/or Data from CERF All-Breeds Report, 2001-2005.

5. ACVO Genetics Committee, 2017 and/or Data from CERF/OFA All-Breeds Report, 2010-2016.

6. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

7. Heitmann M, Hamann H, Brahm R, et al. Analysis of prevalence of presumed inherited eye diseases in Entlebucher Mountain Dogs. *Vet Ophthalmol*. 2005;8:145-151.

8. ACVO Genetics Committee, 2002-2003 and/or Data from CERF All-Breeds Report, 2002-2003.

9. Zangerl B, Goldstein O, Philp AR, et al. Identical mutation in a novel retinal gene causes progressive rod-cone degeneration in dogs and retinitis pigmentosa in humans. *Genomics*. 2006;88:551-563.

10. ACVO Genetics Committee, 2008 and/or Data from CERF All-Breeds Report, 2003-2007.

OCULAR DISORDERS REPORT
ENTLEBUCHER MOUNTAIN DOG

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2013 863 #	1991-2013 863 %	2014-2018 325 #	2014-2018 325 %
EYELIDS						
20.140	ectopic cilia		1	0.1%	0	
21.000	entropion, unspecified		1	0.1%	0	
25.110	distichiasis		11	1.3%	0	
NICTITANS						
52.110	prolapsed gland of the third eyelid		3	0.3%	0	
CORNEA						
70.700	corneal dystrophy		5	0.6%	0	
UVEA						
93.710	persistent pupillary membranes, iris to iris		41	4.8%	15	4.6%
93.720	persistent pupillary membranes, iris to lens		4	0.5%	0	
93.730	persistent pupillary membranes, iris to cornea		2	0.2%	0	
93.740	persistent pupillary membranes, iris sheets		1	0.1%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands		3	0.3%	11	3.4%
93.999	uveal cysts		2	0.2%	0	
LENS						
100.210	cataract. suspect not inherited/significance unknown		51	5.9%	24	7.4%
100.301	punctate cataract, anterior cortex		3	0.3%	2	0.6%
100.302	punctate cataract, posterior cortex		29	3.4%	8	2.5%
100.303	punctate cataract, equatorial cortex		5	0.6%	3	0.9%
100.304	punctate cataract, anterior sutures		1	0.1%	0	
100.305	punctate cataract, posterior sutures		2	0.2%	1	0.3%
100.306	punctate cataract, nucleus		2	0.2%	0	
100.307	punctate cataract, capsular		5	0.6%	3	0.9%
100.311	incipient cataract, anterior cortex		12	1.4%	2	0.6%
100.312	incipient cataract, posterior cortex		64	7.4%	18	5.5%
100.313	incipient cataract, equatorial cortex		9	1.0%	0	
100.315	incipient cataract, posterior sutures		4	0.5%	1	0.3%
100.316	incipient cataract, nucleus		4	0.5%	0	
100.317	incipient cataract, capsular		10	1.2%	1	0.3%
100.322	incomplete cataract, posterior cortex		0		4	1.2%
100.330	generalized/complete cataract		9	1.0%	0	
100.375	subluxation/luxation, unspecified		1	0.1%	0	
100.999	*significant cataracts (summary)*		*159*	*18.4%*	*43*	*13.2%*
VITREOUS						
110.120	persistent hyaloid artery/remnant		1	0.1%	0	
110.200	vitritis		0		1	0.3%
110.320	vitreal degeneration		4	0.5%	4	1.2%
RETINA						
120.170	retinal dysplasia, folds		24	2.8%	6	1.8%
120.180	retinal dysplasia, geographic		6	0.7%	1	0.3%
120.190	retinal dysplasia, detached		1	0.1%	0	
120.310	generalized progressive retinal atrophy (PRA)		30	3.5%	0	
120.960	retinopathy		2	0.2%	0	

	1991-2013		2014-2018	
OPTIC NERVE				
130.110 micropapilla	2	0.2%	0	
130.120 optic nerve hypoplasia	1	0.1%	0	
OTHER				
900.000 other, unspecified	20	2.3%	0	
900.100 other, not inherited	39	4.5%	31	9.5%
900.110 other. suspect not inherited/significance unknown	8	0.9%	5	1.5%
NORMAL				
0.000 normal globe	647	75.0%	222	68.3%

OCULAR DISORDERS REPORT
EPAGNEUL BRETON

There are insufficient breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the EPAGNEUL BRETON breed. Therefore, there are no conditions listed with breeding advice.

OCULAR DISORDERS REPORT
EPAGNEUL BRETON

Diagnostic Name		1991-2013 TOTAL DOGS EXAMINED 0 #	 %	2014-2018 21 #	 %
UVEA					
93.710	persistent pupillary membranes, iris to iris	0		2	9.5%
LENS					
100.311	incipient cataract, anterior cortex	0		1	4.8%
100.313	incipient cataract, equatorial cortex	0		1	4.8%
100.328	posterior suture tip opacities	0		1	4.8%
100.999	*significant cataracts (summary)*	*0*		*2*	*9.5%*
OTHER					
900.100	other, not inherited	0		2	9.5%
NORMAL					
0.000	normal globe	0		16	76.2%

OCULAR DISORDERS REPORT
ESTRELA MOUNTAIN DOG

There are insufficient breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the ESTRELA MOUNTAIN DOG breed. Therefore, there are no conditions listed with breeding advice.

OCULAR DISORDERS REPORT
ESTRELA MOUNTAIN DOG

Diagnostic Name	TOTAL DOGS EXAMINED	1991-2013 3 # %	2014-2018 0 # %
NORMAL			
0.000 normal globe		3 100.0%	0

EURASIER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Glaucoma	Not defined	1, 2	NO
B.	Distichiasis	Not defined	3	Breeder option

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Glaucoma

Glaucoma is characterized by an elevation of intraocular pressure which, when sustained even for a brief period of time, causes intraocular damage resulting in blindness. The elevated intraocular pressure occurs because the fluid cannot leave through the iridocorneal angle. Diagnosis and classification of glaucoma requires measurement of IOP (tonometry) and examination of the iridocorneal angle (gonioscopy). Neither of these tests is part of a routine breed eye screening examination.

References

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2. Rosolen SG, Boillot T, Dulaurent T, et al. Morphological, biometrical and biochemical susceptibilities for glaucoma in a healthy Eurasier dog - ECVO 2014 abstract #44. *Vet Ophthalmol*. 2014;17:E23.

3. ACVO Genetics Committee, 2006 and/or Data from CERF All-Breeds Report, 2001-2005

OCULAR DISORDERS REPORT
EURASIER

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2013 86 #	%	2014-2018 56 #	%
EYELIDS						
25.110	distichiasis		31	36.0%	13	23.2%
CORNEA						
70.700	corneal dystrophy		2	2.3%	2	3.6%
UVEA						
93.710	persistent pupillary membranes, iris to iris		1	1.2%	3	5.4%
93.750	persistent pupillary membranes, lens pigment foci/no strands		0		2	3.6%
LENS						
100.210	cataract. suspect not inherited/significance unknown		4	4.7%	4	7.1%
100.301	punctate cataract, anterior cortex		0		1	1.8%
100.302	punctate cataract, posterior cortex		0		2	3.6%
100.305	punctate cataract, posterior sutures		0		2	3.6%
100.307	punctate cataract, capsular		0		1	1.8%
100.312	incipient cataract, posterior cortex		0		1	1.8%
100.315	incipient cataract, posterior sutures		0		1	1.8%
100.328	posterior suture tip opacities		0		2	3.6%
100.999	*significant cataracts (summary)*		*0*		*8*	*14.3%*
VITREOUS						
110.120	persistent hyaloid artery/remnant		0		1	1.8%
110.320	vitreal degeneration		0		1	1.8%
OPTIC NERVE						
130.110	micropapilla		0		1	1.8%
OTHER						
900.000	other, unspecified		5	5.8%	0	
900.100	other, not inherited		5	5.8%	2	3.6%
900.110	other. suspect not inherited/significance unknown		2	2.3%	0	
NORMAL						
0.000	normal globe		56	65.1%	28	50.0%

FIELD SPANIEL

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Entropion	Not defined	1	Breeder option	
B.	Ectropion	Not defined	1	Breeder option	
C.	Eury/Macroblepharon	Not defined	2	Breeder option	
D.	Distichiasis	Not defined	3	Breeder option	
E.	Imperforate lacrimal punctum	Not defined	4	Breeder option	
F.	Corneal dystrophy - epithelial/stromal	Not defined	5	Breeder option	
G.	Persistent pupillary membranes - iris to iris - lens pigment foci/no strands	 Not defined Not defined	 6, 7 8	 Breeder option Passes with no notation	
H.	Cataract	Not defined	3	NO	
I.	Progressive retinal atrophy – generalized (*prcd)*	Autosomal recessive	9	NO	Mutation in the *prcd* gene
J.	Retinal dysplasia - folds	Not defined	3	Breeder option	

Description and Comments

A. Entropion

A conformational defect resulting in an "in-rolling" of one or both of the eyelids which may cause ocular irritation. It is likely that entropion is influenced by several genes (polygenic), defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull. Selection should be directed against entropion and toward a head conformation that reduces or eliminates the likelihood of the defect.

B. Ectropion

A conformational defect resulting in eversion of the eyelid(s), which may cause ocular irritation due to exposure. It is likely that ectropion is influenced by several genes (polygenic) defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents and the conformation of the skull.

C. Eury/Macroblepharon

Defined as an exceptionally large palpebral fissure, macroblepharon in conjunction with laxity of the lateral canthal structures may lead to lower lid ectropion and upper lid entropion. Either of these conditions may lead to severe ocular irritation. This condition is no longer listed on the CAER form. Please mark other conditions suspected as inherited and describe in the comments section.

D. Distichiasis

Eyelashes abnormally located on the eyelid margin, which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established, although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

E. Imperforate lacrimal punctum

A developmental anomaly resulting in failure of opening of the lacrimal duct located at the medial lid margins. The lower punctum is more frequently affected. This defect usually results in epiphora, an overflow of tears onto the face.

F. Corneal dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

G. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

H. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane,

persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

I. Retinal atrophy - generalized (*prcd*)

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

Studies have shown that the principal form of PRA in the Field Spaniel is *prcd* which is a late-onset form of PRA inherited as autosomal recessive. The mutation is allelic to that present in Miniature Poodles, Labrador Retrievers, English and American Cocker Spaniels, and others. The locus is termed the progressive rod-cone degeneration (*prcd*) gene and at least 30+ breeds are affected. In most affected dogs to date, the disease is recognized clinically in dogs 3-6 years of age or older. This photoreceptor degeneration is characterized by slow death of visual cells following their normal development. The disease begins clinically with signs of night blindness followed by day blindness. A DNA test is available.

J. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Field Spaniel breed. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 2007 and/or Data from CERF All-Breeds Report, 2002-2006.

2. ACVO Genetics Committee, 2006 and/or Data from CERF All-Breeds Report, 2001-2005.

3. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

4. ACVO Genetics Committee 2018 and/or Data from OFA All-Breeds Report 2013-2017.

5. ACVO Genetics Committee, 2015 and Data from OFA All-Breeds Report, 2014-2015.

6. ACVO Genetics Committee, 2002-2003 and/or Data from CERF All-Breeds Report, 2002-2003.

7. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

8. ACVO Genetics Committee, 2017 and/or Data from CERF/OFA All-Breeds Report, 2010-2016.

9. ACVO Genetics Committee, 2018 and/or Data from OFA All-Breeds Report, 2013-2017.

OCULAR DISORDERS REPORT
FIELD SPANIEL

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2013 2094 #	%	2014-2018 806 #	%
GLOBE						
0.110	microphthalmia		0		1	0.1%
EYELIDS						
20.160	macropalpebral fissure		6	0.3%	0	
21.000	entropion, unspecified		10	0.5%	0	
22.000	ectropion, unspecified		10	0.5%	1	0.1%
25.110	distichiasis		143	6.8%	32	4.0%
NASOLACRIMAL						
32.110	imperforate lower nasolacrimal punctum		3	0.1%	11	1.4%
NICTITANS						
52.110	prolapsed gland of the third eyelid		1	0.0%	0	
CORNEA						
70.220	pigmentary keratitis		1	0.0%	0	
70.700	corneal dystrophy		10	0.5%	24	3.0%
70.730	corneal endothelial degeneration		1	0.0%	0	
UVEA						
93.710	persistent pupillary membranes, iris to iris		119	5.7%	80	9.9%
93.720	persistent pupillary membranes, iris to lens		6	0.3%	0	
93.730	persistent pupillary membranes, iris to cornea		7	0.3%	1	0.1%
93.750	persistent pupillary membranes, lens pigment foci/no strands		8	0.4%	26	3.2%
93.760	persistent pupillary membranes, endothelial opacity/no strands		3	0.1%	3	0.4%
LENS						
100.200	cataract, unspecified		3	0.1%	0	
100.210	cataract. suspect not inherited/significance unknown		106	5.1%	34	4.2%
100.301	punctate cataract, anterior cortex		13	0.6%	6	0.7%
100.302	punctate cataract, posterior cortex		3	0.1%	0	
100.304	punctate cataract, anterior sutures		2	0.1%	0	
100.305	punctate cataract, posterior sutures		1	0.0%	0	
100.306	punctate cataract, nucleus		1	0.0%	1	0.1%
100.307	punctate cataract, capsular		7	0.3%	1	0.1%
100.311	incipient cataract, anterior cortex		13	0.6%	4	0.5%
100.312	incipient cataract, posterior cortex		5	0.2%	3	0.4%
100.313	incipient cataract, equatorial cortex		1	0.0%	0	
100.314	incipient cataract, anterior sutures		2	0.1%	1	0.1%
100.315	incipient cataract, posterior sutures		4	0.2%	1	0.1%
100.316	incipient cataract, nucleus		7	0.3%	1	0.1%
100.317	incipient cataract, capsular		3	0.1%	2	0.2%
100.321	incomplete cataract, anterior cortex		0		1	0.1%
100.322	incomplete cataract, posterior cortex		0		1	0.1%
100.328	posterior suture tip opacities		1	0.0%	8	1.0%
100.330	generalized/complete cataract		2	0.1%	1	0.1%
100.999	*significant cataracts (summary)*		*67*	*3.2%*	*23*	*2.9%*

		1991-2013		2014-2018	
VITREOUS					
110.120	persistent hyaloid artery/remnant	2	0.1%	2	0.2%
110.135	PHPV/PTVL	2	0.1%	2	0.2%
110.200	vitritis	0		3	0.4%
110.320	vitreal degeneration	0		3	0.4%
FUNDUS					
97.120	coloboma	1	0.0%	0	
RETINA					
120.170	retinal dysplasia, folds	219	10.5%	68	8.4%
120.180	retinal dysplasia, geographic	9	0.4%	3	0.4%
120.190	retinal dysplasia, detached	0		1	0.1%
120.310	generalized progressive retinal atrophy (PRA)	3	0.1%	2	0.2%
120.400	retinal hemorrhage	4	0.2%	0	
120.910	retinal detachment without dialysis	1	0.0%	0	
120.960	retinopathy	0		1	0.1%
OPTIC NERVE					
130.110	micropapilla	0		3	0.4%
130.120	optic nerve hypoplasia	0		1	0.1%
130.150	optic disc coloboma	0		2	0.2%
OTHER					
900.000	other, unspecified	47	2.2%	0	
900.100	other, not inherited	72	3.4%	62	7.7%
900.110	other. suspect not inherited/significance unknown	9	0.4%	2	0.2%
NORMAL					
0.000	normal globe	1573	75.1%	508	63.0%

OCULAR DISORDERS REPORT
FILA BRASILEIRO

There are insufficient breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the FILA BRASILEIRO breed. Therefore, there are no conditions listed with breeding advice.

OCULAR DISORDERS REPORT
FILA BRASILEIRO

Diagnostic Name	TOTAL DOGS EXAMINED	1991-2013 4 # %	2014-2018 0 # %
OTHER			
900.000	other, unspecified	1 25.0%	0
NORMAL			
0.000	normal globe	4 100.0%	0

FINNISH LAPPHUND

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Persistent pupillary membranes				
	- iris to iris	Not defined	1	Breeder option	
	- iris to cornea	Not defined	2	NO	
B.	Cataract	Not defined	3	NO	
C.	Retinal atrophy - generalized (*prcd)*	Autosomal recessive	1, 4	NO	Mutation in the *prcd* gene
D.	Multifocal retinopathy - *cmr3*	Autosomal recessive	2	NO	Mutation in the *BEST1* gene
E.	Retinal dysplasia - folds	Not defined	2	Breeder option	

Description and Comments

A. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

B. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

C. Retinal atrophy - generalized

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

Studies have shown that the form of PRA in the Finnish Lapphund is *prcd* which is a late-onset form of PRA inherited as autosomal recessive. The mutation is allelic to that present in Miniature Poodles, Labrador Retrievers, English and American Cocker Spaniels and others. The locus is termed the progressive rod-cone degeneration (*prcd*) gene and at least 30+ breeds are affected. In most affected dogs to date, the disease is recognized clinically in dogs 3-6 years of age or older. This photoreceptor degeneration is characterized by slow death of visual cells following their normal development. The disease begins clinically with signs of night blindness followed by day blindness. A DNA test is available.

D. Multifocal retinopathy (*cmr3*)

Canine Multifocal Retinopathy type 3 (*cmr3*) is characterized by numerous distinct (i.e. multifocal), roughly circular patches of elevated retina (multifocal bullous retinal detachments). There may be a serous subretinal fluid, or accumulation of subretinal material that produces gray-tan-pink colored lesions. These lesions, looking somewhat like blisters, vary in location and size, although typically they are present in both eyes of the affected dog.

The disease generally develops in young dogs between 11-20 weeks of age and there is minimal progression after 1 year of age. The lesions may flatten, leaving areas of retinal thinning and RPE hypertrophy, hyperplasia, and pigmentation. Discrete areas of tapetal hyper-reflectivity may be seen in areas of previous retinal and RPE detachments. Most dogs exhibit no noticeable problem with vision or electroretinographic abnormalities despite their abnormal appearing retinas.

Clinically the disease is similar to that seen in the Bullmastiff and Coton deTulear, but the mutation in the Bestrophin 1 gene (*BEST1* alias *VMD2*) is different. The multifocal retinopathy seen in the Lapponian Herder is caused by a deletion at position 1,388 and a substitution at position 1,466 and is therefore called *cmr3*. A DNA test is available.

E. Retinal Dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and the more severe forms of retinal dysplasia is undetermined.

References

1. ACVO Genetics Committee, 2006 and/or Data from CERF All-Breeds Report, 2001-2005.

2. ACVO Genetics Committee, 2016 and/or Data from CERF/OFA All-Breeds Report, 2010-2015.

3. ACVO Genetics Committee, 2011 and/or Data from CERF All-Breeds Report, 2009.

4. Zangerl B, Goldstein O, Philp AR, et al. Identical mutation in a novel retinal gene causes progressive rod-cone degeneration in dogs and retinitis pigmentosa in humans. *Genomics*. 2006 Nov;88:551-563.

OCULAR DISORDERS REPORT
FINNISH LAPPHUND

Diagnostic Name		1991-2013 TOTAL DOGS EXAMINED 420 #	 %	2014-2018 195 #	 %
EYELIDS					
25.110	distichiasis	1	0.2%	0	
CORNEA					
70.220	pigmentary keratitis	1	0.2%	0	
UVEA					
93.710	persistent pupillary membranes, iris to iris	44	10.5%	18	9.2%
93.720	persistent pupillary membranes, iris to lens	1	0.2%	0	
93.730	persistent pupillary membranes, iris to cornea	6	1.4%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	1	0.2%	3	1.5%
LENS					
100.210	cataract. suspect not inherited/significance unknown	27	6.4%	14	7.2%
100.301	punctate cataract, anterior cortex	0		1	0.5%
100.302	punctate cataract, posterior cortex	5	1.2%	2	1.0%
100.305	punctate cataract, posterior sutures	2	0.5%	1	0.5%
100.306	punctate cataract, nucleus	2	0.5%	0	
100.307	punctate cataract, capsular	0		2	1.0%
100.311	incipient cataract, anterior cortex	1	0.2%	0	
100.312	incipient cataract, posterior cortex	1	0.2%	0	
100.313	incipient cataract, equatorial cortex	1	0.2%	1	0.5%
100.328	posterior suture tip opacities	0		1	0.5%
100.330	generalized/complete cataract	1	0.2%	0	
100.999	*significant cataracts (summary)*	*13*	*3.1%*	*7*	*3.6%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	0		1	0.5%
RETINA					
120.170	retinal dysplasia, folds	8	1.9%	2	1.0%
120.310	generalized progressive retinal atrophy (PRA)	0		1	0.5%
120.960	retinopathy	0		1	0.5%
OTHER					
900.000	other, unspecified	10	2.4%	0	
900.100	other, not inherited	13	3.1%	6	3.1%
900.110	other. suspect not inherited/significance unknown	4	1.0%	1	0.5%
NORMAL					
0.000	normal globe	351	83.6%	148	75.9%

FINNISH SPITZ

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Cataract	Not defined	1	NO

Description and Comments

A. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Finnish Spitz breed. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

OCULAR DISORDERS REPORT
FINNISH SPITZ

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2013 242 #	 %	2014-2018 12 #	 %
EYELIDS						
20.140	ectopic cilia		1	0.4%	0	
CORNEA						
70.700	corneal dystrophy		2	0.8%	0	
UVEA						
93.710	persistent pupillary membranes, iris to iris		2	0.8%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands		1	0.4%	4	33.3%
LENS						
100.200	cataract, unspecified		1	0.4%	0	
100.210	cataract. suspect not inherited/significance unknown		33	13.6%	0	
100.301	punctate cataract, anterior cortex		2	0.8%	0	
100.302	punctate cataract, posterior cortex		1	0.4%	0	
100.304	punctate cataract, anterior sutures		1	0.4%	0	
100.307	punctate cataract, capsular		2	0.8%	0	
100.311	incipient cataract, anterior cortex		1	0.4%	0	
100.312	incipient cataract, posterior cortex		1	0.4%	0	
100.999	*significant cataracts (summary)*		*9*	*3.7%*	*0*	
VITREOUS						
110.120	persistent hyaloid artery/remnant		4	1.7%	0	
110.320	vitreal degeneration		3	1.2%	0	
RETINA						
120.170	retinal dysplasia, folds		2	0.8%	0	
120.310	generalized progressive retinal atrophy (PRA)		6	2.5%	0	
OTHER						
900.000	other, unspecified		3	1.2%	0	
900.100	other, not inherited		8	3.3%	0	
900.110	other. suspect not inherited/significance unknown		2	0.8%	0	
NORMAL						
0.000	normal globe		191	78.9%	8	66.7%

FLAT-COATED RETRIEVER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Glaucoma	Not defined	1, 2, 7	NO
B.	Distichiasis	Not defined	3	Breeder option
C.	Corneal dystrophy - epithelial/stromal	Not defined	4	Breeder option
D.	Persistent pupillary membranes			
	- iris to iris	Not defined	4	Breeder option
	- lens pigment foci/no strands	Not defined	5	Passes with no notation
E.	Cataract	Not defined	3	NO
F.	Retinopathy	Not defined	6	Breeder Option

Description and Comments

A. Glaucoma (with pectinate ligament abnormality)

Glaucoma is characterized by an elevation of intraocular pressure (IOP) which, when sustained, causes intraocular damage resulting in blindness. The elevated IOP occurs because the fluid cannot leave through the iridocorneal angle. Diagnosis and classification of glaucoma requires measurement of the intraocular pressure (tonometry) and examination of the iridocorneal angle (gonioscopy). Neither of these tests are part of a routine breed eye screening exam.

Flat-Coated Retrievers have been shown to have a higher prevalence of pectinate ligament abnormalities compared with other breeds. There is a significant association between pectinate ligament abnormalities and glaucoma in this breed. The heritability of pectinate ligament abnormalities in Flat-Coated Retrievers is estimated at 0.7. Since glaucoma and pectinate ligament abnormalities are closely associated, glaucoma may also be heritable.

In a recent report, pectinate ligament abnormalities were prevalent and significantly associated with age in a population of Flat-Coated Retrievers in the UK.

Due to the incidence of PLD in the breed and the increased progression observed with age, it may be prudent to perform repeated gonioscopy examinations over time.

B. Distichiasis

Eyelashes abnormally located on the eyelid margin, which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established, although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

C. Corneal Dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

D. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore is not noted on the certificate.

E. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region. The exact frequency and significance of cataracts in the breed is not known.

F. Retinopathy

Patchy focal unilateral or bilateral hyper reflective tapetal lesions most frequently peripheral but occasionally central around a pigmented spot, usually non progressive. Not usually present prior to 3 months of age but usually present by 18 months of age.

References

1. Read RA, Wood JL, Lakhani KH, Read RA. Pectinate ligament dysplasia (PLD) and glaucoma in Flat-Coated Retrievers. I. Objectives, technique and results of a PLD survey. *Vet Ophthalmol*. 1998;1:85-90.

2. Read RA, Wood JL, Lakhani KH, Read RA. Pectinate ligament dysplasia (PLD) and glaucoma in Flat-Coated Retrievers. II. Assessment of prevalence and heritability. *Vet Ophthalmol.* 1998;1:91-99.

3. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

4. ACVO Genetics Committee, 2002-2003 and/or Data from CERF All-Breeds Report, 2002-2003.

5. ACVO Genetics Committee, 2017 and/or Data from CERF/OFA All-Breeds Report, 2010-2016.

6. ACVO Genetics Committee, 2014-2015 and/or Data from OFA All-Breeds Report, 2014-2015.

7. Oliver JA, Ekiri A, Mellersh CS. Prevalence of pectinate ligament dysplasia and associations with age, sex and intraocular pressure in the Basset Hound, Flat-Coated Retriever and Dandie Dinmont Terrier. Can Genet Epidemiol 2016 March 12;3:1doi: 10.1186/s40575-016-0033-1.

OCULAR DISORDERS REPORT
FLAT-COATED RETRIEVER

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2013 7825 #	%	2014-2018 2096 #	%
GLOBE						
0.110	microphthalmia		2	0.0%	1	0.0%
10.000	glaucoma		2	0.0%	0	
EYELIDS						
20.140	ectopic cilia		8	0.1%	1	0.0%
20.160	macropalpebral fissure		2	0.0%	0	
21.000	entropion, unspecified		15	0.2%	5	0.2%
22.000	ectropion, unspecified		32	0.4%	3	0.1%
25.110	distichiasis		989	12.6%	266	12.7%
NICTITANS						
50.210	pannus of third eyelid		1	0.0%	0	
52.110	prolapsed gland of the third eyelid		4	0.1%	0	
CORNEA						
70.220	pigmentary keratitis		2	0.0%	0	
70.700	corneal dystrophy		45	0.6%	12	0.6%
70.730	corneal endothelial degeneration		4	0.1%	0	
UVEA						
93.110	iris hypoplasia		2	0.0%	0	
93.140	corneal endothelial pigment without PPM		1	0.0%	0	
93.710	persistent pupillary membranes, iris to iris		175	2.2%	89	4.2%
93.720	persistent pupillary membranes, iris to lens		14	0.2%	0	
93.740	persistent pupillary membranes, iris sheets		3	0.0%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands		28	0.4%	71	3.4%
93.760	persistent pupillary membranes, endothelial opacity/no strands		5	0.1%	0	
93.810	uveal melanoma		1	0.0%	3	0.1%
93.999	uveal cysts		27	0.3%	5	0.2%
LENS						
100.200	cataract, unspecified		16	0.2%	0	
100.210	cataract. suspect not inherited/significance unknown		839	10.7%	328	15.6%
100.301	punctate cataract, anterior cortex		67	0.9%	20	1.0%
100.302	punctate cataract, posterior cortex		15	0.2%	5	0.2%
100.303	punctate cataract, equatorial cortex		6	0.1%	4	0.2%
100.304	punctate cataract, anterior sutures		23	0.3%	5	0.2%
100.305	punctate cataract, posterior sutures		13	0.2%	10	0.5%
100.306	punctate cataract, nucleus		10	0.1%	1	0.0%
100.307	punctate cataract, capsular		8	0.1%	8	0.4%
100.311	incipient cataract, anterior cortex		35	0.4%	13	0.6%
100.312	incipient cataract, posterior cortex		19	0.2%	5	0.2%
100.313	incipient cataract, equatorial cortex		16	0.2%	5	0.2%
100.314	incipient cataract, anterior sutures		6	0.1%	2	0.1%
100.315	incipient cataract, posterior sutures		9	0.1%	1	0.0%
100.316	incipient cataract, nucleus		5	0.1%	2	0.1%
100.317	incipient cataract, capsular		3	0.0%	2	0.1%
100.321	incomplete cataract, anterior cortex		0		1	0.0%
100.323	incomplete cataract, equatorial cortex		1	0.0%	0	

LENS CONTINUED		1991-2013		2014-2018	
100.326	incomplete cataract, nucleus	0		1	0.0%
100.328	posterior suture tip opacities	7	0.1%	62	3.0%
100.330	generalized/complete cataract	6	0.1%	2	0.1%
100.375	subluxation/luxation, unspecified	3	0.0%	0	
100.999	*significant cataracts (summary)*	*258*	*3.3%*	*87*	*4.2%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	11	0.1%	6	0.3%
110.135	PHPV/PTVL	5	0.1%	0	
110.200	vitritis	0		2	0.1%
110.320	vitreal degeneration	1	0.0%	1	0.0%
FUNDUS					
97.110	choroidal hypoplasia	1	0.0%	0	
97.120	coloboma	1	0.0%	0	
RETINA					
120.170	retinal dysplasia, folds	17	0.2%	6	0.3%
120.180	retinal dysplasia, geographic	11	0.1%	2	0.1%
120.190	retinal dysplasia, detached	0		1	0.0%
120.310	generalized progressive retinal atrophy (PRA)	49	0.6%	6	0.3%
120.910	retinal detachment without dialysis	1	0.0%	0	
120.920	retinal detachment with dialysis	0		3	0.1%
120.960	retinopathy	3	0.0%	20	1.0%
OPTIC NERVE					
130.110	micropapilla	5	0.1%	3	0.1%
130.120	optic nerve hypoplasia	3	0.0%	0	
130.150	optic disc coloboma	20	0.3%	6	0.3%
OTHER					
900.000	other, unspecified	160	2.0%	0	
900.100	other, not inherited	291	3.7%	170	8.1%
900.110	other. suspect not inherited/significance unknown	56	0.7%	8	0.4%
NORMAL					
0.000	normal globe	6058	77.4%	1238	59.1%

FRENCH BULLDOG

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Entropion	Not defined	1	Breeder option	
B.	Distichiasis	Not defined	2	Breeder option	
C.	Imperforate lacrimal punctum	Not defined	3	Breeder option	
D.	Prolapsed gland of the third eyelid	Not defined	4	Breeder option	
E.	Corneal dystrophy - epithelial/stromal	Not defined	5	Breeder option	
F.	Exposure/Pigmentary keratitis	Not defined	6	Breeder option	
G.	Persistent pupillary membranes				
	- iris to iris	Not defined	1, 7	Breeder option	
	- iris to cornea	Not defined	8	NO	
	- endothelial opacity/no strands	Not defined	8, 9	NO	
H.	Cataract	Autosomal recessive	2, 10	NO	Mutation in the *HSF4* gene
I.	Retinal dysplasia - folds	Not defined	2	Breeder option	

Description and Comments

A. Entropion

A conformational defect resulting in an "in-rolling" of one or both of the eyelids which may cause ocular irritation. It is likely that entropion is influenced by several genes (polygenic), defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

B. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of the dog. It is difficult to make a strong recommendation with regards to breeding dogs with this entity. The hereditary basis has not

been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded and breeding discretion is advised.

C. Imperforate lacrimal punctum

A developmental anomaly resulting in failure of opening of the lacrimal duct located at the medial lid margins. The lower punctum is more frequently affected. This defect usually results in epiphora, an overflow of tears onto the face.

D. Prolapsed gland of the third eyelid

Protrusion of the tear gland associated with the third eyelid. The mode of inheritance of this disorder is unknown. The exposed gland may become irritated. Commonly referred to as "cherry eye."

French Bulldogs were overrepresented in a study of prolapsed gland of the third eyelid. In the study, 100% of the prolapsed glands in French Bulldogs occurred before 1 year of age. French Bulldogs were also more likely to develop bilateral prolapsed glands that occurred either simultaneously with the first prolapse or with a short time interval between prolapses.

E. Corneal dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

F. Exposure/Pigmentary keratitis

A condition characterized by variable degrees of superficial vascularization, fibrosis and/or pigmentation of the cornea. May be associated with excessive exposure/irritation of the globe due to shallow orbits, lower eyelid medial entropion, lagophthalmos and macropalpebral fissure.

G. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

H. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

In the French Bulldog, the condition is inherited as an autosomal recessive mutation in the *HSF4* gene (*HSF4-1*). A DNA test is available.

I. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

References

1. ACVO Genetics Committee, 2003-2004 and/or Data from CERF All-Breeds Report, 2005.

2. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

3. ACVO Genetics Committee, 2016 and/or Data from CERF/OFA All-Breeds Report, 2010-2015.

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OCULAR DISORDERS REPORT
FRENCH BULLDOG

		1991-2013		2014-2018	
	TOTAL DOGS EXAMINED	3168		2056	
Diagnostic Name		#	%	#	%
GLOBE					
0.110	microphthalmia	1	0.0%	1	0.0%
EYELIDS					
20.140	ectopic cilia	1	0.0%	0	
20.160	macropalpebral fissure	3	0.1%	0	
21.000	entropion, unspecified	36	1.1%	14	0.7%
22.000	ectropion, unspecified	5	0.2%	3	0.1%
25.110	distichiasis	223	7.0%	114	5.5%
NASOLACRIMAL					
32.110	imperforate lower nasolacrimal punctum	8	0.3%	50	2.4%
40.910	keratoconjunctivitis sicca	1	0.0%	3	0.1%
NICTITANS					
50.210	pannus of third eyelid	1	0.0%	1	0.0%
52.110	prolapsed gland of the third eyelid	6	0.2%	2	0.1%
CORNEA					
70.210	corneal pannus	4	0.1%	0	
70.220	pigmentary keratitis	14	0.4%	15	0.7%
70.700	corneal dystrophy	24	0.8%	17	0.8%
70.730	corneal endothelial degeneration	5	0.2%	2	0.1%
UVEA					
93.150	iris coloboma	1	0.0%	0	
93.710	persistent pupillary membranes, iris to iris	71	2.2%	64	3.1%
93.720	persistent pupillary membranes, iris to lens	5	0.2%	2	0.1%
93.730	persistent pupillary membranes, iris to cornea	46	1.5%	24	1.2%
93.740	persistent pupillary membranes, iris sheets	3	0.1%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	4	0.1%	7	0.3%
93.760	persistent pupillary membranes, endothelial opacity/no strands	23	0.7%	39	1.9%
93.810	uveal melanoma	0		2	0.1%
93.999	uveal cysts	9	0.3%	1	0.0%
97.150	chorioretinal coloboma, congenital	0		1	0.0%
LENS					
100.210	cataract. suspect not inherited/significance unknown	74	2.3%	42	2.0%
100.301	punctate cataract, anterior cortex	8	0.3%	7	0.3%
100.302	punctate cataract, posterior cortex	3	0.1%	3	0.1%
100.303	punctate cataract, equatorial cortex	5	0.2%	5	0.2%
100.305	punctate cataract, posterior sutures	2	0.1%	1	0.0%
100.306	punctate cataract, nucleus	2	0.1%	5	0.2%
100.307	punctate cataract, capsular	1	0.0%	1	0.0%
100.311	incipient cataract, anterior cortex	34	1.1%	12	0.6%
100.312	incipient cataract, posterior cortex	14	0.4%	1	0.0%
100.313	incipient cataract, equatorial cortex	12	0.4%	8	0.4%
100.314	incipient cataract, anterior sutures	3	0.1%	0	
100.315	incipient cataract, posterior sutures	4	0.1%	0	
100.316	incipient cataract, nucleus	7	0.2%	8	0.4%

LENS CONTINUED		1991-2013		2014-2018	
100.317	incipient cataract, capsular	5	0.2%	5	0.2%
100.321	incomplete cataract, anterior cortex	1	0.0%	2	0.1%
100.322	incomplete cataract, posterior cortex	0		2	0.1%
100.323	incomplete cataract, equatorial cortex	0		1	0.0%
100.326	incomplete cataract, nucleus	0		4	0.2%
100.328	posterior suture tip opacities	0		2	0.1%
100.330	generalized/complete cataract	18	0.6%	1	0.0%
100.999	*significant cataracts (summary)*	*119*	*3.8%*	*66*	*3.2%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	10	0.3%	19	0.9%
110.135	PHPV/PTVL	1	0.0%	0	
110.320	vitreal degeneration	7	0.2%	6	0.3%
RETINA					
120.170	retinal dysplasia, folds	73	2.3%	45	2.2%
120.180	retinal dysplasia, geographic	8	0.3%	7	0.3%
120.310	generalized progressive retinal atrophy (PRA)	1	0.0%	0	
120.400	retinal hemorrhage	1	0.0%	0	
120.910	retinal detachment without dialysis	1	0.0%	0	
120.920	retinal detachment with dialysis	0		1	0.0%
120.960	retinopathy	2	0.1%	0	
OPTIC NERVE					
130.110	micropapilla	0		1	0.0%
OTHER					
900.000	other, unspecified	65	2.1%	0	
900.100	other, not inherited	100	3.2%	86	4.2%
900.110	other. suspect not inherited/significance unknown	11	0.3%	9	0.4%
NORMAL					
0.000	normal globe	2652	83.7%	1537	74.8%

OCULAR DISORDERS REPORT
FRENCH POINTER

There are insufficient breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the FRENCH POINTER breed. Therefore, there are no conditions listed with breeding advice.

OCULAR DISORDERS REPORT
FRENCH POINTER

Diagnostic Name	TOTAL DOGS EXAMINED	1991-2013 0 #	%	2014-2018 2 #	%
LENS					
100.328 posterior suture tip opacities		0		1	50.0%
NORMAL					
0.000 normal globe		0		1	50.0%

OCULAR DISORDERS REPORT
FRENCH SPANIEL

There are insufficient breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the FRENCH SPANIEL breed. Therefore, there are no conditions listed with breeding advice.

OCULAR DISORDERS REPORT
FRENCH SPANIEL

Diagnostic Name	TOTAL DOGS EXAMINED	1991-2013 2 #	%	2014-2018 0 #	%
GLOBE					
0.110	microphthalmia	1	50.0%	0	
UVEA					
93.720	persistent pupillary membranes, iris to lens	1	50.0%	0	
LENS					
100.301	punctate cataract, anterior cortex	1	50.0%	0	
100.302	punctate cataract, posterior cortex	1	50.0%	0	
100.303	punctate cataract, equatorial cortex	1	50.0%	0	
100.306	punctate cataract, nucleus	1	50.0%	0	
100.307	punctate cataract, capsular	1	50.0%	0	
100.999	*significant cataracts (summary)*	*5*	*250.0%*	*0*	
VITREOUS					
110.320	vitreal degeneration	1	50.0%	0	
OTHER					
900.000	other, unspecified	3	150.0%	0	

OCULAR DISORDERS REPORT
GERMAN LONGHAIRED POINTER

There are insufficient breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the GERMAN LONGHAIRED POINTER breed. Therefore, there are no conditions listed with breeding advice.

OCULAR DISORDERS REPORT
GERMAN LONGHAIRED POINTER

Diagnostic Name		1991-2013 TOTAL DOGS EXAMINED 7 #	 %	2014-2018 23 #	 %
EYELIDS					
21.000	entropion, unspecified	0		1	4.3%
UVEA					
93.710	persistent pupillary membranes, iris to iris	1	14.3%	1	4.3%
93.750	persistent pupillary membranes, lens pigment foci/no strands	1	14.3%	1	4.3%
93.999	uveal cysts	1	14.3%	0	
LENS					
100.302	punctate cataract, posterior cortex	0		1	4.3%
100.305	punctate cataract, posterior sutures	0		1	4.3%
100.311	incipient cataract, anterior cortex	0		1	4.3%
100.312	incipient cataract, posterior cortex	0		1	4.3%
100.999	*significant cataracts (summary)*	*0*		*4*	*17.4%*
VITREOUS					
110.320	vitreal degeneration	0		1	4.3%
OTHER					
900.000	other, unspecified	1	14.3%	0	
NORMAL					
0.000	normal globe	5	71.4%	17	73.9%

GERMAN PINSCHER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Corneal dystrophy - epithelial/stromal	Not defined	1	Breeder option
B.	Persistent pupillary membranes			
	- iris to lens	Not defined	2	NO
	- lens pigment foci/no strands	Not defined	3	Passes with no notation
C.	Cataract	Not defined	1, 4-6	NO
D.	Persistent hyperplastic tunica vasculosa lentis (PHTVL)	Not defined	5, 6	NO
E.	Vitreous degeneration	Not defined	4	Breeder option
F.	Optic nerve hypoplasia	Not defined	7, 8	NO
G.	Micropapilla	Not defined	7, 8	Breeder option

Description and Comments

A. Corneal dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

B. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

C. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes

of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

There may be more than one type of inherited cataract in German Pinschers. One form is reported in Finland with a later age of onset in which a pedigree analysis suggested autosomal recessive or incomplete dominant inheritance (4). Another form is reported in Germany with an earlier age of onset in which a pedigree analysis suggested autosomal recessive inheritance (5). Cataracts may involve the lens completely (diffuse) or in a localized region.

D. Persistent hyperplastic tunica vasculosa lentis (PHTVL)

Persistent tunica vasculosa lentis results from the failure of regression of the embryologic vascular network which surrounds the developing lens. This disorder has been observed in German Pinschers in Finland and Germany. A pedigree analysis suggested recessive or incomplete dominant inheritance (4).

E. Vitreous degeneration

Liquefaction of the vitreous gel which may predispose to retinal detachment.

F. Optic nerve hypoplasia

A congenital defect of the optic nerve which causes blindness and abnormal pupil response in the affected eye. May be unable to differentiate from micropapilla on a routine (dilated) screening ophthalmoscopic exam.

G. Micropapilla

Micropapilla refers to a small optic disc which is not associated with vision impairment. Optic nerve hypoplasia refers to a congenital defect of the optic nerve which causes blindness and abnormal pupil response in the affected eye. It may be difficult to differentiate between micropapilla and optic nerve hypoplasia on a routine (dilated) screening ophthalmoscopic exam.

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OCULAR DISORDERS REPORT
GERMAN PINSCHER

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2013 932 #	1991-2013 932 %	2014-2018 484 #	2014-2018 484 %
EYELIDS						
25.110	distichiasis		3	0.3%	6	1.2%
NICTITANS						
52.110	prolapsed gland of the third eyelid		1	0.1%	0	
CORNEA						
70.700	corneal dystrophy		17	1.8%	3	0.6%
UVEA						
93.710	persistent pupillary membranes, iris to iris		6	0.6%	4	0.8%
93.720	persistent pupillary membranes, iris to lens		5	0.5%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands		3	0.3%	18	3.7%
LENS						
100.210	cataract. suspect not inherited/significance unknown		59	6.3%	40	8.3%
100.301	punctate cataract, anterior cortex		14	1.5%	3	0.6%
100.302	punctate cataract, posterior cortex		22	2.4%	5	1.0%
100.303	punctate cataract, equatorial cortex		0		2	0.4%
100.304	punctate cataract, anterior sutures		6	0.6%	0	
100.305	punctate cataract, posterior sutures		8	0.9%	1	0.2%
100.306	punctate cataract, nucleus		1	0.1%	0	
100.307	punctate cataract, capsular		6	0.6%	1	0.2%
100.311	incipient cataract, anterior cortex		17	1.8%	8	1.7%
100.312	incipient cataract, posterior cortex		32	3.4%	11	2.3%
100.313	incipient cataract, equatorial cortex		6	0.6%	3	0.6%
100.314	incipient cataract, anterior sutures		5	0.5%	1	0.2%
100.315	incipient cataract, posterior sutures		8	0.9%	1	0.2%
100.316	incipient cataract, nucleus		5	0.5%	2	0.4%
100.317	incipient cataract, capsular		8	0.9%	2	0.4%
100.321	incomplete cataract, anterior cortex		0		1	0.2%
100.322	incomplete cataract, posterior cortex		0		3	0.6%
100.325	incomplete cataract, posterior sutures		0		1	0.2%
100.328	posterior suture tip opacities		1	0.1%	5	1.0%
100.330	generalized/complete cataract		8	0.9%	1	0.2%
100.999	*significant cataracts (summary)*		*146*	*15.7%*	*46*	*9.5%*
VITREOUS						
110.120	persistent hyaloid artery/remnant		2	0.2%	0	
110.135	PHPV/PTVL		4	0.4%	0	
110.320	vitreal degeneration		12	1.3%	4	0.8%
RETINA						
120.170	retinal dysplasia, folds		2	0.2%	0	
120.180	retinal dysplasia, geographic		1	0.1%	0	
120.400	retinal hemorrhage		1	0.1%	0	
120.960	retinopathy		1	0.1%	1	0.2%
OPTIC NERVE						
130.110	micropapilla		10	1.1%	3	0.6%
130.120	optic nerve hypoplasia		6	0.6%	1	0.2%

		1991-2013		2014-2018	
OTHER					
900.000	other, unspecified	26	2.8%	0	
900.100	other, not inherited	36	3.9%	29	6.0%
900.110	other. suspect not inherited/significance unknown	3	0.3%	1	0.2%
NORMAL					
0.000	normal globe	766	82.2%	354	73.1%

GERMAN SHEPHERD DOG

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Distichiasis	Not defined	1	Breeder option	
B.	Plasmoma/atypical pannus	Not defined	2	NO	
C.	Corneal dystrophy - epithelial/stromal	Not defined	3, 4	Breeder option	
D.	Chronic superficial keratitis/pannus	Not defined	3, 5-11	NO	
E.	Persistent pupillary membranes - iris to iris - lens pigment foci/no strands	 Not defined Not defined	 12, 13 14	 Breeder option Passes with no notation	
F.	Cataract 1. Congenital	 Presumed autosomal dominant	 3, 15, 16	 NO	
	2. Cortical	Presumed autosomal recessive	3, 17	NO	
G.	Retinal atrophy - generalized	Not defined	3, 18-20	NO	
H.	Cone degeneration - hemeralopia/ achromatopsia	Autosomal recessive	21	NO	
I.	Retinal dysplasia - folds	Not defined	3	Breeder option	Mutation in the *CNGA3* gene
J.	Retinal dysplasia -geographic/detached	Not defined	22	NO	
K.	Optic nerve hypoplasia	Not defined	3	NO	
L.	Micropapilla	Not defined	23	Breeder option	

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
M.	Limbal melanoma	Not defined	24, 25	NO	

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Plasmoma/atypical pannus

Bilateral lymphocytic/plasmocytic infiltration of the nictitating membranes which may occur independent of corneal Pannus.

C. Corneal dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

D. Chronic superficial keratitis/pannus

A bilateral inflammatory disease of the cornea which usually starts as a grayish haze to the ventral or ventrolateral cornea, followed by the formation of a vascularized subepithelial growth that begins to spread toward the central cornea; pigmentation follows the vascularization. If severe, vision impairment occurs. Pannus may be associated with plasma cell infiltration of the nictitans which may also occur independent of corneal disease.

The German Shepherd Dog has a higher incidence of pannus than any other breed. The MHC class II risk haplotype has been shown. Although there are likely several other genes and environmental factors that contribute to CSK, a recent paper suggested that MHC class II is a major genetic risk factor. Dogs with the risk haplotype were 2.7 times more likely to develop CSK. Homozygosity of the risk haplotype increased the risk of CSK to over eightfold.

E. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted

on the certificate.

F. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

1. **Congenital:** Reported by von Hippel in Germany in 1930, these cataracts are present at birth and visible when the eyes open. They are usually non-progressive. Test breedings indicate an autosomal dominant mode of transmission. The occurrence is rare.

2. **Cortical:** Reported by Barnett in Great Britain, opacities are first apparent at 8-12 weeks of age, in the posterior cortex and progress to involve the Y-sutures and nucleus. The equatorial subcapsular cortex is unaffected. No progression is noted after 1-2 years of age. Test breeding suggests an autosomal recessive mode of inheritance.

G. Retinal atrophy - generalized

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. Except for X-linked PRA in the Siberian Husky, in all breeds studied to date, PRA is inherited as an autosomal recessive trait.

H. Cone degeneration - hemeralopia/achromatopsia

Autosomal recessively inherited early degeneration of the cone photoreceptors. Afflicted puppies develop day-blindness and colorblindness. Afflicted dogs remain ophthalmoscopically normal their entire life. Electroretinography is required to definitively diagnose the disorder. A 5-month-old German Shepherd puppy with vision loss during daylight hours was recently identified with a mutation in the *CNGA3* gene.

I. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

J. Retinal dysplasia - geographic, detached

Abnormal development of the retina present at birth; however, in the Golden Retriever, Labrador Retriever, and German Shepherd it has been demonstrated that the geographic

form of retinal dysplasia may not be apparent before dogs are 10 weeks of age.

Retinal dysplasia - geographic: Any irregularly shaped area of abnormal retinal development containing both areas of thinning and areas of elevation representing folds and retinal disorganization.

Retinal dysplasia - detached: Severe retinal disorganization associated with separation (detachment) of the retina.

These two forms are associated with vision impairment or blindness. Retinal dysplasia is known to be inherited in many breeds. The genetic relationship among the three forms of retinal dysplasia is not known for all breeds

K. Optic nerve hypoplasia

A congenital defect of the optic nerve which causes blindness and abnormal pupil response in the affected eye. May be unable to differentiate from micropapilla on a routine (dilated) screening ophthalmoscopic exam.

L. Micropapilla

Micropapilla refers to a small optic disc which is not associated with vision impairment. Optic nerve hypoplasia refers to a congenital defect of the optic nerve which causes blindness and abnormal pupil response in the affected eye. It may be difficult to differentiate between micropapilla and optic nerve hypoplasia on a routine (dilated) screening ophthalmoscopic exam.

M. Limbal melanoma

Most limbal melanomas are really epibulbar melanocytomas, but there is a possibility of an extension of an intraocular melanoma extending outward and presenting as a limbal melanoma. An epibulbar melanocytoma originates from the superficial pigment lining the limbus and the lesion may eventually extend into the eye. Metastasis has not been documented and the mass is characterized by large epithelioid cells The lesion presents as a subconjunctival smooth mass most commonly in the dorsolateral limbal region and extends later into the cornea and posterior on the sclera. Breed predisposition have been noted in the German Shepherd, Labrador and Golden Retriever.

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OCULAR DISORDERS REPORT
GERMAN SHEPHERD DOG

		1991-2013		2014-2018	
	TOTAL DOGS EXAMINED	4304		1029	
Diagnostic Name		#	%	#	%
GLOBE					
0.110	microphthalmia	7	0.2%	1	0.1%
10.000	glaucoma	3	0.1%	0	
EYELIDS					
20.140	ectopic cilia	1	0.0%	0	
20.160	macropalpebral fissure	1	0.0%	0	
21.000	entropion, unspecified	3	0.1%	1	0.1%
22.000	ectropion, unspecified	4	0.1%	0	
25.110	distichiasis	51	1.2%	6	0.6%
NASOLACRIMAL					
32.110	imperforate lower nasolacrimal punctum	1	0.0%	0	
40.910	keratoconjunctivitis sicca	3	0.1%	0	
NICTITANS					
50.210	pannus of third eyelid	4	0.1%	16	1.6%
51.100	third eyelid cartilage anomaly	3	0.1%	1	0.1%
52.110	prolapsed gland of the third eyelid	1	0.0%	0	
CORNEA					
70.210	corneal pannus	103	2.4%	19	1.8%
70.220	pigmentary keratitis	0		2	0.2%
70.700	corneal dystrophy	206	4.8%	35	3.4%
70.730	corneal endothelial degeneration	2	0.0%	0	
UVEA					
93.710	persistent pupillary membranes, iris to iris	51	1.2%	23	2.2%
93.720	persistent pupillary membranes, iris to lens	16	0.4%	0	
93.730	persistent pupillary membranes, iris to cornea	8	0.2%	1	0.1%
93.740	persistent pupillary membranes, iris sheets	2	0.0%	1	0.1%
93.750	persistent pupillary membranes, lens pigment foci/no strands	3	0.1%	14	1.4%
93.760	persistent pupillary membranes, endothelial opacity/no strands	1	0.0%	0	
93.810	uveal melanoma	1	0.0%	1	0.1%
93.999	uveal cysts	21	0.5%	5	0.5%
LENS					
100.200	cataract, unspecified	28	0.7%	0	
100.210	cataract. suspect not inherited/significance unknown	213	4.9%	81	7.9%
100.301	punctate cataract, anterior cortex	24	0.6%	10	1.0%
100.302	punctate cataract, posterior cortex	14	0.3%	2	0.2%
100.303	punctate cataract, equatorial cortex	12	0.3%	1	0.1%
100.304	punctate cataract, anterior sutures	1	0.0%	1	0.1%
100.305	punctate cataract, posterior sutures	10	0.2%	9	0.9%
100.306	punctate cataract, nucleus	28	0.7%	9	0.9%
100.307	punctate cataract, capsular	6	0.1%	4	0.4%
100.311	incipient cataract, anterior cortex	34	0.8%	3	0.3%
100.312	incipient cataract, posterior cortex	29	0.7%	6	0.6%
100.313	incipient cataract, equatorial cortex	20	0.5%	2	0.2%
100.314	incipient cataract, anterior sutures	3	0.1%	2	0.2%

LENS CONTINUED		1991-2013		2014-2018	
100.315	incipient cataract, posterior sutures	5	0.1%	3	0.3%
100.316	incipient cataract, nucleus	52	1.2%	14	1.4%
100.317	incipient cataract, capsular	2	0.0%	3	0.3%
100.322	incomplete cataract, posterior cortex	0		2	0.2%
100.323	incomplete cataract, equatorial cortex	0		1	0.1%
100.326	incomplete cataract, nucleus	0		1	0.1%
100.327	incomplete cataract, capsular	0		1	0.1%
100.328	posterior suture tip opacities	0		19	1.8%
100.330	generalized/complete cataract	21	0.5%	4	0.4%
100.375	subluxation/luxation, unspecified	6	0.1%	2	0.2%
100.999	*significant cataracts (summary)*	*289*	*6.7%*	*78*	*7.6%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	4	0.1%	5	0.5%
110.135	PHPV/PTVL	3	0.1%	0	
110.200	vitritis	0		2	0.2%
110.320	vitreal degeneration	13	0.3%	1	0.1%
FUNDUS					
97.110	choroidal hypoplasia	1	0.0%	0	
RETINA					
120.170	retinal dysplasia, folds	83	1.9%	15	1.5%
120.180	retinal dysplasia, geographic	16	0.4%	3	0.3%
120.310	generalized progressive retinal atrophy (PRA)	19	0.4%	1	0.1%
120.910	retinal detachment without dialysis	4	0.1%	0	
120.920	retinal detachment with dialysis	1	0.0%	1	0.1%
120.960	retinopathy	1	0.0%	1	0.1%
OPTIC NERVE					
130.110	micropapilla	24	0.6%	10	1.0%
130.120	optic nerve hypoplasia	33	0.8%	3	0.3%
130.150	optic disc coloboma	3	0.1%	1	0.1%
OTHER					
900.000	other, unspecified	58	1.3%	0	
900.100	other, not inherited	148	3.4%	72	7.0%
900.110	other. suspect not inherited/significance unknown	38	0.9%	5	0.5%
NORMAL					
0.000	normal globe	3333	77.4%	707	68.7%

GERMAN SHORTHAIRED POINTER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Distichiasis	Not defined	1	Breeder option	
B.	Nictitans cartilage anomaly/eversion	Not defined	1, 2	Breeder option	
C.	Persistent pupillary membranes - iris to iris	Not defined	1, 3	Breeder option	
D.	Cataract	Not defined	1	NO	
E.	Retinal atrophy - generalized	Not defined	1, 4	NO	
F.	Retinal dysplasia - folds	Not defined	1	Breeder option	
G.	Cone degeneration - (achromatopsia)	Autosomal recessive	5	NO	Mutation in the *CNGB3* gene

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established, although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Nictitans cartilage anomaly/eversion

A scroll-like curling of the cartilage of the third eyelid, usually everting the margin. This condition may occur in one or both eyes and may cause mild ocular irritation.

C. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

D. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

E. Retinal atrophy - generalized

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. Except for X-linked PRA in the Siberian Husky, in all breeds studied to date, PRA is inherited as an autosomal recessive trait.

F. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

G. Cone degeneration - hemeralopia/achromatopsia

Autosomal recessively inherited early degeneration of the cone photoreceptors. Afflicted puppies develop day-blindness, colorblindness, and photophobia between 8 and 12 weeks of age. Afflicted dogs remain ophthalmoscopically normal their entire life. Electroretinography is required to definitively diagnose the disorder. A missense mutation in the same gene (*CNGB3*) that has been identified in CD-affected Alaskan Malamute-derived dogs has been detected in German Shorthaired Pointers affected with a clinically identical allelic disorder. A DNA test is available.

References

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5. Sidjanin DJ, Lowe JK, McElwee JL, et al. Canine CNGB3 mutations establish cone degeneration as orthologous to the human achromatopsia locus ACHM3. *Human Molecular Genetics*. 2002;11:1823-1833.

OCULAR DISORDERS REPORT
GERMAN SHORTHAIRED POINTER

	TOTAL DOGS EXAMINED	1991-2013 5301		2014-2018 2097	
Diagnostic Name		#	%	#	%
GLOBE					
10.000	glaucoma	1	0.0%	0	
EYELIDS					
20.160	macropalpebral fissure	1	0.0%	0	
21.000	entropion, unspecified	10	0.2%	1	0.0%
22.000	ectropion, unspecified	3	0.1%	2	0.1%
25.110	distichiasis	185	3.5%	118	5.6%
NASOLACRIMAL					
40.910	keratoconjunctivitis sicca	1	0.0%	0	
NICTITANS					
51.100	third eyelid cartilage anomaly	1	0.0%	2	0.1%
52.110	prolapsed gland of the third eyelid	0		2	0.1%
CORNEA					
70.210	corneal pannus	1	0.0%	0	
70.700	corneal dystrophy	15	0.3%	5	0.2%
70.730	corneal endothelial degeneration	1	0.0%	0	
UVEA					
93.110	iris hypoplasia	1	0.0%	1	0.0%
93.140	corneal endothelial pigment without PPM	1	0.0%	0	
93.150	iris coloboma	2	0.0%	0	
93.710	persistent pupillary membranes, iris to iris	370	7.0%	135	6.4%
93.720	persistent pupillary membranes, iris to lens	16	0.3%	3	0.1%
93.730	persistent pupillary membranes, iris to cornea	5	0.1%	3	0.1%
93.740	persistent pupillary membranes, iris sheets	1	0.0%	1	0.0%
93.750	persistent pupillary membranes, lens pigment foci/no strands	8	0.2%	30	1.4%
93.760	persistent pupillary membranes, endothelial opacity/no strands	3	0.1%	1	0.0%
93.810	uveal melanoma	1	0.0%	0	
93.999	uveal cysts	6	0.1%	3	0.1%
97.150	chorioretinal coloboma, congenital	0		1	0.0%
LENS					
100.200	cataract, unspecified	9	0.2%	0	
100.210	cataract. suspect not inherited/significance unknown	271	5.1%	93	4.4%
100.301	punctate cataract, anterior cortex	25	0.5%	2	0.1%
100.302	punctate cataract, posterior cortex	46	0.9%	10	0.5%
100.303	punctate cataract, equatorial cortex	11	0.2%	3	0.1%
100.304	punctate cataract, anterior sutures	2	0.0%	0	
100.305	punctate cataract, posterior sutures	11	0.2%	6	0.3%
100.306	punctate cataract, nucleus	13	0.2%	2	0.1%
100.307	punctate cataract, capsular	7	0.1%	7	0.3%
100.311	incipient cataract, anterior cortex	17	0.3%	2	0.1%
100.312	incipient cataract, posterior cortex	84	1.6%	17	0.8%
100.313	incipient cataract, equatorial cortex	20	0.4%	1	0.0%
100.314	incipient cataract, anterior sutures	2	0.0%	0	
100.315	incipient cataract, posterior sutures	15	0.3%	2	0.1%

LENS CONTINUED		1991-2013		2014-2018	
100.316	incipient cataract, nucleus	17	0.3%	3	0.1%
100.317	incipient cataract, capsular	9	0.2%	7	0.3%
100.321	incomplete cataract, anterior cortex	0		2	0.1%
100.322	incomplete cataract, posterior cortex	2	0.0%	5	0.2%
100.325	incomplete cataract, posterior sutures	0		1	0.0%
100.326	incomplete cataract, nucleus	0		1	0.0%
100.328	posterior suture tip opacities	2	0.0%	10	0.5%
100.330	generalized/complete cataract	14	0.3%	0	
100.340	resorbing/hypermature cataract	0		1	0.0%
100.375	subluxation/luxation, unspecified	2	0.0%	0	
100.999	*significant cataracts (summary)*	*304*	*5.7%*	*72*	*3.4%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	2	0.0%	22	1.0%
110.135	PHPV/PTVL	8	0.2%	8	0.4%
110.200	vitritis	1	0.0%	0	
110.320	vitreal degeneration	20	0.4%	6	0.3%
FUNDUS					
97.110	choroidal hypoplasia	1	0.0%	0	
RETINA					
120.170	retinal dysplasia, folds	112	2.1%	28	1.3%
120.180	retinal dysplasia, geographic	24	0.5%	3	0.1%
120.310	generalized progressive retinal atrophy (PRA)	8	0.2%	1	0.0%
120.920	retinal detachment with dialysis	1	0.0%	2	0.1%
120.960	retinopathy	1	0.0%	7	0.3%
OPTIC NERVE					
130.110	micropapilla	3	0.1%	0	
130.120	optic nerve hypoplasia	4	0.1%	1	0.0%
130.150	optic disc coloboma	1	0.0%	0	
OTHER					
900.000	other, unspecified	99	1.9%	0	
900.100	other, not inherited	146	2.8%	97	4.6%
900.110	other. suspect not inherited/significance unknown	18	0.3%	3	0.1%
NORMAL					
0.000	normal globe	4357	82.2%	1556	74.2%

OCULAR DISORDERS REPORT
GERMAN SPANIEL

There are insufficient breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the GERMAN SPANIEL breed. Therefore, there are no conditions listed with breeding advice.

OCULAR DISORDERS REPORT
GERMAN SPANIEL

Diagnostic Name	TOTAL DOGS EXAMINED	1991-2013 0 #	%	2014-2018 1 #	%
NORMAL					
0.000 normal globe		0		1	100.0%

GERMAN SPITZ

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Retinal atrophy - generalized *(prcd)*	Autosomal recessive	1	NO	Mutation in the *prcd* gene

Description and Comments

A. Retinal atrophy - generalized (*prcd)*

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

Studies have shown that the principal form of PRA in the German Spitz is *prcd* which is a late-onset form of PRA inherited as autosomal recessive. The mutation is allelic to that present in Miniature Poodles, Labrador Retrievers, English and American Cocker Spaniels, and others. The locus is termed the progressive rod-cone degeneration (*prcd*) gene and at least 30+ breeds are affected. In most affected dogs to date, the disease is recognized clinically in dogs 3-6 years of age or older. However in the American Eskimo Dog the phenotype can be very variable in the age of onset. This photoreceptor degeneration is characterized by slow death of visual cells following their normal development. The disease begins clinically with signs of night blindness followed by day blindness. A DNA test is available.

Other forms of retinal degeneration that are not PRCD are recognized in the breed. The currently available genetic test will not detect these other forms of PRA.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the German Spitz breed. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 2016 and/or Data from CERF/OFA All-Breeds Report, 2010-2015.

OCULAR DISORDERS REPORT
GERMAN SPITZ

Diagnostic Name	TOTAL DOGS EXAMINED	1991-2013 4 #	%	2014-2018 6 #	%
UVEA					
93.710	persistent pupillary membranes, iris to iris	1	25.0%	0	
RETINA					
120.960	retinopathy	0		1	16.7%
NORMAL					
0.000	normal globe	4	100.0%	5	83.3%

GERMAN WIREHAIRED POINTER

(Drathaar, Deutsch Drathaar)

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Distichiasis	Not defined	1	Breeder option
B.	Persistent pupillary membranes - iris to iris	Not defined	2	Breeder option
C.	Cataract	Not defined	3	NO

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

C. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the German Wirehaired Pointer breed. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 2018 and/or Data from OFA All-Breeds Report, 2013-2017.

2. ACVO Genetics Committee, 2017 and/or Data from CERF/OFA All-Breeds Report, 2010-2016.

3. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

OCULAR DISORDERS REPORT
GERMAN WIREHAIRED POINTER

Diagnostic Name		1991-2013 528 #	1991-2013 528 %	2014-2018 378 #	2014-2018 378 %
EYELIDS					
20.160	macropalpebral fissure	1	0.2%	0	
25.110	distichiasis	6	1.1%	7	1.9%
UVEA					
93.110	iris hypoplasia	0		1	0.3%
93.710	persistent pupillary membranes, iris to iris	8	1.5%	9	2.4%
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		1	0.3%
LENS					
100.200	cataract, unspecified	5	0.9%	0	
100.210	cataract. suspect not inherited/significance unknown	11	2.1%	15	4.0%
100.301	punctate cataract, anterior cortex	2	0.4%	0	
100.302	punctate cataract, posterior cortex	5	0.9%	1	0.3%
100.305	punctate cataract, posterior sutures	1	0.2%	2	0.5%
100.312	incipient cataract, posterior cortex	8	1.5%	3	0.8%
100.315	incipient cataract, posterior sutures	1	0.2%	0	
100.316	incipient cataract, nucleus	0		2	0.5%
100.317	incipient cataract, capsular	2	0.4%	1	0.3%
100.327	incomplete cataract, capsular	0		1	0.3%
100.328	posterior suture tip opacities	0		2	0.5%
100.330	generalized/complete cataract	2	0.4%	0	
100.999	*significant cataracts (summary)*	*26*	*4.9%*	*10*	*2.6%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	2	0.4%	0	
110.200	vitritis	0		1	0.3%
110.320	vitreal degeneration	2	0.4%	1	0.3%
RETINA					
120.170	retinal dysplasia, folds	3	0.6%	0	
120.180	retinal dysplasia, geographic	0		2	0.5%
120.190	retinal dysplasia, detached	0		1	0.3%
120.910	retinal detachment without dialysis	1	0.2%	0	
OTHER					
900.000	other, unspecified	9	1.7%	0	
900.100	other, not inherited	9	1.7%	15	4.0%
900.110	other. suspect not inherited/significance unknown	4	0.8%	0	
NORMAL					
0.000	normal globe	472	89.4%	323	85.4%

GIANT SCHNAUZER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Nictitans cartilage anomaly/eversion	Not defined	1	Breeder option	
B.	Persistent pupillary membranes				
	- iris to iris	Not defined	2	Breeder option	
	- iris to cornea	Not defined	1	NO	
	- lens pigment foci/no strands	Not defined	3	Passes with no notation	
C.	Cataract	Not defined	1	NO	
D.	Retinal atrophy generalized (*prcd*)	Autosomal recessive	4	NO	Mutation in the *prcd* gene
E.	Retinal dysplasia - folds	Not defined	1	Breeder option	

Description and Comments

A. Nictitans cartilage anomaly/eversion

A scroll-like curling of the cartilage of the third eyelid, usually everting the margin. This condition may occur in one or both eyes and may cause mild ocular irritation.

B. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

C. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely

(diffuse) or in a localized region.

D. Retinal atrophy - generalized (*prcd*)

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. This photoreceptor degeneration is characterized by slow death of visual cells following their normal development. The disease begins clinically with signs of night blindness followed by day blindness. A genetic test is available.

E. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Giant Schnauzer breed. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

2. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

3. ACVO Genetics Committee, 2016 and/or Data from CERF/OFA All-Breeds Report, 2010-2015.

4. ACVO Genetics Committee, 2014 and/or Data from CERF/OFA All-Breeds Report 2008-2013.

OCULAR DISORDERS REPORT
GIANT SCHNAUZER

		1991-2013		2014-2018	
	TOTAL DOGS EXAMINED	985		379	
Diagnostic Name		#	%	#	%
GLOBE					
0.110	microphthalmia	1	0.1%	0	
EYELIDS					
25.110	distichiasis	3	0.3%	3	0.8%
NASOLACRIMAL					
32.110	imperforate lower nasolacrimal punctum	0		1	0.3%
NICTITANS					
51.100	third eyelid cartilage anomaly	8	0.8%	4	1.1%
52.110	prolapsed gland of the third eyelid	2	0.2%	0	
CORNEA					
70.700	corneal dystrophy	1	0.1%	0	
70.730	corneal endothelial degeneration	1	0.1%	0	
UVEA					
93.710	persistent pupillary membranes, iris to iris	45	4.6%	16	4.2%
93.720	persistent pupillary membranes, iris to lens	4	0.4%	0	
93.730	persistent pupillary membranes, iris to cornea	6	0.6%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	5	0.5%	7	1.8%
93.760	persistent pupillary membranes, endothelial opacity/no strands	0		1	0.3%
93.999	uveal cysts	1	0.1%	2	0.5%
LENS					
100.200	cataract, unspecified	5	0.5%	0	
100.210	cataract. suspect not inherited/significance unknown	48	4.9%	19	5.0%
100.301	punctate cataract, anterior cortex	3	0.3%	1	0.3%
100.302	punctate cataract, posterior cortex	7	0.7%	1	0.3%
100.304	punctate cataract, anterior sutures	1	0.1%	0	
100.305	punctate cataract, posterior sutures	2	0.2%	2	0.5%
100.306	punctate cataract, nucleus	1	0.1%	0	
100.307	punctate cataract, capsular	4	0.4%	5	1.3%
100.311	incipient cataract, anterior cortex	3	0.3%	0	
100.312	incipient cataract, posterior cortex	22	2.2%	5	1.3%
100.313	incipient cataract, equatorial cortex	7	0.7%	2	0.5%
100.315	incipient cataract, posterior sutures	4	0.4%	1	0.3%
100.316	incipient cataract, nucleus	2	0.2%	0	
100.317	incipient cataract, capsular	1	0.1%	3	0.8%
100.328	posterior suture tip opacities	0		6	1.6%
100.330	generalized/complete cataract	2	0.2%	0	
100.375	subluxation/luxation, unspecified	2	0.2%	0	
100.999	*significant cataracts (summary)*	*64*	*6.5%*	*20*	*5.3%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	5	0.5%	3	0.8%
110.135	PHPV/PTVL	5	0.5%	0	
110.320	vitreal degeneration	2	0.2%	0	

		1991-2013		2014-2018	
RETINA					
120.170	retinal dysplasia, folds	24	2.4%	5	1.3%
120.180	retinal dysplasia, geographic	1	0.1%	2	0.5%
120.310	generalized progressive retinal atrophy (PRA)	8	0.8%	0	
120.960	retinopathy	1	0.1%	1	0.3%
OPTIC NERVE					
130.110	micropapilla	0		1	0.3%
OTHER					
900.000	other, unspecified	26	2.6%	0	
900.100	other, not inherited	24	2.4%	12	3.2%
900.110	other. suspect not inherited/significance unknown	3	0.3%	0	
NORMAL					
0.000	normal globe	839	85.2%	297	78.4%

GLEN OF IMAAL TERRIER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Distichiasis	Not defined	1	Breeder option	
B.	Cataract	Not defined	2	NO	
C.	Retinal atrophy - generalized	Not defined	1-3	NO	
D.	Cone rod dystrophy (*crd3*)	Autosomal recessive	4, 5	NO	Mutation in the *ADAM9* gene

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

C. Retinal atrophy-generalized

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

D. Cone rod dystrophy

A form of late-onset PRA identified in Glen of Imaal Terriers. Ophthalmoscopic lesions are typically diagnosed by 5 years of age, however lesions may be present as early as 3 years of age in affected dogs. Two distinct phenotypes are observed in affected Glen of Imaal Terriers. The most common phenotype is subtle but generalized tapetal hyperreflectivity and retinal vascular attenuation that progresses over 1 - 2 years after initial examination. The less common phenotype is a focal mid-temporal (area centralis) area of distinct tapetal hyperreflectivity without generalized retinal disease. This lesion may remain unchanged for over a year but will progress to generalized retinal atrophy by 2 - 4 years after initial examination. ERG dysfunction can be observed as early as 15 weeks of age. The disorder is caused by a mutation present in the *ADAM9* gene. A DNA test is available that will unequivocally identify normal, affected, and carrier dogs. The test is accurate only for this mutation and will not identify other forms of PRA.

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OCULAR DISORDERS REPORT
GLEN OF IMAAL TERRIER

Diagnostic Name		1991-2013 546 #	%	2014-2018 184 #	%
GLOBE					
0.110	microphthalmia	1	0.2%	0	
EYELIDS					
21.000	entropion, unspecified	2	0.4%	0	
25.110	distichiasis	19	3.5%	7	3.8%
NASOLACRIMAL					
32.110	imperforate lower nasolacrimal punctum	0		1	0.5%
CORNEA					
70.220	pigmentary keratitis	0		1	0.5%
UVEA					
93.720	persistent pupillary membranes, iris to lens	1	0.2%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		1	0.5%
93.999	uveal cysts	1	0.2%	1	0.5%
97.150	chorioretinal coloboma, congenital	0		1	0.5%
LENS					
100.210	cataract. suspect not inherited/significance unknown	50	9.2%	11	6.0%
100.301	punctate cataract, anterior cortex	3	0.5%	2	1.1%
100.302	punctate cataract, posterior cortex	1	0.2%	1	0.5%
100.303	punctate cataract, equatorial cortex	4	0.7%	2	1.1%
100.305	punctate cataract, posterior sutures	0		1	0.5%
100.306	punctate cataract, nucleus	2	0.4%	0	
100.307	punctate cataract, capsular	3	0.5%	1	0.5%
100.311	incipient cataract, anterior cortex	3	0.5%	3	1.6%
100.312	incipient cataract, posterior cortex	0		1	0.5%
100.313	incipient cataract, equatorial cortex	5	0.9%	1	0.5%
100.314	incipient cataract, anterior sutures	1	0.2%	0	
100.315	incipient cataract, posterior sutures	2	0.4%	0	
100.316	incipient cataract, nucleus	1	0.2%	0	
100.321	incomplete cataract, anterior cortex	0		1	0.5%
100.322	incomplete cataract, posterior cortex	0		1	0.5%
100.328	posterior suture tip opacities	1	0.2%	0	
100.330	generalized/complete cataract	1	0.2%	0	
100.375	subluxation/luxation, unspecified	3	0.5%	0	
100.999	*significant cataracts (summary)*	*26*	*4.8%*	*14*	*7.6%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	1	0.2%	1	0.5%
110.320	vitreal degeneration	2	0.4%	0	
RETINA					
120.170	retinal dysplasia, folds	5	0.9%	2	1.1%
120.180	retinal dysplasia, geographic	3	0.5%	1	0.5%
120.310	generalized progressive retinal atrophy (PRA)	21	3.8%	3	1.6%
120.960	retinopathy	0		1	0.5%

	1991-2013		2014-2018	
OPTIC NERVE				
130.120 optic nerve hypoplasia	0		1	0.5%
130.150 optic disc coloboma	4	0.7%	1	0.5%
OTHER				
900.000 other, unspecified	12	2.2%	0	
900.100 other, not inherited	22	4.0%	8	4.3%
900.110 other. suspect not inherited/significance unknown	14	2.6%	2	1.1%
NORMAL				
0.000 normal globe	442	81.0%	144	78.3%

GOLDEN RETRIEVER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Glaucoma	Not defined	1	NO	
B.	Entropion	Not defined	1	Breeder option	
C.	Distichiasis	Not defined	1	Breeder option	
D.	Corneal dystrophy - epithelial/stromal	Not defined	1	Breeder option	
E.	Uveal cysts	Not defined	1-4	Breeder option	
F.	Pigmentary uveitis	Not defined	1-6	NO	
G.	Persistent pupillary membranes				
	- iris to iris	Not defined	1, 7	Breeder option	
	- lens pigment foci/no strands	Not defined	8	Passes with no notation	
H.	Cataract	Not defined	1, 9-14	NO	
I.	Persistent hyaloid artery	Not defined	8	Breeder option	
J.	Vitreous degeneration	Not defined	8	Breeder option	
K.	Retinal atrophy - generalized				
	prcd	Autosomal recessive	1, 15-17	NO	Mutation in the *prcd* gene
	PRA1	Autosomal recessive	16	NO	Mutation in the *SLC4A3* gene
	PRA2	Autosomal recessive	2	NO	Mutation in the *TTC8* gene
L.	Retinal dysplasia - folds	Not defined	8	Breeder option	
M.	Retinal dysplasia - geographic/ detached	Not defined	1, 18, 19	NO	

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
N.	Limbal melanoma	Not defined	20	NO	

Description and Comments

A. Glaucoma

Glaucoma is characterized by an elevation of intraocular pressure (IOP) which, when sustained, causes intraocular damage resulting in blindness. The elevated intraocular pressure occurs because the fluid cannot leave through the iridocorneal angle. Diagnosis and classification of glaucoma requires measurement of the IOP (tonometry) and examination of the iridocorneal angle (gonioscopy). Neither of these tests is part of a routine screening exam for certification.

B. Entropion

A conformational defect resulting in an "in-rolling" of one or both of the eyelids which may cause ocular irritation. It is likely that entropion is influenced by several genes (polygenic), defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull. Selection should be directed against entropion and toward a head conformation that reduces or eliminates the likelihood of the defect.

C. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

D. Corneal dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

E. Uveal cysts

Fluid filled sacs arising from the posterior surface of the iris, to which they may remain attached or break free and float into the anterior chamber. Usually occur in mature dogs.

This disorder may be observed in any breed but retriever breeds tend to be predisposed. There is usually no effect on vision unless the cysts are heavily clustered and impinge on the pupillary area. Less frequently, the cysts may rupture and adhere to the cornea or

anterior lens capsule. Multiple cysts may occlude the iridocorneal angle and cause glaucoma.

F. Pigmentary uveitis

A unique uveitis observed in the Golden Retriever that is not associated with other ocular or systemic disorders. Adhesions develop between iris and lens and the peripheral iris and cornea. Pigment dispersion (exfoliation) occurs across the anterior lens capsule from the pigmented cells of the posterior iris. Other complications include secondary cataract and obstructive glaucoma. Onset is usually between 5-10 years of age.

G. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

H. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

The most common cataract reported in the Golden Retriever is a posterior polar (posterior cortical) cataract. These are generally bilateral, although an occasional unilateral affliction may be observed. These focal opacities will occasionally remain stationary. These cataracts are usually observed between 9 months and 3 years of age. A more generalized cataract is also observed in this breed and is not always associated with the previously mentioned polar cataract. There are also cataract changes involving the Y sutures which may or may not progress.

The existence of cataracts in the Golden Retriever, often with limited clinical significance, presents problems with breeder recognition as the majority of these dogs do not evidence visual impairment. It is strongly recommended that all Golden Retrievers that are used in breeding programs be examined annually as cataract changes have been observed in multiple locations of the lens and variable age of onset.

I. Persistent hyaloid artery (PHA)

Congenital defect resulting from abnormalities in the development and regression of the hyaloid artery. The blood vessel remnant can be present in the vitreous as a small patent vascular strand (PHA) or as a non-vascular strand that appears gray-white

(persistent hyaloid remnant).

J. Vitreous degeneration

A liquefaction of the vitreous gel which may predispose to retinal detachment.

K. Retinal atrophy - generalized

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

Studies have shown that one form of PRA in the Golden Retriever is *prcd* which is a late-onset form of PRA inherited as autosomal recessive. The mutation is allelic to that present in Miniature Poodles, Labrador Retrievers, English and American Cocker Spaniels, and others. The locus is termed the progressive rod-cone degeneration (*prcd*) gene and at least 30+ breeds are affected. In most affected dogs to date, the disease is recognized clinically in dogs 3-6 years of age or older. This photoreceptor degeneration is characterized by slow death of visual cells following their normal development. The disease begins clinically with signs of night blindness followed by day blindness. A DNA test is available.

In addition, two other known mutations that cause PRA are present in the breed. Golden Retriever PRA 1 (GR PRA1) is an autosomal recessive trait and is the predominant form in European lines of Golden Retrievers. Golden Retriever PRA 2 (GR PRA2) has also been identified within the breed. Therefore three different DNA tests are available. However these tests will only detect these three mutations.

L. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

M. Retinal dysplasia - geographic, detached

Abnormal development of the retina present at birth; however, in the Golden Retriever, Labrador Retriever, and German Shepherd it has been demonstrated that the geographic form of retinal dysplasia may not be apparent before dogs are 10 weeks of age.

Retinal dysplasia - geographic: Any irregularly shaped area of abnormal retinal development containing both areas of thinning and areas of elevation representing folds and retinal disorganization.

Retinal dysplasia - detached: Severe retinal disorganization associated with separation

(detachment) of the retina.

These two forms are associated with vision impairment or blindness. Retinal dysplasia is known to be inherited in many breeds. The genetic relationship among the three forms of retinal dysplasia is not known for all breeds.

N. Limbal melanoma

Most limbal melanomas are really epibulbar melanocytomas, but there is a possibility of an extension of an intraocular melanoma extending outward and presenting as a limbal melanoma. An epibulbar melanocytoma originates from the superficial pigment lining the limbus and the lesion may eventually extend into the eye. Metastasis has not been documented and the mass is characterized by large epithelioid cells. The lesion presents as a subconjunctival smooth mass most commonly in the dorsolateral limbal region and extends later into the cornea and posterior on the sclera. Breed predispositions have been noted in the German Shepherd Dog, and Labrador and Golden Retrievers.

Historical Note:

Central progressive retinal atrophy was previously a condition listed for this breed. However as the condition is no longer identified in the breed, the condition has been removed. Central progressive retinal atrophy was a progressive retinal degeneration in which photoreceptor death occurred secondary to disease of the underlying pigment epithelium. Progression was slow and some animals never lost vision. CPRA occurred in England, but was uncommon elsewhere.

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OCULAR DISORDERS REPORT
GOLDEN RETRIEVER

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2013 140691 #	%	2014-2018 42862 #	%
GLOBE						
0.110	microphthalmia		47	0.0%	9	0.0%
10.000	glaucoma		31	0.0%	2	0.0%
EYELIDS						
20.110	eyelid dermoid		3	0.0%	0	
20.140	ectopic cilia		49	0.0%	9	0.0%
20.160	macropalpebral fissure		22	0.0%	0	
21.000	entropion, unspecified		346	0.2%	63	0.1%
22.000	ectropion, unspecified		95	0.1%	13	0.0%
25.110	distichiasis		15443	11.0%	3842	9.0%
NASOLACRIMAL						
32.110	imperforate lower nasolacrimal punctum		16	0.0%	44	0.1%
40.910	keratoconjunctivitis sicca		3	0.0%	2	0.0%
NICTITANS						
50.210	pannus of third eyelid		0		2	0.0%
51.100	third eyelid cartilage anomaly		12	0.0%	8	0.0%
52.110	prolapsed gland of the third eyelid		39	0.0%	3	0.0%
CORNEA						
70.210	corneal pannus		10	0.0%	1	0.0%
70.220	pigmentary keratitis		10	0.0%	15	0.0%
70.700	corneal dystrophy		563	0.4%	208	0.5%
70.730	corneal endothelial degeneration		35	0.0%	7	0.0%
UVEA						
90.200	uveitis		157	0.1%	602	1.4%
90.250	pigmentary uveitis		538	0.4%	0	
93.110	iris hypoplasia		3	0.0%	5	0.0%
93.140	corneal endothelial pigment without PPM		17	0.0%	0	
93.150	iris coloboma		18	0.0%	3	0.0%
93.710	persistent pupillary membranes, iris to iris		2927	2.1%	1238	2.9%
93.720	persistent pupillary membranes, iris to lens		110	0.1%	16	0.0%
93.730	persistent pupillary membranes, iris to cornea		78	0.1%	10	0.0%
93.740	persistent pupillary membranes, iris sheets		109	0.1%	3	0.0%
93.750	persistent pupillary membranes, lens pigment foci/no strands		223	0.2%	538	1.3%
93.760	persistent pupillary membranes, endothelial opacity/no strands		40	0.0%	17	0.0%
93.810	uveal melanoma		12	0.0%	23	0.1%
93.999	uveal cysts		6429	4.6%	3593	8.4%
97.150	chorioretinal coloboma, congenital		0		2	0.0%
LENS						
100.200	cataract, unspecified		952	0.7%	0	
100.210	cataract. suspect not inherited/significance unknown		7989	5.7%	3357	7.8%
100.301	punctate cataract, anterior cortex		610	0.4%	317	0.7%
100.302	punctate cataract, posterior cortex		2037	1.4%	538	1.3%
100.303	punctate cataract, equatorial cortex		395	0.3%	174	0.4%
100.304	punctate cataract, anterior sutures		88	0.1%	38	0.1%

LENS CONTINUED		1991-2013		2014-2018	
100.305	punctate cataract, posterior sutures	732	0.5%	167	0.4%
100.306	punctate cataract, nucleus	181	0.1%	110	0.3%
100.307	punctate cataract, capsular	245	0.2%	189	0.4%
100.311	incipient cataract, anterior cortex	747	0.5%	297	0.7%
100.312	incipient cataract, posterior cortex	2836	2.0%	746	1.7%
100.313	incipient cataract, equatorial cortex	803	0.6%	340	0.8%
100.314	incipient cataract, anterior sutures	60	0.0%	17	0.0%
100.315	incipient cataract, posterior sutures	672	0.5%	145	0.3%
100.316	incipient cataract, nucleus	264	0.2%	161	0.4%
100.317	incipient cataract, capsular	219	0.2%	146	0.3%
100.321	incomplete cataract, anterior cortex	4	0.0%	59	0.1%
100.322	incomplete cataract, posterior cortex	12	0.0%	127	0.3%
100.323	incomplete cataract, equatorial cortex	4	0.0%	31	0.1%
100.324	incomplete cataract, anterior sutures	1	0.0%	0	
100.325	incomplete cataract, posterior sutures	1	0.0%	16	0.0%
100.326	incomplete cataract, nucleus	2	0.0%	34	0.1%
100.327	incomplete cataract, capsular	2	0.0%	16	0.0%
100.328	posterior suture tip opacities	39	0.0%	244	0.6%
100.330	generalized/complete cataract	335	0.2%	36	0.1%
100.340	resorbing/hypermature cataract	0		9	0.0%
100.375	subluxation/luxation, unspecified	29	0.0%	4	0.0%
100.999	*significant cataracts (summary)*	*11202*	*8.0%*	*3713*	*8.7%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	114	0.1%	83	0.2%
110.135	PHPV/PTVL	36	0.0%	7	0.0%
110.200	vitritis	3	0.0%	4	0.0%
110.320	vitreal degeneration	238	0.2%	85	0.2%
FUNDUS					
97.110	choroidal hypoplasia	9	0.0%	0	
97.120	coloboma	8	0.0%	0	
RETINA					
120.170	retinal dysplasia, folds	1772	1.3%	494	1.2%
120.180	retinal dysplasia, geographic	694	0.5%	231	0.5%
120.190	retinal dysplasia, detached	37	0.0%	5	0.0%
120.310	generalized progressive retinal atrophy (PRA)	163	0.1%	18	0.0%
120.400	retinal hemorrhage	18	0.0%	0	
120.910	retinal detachment without dialysis	28	0.0%	0	
120.920	retinal detachment with dialysis	0		5	0.0%
120.960	retinopathy	12	0.0%	51	0.1%
OPTIC NERVE					
130.110	micropapilla	8	0.0%	8	0.0%
130.120	optic nerve hypoplasia	36	0.0%	6	0.0%
130.150	optic disc coloboma	56	0.0%	5	0.0%
OTHER					
900.000	other, unspecified	1783	1.3%	0	
900.100	other, not inherited	3349	2.4%	2053	4.8%
900.110	other. suspect not inherited/significance unknown	843	0.6%	98	0.2%

	1991-2013	2014-2018
NORMAL		
0.000 normal globe	108404 77.1%	27300 63.7%

GORDON SETTER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Ectropion	Not defined	1	Breeder option	
B.	Distichiasis	Not defined	2	Breeder option	
C.	Uveal cysts	Not defined	2	Breeder option	
D.	Persistent pupillary membranes				
	- iris to iris	Not defined	1, 2	Breeder option	
	- lens pigment foci/no strands	Not defined	3	Passes with no notation	
E.	Cataract	Not defined	1	NO	
F.	Persistent hyaloid artery	Not defined	4	Breeder option	
G.	Retinal atrophy - generalized	Not defined	5, 7	NO	
H.	Retinal atrophy - rod-cone dysplasia type 4 (*rcd4*)	Autosomal recessive	8	NO	Mutation in the *C2orf71* gene
I.	Cone degeneration - achromatopsia	Not defined	9	NO	
J.	Retinal dysplasia - folds	Not defined	1	Breeder option	

Description and Comments

A. Ectropion

A conformational defect resulting in eversion of the eyelids which may cause ocular irritation. It is likely that ectropion is influenced by several genes (polygenic) defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

B. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

C. Uveal cysts

A pigmented, fluid-filled epithelial-lined structure arising from the posterior iris or ciliary body epithelium. Cysts may remain attached to the pupil margin, iris, or ciliary body, or may detach and be free-floating within the anterior chamber. They may rupture and adhere to the cornea or anterior lens capsule. Uveal cysts may occur in any breed. Uveal cysts are commonly benign, although they may be associated with other pathologic conditions is various breeds.

D. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

E. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

F. Persistent hyaloid artery (PHA)

Congenital defect resulting from abnormalities in the development and regression of the hyaloid artery. The blood vessel remnant can be present in the vitreous as a small patent vascular strand (PHA) or as a non-vascular strand that appears gray-white (persistent hyaloid remnant).

G. Retinal atrophy - generalized

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. Except for X-linked PRA in the Siberian Husky, in all breeds studied to date, PRA is inherited as an autosomal recessive trait.

H. Rod-cone dysplasia, type 4 (*rcd4*)

A form of PRA identified in the Gordon and Irish Setter breeds. Clinical night blindness is observed on average as late as 10 years of age and progresses to total blindness. This form of PRA has been referred to as late-onset PRA (LOPRA). The disorder is caused by a mutation present in the *C2orf71* gene. A DNA test is now available that will unequivocally identify genetically normal, affected and carrier dogs. The test is accurate only for this mutation and will not identify other forms of PRA.

I. Cone degeneration - achromatopsia

Suspected inherited retinopathy characterized by degeneration of the cone receptors and loss of vision in bright light. Age of onset is variable. Ophthalmoscopic examination is normal. The ERG abnormalities are more suggestive of a cone-rod dystrophy. The mode of inheritance and genetic mutation are not yet known.

J. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

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3. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

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OCULAR DISORDERS REPORT
GORDON SETTER

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2013 2011 #	 %	2014-2018 391 #	 %
GLOBE						
0.110	microphthalmia		1	0.0%	1	0.3%
EYELIDS						
20.140	ectopic cilia		1	0.0%	0	
20.160	macropalpebral fissure		9	0.4%	0	
21.000	entropion, unspecified		13	0.6%	4	1.0%
22.000	ectropion, unspecified		48	2.4%	7	1.8%
25.110	distichiasis		40	2.0%	4	1.0%
NASOLACRIMAL						
40.910	keratoconjunctivitis sicca		1	0.0%	2	0.5%
NICTITANS						
51.100	third eyelid cartilage anomaly		1	0.0%	0	
CORNEA						
70.210	corneal pannus		3	0.1%	0	
70.700	corneal dystrophy		8	0.4%	0	
UVEA						
93.710	persistent pupillary membranes, iris to iris		98	4.9%	19	4.9%
93.720	persistent pupillary membranes, iris to lens		7	0.3%	0	
93.730	persistent pupillary membranes, iris to cornea		4	0.2%	0	
93.740	persistent pupillary membranes, iris sheets		2	0.1%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands		6	0.3%	13	3.3%
93.760	persistent pupillary membranes, endothelial opacity/no strands		2	0.1%	2	0.5%
93.999	uveal cysts		19	0.9%	2	0.5%
LENS						
100.200	cataract, unspecified		9	0.4%	0	
100.210	cataract. suspect not inherited/significance unknown		66	3.3%	24	6.1%
100.301	punctate cataract, anterior cortex		5	0.2%	1	0.3%
100.302	punctate cataract, posterior cortex		6	0.3%	5	1.3%
100.303	punctate cataract, equatorial cortex		3	0.1%	0	
100.305	punctate cataract, posterior sutures		2	0.1%	2	0.5%
100.306	punctate cataract, nucleus		5	0.2%	2	0.5%
100.307	punctate cataract, capsular		0		1	0.3%
100.311	incipient cataract, anterior cortex		6	0.3%	1	0.3%
100.312	incipient cataract, posterior cortex		13	0.6%	2	0.5%
100.313	incipient cataract, equatorial cortex		4	0.2%	4	1.0%
100.315	incipient cataract, posterior sutures		0		2	0.5%
100.316	incipient cataract, nucleus		3	0.1%	1	0.3%
100.317	incipient cataract, capsular		3	0.1%	2	0.5%
100.327	incomplete cataract, capsular		0		1	0.3%
100.328	posterior suture tip opacities		1	0.0%	1	0.3%
100.330	generalized/complete cataract		10	0.5%	0	
100.999	*significant cataracts (summary)*		*69*	*3.4%*	*24*	*6.1%*

		1991-2013		2014-2018	
VITREOUS					
110.120	persistent hyaloid artery/remnant	9	0.4%	6	1.5%
110.135	PHPV/PTVL	5	0.2%	2	0.5%
110.320	vitreal degeneration	5	0.2%	0	
RETINA					
120.170	retinal dysplasia, folds	29	1.4%	10	2.6%
120.180	retinal dysplasia, geographic	3	0.1%	1	0.3%
120.190	retinal dysplasia, detached	1	0.0%	0	
120.310	generalized progressive retinal atrophy (PRA)	17	0.8%	0	
120.910	retinal detachment without dialysis	2	0.1%	0	
OPTIC NERVE					
130.110	micropapilla	8	0.4%	0	
130.120	optic nerve hypoplasia	8	0.4%	0	
130.150	optic disc coloboma	1	0.0%	0	
OTHER					
900.000	other, unspecified	40	2.0%	0	
900.100	other, not inherited	64	3.2%	23	5.9%
900.110	other. suspect not inherited/significance unknown	11	0.5%	1	0.3%
NORMAL					
0.000	normal globe	1662	82.6%	289	73.9%

GRAND BASSET GRIFFON VENDEEN

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Persistent pupillary membranes			
	- iris to iris	Not defined	1	Breeder Option
	- iris to cornea	Not defined	2	NO
	- endothelial opacity/no strands	Not defined	2	NO

Description and Comments

A. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Grand Basset Griffon Vendeen breed. The conditions listed above are generally recognized to exist in the breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 2018 and/or Data from OFA All-Breeds Report, 2013-2017.

2. ACVO Genetics Committee, 2017 and/or Data from CERF/OFA All-Breeds Report, 2010-2016.

OCULAR DISORDERS REPORT
GRAND BASSET GRIFFON VENDEEN

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2013 39 #	%	2014-2018 82 #	%
EYELIDS						
25.110	distichiasis		1	2.6%	0	
UVEA						
93.710	persistent pupillary membranes, iris to iris		2	5.1%	4	4.9%
93.730	persistent pupillary membranes, iris to cornea		5	12.8%	2	2.4%
93.750	persistent pupillary membranes, lens pigment foci/no strands		0		2	2.4%
93.760	persistent pupillary membranes, endothelial opacity/no strands		4	10.3%	2	2.4%
LENS						
100.210	cataract. suspect not inherited/significance unknown		1	2.6%	6	7.3%
100.311	incipient cataract, anterior cortex		0		1	1.2%
100.317	incipient cataract, capsular		0		2	2.4%
100.321	incomplete cataract, anterior cortex		0		1	1.2%
100.327	incomplete cataract, capsular		1	2.6%	0	
100.328	posterior suture tip opacities		0		1	1.2%
100.999	*significant cataracts (summary)*		*1*	*2.6%*	*4*	*4.9%*
VITREOUS						
110.135	PHPV/PTVL		1	2.6%	0	
RETINA						
120.170	retinal dysplasia, folds		1	2.6%	0	
120.310	generalized progressive retinal atrophy (PRA)		1	2.6%	0	
OTHER						
900.000	other, unspecified		2	5.1%	0	
900.100	other, not inherited		0		1	1.2%
900.110	other. suspect not inherited/significance unknown		1	2.6%	0	
NORMAL						
0.000	normal globe		24	61.5%	65	79.3%

GREAT DANE

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Microphthalmia with multiple ocular defects associated with partial Albinism	Presumed autosomal dominant	1, 2	NO
B.	Glaucoma	Not defined	1, 3, 4	NO
C.	Entropion	Not defined	1	Breeder option
D.	Ectropion	Not defined	1	Breeder option
E.	Eury/macroblepharon	Not defined	4	Breeder option
F.	Distichiasis	Not defined	1	Breeder option
G.	Nictitans cartilage anomaly/eversion	Not defined	1	Breeder option
H.	Prolapsed gland of the third eyelid	Not defined	5	Breeder option
I.	Uveal cysts	Not defined	4, 6	Breeder option
J.	Persistent pupillary membranes - iris to iris	Not defined	4	Breeder option
K.	Cataract	Not defined	1	NO

Description and Comments

A. Microphthalmia with multiple ocular defects associated with partial albinism

Multiple ocular defects are seen associated with partial albinism (white or light coat color) and deafness in Great Danes. The abnormalities are thought to stem from a common developmental defect. Ocular defects are anterior segment dysgenesis, equatorial staphylomas, microphthalmia, cortical cataracts, lens luxation, spherophakia, iris coloboma, and blue irides. An autosomal dominant mode of inheritance is suspected. The hearing loss is attributable to cochlea-saccular degeneration.

B. Glaucoma

Glaucoma is characterized by an elevation of intraocular pressure (IOP) which, when sustained, causes intraocular damage resulting in blindness. The elevated intraocular pressure occurs because the fluid cannot leave through the iridocorneal angle. Diagnosis and classification of glaucoma requires measurement of the IOP (tonometry) and examination of the iridocorneal angle (gonioscopy). Neither of these tests is part of a routine screening exam for certification.

C. Entropion

A conformational defect resulting in an "in-rolling" of one or both of the eyelids which may cause ocular irritation. It is likely that entropion is influenced by several genes (polygenic), defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull. Entropion and ectropion often occur together in this breed, associated with an abnormally large palpebral fissure.

D. Ectropion

A conformational defect resulting in eversion of the eyelids which may cause ocular irritation. It is likely that ectropion is influenced by several genes (polygenic) defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

E. Eury/macroblepharon

Defined as an exceptionally large palpebral fissure, macroblepharon in conjunction with laxity of the lateral canthal structures may lead to lower lid ectropion and upper lid entropion. Either of these conditions may lead to severe ocular irritation. This condition is no longer listed on the CAER form. Please mark other conditions suspected as inherited and describe in the comments section.

F. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established, although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

G. Nictitans cartilage anomaly/eversion

A scroll-like curling of the cartilage of the third eyelid, usually everting the margin. This condition may occur in one or both eyes and may cause mild ocular irritation.

H. Prolapsed gland of the third eyelid

Protrusion of the tear gland associated with the third eyelid. The mode of inheritance of this disorder is unknown. The exposed gland may become irritated. Commonly referred to as

"cherry eye."

Great Danes were overrepresented in a study of prolapsed gland of the third eyelid. In the study, 83% of the prolapsed glands in Great Danes occurred before 1 year of age. Great Danes were also more likely to develop bilateral prolapsed glands that occurred either simultaneously with the first prolapse or with a short time interval between prolapses.

I. Uveal cysts

Fluid filled sacs arising from the posterior surface of the iris, to which they may remain attached or break free and float into the anterior chamber. Usually occur in mature dogs. In the Great Dane, pigmented cysts may also arise from pigmented epithelial cells of the ciliary body. Ciliary body cysts may predispose to glaucoma in the Great Dane.

J. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

K. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

References

1. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

2. Gwin RM, Wyman M, Lim DJ, et al. Multiple ocular defects associated with partial albinism and deafness in the dog. *J Am Anim Hosp Assoc*. 1981;17:401-408.

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4. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

5. Mazzucchelli S, Vaillant MD, Weverberg F, et al. Retrospective study of 155 cases of prolapse of the nictitating membrane gland in dogs. *Vet Rec*. 2012;170:443.

6. Spiess BM, Bolliger JO, Guscetti F, et al. Multiple ciliary body cysts and secondary glaucoma in the Great Dane: a report of nine cases. *Vet Ophthalmol*. 1998;1:41-45.

7. ACVO Genetics Committee, 2015 and Data from OFA All-Breeds Report, 2014-2015.

OCULAR DISORDERS REPORT
GREAT DANE

Diagnostic Name		1991-2013 TOTAL DOGS EXAMINED 5726 #	%	2014-2018 2684 #	%
GLOBE					
0.110	microphthalmia	22	0.4%	3	0.1%
10.000	glaucoma	2	0.0%	0	
EYELIDS					
20.160	macropalpebral fissure	124	2.2%	0	
21.000	entropion, unspecified	137	2.4%	108	4.0%
22.000	ectropion, unspecified	227	4.0%	102	3.8%
25.110	distichiasis	306	5.3%	150	5.6%
NASOLACRIMAL					
32.110	imperforate lower nasolacrimal punctum	1	0.0%	6	0.2%
40.910	keratoconjunctivitis sicca	1	0.0%	1	0.0%
NICTITANS					
51.100	third eyelid cartilage anomaly	102	1.8%	86	3.2%
52.110	prolapsed gland of the third eyelid	12	0.2%	8	0.3%
CORNEA					
70.210	corneal pannus	2	0.0%	0	
70.220	pigmentary keratitis	2	0.0%	5	0.2%
70.700	corneal dystrophy	24	0.4%	10	0.4%
UVEA					
90.200	uveitis	0		1	0.0%
90.250	pigmentary uveitis	1	0.0%	0	
93.110	iris hypoplasia	5	0.1%	4	0.1%
93.140	corneal endothelial pigment without PPM	2	0.0%	0	
93.150	iris coloboma	17	0.3%	2	0.1%
93.710	persistent pupillary membranes, iris to iris	63	1.1%	25	0.9%
93.720	persistent pupillary membranes, iris to lens	15	0.3%	1	0.0%
93.730	persistent pupillary membranes, iris to cornea	8	0.1%	0	
93.740	persistent pupillary membranes, iris sheets	4	0.1%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	12	0.2%	20	0.7%
93.760	persistent pupillary membranes, endothelial opacity/no strands	1	0.0%	2	0.1%
93.810	uveal melanoma	3	0.1%	1	0.0%
93.999	uveal cysts	68	1.2%	58	2.2%
LENS					
100.200	cataract, unspecified	15	0.3%	0	
100.210	cataract. suspect not inherited/significance unknown	201	3.5%	87	3.2%
100.301	punctate cataract, anterior cortex	22	0.4%	9	0.3%
100.302	punctate cataract, posterior cortex	61	1.1%	21	0.8%
100.303	punctate cataract, equatorial cortex	13	0.2%	6	0.2%
100.304	punctate cataract, anterior sutures	4	0.1%	1	0.0%
100.305	punctate cataract, posterior sutures	24	0.4%	5	0.2%
100.306	punctate cataract, nucleus	12	0.2%	2	0.1%
100.307	punctate cataract, capsular	10	0.2%	9	0.3%
100.311	incipient cataract, anterior cortex	61	1.1%	20	0.7%
100.312	incipient cataract, posterior cortex	135	2.4%	41	1.5%

LENS CONTINUED		1991-2013		2014-2018	
100.313	incipient cataract, equatorial cortex	40	0.7%	12	0.4%
100.314	incipient cataract, anterior sutures	6	0.1%	0	
100.315	incipient cataract, posterior sutures	19	0.3%	5	0.2%
100.316	incipient cataract, nucleus	32	0.6%	2	0.1%
100.317	incipient cataract, capsular	19	0.3%	10	0.4%
100.321	incomplete cataract, anterior cortex	2	0.0%	7	0.3%
100.322	incomplete cataract, posterior cortex	1	0.0%	11	0.4%
100.323	incomplete cataract, equatorial cortex	0		2	0.1%
100.326	incomplete cataract, nucleus	0		3	0.1%
100.327	incomplete cataract, capsular	1	0.0%	1	0.0%
100.328	posterior suture tip opacities	2	0.0%	5	0.2%
100.330	generalized/complete cataract	48	0.8%	6	0.2%
100.375	subluxation/luxation, unspecified	7	0.1%	7	0.3%
100.999	*significant cataracts (summary)*	*525*	*9.2%*	*173*	*6.4%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	8	0.1%	11	0.4%
110.135	PHPV/PTVL	10	0.2%	6	0.2%
110.200	vitritis	2	0.0%	6	0.2%
110.320	vitreal degeneration	34	0.6%	7	0.3%
FUNDUS					
97.110	choroidal hypoplasia	1	0.0%	0	
97.120	coloboma	2	0.0%	0	
RETINA					
120.170	retinal dysplasia, folds	20	0.3%	6	0.2%
120.180	retinal dysplasia, geographic	3	0.1%	0	
120.190	retinal dysplasia, detached	0		2	0.1%
120.310	generalized progressive retinal atrophy (PRA)	7	0.1%	0	
120.910	retinal detachment without dialysis	1	0.0%	0	
120.920	retinal detachment with dialysis	1	0.0%	0	
120.960	retinopathy	2	0.0%	0	
OPTIC NERVE					
130.110	micropapilla	1	0.0%	0	
130.120	optic nerve hypoplasia	3	0.1%	1	0.0%
130.150	optic disc coloboma	2	0.0%	0	
OTHER					
900.000	other, unspecified	60	1.0%	0	
900.100	other, not inherited	149	2.6%	96	3.6%
900.110	other. suspect not inherited/significance unknown	33	0.6%	21	0.8%
NORMAL					
0.000	normal globe	4550	79.5%	1932	72.0%

GREAT PYRENEES

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Entropion	Not defined	1	Breeder option	
B.	Distichiasis	Not defined	2	Breeder option	
C.	Corneal dystrophy - epithelial/stromal	Not defined	3	Breeder option	
D.	Persistent pupillary membranes - iris to iris	Not defined	1, 2, 4	Breeder option	
E.	Cataract	Not defined	1, 4	NO	
F.	Multifocal retinopathy - *cmr1*	Autosomal recessive	5-7	Breeder option	Mutation in the *BEST1* gene

Description and Comments

A. Entropion

A conformational defect resulting in an "in-rolling" of one or both of the eyelids which may cause ocular irritation. It is likely that entropion is influenced by several genes (polygenic) defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

B. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time. It is difficult to make a strong recommendation with regards to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded and breeding discretion is advised.

C. Corneal dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral. In the Great Pyrenees, lesions are circular or semicircular central crystalline deposits in the anterior corneal stroma that appear between 2 and 5 years of age. It may be associated with exophthalmos and

lagophthalmos common in these dogs.

D. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

E. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

F. Multifocal retinopathy

Canine Multifocal Retinopathy type 1 (cmr1) is characterized by numerous distinct (i.e. multifocal), roughly circular patches of elevated retina (multifocal bullous retinal detachments). There may be a serous sub-retinal fluid, or accumulation of sub-retinal material that produces gray-tan-pink colored lesions. These lesions, looking somewhat like blisters, vary in location and size, although typically they are present in both eyes of the affected dog.

The disease generally develops in young dogs between 11-20 weeks of age and there is minimal progression after 1 year of age. The lesions may flatten, leaving areas of retinal thinning and RPE hypertrophy, hyperplasia, and pigmentation. Discrete areas of tapetal hyper-reflectivity may be seen in areas of previous retinal and RPE detachments. Most dogs exhibit no noticeable problem with vision or electroretinographic abnormalities despite their abnormal appearing retinas.

Canine Multifocal Retinopathy type 1 is caused by a mutation in the Bestrophin 1 gene (*BEST1*) and is described to be recessively inherited in the Great Pyrenees, Dogue de Bordeaux, Bullmastiff, and Mastiff. A DNA test is available.

References

1. ACVO Genetics Committee, 2000-2002 and/or Data from CERF All-Breeds Report, 2000-2002.

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OCULAR DISORDERS REPORT
GREAT PYRENEES

Diagnostic Name		1991-2013 TOTAL DOGS EXAMINED 1173 #	%	2014-2018 162 #	%
GLOBE					
0.110	microphthalmia	2	0.2%	0	
EYELIDS					
20.160	macropalpebral fissure	3	0.3%	0	
21.000	entropion, unspecified	14	1.2%	1	0.6%
22.000	ectropion, unspecified	3	0.3%	0	
25.110	distichiasis	16	1.4%	0	
NASOLACRIMAL					
32.110	imperforate lower nasolacrimal punctum	0		1	0.6%
CORNEA					
70.210	corneal pannus	0		1	0.6%
70.700	corneal dystrophy	12	1.0%	5	3.1%
70.730	corneal endothelial degeneration	3	0.3%	0	
UVEA					
93.110	iris hypoplasia	1	0.1%	0	
93.150	iris coloboma	1	0.1%	0	
93.710	persistent pupillary membranes, iris to iris	297	25.3%	39	24.1%
93.720	persistent pupillary membranes, iris to lens	9	0.8%	4	2.5%
93.730	persistent pupillary membranes, iris to cornea	7	0.6%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		1	0.6%
93.760	persistent pupillary membranes, endothelial opacity/no strands	1	0.1%	1	0.6%
93.810	uveal melanoma	1	0.1%	0	
93.999	uveal cysts	6	0.5%	3	1.9%
LENS					
100.200	cataract, unspecified	3	0.3%	0	
100.210	cataract. suspect not inherited/significance unknown	48	4.1%	8	4.9%
100.301	punctate cataract, anterior cortex	10	0.9%	2	1.2%
100.302	punctate cataract, posterior cortex	12	1.0%	1	0.6%
100.303	punctate cataract, equatorial cortex	6	0.5%	0	
100.304	punctate cataract, anterior sutures	3	0.3%	0	
100.305	punctate cataract, posterior sutures	3	0.3%	0	
100.306	punctate cataract, nucleus	3	0.3%	1	0.6%
100.307	punctate cataract, capsular	1	0.1%	0	
100.311	incipient cataract, anterior cortex	22	1.9%	3	1.9%
100.312	incipient cataract, posterior cortex	17	1.4%	4	2.5%
100.313	incipient cataract, equatorial cortex	20	1.7%	3	1.9%
100.315	incipient cataract, posterior sutures	4	0.3%	1	0.6%
100.316	incipient cataract, nucleus	1	0.1%	0	
100.317	incipient cataract, capsular	4	0.3%	0	
100.321	incomplete cataract, anterior cortex	0		1	0.6%
100.322	incomplete cataract, posterior cortex	0		1	0.6%
100.323	incomplete cataract, equatorial cortex	0		1	0.6%
100.325	incomplete cataract, posterior sutures	0		1	0.6%
100.330	generalized/complete cataract	5	0.4%	0	
100.375	subluxation/luxation, unspecified	1	0.1%	0	

LENS CONTINUED		1991-2013		2014-2018	
100.999	*significant cataracts (summary)*	*114*	*9.7%*	*19*	*11.7%*
VITREOUS					
110.135	PHPV/PTVL	1	0.1%	0	
FUNDUS					
97.110	choroidal hypoplasia	2	0.2%	0	
97.120	coloboma	1	0.1%	0	
RETINA					
120.170	retinal dysplasia, folds	9	0.8%	0	
120.180	retinal dysplasia, geographic	15	1.3%	1	0.6%
120.190	retinal dysplasia, detached	2	0.2%	0	
120.310	generalized progressive retinal atrophy (PRA)	5	0.4%	0	
120.910	retinal detachment without dialysis	4	0.3%	0	
120.960	retinopathy	1	0.1%	8	4.9%
OPTIC NERVE					
130.110	micropapilla	6	0.5%	0	
130.120	optic nerve hypoplasia	5	0.4%	0	
130.150	optic disc coloboma	2	0.2%	0	
OTHER					
900.000	other, unspecified	7	0.6%	0	
900.100	other, not inherited	37	3.2%	4	2.5%
900.110	other. suspect not inherited/significance unknown	12	1.0%	0	
NORMAL					
0.000	normal globe	782	66.7%	91	56.2%

GREATER SWISS MOUNTAIN DOG

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Distichiasis	Not defined	1	Breeder option
B.	Entropion	Not defined	2	Breeder option
C.	Persistent pupillary membranes - iris to iris	Not defined	3-5	Breeder option
D.	Cataract	Not defined	1	NO
E.	Persistent hyaloid artery	Not defined	6	Breeder option

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Entropion

A conformational defect resulting in an "in-rolling" of one or both of the eyelids which may cause ocular irritation. It is likely that entropion is influenced by several genes (polygenic), defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull. Entropion and ectropion often occur together in this breed, associated with an abnormally large palpebral fissure.

C. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

D. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume

cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

E. Persistent hyaloid artery (PHA)

Congenital defect resulting from abnormalities in the development and regression of the hyaloid artery. The blood vessel remnant can be present in the vitreous as a small patent vascular strand (PHA) or as a non-vascular strand that appears gray-white (persistent hyaloid remnant).

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Greater Swiss Mountain Dog breed. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

2. ACVO Genetics Committee, 2013-2014 and Data from OFA All-Breeds Report, 2013-2014.

3. ACVO Genetics Committee, 2000-2002 and/or Data from CERF All-Breeds Report, 2000-2002.

4. ACVO Genetics Committee, 2002-2003 and/or Data from CERF All-Breeds Report, 2002-2003.

5. ACVO Genetics Committee, 2003-2004 and/or Data from CERF All-Breeds Report, 2005.

6. ACVO Genetics Committee, 2018 and/or Data from OFA All-Breeds Report, 2013-2017.

OCULAR DISORDERS REPORT
GREATER SWISS MOUNTAIN DOG

		1991-2013		2014-2018	
	TOTAL DOGS EXAMINED	2741		718	
Diagnostic Name		#	%	#	%
GLOBE					
0.110	microphthalmia	0		1	0.1%
EYELIDS					
20.140	ectopic cilia	1	0.0%	0	
20.160	macropalpebral fissure	1	0.0%	0	
21.000	entropion, unspecified	15	0.5%	6	0.8%
22.000	ectropion, unspecified	3	0.1%	0	
25.110	distichiasis	918	33.5%	196	27.3%
NICTITANS					
51.100	third eyelid cartilage anomaly	4	0.1%	1	0.1%
CORNEA					
70.210	corneal pannus	2	0.1%	0	
70.220	pigmentary keratitis	1	0.0%	0	
70.700	corneal dystrophy	13	0.5%	1	0.1%
70.730	corneal endothelial degeneration	1	0.0%	0	
UVEA					
93.150	iris coloboma	1	0.0%	0	
93.710	persistent pupillary membranes, iris to iris	93	3.4%	26	3.6%
93.720	persistent pupillary membranes, iris to lens	5	0.2%	1	0.1%
93.730	persistent pupillary membranes, iris to cornea	5	0.2%	1	0.1%
93.740	persistent pupillary membranes, iris sheets	5	0.2%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	1	0.0%	1	0.1%
93.760	persistent pupillary membranes, endothelial opacity/no strands	1	0.0%	0	
93.999	uveal cysts	2	0.1%	3	0.4%
LENS					
100.210	cataract. suspect not inherited/significance unknown	244	8.9%	53	7.4%
100.301	punctate cataract, anterior cortex	54	2.0%	3	0.4%
100.302	punctate cataract, posterior cortex	48	1.8%	11	1.5%
100.303	punctate cataract, equatorial cortex	25	0.9%	3	0.4%
100.304	punctate cataract, anterior sutures	2	0.1%	1	0.1%
100.305	punctate cataract, posterior sutures	9	0.3%	4	0.6%
100.306	punctate cataract, nucleus	5	0.2%	0	
100.307	punctate cataract, capsular	10	0.4%	3	0.4%
100.311	incipient cataract, anterior cortex	48	1.8%	18	2.5%
100.312	incipient cataract, posterior cortex	84	3.1%	14	1.9%
100.313	incipient cataract, equatorial cortex	64	2.3%	12	1.7%
100.314	incipient cataract, anterior sutures	2	0.1%	0	
100.315	incipient cataract, posterior sutures	9	0.3%	3	0.4%
100.316	incipient cataract, nucleus	8	0.3%	0	
100.317	incipient cataract, capsular	9	0.3%	2	0.3%
100.321	incomplete cataract, anterior cortex	1	0.0%	2	0.3%
100.322	incomplete cataract, posterior cortex	0		2	0.3%
100.323	incomplete cataract, equatorial cortex	0		3	0.4%
100.326	incomplete cataract, nucleus	0		1	0.1%
100.327	incomplete cataract, capsular	0		1	0.1%

LENS CONTINUED		1991-2013		2014-2018	
100.328	posterior suture tip opacities	2	0.1%	2	0.3%
100.330	generalized/complete cataract	6	0.2%	1	0.1%
100.375	subluxation/luxation, unspecified	2	0.1%	1	0.1%
100.999	*significant cataracts (summary)*	*384*	*14.0%*	*84*	*11.7%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	6	0.2%	9	1.3%
110.135	PHPV/PTVL	3	0.1%	1	0.1%
110.320	vitreal degeneration	2	0.1%	1	0.1%
RETINA					
120.170	retinal dysplasia, folds	14	0.5%	5	0.7%
120.180	retinal dysplasia, geographic	5	0.2%	2	0.3%
120.190	retinal dysplasia, detached	1	0.0%	0	
120.310	generalized progressive retinal atrophy (PRA)	3	0.1%	1	0.1%
OPTIC NERVE					
130.110	micropapilla	7	0.3%	0	
130.120	optic nerve hypoplasia	5	0.2%	0	
OTHER					
900.000	other, unspecified	29	1.1%	0	
900.100	other, not inherited	73	2.7%	24	3.3%
900.110	other. suspect not inherited/significance unknown	10	0.4%	2	0.3%
NORMAL					
0.000	normal globe	1609	58.7%	392	54.6%

OCULAR DISORDERS REPORT
GREENLAND DOG

There are insufficient breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the GREENLAND DOG breed. Therefore, there are no conditions listed with breeding advice.

OCULAR DISORDERS REPORT
GREENLAND DOG

Diagnostic Name	TOTAL DOGS EXAMINED	1991-2013 0 #	%	2014-2018 1 #	%
UVEA					
90.200 uveitis		0		1	100.0%

GREYHOUND

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Chronic superficial keratitis/pannus	Not defined	1, 2	NO
B.	Cataract	Not defined	3	NO
C.	Persistent hyperplastic primary vitreous (PHPV)	Not defined	4	NO
D.	Vitreous degeneration	Not defined	5	Breeder option
E.	Retinal atrophy - generalized	Not defined	6	NO

Description and Comments

A. Chronic superficial keratitis/Pannus

A bilateral disease of the cornea which usually starts as a grayish haze to the ventral or ventrolateral cornea, followed by the formation of a vascularized subepithelial growth that begins to spread toward the central cornea; pigmentation follows the vascularization. If severe, vision impairment occurs. Pannus may be associated with plasma cell infiltration of the nictitans.

B. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

C. Persistent hyperplastic primary vitreous (PHPV)

Persistent hyperplastic primary vitreous is a congenital defect resulting from abnormalities in the development and regression of the hyaloid artery (the primary vitreous) and the interaction of this blood vessel with the posterior lens capsule/cortex during embryogenesis.

D. Vitreous degeneration

Liquefaction of the vitreous gel which may predispose to retinal detachment.

E. Retinal atrophy - generalized

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

PRA in the Greyhound may begin as early as 12 months of age, and affected dogs may progress to complete blindness at a relatively young age. In contrast to PRA in other dog breeds, nyctalopia (night blindness) is not an initial finding. In the early stages, the fundus has a characteristic "moth-eaten" appearance with patches of tapetal hyper-reflectivity alternating between areas of decreased reflectivity. In advanced stages, tapetal hyper-reflectivity is more diffuse.

References

1. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

2. Peiffer RL, Jr., Gelatt KN, Gwin RM. Chronic superficial keratitis. *Vet Med Small Anim Clin*. 1977;72:35-37.

3. ACVO Genetics Committee, 2003-2004 and/or Data from CERF All-Breeds Report, 2005.

4. Grimes TD, Mullaney J. Persistent hyperplastic primary vitreous in a Greyhound. *Vet Rec*. 1969;85:607-610.

5. ACVO Genetics Committee, 2002-2003 and/or Data from CERF All-Breeds Report, 2002-2003.

6. Slatter DH, Blogg JR, Constable IJ. Retinal degeneration in Greyhounds. *Aust Vet J*. 1980;56:106-115.

OCULAR DISORDERS REPORT
GREYHOUND

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2013 597 #	 %	2014-2018 124 #	 %
GLOBE						
0.110	microphthalmia		1	0.2%	0	
EYELIDS						
25.110	distichiasis		1	0.2%	1	0.8%
NASOLACRIMAL						
40.910	keratoconjunctivitis sicca		1	0.2%	0	
NICTITANS						
50.210	pannus of third eyelid		0		2	1.6%
51.100	third eyelid cartilage anomaly		2	0.3%	0	
CORNEA						
70.210	corneal pannus		18	3.0%	3	2.4%
70.700	corneal dystrophy		5	0.8%	1	0.8%
70.730	corneal endothelial degeneration		1	0.2%	0	
UVEA						
93.710	persistent pupillary membranes, iris to iris		2	0.3%	0	
93.730	persistent pupillary membranes, iris to cornea		2	0.3%	0	
93.760	persistent pupillary membranes, endothelial opacity/no strands		1	0.2%	0	
LENS						
100.200	cataract, unspecified		2	0.3%	0	
100.210	cataract. suspect not inherited/significance unknown		18	3.0%	9	7.3%
100.301	punctate cataract, anterior cortex		5	0.8%	0	
100.302	punctate cataract, posterior cortex		0		2	1.6%
100.304	punctate cataract, anterior sutures		2	0.3%	0	
100.306	punctate cataract, nucleus		1	0.2%	1	0.8%
100.307	punctate cataract, capsular		1	0.2%	0	
100.311	incipient cataract, anterior cortex		6	1.0%	0	
100.312	incipient cataract, posterior cortex		6	1.0%	4	3.2%
100.313	incipient cataract, equatorial cortex		6	1.0%	0	
100.314	incipient cataract, anterior sutures		1	0.2%	0	
100.316	incipient cataract, nucleus		2	0.3%	0	
100.317	incipient cataract, capsular		1	0.2%	1	0.8%
100.322	incomplete cataract, posterior cortex		0		1	0.8%
100.330	generalized/complete cataract		1	0.2%	0	
100.375	subluxation/luxation, unspecified		2	0.3%	0	
100.999	*significant cataracts (summary)*		*34*	*5.7%*	*9*	*7.3%*
VITREOUS						
110.120	persistent hyaloid artery/remnant		1	0.2%	1	0.8%
110.320	vitreal degeneration		16	2.7%	0	
RETINA						
120.170	retinal dysplasia, folds		3	0.5%	2	1.6%
120.180	retinal dysplasia, geographic		1	0.2%	0	
120.310	generalized progressive retinal atrophy (PRA)		6	1.0%	0	

RETINA CONTINUED	1991-2013		2014-2018	
120.920 retinal detachment with dialysis	0		1	0.8%
OPTIC NERVE				
130.110 micropapilla	2	0.3%	0	
130.120 optic nerve hypoplasia	2	0.3%	0	
OTHER				
900.000 other, unspecified	8	1.3%	0	
900.100 other, not inherited	15	2.5%	20	16.1%
900.110 other. suspect not inherited/significance unknown	12	2.0%	1	0.8%
NORMAL				
0.000 normal globe	497	83.2%	83	66.9%

OCULAR DISORDERS REPORT
HANOVERIAN HOUND

There are insufficient breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the HANOVERIAN HOUND breed. Therefore, there are no conditions listed with breeding advice.

OCULAR DISORDERS REPORT
HANOVERIAN HOUND

Diagnostic Name	TOTAL DOGS EXAMINED	1991-2013 0 #	%	2014-2018 1 #	%
NORMAL					
0.000 normal globe		0		1	100.0%

HARRIER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Persistent pupillary membranes - iris to iris	Not defined	1, 2	Breeder option
B.	Cataract	Not defined	3	NO

Description and Comments

A. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

B. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Harrier breed. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 2000-2002 and/or Data from CERF All-Breeds Report, 2000-2002.

2. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

3. ACVO Genetics Committee, 2008 and/or Data from CERF All-Breeds Report, 2003-2007.

OCULAR DISORDERS REPORT
HARRIER

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2013 398 #	 %	2014-2018 19 #	 %
EYELIDS						
21.000	entropion, unspecified		1	0.3%	0	
25.110	distichiasis		2	0.5%	0	
CORNEA						
70.210	corneal pannus		1	0.3%	0	
70.700	corneal dystrophy		0		1	5.3%
UVEA						
93.710	persistent pupillary membranes, iris to iris		12	3.0%	0	
93.730	persistent pupillary membranes, iris to cornea		1	0.3%	0	
93.740	persistent pupillary membranes, iris sheets		1	0.3%	0	
LENS						
100.210	cataract. suspect not inherited/significance unknown		7	1.8%	1	5.3%
100.302	punctate cataract, posterior cortex		2	0.5%	0	
100.306	punctate cataract, nucleus		1	0.3%	0	
100.311	incipient cataract, anterior cortex		4	1.0%	0	
100.312	incipient cataract, posterior cortex		3	0.8%	0	
100.322	incomplete cataract, posterior cortex		0		1	5.3%
100.999	*significant cataracts (summary)*		*10*	*2.5%*	*1*	*5.3%*
VITREOUS						
110.120	persistent hyaloid artery/remnant		0		1	5.3%
FUNDUS						
97.120	coloboma		1	0.3%	0	
RETINA						
120.310	generalized progressive retinal atrophy (PRA)		3	0.8%	0	
OPTIC NERVE						
130.150	optic disc coloboma		1	0.3%	0	
OTHER						
900.000	other, unspecified		2	0.5%	0	
900.100	other, not inherited		12	3.0%	1	5.3%
900.110	other. suspect not inherited/significance unknown		3	0.8%	0	
NORMAL						
0.000	normal globe		368	92.5%	16	84.2%

HAVANA SILK DOG

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Distichiasis	Not defined	1	Breeder option
B.	Corneal dystrophy - epithelial/stromal	Not defined	2	Breeder option
C.	Persistent pupillary membranes - iris to iris	Not defined	1, 3	Breeder option
D.	Cataract	Not defined	1	NO

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin, which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established, although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Corneal Dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

C. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

D. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region. The exact frequency and significance of cataracts in the breed is not known.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Havana Silk Dog breed. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

2. ACVO Genetics Committee, 2016 and/or Data from CERF/OFA All-Breeds Report, 2010-2015.

3. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

OCULAR DISORDERS REPORT
HAVANA SILK DOG

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2013 523 #	%	2014-2018 204 #	%
EYELIDS						
25.110	distichiasis		26	5.0%	9	4.4%
NICTITANS						
52.110	prolapsed gland of the third eyelid		2	0.4%	1	0.5%
CORNEA						
70.700	corneal dystrophy		4	0.8%	7	3.4%
UVEA						
93.710	persistent pupillary membranes, iris to iris		32	6.1%	3	1.5%
93.740	persistent pupillary membranes, iris sheets		1	0.2%	0	
93.760	persistent pupillary membranes, endothelial opacity/no strands		1	0.2%	0	
LENS						
100.210	cataract. suspect not inherited/significance unknown		10	1.9%	12	5.9%
100.301	punctate cataract, anterior cortex		1	0.2%	0	
100.304	punctate cataract, anterior sutures		1	0.2%	0	
100.311	incipient cataract, anterior cortex		2	0.4%	0	
100.312	incipient cataract, posterior cortex		3	0.6%	0	
100.313	incipient cataract, equatorial cortex		1	0.2%	0	
100.316	incipient cataract, nucleus		1	0.2%	0	
100.328	posterior suture tip opacities		3	0.6%	3	1.5%
100.330	generalized/complete cataract		2	0.4%	0	
100.375	subluxation/luxation, unspecified		1	0.2%	0	
100.999	*significant cataracts (summary)*		*11*	*2.1%*	*0*	
VITREOUS						
110.120	persistent hyaloid artery/remnant		2	0.4%	0	
110.320	vitreal degeneration		6	1.1%	1	0.5%
RETINA						
120.170	retinal dysplasia, folds		1	0.2%	0	
OTHER						
900.000	other, unspecified		7	1.3%	0	
900.100	other, not inherited		5	1.0%	3	1.5%
NORMAL						
0.000	normal globe		457	87.4%	171	83.8%

HAVANESE

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Distichiasis	Not defined	1	Breeder option
B.	Prolapsed gland of third eyelid	Not defined	6	Breeder option
C.	Corneal dystrophy	Not defined	6	Breeder option
D.	Persistent pupillary membranes - iris to iris	Not defined	1, 2	Breeder option
E.	Cataract	Not defined	1, 3	NO
F.	Vitreous degeneration	Not defined	1, 4	Breeder option
G.	Retinal dysplasia - folds	Not defined	5	Breeder option
H.	Retinal atrophy - generalized	Not defined	1	NO

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin, which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established, although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Prolapsed gland of the third eyelid

Protrusion of the tear gland associated with the third eyelid. The mode of inheritance of this disorder is unknown. The exposed gland may become irritated. Commonly referred to as "cherry eye."

C. Corneal dystrophy

Non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers.

D. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

E. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region. The exact frequency and significance of cataracts in the breed is not known.

F. Vitreous degeneration

A liquefaction of the vitreous gel which may predispose to retinal detachment.

G. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached), which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

H. Retinal atrophy - generalized

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. Except for X-linked PRA in the Siberian Husky, in all breeds studied to date, PRA is inherited as an autosomal recessive trait. To date all reports of PRA in the Havanese to CERF or the OFA have been listed as "suspicious" and not affected. Breeder concern has caused the listing here.

References

1. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

2. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

3. Starr AN, Famula TR, Markward NJ, et al. Hereditary evaluation of multiple developmental abnormalities in the Havanese dog breed. *J Hered.* 2007;98:510-517.

4. ACVO Genetics Committee, 2009 and/or Data from CERF All-Breeds Report, 2008.

5. ACVO Genetics Committee, 2008 and/or Data from CERF All-Breeds Report, 2003-2007.

6. ACVO Genetics Committee, 2017 and/or Data from CERF/OFA All-Breeds Report, 2010-2016.

OCULAR DISORDERS REPORT
HAVANESE

		1991-2013 24764		2014-2018 6685	
	TOTAL DOGS EXAMINED				
Diagnostic Name		#	%	#	%
GLOBE					
0.110	microphthalmia	5	0.0%	1	0.0%
EYELIDS					
20.140	ectopic cilia	10	0.0%	1	0.0%
21.000	entropion, unspecified	18	0.1%	0	
22.000	ectropion, unspecified	4	0.0%	0	
25.110	distichiasis	1215	4.9%	348	5.2%
NASOLACRIMAL					
32.110	imperforate lower nasolacrimal punctum	1	0.0%	10	0.1%
40.910	keratoconjunctivitis sicca	6	0.0%	4	0.1%
NICTITANS					
51.100	third eyelid cartilage anomaly	2	0.0%	1	0.0%
52.110	prolapsed gland of the third eyelid	114	0.5%	34	0.5%
CORNEA					
70.210	corneal pannus	1	0.0%	1	0.0%
70.220	pigmentary keratitis	2	0.0%	6	0.1%
70.700	corneal dystrophy	96	0.4%	31	0.5%
70.730	corneal endothelial degeneration	3	0.0%	2	0.0%
UVEA					
90.250	pigmentary uveitis	1	0.0%	0	
93.110	iris hypoplasia	0		1	0.0%
93.140	corneal endothelial pigment without PPM	3	0.0%	0	
93.150	iris coloboma	1	0.0%	2	0.0%
93.710	persistent pupillary membranes, iris to iris	1554	6.3%	362	5.4%
93.720	persistent pupillary membranes, iris to lens	26	0.1%	6	0.1%
93.730	persistent pupillary membranes, iris to cornea	13	0.1%	1	0.0%
93.740	persistent pupillary membranes, iris sheets	18	0.1%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	17	0.1%	25	0.4%
93.760	persistent pupillary membranes, endothelial opacity/no strands	4	0.0%	1	0.0%
93.810	uveal melanoma	3	0.0%	0	
93.999	uveal cysts	3	0.0%	2	0.0%
LENS					
100.200	cataract, unspecified	22	0.1%	0	
100.210	cataract. suspect not inherited/significance unknown	1376	5.6%	471	7.0%
100.301	punctate cataract, anterior cortex	104	0.4%	38	0.6%
100.302	punctate cataract, posterior cortex	90	0.4%	32	0.5%
100.303	punctate cataract, equatorial cortex	32	0.1%	6	0.1%
100.304	punctate cataract, anterior sutures	23	0.1%	10	0.1%
100.305	punctate cataract, posterior sutures	171	0.7%	70	1.0%
100.306	punctate cataract, nucleus	15	0.1%	8	0.1%
100.307	punctate cataract, capsular	35	0.1%	19	0.3%
100.311	incipient cataract, anterior cortex	108	0.4%	27	0.4%
100.312	incipient cataract, posterior cortex	198	0.8%	41	0.6%
100.313	incipient cataract, equatorial cortex	44	0.2%	16	0.2%

LENS CONTINUED		1991-2013		2014-2018	
100.314	incipient cataract, anterior sutures	14	0.1%	3	0.0%
100.315	incipient cataract, posterior sutures	86	0.3%	17	0.3%
100.316	incipient cataract, nucleus	20	0.1%	2	0.0%
100.317	incipient cataract, capsular	45	0.2%	6	0.1%
100.321	incomplete cataract, anterior cortex	2	0.0%	5	0.1%
100.322	incomplete cataract, posterior cortex	4	0.0%	13	0.2%
100.323	incomplete cataract, equatorial cortex	1	0.0%	0	
100.325	incomplete cataract, posterior sutures	0		1	0.0%
100.326	incomplete cataract, nucleus	0		3	0.0%
100.327	incomplete cataract, capsular	0		1	0.0%
100.328	posterior suture tip opacities	34	0.1%	262	3.9%
100.330	generalized/complete cataract	118	0.5%	8	0.1%
100.340	resorbing/hypermature cataract	1	0.0%	2	0.0%
100.375	subluxation/luxation, unspecified	11	0.0%	2	0.0%
100.999	*significant cataracts (summary)*	*1133*	*4.6%*	*328*	*4.9%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	27	0.1%	3	0.0%
110.135	PHPV/PTVL	3	0.0%	0	
110.200	vitritis	5	0.0%	20	0.3%
110.320	vitreal degeneration	468	1.9%	75	1.1%
FUNDUS					
97.110	choroidal hypoplasia	2	0.0%	0	
97.120	coloboma	4	0.0%	0	
RETINA					
120.170	retinal dysplasia, folds	129	0.5%	14	0.2%
120.180	retinal dysplasia, geographic	19	0.1%	6	0.1%
120.190	retinal dysplasia, detached	1	0.0%	0	
120.310	generalized progressive retinal atrophy (PRA)	104	0.4%	4	0.1%
120.400	retinal hemorrhage	1	0.0%	0	
120.910	retinal detachment without dialysis	12	0.0%	0	
120.920	retinal detachment with dialysis	0		3	0.0%
120.960	retinopathy	8	0.0%	14	0.2%
OPTIC NERVE					
130.110	micropapilla	1	0.0%	0	
130.120	optic nerve hypoplasia	3	0.0%	0	
130.150	optic disc coloboma	7	0.0%	1	0.0%
OTHER					
900.000	other, unspecified	257	1.0%	0	
900.100	other, not inherited	608	2.5%	223	3.3%
900.110	other. suspect not inherited/significance unknown	58	0.2%	8	0.1%
NORMAL					
0.000	normal globe	20760	83.8%	4983	74.5%

HOKKAIDO DOG

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Choroidal hypoplasia (Collie Eye Anomaly) - staphyloma/coloboma - retinal detachment - retinal hemorrhage - optic nerve coloboma	Autosomal recessive	1	NO	Mutation in the *NHEJ1* gene

Description and Comments

A. Choroidal hypoplasia (Collie Eye Anomaly)
- staphyloma/coloboma
- retinal detachment
- retinal hemorrhage
- optic nerve coloboma

A spectrum of malformations present at birth and ranging from inadequate development of the choroid (choroidal hypoplasia) to defects of the choroid, sclera, and/or optic nerve (coloboma/staphyloma) to complete retinal detachment (with or without hemorrhage). Mildly affected animals will have no detectable vision deficit.

This disorder is collectively referred to as "Collie Eye Anomaly." The choroidal hypoplasia component is caused by a 7799 base pair deletion with the gene *NHEJ1.* The mutation is a recessive trait. A DNA test is available and is diagnostic only for the choroidal hypoplasia component of CEA. For colobomas to develop, an additional mutation in a second gene has to be present; that gene is still unknown.

A DNA test is available and may not be predictive of all populations. As the genotype-phenotype correlation is complex, and not always straightforward, one should refer to http://www.optigen.com/opt9_coloboma_res.html for a summary and more details of the molecular studies of CEA.

References

There are no breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the Hokkaido Dog. The conditions listed above are currently noted solely due to the availability of a genetic test for the disease.

1. ACVO Genetics Committee, 2017 and/or Data from CERF/OFA All-Breeds Report, 2010-2016.

OCULAR DISORDERS REPORT
HOKKAIDO DOG

Diagnostic Name		1991-2013 TOTAL DOGS EXAMINED 0 #	 %	2014-2018 8 #	 %
UVEA					
93.710	persistent pupillary membranes, iris to iris	0		4	50.0%
93.720	persistent pupillary membranes, iris to lens	0		1	12.5%
LENS					
100.311	incipient cataract, anterior cortex	0		1	12.5%
100.999	*significant cataracts (summary)*	*0*		*1*	*12.5%*
FUNDUS					
97.110	choroidal hypoplasia	0		4	50.0%
RETINA					
120.170	retinal dysplasia, folds	0		1	12.5%
NORMAL					
0.000	normal globe	0		2	25.0%

OCULAR DISORDERS REPORT
HOVAWART

There are insufficient breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the HOVAWART breed. Therefore, there are no conditions listed with breeding advice.

OCULAR DISORDERS REPORT
HOVAWART

Diagnostic Name	TOTAL DOGS EXAMINED	1991-2013 17 #	 %	2014-2018 30 #	 %
EYELIDS					
25.110	distichiasis	0		2	6.7%
UVEA					
93.710	persistent pupillary membranes, iris to iris	1	5.9%	1	3.3%
93.999	uveal cysts	0		1	3.3%
LENS					
100.210	cataract. suspect not inherited/significance unknown	0		2	6.7%
100.301	punctate cataract, anterior cortex	0		1	3.3%
100.306	punctate cataract, nucleus	0		1	3.3%
100.999	*significant cataracts (summary)*	*0*		*2*	*6.7%*
VITREOUS					
110.320	vitreal degeneration	0		1	3.3%
OTHER					
900.100	other, not inherited	0		1	3.3%
NORMAL					
0.000	normal globe	16	94.1%	22	73.3%

IBIZAN HOUND

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Persistent pupillary membranes			
	- iris to iris	Not defined	1	Breeder option
	- lens pigment foci/no strands	Not defined	2	Passes with no notation
B.	Cataract	Not defined	3	NO

Description and Comments

A. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

B. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Ibizan Hound breed. The conditions listed above are generally recognized to exist in the breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 2002-2003 and/or Data from CERF All-Breeds Report, 2002-2003.

2. ACVO Genetics Committee, 2016 and/or Data from CERF/OFA All-Breeds Report, 2010-2015.

3. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

OCULAR DISORDERS REPORT
IBIZAN HOUND

		1991-2013 1096		2014-2018 529	
	TOTAL DOGS EXAMINED				
Diagnostic Name		**#**	**%**	**#**	**%**
GLOBE					
0.110	microphthalmia	2	0.2%	2	0.4%
EYELIDS					
25.110	distichiasis	4	0.4%	0	
NASOLACRIMAL					
40.910	keratoconjunctivitis sicca	1	0.1%	0	
NICTITANS					
51.100	third eyelid cartilage anomaly	1	0.1%	0	
52.110	prolapsed gland of the third eyelid	0		1	0.2%
CORNEA					
70.700	corneal dystrophy	8	0.7%	2	0.4%
UVEA					
93.140	corneal endothelial pigment without PPM	1	0.1%	0	
93.150	iris coloboma	0		1	0.2%
93.710	persistent pupillary membranes, iris to iris	129	11.8%	63	11.9%
93.720	persistent pupillary membranes, iris to lens	1	0.1%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	7	0.6%	8	1.5%
93.760	persistent pupillary membranes, endothelial opacity/no strands	5	0.5%	0	
93.999	uveal cysts	3	0.3%	1	0.2%
97.150	chorioretinal coloboma, congenital	0		1	0.2%
LENS					
100.200	cataract, unspecified	4	0.4%	0	
100.210	cataract. suspect not inherited/significance unknown	66	6.0%	24	4.5%
100.301	punctate cataract, anterior cortex	3	0.3%	1	0.2%
100.302	punctate cataract, posterior cortex	2	0.2%	2	0.4%
100.303	punctate cataract, equatorial cortex	0		1	0.2%
100.304	punctate cataract, anterior sutures	1	0.1%	1	0.2%
100.305	punctate cataract, posterior sutures	0		6	1.1%
100.306	punctate cataract, nucleus	7	0.6%	0	
100.307	punctate cataract, capsular	2	0.2%	3	0.6%
100.311	incipient cataract, anterior cortex	6	0.5%	0	
100.312	incipient cataract, posterior cortex	7	0.6%	3	0.6%
100.313	incipient cataract, equatorial cortex	4	0.4%	1	0.2%
100.314	incipient cataract, anterior sutures	1	0.1%	1	0.2%
100.316	incipient cataract, nucleus	16	1.5%	10	1.9%
100.317	incipient cataract, capsular	2	0.2%	1	0.2%
100.322	incomplete cataract, posterior cortex	0		1	0.2%
100.327	incomplete cataract, capsular	0		1	0.2%
100.328	posterior suture tip opacities	1	0.1%	1	0.2%
100.330	generalized/complete cataract	2	0.2%	0	
100.375	subluxation/luxation, unspecified	1	0.1%	2	0.4%
100.999	*significant cataracts (summary)*	*57*	*5.2%*	*32*	*6.0%*

		1991-2013		2014-2018	
VITREOUS					
110.120	persistent hyaloid artery/remnant	2	0.2%	2	0.4%
110.200	vitritis	0		2	0.4%
110.320	vitreal degeneration	13	1.2%	2	0.4%
FUNDUS					
97.110	choroidal hypoplasia	0		1	0.2%
RETINA					
120.170	retinal dysplasia, folds	11	1.0%	0	
120.180	retinal dysplasia, geographic	2	0.2%	0	
120.310	generalized progressive retinal atrophy (PRA)	4	0.4%	0	
120.910	retinal detachment without dialysis	1	0.1%	0	
120.960	retinopathy	0		1	0.2%
OPTIC NERVE					
130.150	optic disc coloboma	3	0.3%	0	
OTHER					
900.000	other, unspecified	24	2.2%	0	
900.100	other, not inherited	20	1.8%	19	3.6%
900.110	other. suspect not inherited/significance unknown	2	0.2%	1	0.2%
NORMAL					
0.000	normal globe	897	81.8%	388	73.3%

ICELANDIC SHEEPDOG

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder option
B.	Cataract	Not defined	2	NO

Description and Comments

A. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

B. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Icelandic Sheepdog breed. The conditions listed above are generally recognized to exist in the breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

2. ACVO Genetics Committee, 2006 and/or Data from CERF All-Breeds Report, 2001-2005.

OCULAR DISORDERS REPORT
ICELANDIC SHEEPDOG

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2013 1556 #	%	2014-2018 921 #	%
EYELIDS						
21.000	entropion, unspecified		5	0.3%	0	
25.110	distichiasis		16	1.0%	6	0.7%
NICTITANS						
50.210	pannus of third eyelid		0		1	0.1%
CORNEA						
70.210	corneal pannus		0		1	0.1%
70.220	pigmentary keratitis		0		1	0.1%
70.700	corneal dystrophy		6	0.4%	3	0.3%
UVEA						
93.110	iris hypoplasia		2	0.1%	0	
93.710	persistent pupillary membranes, iris to iris		91	5.8%	25	2.7%
93.720	persistent pupillary membranes, iris to lens		1	0.1%	0	
93.730	persistent pupillary membranes, iris to cornea		3	0.2%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands		0		2	0.2%
LENS						
100.210	cataract. suspect not inherited/significance unknown		35	2.2%	27	2.9%
100.301	punctate cataract, anterior cortex		3	0.2%	4	0.4%
100.302	punctate cataract, posterior cortex		4	0.3%	2	0.2%
100.303	punctate cataract, equatorial cortex		1	0.1%	0	
100.304	punctate cataract, anterior sutures		1	0.1%	1	0.1%
100.305	punctate cataract, posterior sutures		3	0.2%	6	0.7%
100.307	punctate cataract, capsular		0		1	0.1%
100.311	incipient cataract, anterior cortex		1	0.1%	2	0.2%
100.312	incipient cataract, posterior cortex		10	0.6%	4	0.4%
100.313	incipient cataract, equatorial cortex		3	0.2%	0	
100.315	incipient cataract, posterior sutures		8	0.5%	0	
100.317	incipient cataract, capsular		1	0.1%	1	0.1%
100.321	incomplete cataract, anterior cortex		1	0.1%	3	0.3%
100.322	incomplete cataract, posterior cortex		2	0.1%	2	0.2%
100.328	posterior suture tip opacities		0		6	0.7%
100.330	generalized/complete cataract		1	0.1%	0	
100.999	*significant cataracts (summary)*		*39*	*2.5%*	*26*	*2.8%*
VITREOUS						
110.120	persistent hyaloid artery/remnant		2	0.1%	1	0.1%
110.320	vitreal degeneration		3	0.2%	1	0.1%
RETINA						
120.170	retinal dysplasia, folds		9	0.6%	0	
120.180	retinal dysplasia, geographic		1	0.1%	0	
120.310	generalized progressive retinal atrophy (PRA)		1	0.1%	0	
120.960	retinopathy		0		2	0.2%
OPTIC NERVE						
130.150	optic disc coloboma		2	0.1%	0	

		1991-2013		2014-2018	
OTHER					
900.000	other, unspecified	25	1.6%	0	
900.100	other, not inherited	41	2.6%	43	4.7%
900.110	other. suspect not inherited/significance unknown	1	0.1%	1	0.1%
NORMAL					
0.000	normal globe	1439	92.5%	792	86.0%

IRISH RED AND WHITE SETTER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Distichiasis	Not defined	1	Breeder option	
B.	Persistent pupillary membranes - iris to iris	Not defined	2	Breeder option	
C.	Retinal atrophy - rod-cone dysplasia, type 1 (*rcd1*)	Autosomal recessive	**	NO	Mutation of the *PDE6B* gene
D.	Retinal atrophy - rod-cone dysplasia, type 4 (*rcd4*)	Autosomal recessive	3	NO	mutation of the *C2orf71* gene
E.	Cataract	Not defined	4	NO	

*see numerous *rcd1* PRA references under Irish Setters

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment.

C. Retinal atrophy - rod-cone dysplasia, type 1 (*rcd1*)

A form of PRA identified in Irish Setters and Irish Red and White Setters. Clinical night blindness is observed as early as 6 weeks of age progressing to total blindness by one year.

It may be diagnosed as early as 24 days with an ERG. Histologically the disease can be detected by 6 weeks. The disorder is caused by a mutation present in exon 21/codon 807 of the *PDE6B* gene. A DNA test is now available that will unequivocally identify genetically normal, affected and carrier dogs. The test is accurate only for this mutation and will not identify other forms of PRA.

D. Retinal atrophy - rod-cone dysplasia, type 4 (*rcd4*)

A form of PRA identified in the Gordon and Irish Setter breeds. Clinical night blindness is observed on average as late as 10 years of age and progresses to total blindness. This form of PRA has been referred to as late-onset PRA (LOPRA). The disorder is caused by a mutation present in the *C2orf71* gene. A DNA test is now available that will unequivocally identify genetically normal, affected and carrier dogs. The test is accurate only for this mutation and will not identify other forms of PRA.

E. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

References

1. ACVO Genetics Committee, 2000-2002 and/or Data from CERF All-Breeds Report, 2000-2002.

2. ACVO Genetics Committee, 2009 and/or Data from CERF All-Breeds Report, 2008.

3. Downs LM, Bell JS, Freeman J, et al. Late-onset progressive retinal atrophy in the Gordon and Irish Setter breeds is associated with a frameshift mutation in C2orf71. *Anim Genet*. 2012 Jun 12.

4. ACVO Genetics Committee, 2016 and/or Data from CERF/OFA All-Breeds Report, 2010-2015.

OCULAR DISORDERS REPORT
IRISH RED & WHITE SETTER

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2013 343 #	%	2014-2018 251 #	%
EYELIDS						
21.000	entropion, unspecified		0		1	0.4%
25.110	distichiasis		19	5.5%	4	1.6%
CORNEA						
70.210	corneal pannus		2	0.6%	0	
70.700	corneal dystrophy		1	0.3%	0	
70.730	corneal endothelial degeneration		0		1	0.4%
UVEA						
93.710	persistent pupillary membranes, iris to iris		5	1.5%	3	1.2%
93.750	persistent pupillary membranes, lens pigment foci/no strands		1	0.3%	1	0.4%
93.760	persistent pupillary membranes, endothelial opacity/no strands		1	0.3%	0	
93.999	uveal cysts		1	0.3%	2	0.8%
LENS						
100.210	cataract. suspect not inherited/significance unknown		14	4.1%	10	4.0%
100.301	punctate cataract, anterior cortex		2	0.6%	2	0.8%
100.302	punctate cataract, posterior cortex		5	1.5%	3	1.2%
100.304	punctate cataract, anterior sutures		1	0.3%	0	
100.307	punctate cataract, capsular		0		2	0.8%
100.311	incipient cataract, anterior cortex		2	0.6%	3	1.2%
100.312	incipient cataract, posterior cortex		5	1.5%	3	1.2%
100.315	incipient cataract, posterior sutures		1	0.3%	0	
100.316	incipient cataract, nucleus		0		3	1.2%
100.321	incomplete cataract, anterior cortex		0		1	0.4%
100.322	incomplete cataract, posterior cortex		0		1	0.4%
100.375	subluxation/luxation, unspecified		1	0.3%	0	
100.999	*significant cataracts (summary)*		*16*	*4.7%*	*18*	*7.2%*
VITREOUS						
110.135	PHPV/PTVL		1	0.3%	0	
110.200	vitritis		0		1	0.4%
110.320	vitreal degeneration		1	0.3%	3	1.2%
RETINA						
120.170	retinal dysplasia, folds		4	1.2%	0	
120.180	retinal dysplasia, geographic		2	0.6%	0	
120.310	generalized progressive retinal atrophy (PRA)		2	0.6%	1	0.4%
120.960	retinopathy		0		1	0.4%
OTHER						
900.000	other, unspecified		5	1.5%	0	
900.100	other, not inherited		10	2.9%	17	6.8%
900.110	other. suspect not inherited/significance unknown		1	0.3%	0	
NORMAL						
0.000	normal globe		299	87.2%	199	79.3%

IRISH SETTER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Entropion	Not defined	1	Breeder option	
B.	Distichiasis	Not defined	1	Breeder option	
C.	Persistent pupillary membranes				
	- iris to iris	Not defined	1	Breeder option	
	- lens pigment foci/no strands	Not defined	2	Passes with no notation	
D.	Cataract	Not defined	1	NO	
E.	Persistent hyaloid artery	Not defined	1	Breeder option	
F.	Retinal dysplasia - folds	Not defined	3	Breeder option	
G.	Retinal atrophy - generalized	Presumed autosomal recessive	1, 4-24	NO	
H.	Retinal atrophy - rod-cone dysplasia, type 1 (*rcd1*)	Autosomal recessive	1, 4-23	NO	Mutation of the *PDE6B* gene
I.	Retinal atrophy - rod-cone dysplasia type 4 (*rcd4*)	Autosomal recessive	25	NO	Mutation of the *C2orf71* gene
J.	Amblyopia with quadriplegia	Autosomal recessive	26, 27	NO	

Description and Comments

A. Entropion

A conformational defect resulting in an "in-rolling" of one or both of the eyelids which may cause ocular irritation. It is likely that entropion is influenced by several genes (polygenic), defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull. In the Irish Setter, the entropion usually involves the lower eyelids.

B. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established, although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

C. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

D. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

E. Persistent hyaloid artery (PHA)

A congenital defect resulting from abnormalities in the development and regression of the hyaloid artery. The blood vessel remnant can be present in the vitreous as a small vascular strand (PHA) or as a non-vascular strand that appears gray-white (persistent hyaloid remnant).

F. Retinal dystrophy – folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and the more severe forms of retinal dysplasia is undetermined.

G. Retinal atrophy - generalized

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. Except for X-linked PRA in the Siberian Husky, in all breeds studied to date, PRA is inherited as an autosomal recessive trait.

In the Irish Setter, a later form of progressive retinal atrophy has been observed by several ophthalmologists at 4-5 years of age. Cases seen in this category appear to advance more rapidly than those with rod-cone dysplasia.

H. Retinal atrophy - rod-cone dysplasia, type 1 (*rcd1*)

A form of PRA identified in Irish Setters. Clinical night blindness is observed as early as 6 weeks of age progressing to total blindness by one year. It may be diagnosed as early as 24 days with an ERG. Histologically the disease can be detected by 6 weeks. The disorder is caused by a mutation present in exon 21/codon 807 of the *PDE6B* gene. A DNA test is available that will unequivocally identify genetically normal, affected and carrier dogs. The test is accurate only for this mutation and will not identify other forms of PRA.

I. Retinal atrophy - rod-cone dysplasia, type 4 (*rcd4*)

A form of PRA identified in the Gordon and Irish Setter breeds. Clinical night blindness is observed on average as late as 10 years of age and progresses to total blindness. This form of PRA has been referred to as late-onset PRA (LOPRA). The disorder is caused by a mutation present in the *C2orf71* gene. A DNA test is available that will unequivocally identify genetically normal, affected and carrier dogs. The test is accurate only for this mutation and will not identify other forms of PRA.

J. Amblyopia with quadriplegia

A congenital quadriplegia and amblyopia. The main symptoms include inability to stand or walk, amblyopia, tremor, nystagmus and possible seizures. Pathologic lesions are confined to the cerebellum. The condition was shown to be due to a fully penetrant autosomal recessive gene that is post-natally lethal in the homozygote.

References

1. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

2. ACVO Genetics Committee, 2016 and/or Data from CERF/OFA All-Breeds Report, 2010-2015.

3. ACVO Genetics Committee, 2017 and/or Data from CERF/OFA All-Breeds Report, 2010-2016.

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OCULAR DISORDERS REPORT
IRISH SETTER

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2013 1857 #	%	2014-2018 359 #	%
GLOBE						
0.110	microphthalmia		1	0.1%	1	0.3%
10.000	glaucoma		1	0.1%	0	
EYELIDS						
20.140	ectopic cilia		1	0.1%	0	
20.160	macropalpebral fissure		2	0.1%	0	
21.000	entropion, unspecified		47	2.5%	7	1.9%
22.000	ectropion, unspecified		8	0.4%	1	0.3%
25.110	distichiasis		112	6.0%	14	3.9%
NASOLACRIMAL						
32.110	imperforate lower nasolacrimal punctum		1	0.1%	1	0.3%
40.910	keratoconjunctivitis sicca		1	0.1%	0	
NICTITANS						
52.110	prolapsed gland of the third eyelid		3	0.2%	0	
CORNEA						
70.210	corneal pannus		1	0.1%	0	
70.220	pigmentary keratitis		1	0.1%	0	
70.700	corneal dystrophy		6	0.3%	0	
70.730	corneal endothelial degeneration		1	0.1%	0	
UVEA						
93.140	corneal endothelial pigment without PPM		2	0.1%	0	
93.710	persistent pupillary membranes, iris to iris		71	3.8%	24	6.7%
93.720	persistent pupillary membranes, iris to lens		7	0.4%	0	
93.730	persistent pupillary membranes, iris to cornea		5	0.3%	1	0.3%
93.750	persistent pupillary membranes, lens pigment foci/no strands		14	0.8%	16	4.5%
93.760	persistent pupillary membranes, endothelial opacity/no strands		0		4	1.1%
93.810	uveal melanoma		1	0.1%	0	
93.999	uveal cysts		2	0.1%	3	0.8%
LENS						
100.200	cataract, unspecified		31	1.7%	0	
100.210	cataract. suspect not inherited/significance unknown		94	5.1%	15	4.2%
100.301	punctate cataract, anterior cortex		4	0.2%	6	1.7%
100.302	punctate cataract, posterior cortex		9	0.5%	3	0.8%
100.303	punctate cataract, equatorial cortex		3	0.2%	1	0.3%
100.304	punctate cataract, anterior sutures		0		1	0.3%
100.305	punctate cataract, posterior sutures		2	0.1%	1	0.3%
100.306	punctate cataract, nucleus		4	0.2%	0	
100.307	punctate cataract, capsular		6	0.3%	4	1.1%
100.311	incipient cataract, anterior cortex		19	1.0%	1	0.3%
100.312	incipient cataract, posterior cortex		18	1.0%	3	0.8%
100.313	incipient cataract, equatorial cortex		5	0.3%	0	
100.314	incipient cataract, anterior sutures		4	0.2%	0	
100.315	incipient cataract, posterior sutures		3	0.2%	1	0.3%
100.316	incipient cataract, nucleus		8	0.4%	1	0.3%

LENS CONTINUED		1991-2013		2014-2018	
100.317	incipient cataract, capsular	2	0.1%	2	0.6%
100.321	incomplete cataract, anterior cortex	0		1	0.3%
100.322	incomplete cataract, posterior cortex	0		1	0.3%
100.325	incomplete cataract, posterior sutures	1	0.1%	0	
100.328	posterior suture tip opacities	0		1	0.3%
100.330	generalized/complete cataract	16	0.9%	2	0.6%
100.340	resorbing/hypermature cataract	0		1	0.3%
100.375	subluxation/luxation, unspecified	1	0.1%	0	
100.999	*significant cataracts (summary)*	*135*	*7.3%*	*29*	*8.1%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	20	1.1%	4	1.1%
110.135	PHPV/PTVL	10	0.5%	0	
110.320	vitreal degeneration	4	0.2%	0	
RETINA					
120.170	retinal dysplasia, folds	8	0.4%	3	0.8%
120.180	retinal dysplasia, geographic	1	0.1%	0	
120.310	generalized progressive retinal atrophy (PRA)	18	1.0%	0	
120.960	retinopathy	0		1	0.3%
OPTIC NERVE					
130.120	optic nerve hypoplasia	4	0.2%	0	
130.150	optic disc coloboma	1	0.1%	0	
OTHER					
900.000	other, unspecified	19	1.0%	0	
900.100	other, not inherited	44	2.4%	21	5.8%
900.110	other. suspect not inherited/significance unknown	18	1.0%	1	0.3%
NORMAL					
0.000	normal globe	1442	77.7%	243	67.7%

IRISH WATER SPANIEL

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Distichiasis	Not defined	1	Breeder option
B.	Persistent pupillary membranes - iris to iris	Not defined	2	Breeder option
C.	Cataract	Not defined	1	NO

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

C. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Irish Water Spaniel breed. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

2. ACVO Genetics Committee, 2002-2003 and/or Data from CERF All-Breeds Report, 2002-2003.

OCULAR DISORDERS REPORT
IRISH WATER SPANIEL

		1991-2013		2014-2018	
	TOTAL DOGS EXAMINED	950		276	
Diagnostic Name		#	%	#	%
EYELIDS					
20.140	ectopic cilia	1	0.1%	0	
21.000	entropion, unspecified	10	1.1%	0	
22.000	ectropion, unspecified	3	0.3%	0	
25.110	distichiasis	240	25.3%	74	26.8%
CORNEA					
70.700	corneal dystrophy	3	0.3%	2	0.7%
UVEA					
93.150	iris coloboma	1	0.1%	0	
93.710	persistent pupillary membranes, iris to iris	29	3.1%	26	9.4%
93.730	persistent pupillary membranes, iris to cornea	2	0.2%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	1	0.1%	2	0.7%
93.760	persistent pupillary membranes, endothelial opacity/no strands	1	0.1%	0	
93.999	uveal cysts	2	0.2%	0	
LENS					
100.200	cataract, unspecified	3	0.3%	0	
100.210	cataract. suspect not inherited/significance unknown	82	8.6%	31	11.2%
100.301	punctate cataract, anterior cortex	12	1.3%	6	2.2%
100.302	punctate cataract, posterior cortex	9	0.9%	0	
100.303	punctate cataract, equatorial cortex	4	0.4%	0	
100.305	punctate cataract, posterior sutures	1	0.1%	0	
100.306	punctate cataract, nucleus	0		1	0.4%
100.311	incipient cataract, anterior cortex	14	1.5%	0	
100.312	incipient cataract, posterior cortex	22	2.3%	1	0.4%
100.313	incipient cataract, equatorial cortex	9	0.9%	1	0.4%
100.314	incipient cataract, anterior sutures	2	0.2%	0	
100.315	incipient cataract, posterior sutures	2	0.2%	0	
100.316	incipient cataract, nucleus	5	0.5%	1	0.4%
100.317	incipient cataract, capsular	4	0.4%	1	0.4%
100.326	incomplete cataract, nucleus	0		1	0.4%
100.328	posterior suture tip opacities	0		1	0.4%
100.330	generalized/complete cataract	1	0.1%	0	
100.999	*significant cataracts (summary)*	*88*	*9.3%*	*12*	*4.3%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	2	0.2%	0	
110.320	vitreal degeneration	2	0.2%	0	
RETINA					
120.170	retinal dysplasia, folds	3	0.3%	2	0.7%
120.180	retinal dysplasia, geographic	1	0.1%	0	
120.310	generalized progressive retinal atrophy (PRA)	5	0.5%	0	
120.910	retinal detachment without dialysis	1	0.1%	0	
120.960	retinopathy	2	0.2%	1	0.4%

		1991-2013		2014-2018	
OTHER					
900.000	other, unspecified	20	2.1%	0	
900.100	other, not inherited	16	1.7%	12	4.3%
900.110	other. suspect not inherited/significance unknown	4	0.4%	0	
NORMAL					
0.000	normal globe	673	70.8%	145	52.5%

IRISH WOLFHOUND

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Distichiasis	Not defined	1	Breeder option
B.	Nictitans cartilage anomaly/eversion	Not defined	1	Breeder option
C.	Corneal dystrophy - epithelial/stromal	Not defined	1	Breeder option
D.	Persistent pupillary membranes			
	- iris to iris	Not defined	2	Breeder option
	- iris to cornea	Not defined	2	NO
E.	Uveal cysts	Not defined	1	Breeder option
F.	Cataract	Not defined	1	NO
G.	Retinal dysplasia - folds	Not defined	2	Breeder option
H.	Optic nerve hypoplasia	Not defined	4	NO

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Nictitans cartilage anomaly/eversion

A scroll-like curling of the cartilage of the third eyelid, usually everting the margin. This condition may occur in one or both eyes and may cause mild ocular irritation.

C. Corneal dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

D. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally in the neonatal period. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

E. Uveal cysts

Fluid filled sacs arising from the posterior surface of the iris, to which they may remain attached or break free and float into the anterior chamber. Usually occur in mature dogs.

F. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

G. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

H. Optic nerve hypoplasia

A congenital defect of the optic nerve which causes blindness and abnormal pupil response in the affected eye. May be unable to differentiate from micropapilla on a routine (dilated) screening ophthalmoscopic exam.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Irish Wolfhound breed. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

2. ACVO Genetics Committee, 2002-2003 and/or Data from CERF All-Breeds Report, 2002-2003.

3. ACVO Genetics Committee, 2007 and/or Data from CERF All-Breeds Report, 2002-2006.

4. ACVO Genetics Committee, 2013-2014 and Data from OFA All-Breeds Report, 2013-2014.

OCULAR DISORDERS REPORT
IRISH WOLFHOUND

		1991-2013 1547		2014-2018 590	
	TOTAL DOGS EXAMINED				
Diagnostic Name		**#**	**%**	**#**	**%**
GLOBE					
0.110	microphthalmia	1	0.1%	0	
EYELIDS					
20.140	ectopic cilia	1	0.1%	0	
21.000	entropion, unspecified	6	0.4%	0	
25.110	distichiasis	77	5.0%	29	4.9%
NICTITANS					
50.210	pannus of third eyelid	0		2	0.3%
51.100	third eyelid cartilage anomaly	14	0.9%	7	1.2%
CORNEA					
70.220	pigmentary keratitis	1	0.1%	0	
70.700	corneal dystrophy	34	2.2%	5	0.8%
70.730	corneal endothelial degeneration	2	0.1%	0	
UVEA					
93.710	persistent pupillary membranes, iris to iris	17	1.1%	6	1.0%
93.720	persistent pupillary membranes, iris to lens	4	0.3%	3	0.5%
93.730	persistent pupillary membranes, iris to cornea	10	0.6%	1	0.2%
93.740	persistent pupillary membranes, iris sheets	4	0.3%	1	0.2%
93.760	persistent pupillary membranes, endothelial opacity/no strands	0		2	0.3%
93.810	uveal melanoma	0		1	0.2%
93.999	uveal cysts	76	4.9%	45	7.6%
LENS					
100.200	cataract, unspecified	12	0.8%	0	
100.210	cataract. suspect not inherited/significance unknown	63	4.1%	33	5.6%
100.301	punctate cataract, anterior cortex	9	0.6%	3	0.5%
100.302	punctate cataract, posterior cortex	21	1.4%	4	0.7%
100.303	punctate cataract, equatorial cortex	2	0.1%	0	
100.304	punctate cataract, anterior sutures	1	0.1%	0	
100.305	punctate cataract, posterior sutures	8	0.5%	0	
100.306	punctate cataract, nucleus	3	0.2%	2	0.3%
100.307	punctate cataract, capsular	3	0.2%	2	0.3%
100.311	incipient cataract, anterior cortex	9	0.6%	4	0.7%
100.312	incipient cataract, posterior cortex	30	1.9%	8	1.4%
100.313	incipient cataract, equatorial cortex	7	0.5%	2	0.3%
100.314	incipient cataract, anterior sutures	1	0.1%	0	
100.315	incipient cataract, posterior sutures	10	0.6%	4	0.7%
100.316	incipient cataract, nucleus	9	0.6%	2	0.3%
100.317	incipient cataract, capsular	1	0.1%	2	0.3%
100.322	incomplete cataract, posterior cortex	0		2	0.3%
100.323	incomplete cataract, equatorial cortex	0		1	0.2%
100.326	incomplete cataract, nucleus	0		1	0.2%
100.328	posterior suture tip opacities	0		2	0.3%
100.330	generalized/complete cataract	4	0.3%	1	0.2%
100.999	*significant cataracts (summary)*	*130*	*8.4%*	*38*	*6.4%*

		1991-2013		2014-2018	
VITREOUS					
110.120	persistent hyaloid artery/remnant	5	0.3%	2	0.3%
110.320	vitreal degeneration	6	0.4%	1	0.2%
RETINA					
120.170	retinal dysplasia, folds	22	1.4%	6	1.0%
120.180	retinal dysplasia, geographic	11	0.7%	0	
120.190	retinal dysplasia, detached	2	0.1%	0	
120.310	generalized progressive retinal atrophy (PRA)	2	0.1%	0	
120.400	retinal hemorrhage	1	0.1%	0	
120.910	retinal detachment without dialysis	1	0.1%	0	
120.960	retinopathy	0		1	0.2%
OPTIC NERVE					
130.110	micropapilla	11	0.7%	4	0.7%
130.120	optic nerve hypoplasia	25	1.6%	4	0.7%
130.150	optic disc coloboma	2	0.1%	0	
OTHER					
900.000	other, unspecified	22	1.4%	0	
900.100	other, not inherited	62	4.0%	36	6.1%
900.110	other. suspect not inherited/significance unknown	13	0.8%	1	0.2%
NORMAL					
0.000	normal globe	1203	77.8%	411	69.7%

ITALIAN GREYHOUND

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Cataract	Not defined	1	NO	
B.	Vitreous degeneration	Not defined	1, 2, 3, 4	Breeder option	
C.	Retinal atrophy - generalized (*IG-PRA1*)	Autosomal recessive	1, 4, 5	NO	A genetic test for susceptibility is available
D.	Choroidal hypoplasia	Not defined	4	NO	

Description and Comments

A. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

In the Italian Greyhound, posterior subcapsular and cortical cataracts at two to three years of age appear to be the more common location of occurrence, with progression noted in an undetermined percentage of dogs.

B. Vitreous degeneration

A liquefaction of the vitreous gel which may predispose to retinal detachment.

C. Retinal atrophy - generalized *(IG-PRA1*)

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

Italian Greyhound PRA (*IG-PRA1*) is considered a "late onset" PRA with clinical signs detected between 3-5 years of age. Dogs initially lose night vision followed by decreased vision in bright light conditions. Clinically increases in tapetal reflectivity and retinal vessel attenuation are noted. The risk allele is known, but the genetic mutation has not been determined. The disease has been presumed to be inherited as an autosomal recessive

trait. However some affected dogs had only one copy of the risk allele suggesting an autosomal dominant with incomplete penetrance mode of inheritance. A DNA test is available for the risk allele. At least one other form of PRA appears to be present in the breed and will not be detected with this test.

D. Choroidal hypoplasia

Inadequate development of the choroid present at birth and non-progressive. This condition is more commonly identified in the Collie breed where it is a manifestation of "Collie Eye Anomaly."

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Italian Greyhound breed. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

2. ACVO Genetics Committee, 2000-2002 and/or Data from CERF All-Breeds Report, 2000-2002.

3. ACVO Genetics Committee, 2009 and/or Data from CERF All-Breeds Report, 2008.

4. ACVO Genetics Committee, 2016 and/or Data from CERF/OFA All-Breeds Report, 2010-2015.

5. Goldstein O, Pearce-Kelling, SE, Aguirre GD, Acland GM. Adult onset autosomal recessive hereditary retinal degeneration in Italian Greyhound dogs. *IOVS*, April 2011, Vol 52, 4351.

OCULAR DISORDERS REPORT
ITALIAN GREYHOUND

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2013 7091 #	%	2014-2018 930 #	%
GLOBE						
0.110	microphthalmia		1	0.0%	0	
EYELIDS						
25.110	distichiasis		17	0.2%	6	0.6%
NASOLACRIMAL						
32.110	imperforate lower nasolacrimal punctum		3	0.0%	5	0.5%
CORNEA						
70.210	corneal pannus		6	0.1%	1	0.1%
70.220	pigmentary keratitis		2	0.0%	0	
70.700	corneal dystrophy		18	0.3%	3	0.3%
UVEA						
93.110	iris hypoplasia		1	0.0%	0	
93.140	corneal endothelial pigment without PPM		3	0.0%	0	
93.150	iris coloboma		6	0.1%	0	
93.710	persistent pupillary membranes, iris to iris		49	0.7%	3	0.3%
93.720	persistent pupillary membranes, iris to lens		6	0.1%	0	
93.730	persistent pupillary membranes, iris to cornea		5	0.1%	0	
93.740	persistent pupillary membranes, iris sheets		5	0.1%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands		5	0.1%	2	0.2%
93.760	persistent pupillary membranes, endothelial opacity/no strands		3	0.0%	2	0.2%
93.999	uveal cysts		2	0.0%	1	0.1%
LENS						
100.200	cataract, unspecified		17	0.2%	0	
100.210	cataract. suspect not inherited/significance unknown		293	4.1%	60	6.5%
100.301	punctate cataract, anterior cortex		83	1.2%	13	1.4%
100.302	punctate cataract, posterior cortex		73	1.0%	12	1.3%
100.303	punctate cataract, equatorial cortex		23	0.3%	5	0.5%
100.304	punctate cataract, anterior sutures		5	0.1%	0	
100.305	punctate cataract, posterior sutures		16	0.2%	2	0.2%
100.306	punctate cataract, nucleus		5	0.1%	2	0.2%
100.307	punctate cataract, capsular		11	0.2%	0	
100.311	incipient cataract, anterior cortex		167	2.4%	12	1.3%
100.312	incipient cataract, posterior cortex		159	2.2%	23	2.5%
100.313	incipient cataract, equatorial cortex		97	1.4%	7	0.8%
100.314	incipient cataract, anterior sutures		7	0.1%	1	0.1%
100.315	incipient cataract, posterior sutures		15	0.2%	3	0.3%
100.316	incipient cataract, nucleus		14	0.2%	1	0.1%
100.317	incipient cataract, capsular		15	0.2%	3	0.3%
100.321	incomplete cataract, anterior cortex		4	0.1%	7	0.8%
100.322	incomplete cataract, posterior cortex		3	0.0%	10	1.1%
100.323	incomplete cataract, equatorial cortex		2	0.0%	3	0.3%
100.324	incomplete cataract, anterior sutures		0		1	0.1%
100.326	incomplete cataract, nucleus		0		1	0.1%
100.328	posterior suture tip opacities		0		2	0.2%
100.330	generalized/complete cataract		48	0.7%	1	0.1%

LENS CONTINUED		1991-2013		2014-2018	
100.375	subluxation/luxation, unspecified	35	0.5%	1	0.1%
100.999	*significant cataracts (summary)*	*764*	*10.8%*	*107*	*11.5%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	22	0.3%	0	
110.135	PHPV/PTVL	3	0.0%	0	
110.200	vitritis	58	0.8%	200	21.5%
110.320	vitreal degeneration	2401	33.9%	166	17.8%
FUNDUS					
97.110	choroidal hypoplasia	22	0.3%	0	
RETINA					
120.170	retinal dysplasia, folds	19	0.3%	7	0.8%
120.180	retinal dysplasia, geographic	4	0.1%	0	
120.190	retinal dysplasia, detached	1	0.0%	0	
120.310	generalized progressive retinal atrophy (PRA)	233	3.3%	17	1.8%
120.400	retinal hemorrhage	19	0.3%	0	
120.910	retinal detachment without dialysis	8	0.1%	0	
120.920	retinal detachment with dialysis	1	0.0%	2	0.2%
120.960	retinopathy	3	0.0%	4	0.4%
OPTIC NERVE					
130.110	micropapilla	15	0.2%	6	0.6%
130.120	optic nerve hypoplasia	34	0.5%	2	0.2%
130.150	optic disc coloboma	4	0.1%	0	
OTHER					
900.000	other, unspecified	63	0.9%	0	
900.100	other, not inherited	141	2.0%	49	5.3%
900.110	other. suspect not inherited/significance unknown	61	0.9%	8	0.9%
NORMAL					
0.000	normal globe	4698	66.3%	530	57.0%

JACK RUSSELL TERRIER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Distichiasis	Not defined	1	Breeder option	
B.	Persistent pupillary membranes - iris to iris	Not defined	2	Breeder option	
C.	Cataract	Not defined	1, 3	NO	
D.	Lens luxation	Autosomal recessive	1, 4-9	NO	Mutation of the *ADAMTS17* gene
E.	Retinal atrophy – generalized (*prcd*)	Autosomal recessive	10	NO	Mutation of the *prcd* gene
F.	Vitreous degeneration	Not defined	3, 4	Breeder option	

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

C. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens

completely (diffuse) or in a localized region.

D. Lens luxation

Partial (subluxation) or complete displacement of the lens from its normal anatomic site behind the pupil. Lens luxation not associated with trauma or inflammation is presumed to be inherited. Lens luxation may result in elevated intraocular pressure (glaucoma) causing vision impairment or blindness. A mutation in *ADAMTS17* has been associated with primary lens luxation. A DNA test is available.

E. A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

Studies have shown that one form of PRA in the Jack Russell Terrier is *prcd* which is a late-onset form of PRA inherited as autosomal recessive. The mutation is allelic to that present in Miniature Poodles, Labrador Retrievers, English and American Cocker Spaniels, and others. The locus is termed the progressive rod-cone degeneration (*prcd*) gene and at least 30+ breeds are affected. In most affected dogs to date, the disease is recognized clinically in dogs 3-6 years of age or older. This photoreceptor degeneration is characterized by slow death of visual cells following their normal development. The disease begins clinically with signs of night blindness followed by day blindness. A DNA test is available.

F. Vitreous degeneration

Liquefaction of the vitreous gel which may predispose to retinal detachment.

References

1. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.
2. ACVO Genetics Committee, 2000-2002 and/or Data from CERF All-Breeds Report, 2000-2002.
3. ACVO Genetics Committee, 2009 and/or Data from CERF All-Breeds Report, 2008.
4. Lawson DD. Luxation of the crystalline lens in the dog. J Small Anim Pract. 1969;10:461-463.
5. Curtis R, Barnett KC. Primary lens luxation in the dog. J Small Anim Pract. 1980;21:657-668.
6. Curtis R, Barnett KC, Lewis SJ. Clinical and pathological observations concerning the aetiology of primary lens luxation in the dog. Vet Rec. 1983;112:238-246.
7. Oberbauer AM, Hollingsworth SR, Belanger JM, et al. Inheritance of cataracts and primary lens luxation in Jack Russell Terriers. Am J Vet Res. 2008;69:222-227.

8. Farias FH, Johnson GS, Taylor JF, et al. An ADAMTS17 splice donor site mutation in dogs with primary lens luxation. Invest Ophthalmol Vis Sci. 2010;51:4716-4721.

9. Gould D, Pettitt L, McLaughlin B, et al. ADAMTS17 mutation associated with primary lens luxation is widespread among breeds. Vet Ophthalmol. 2011;14:378-384.

10. ACVO Genetics Committee 2018 and/or Data from OFA All-Breeds Report 2013-2017.

OCULAR DISORDERS REPORT
JACK RUSSELL TERRIER

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2013 14639 #	%	2014-2018 1692 #	%
GLOBE						
0.110	microphthalmia		5	0.0%	0	
10.000	glaucoma		3	0.0%	0	
EYELIDS						
20.140	ectopic cilia		2	0.0%	0	
20.160	macropalpebral fissure		1	0.0%	0	
21.000	entropion, unspecified		3	0.0%	0	
25.110	distichiasis		347	2.4%	21	1.2%
NASOLACRIMAL						
40.910	keratoconjunctivitis sicca		1	0.0%	1	0.1%
NICTITANS						
52.110	prolapsed gland of the third eyelid		1	0.0%	0	
CORNEA						
70.210	corneal pannus		1	0.0%	0	
70.220	pigmentary keratitis		9	0.1%	0	
70.700	corneal dystrophy		57	0.4%	7	0.4%
70.730	corneal endothelial degeneration		8	0.1%	3	0.2%
UVEA						
93.140	corneal endothelial pigment without PPM		1	0.0%	0	
93.150	iris coloboma		4	0.0%	0	
93.710	persistent pupillary membranes, iris to iris		670	4.6%	62	3.7%
93.720	persistent pupillary membranes, iris to lens		39	0.3%	1	0.1%
93.730	persistent pupillary membranes, iris to cornea		18	0.1%	0	
93.740	persistent pupillary membranes, iris sheets		10	0.1%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands		3	0.0%	10	0.6%
93.760	persistent pupillary membranes, endothelial opacity/no strands		6	0.0%	0	
93.999	uveal cysts		7	0.0%	0	
LENS						
100.200	cataract, unspecified		4	0.0%	0	
100.210	cataract. suspect not inherited/significance unknown		509	3.5%	49	2.9%
100.301	punctate cataract, anterior cortex		71	0.5%	12	0.7%
100.302	punctate cataract, posterior cortex		77	0.5%	5	0.3%
100.303	punctate cataract, equatorial cortex		21	0.1%	2	0.1%
100.304	punctate cataract, anterior sutures		13	0.1%	2	0.1%
100.305	punctate cataract, posterior sutures		47	0.3%	5	0.3%
100.306	punctate cataract, nucleus		19	0.1%	3	0.2%
100.307	punctate cataract, capsular		16	0.1%	5	0.3%
100.311	incipient cataract, anterior cortex		181	1.2%	13	0.8%
100.312	incipient cataract, posterior cortex		363	2.5%	22	1.3%
100.313	incipient cataract, equatorial cortex		64	0.4%	5	0.3%
100.314	incipient cataract, anterior sutures		8	0.1%	0	
100.315	incipient cataract, posterior sutures		127	0.9%	17	1.0%
100.316	incipient cataract, nucleus		29	0.2%	2	0.1%
100.317	incipient cataract, capsular		26	0.2%	2	0.1%

LENS CONTINUED		1991-2013		2014-2018	
100.321	incomplete cataract, anterior cortex	1	0.0%	2	0.1%
100.322	incomplete cataract, posterior cortex	4	0.0%	7	0.4%
100.323	incomplete cataract, equatorial cortex	0		1	0.1%
100.325	incomplete cataract, posterior sutures	0		1	0.1%
100.328	posterior suture tip opacities	3	0.0%	6	0.4%
100.330	generalized/complete cataract	90	0.6%	7	0.4%
100.375	subluxation/luxation, unspecified	79	0.5%	3	0.2%
100.999	*significant cataracts (summary)*	*1161*	*7.9%*	*113*	*6.7%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	17	0.1%	3	0.2%
110.135	PHPV/PTVL	4	0.0%	0	
110.200	vitritis	0		3	0.2%
110.320	vitreal degeneration	223	1.5%	18	1.1%
FUNDUS					
97.120	coloboma	2	0.0%	0	
RETINA					
120.170	retinal dysplasia, folds	58	0.4%	1	0.1%
120.180	retinal dysplasia, geographic	20	0.1%	0	
120.190	retinal dysplasia, detached	4	0.0%	0	
120.310	generalized progressive retinal atrophy (PRA)	84	0.6%	1	0.1%
120.400	retinal hemorrhage	4	0.0%	0	
120.910	retinal detachment without dialysis	8	0.1%	0	
120.960	retinopathy	2	0.0%	1	0.1%
OPTIC NERVE					
130.110	micropapilla	7	0.0%	0	
130.120	optic nerve hypoplasia	12	0.1%	1	0.1%
130.150	optic disc coloboma	1	0.0%	0	
OTHER					
900.000	other, unspecified	113	0.8%	0	
900.100	other, not inherited	657	4.5%	77	4.6%
900.110	other. suspect not inherited/significance unknown	64	0.4%	4	0.2%
NORMAL					
0.000	normal globe	12126	82.8%	1368	80.9%

JAGDTERRIER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Lens luxation	Autosomal recessive	1	NO	Mutation of the *ADAMTS17* gene

Description and Comments

A. Lens luxation

Partial (subluxation) or complete displacement of the lens from the normal anatomic site behind the pupil. Lens luxation not associated with trauma or inflammation is presumed to be inherited. Lens luxation may result in elevated intraocular pressure (glaucoma), causing vision impairment or blindness. A mutation in *ADAMTS17* has been associated with primary lens luxation. A DNA test is available.

References

There are no breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the Jagdterrier. The condition listed above is currently noted solely due to the availability of a genetic test for the disease.

1. Gould D, Pettitt L, McLaughlin B, et al. ADAMTS17 mutation associated with primary lens luxation is widespread among breeds. Vet Ophthalmol. 2011; 14: 378-384.

OCULAR DISORDERS REPORT
JAGDTERRIER

Diagnostic Name	TOTAL DOGS EXAMINED	1991-2013 0 #	%	2014-2018 2 #	%
NORMAL					
0.000 normal globe		0		2	100.0%

JAMTHUND

(Swedish Elkhound)

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Retinal atrophy - generalized (*prcd*)	Autosomal recessive	1	NO	Mutation of the *prcd* gene

Description and Comments

A. Retinal atrophy - generalized (*prcd*)

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

Studies have shown that the principal form of PRA in the Jamthund is *prcd* which is a late-onset form of PRA inherited as autosomal recessive. The mutation is allelic to that present in Miniature Poodles, Labrador Retrievers, English and American Cocker Spaniels, and others. The locus is termed the progressive rod-cone degeneration (*prcd*) gene and at least 30+ breeds are affected. In most affected dogs to date, the disease is recognized clinically in dogs 3-6 years of age or older. This photoreceptor degeneration is characterized by slow death of visual cells following their normal development. The disease begins clinically with signs of night blindness followed by day blindness. A DNA test is available.

References

There are no breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the Jamthund. The conditions listed above are currently noted solely due to the availability of a genetic test for the disease.

1. Zangerl B, Goldstein O, Philp AR, et al. Identical mutation in a novel retinal gene causes progressive rod-cone degeneration in dogs and retinitis pigmentosa in humans. *Genomics*. 2006 Nov;88:551-563.

OCULAR DISORDERS REPORT
JAPANESE AKITA

There are insufficient breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the JAPANESE AKITA breed. Therefore, there are no conditions listed with breeding advice.

OCULAR DISORDERS REPORT
JAPANESE AKITA

Diagnostic Name		1991-2013 TOTAL DOGS EXAMINED 4 #	 %	2014-2018 71 #	 %
EYELIDS					
25.110	distichiasis	0		1	1.4%
CORNEA					
70.700	corneal dystrophy	0		1	1.4%
UVEA					
93.710	persistent pupillary membranes, iris to iris	0		6	8.5%
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		1	1.4%
LENS					
100.210	cataract. suspect not inherited/significance unknown	1	25.0%	3	4.2%
100.301	punctate cataract, anterior cortex	0		1	1.4%
100.305	punctate cataract, posterior sutures	0		1	1.4%
100.999	*significant cataracts (summary)*	*0*		*2*	*2.8%*
RETINA					
120.170	retinal dysplasia, folds	0		3	4.2%
OTHER					
900.100	other, not inherited	0		5	7.0%
NORMAL					
0.000	normal globe	3	75.0%	52	73.2%

JAPANESE CHIN
(JAPANESE SPANIEL)

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Entropion	Not defined	1	Breeder option	
B.	Eury/Macroblepharon	Not defined	2	Breeder option	
C.	Distichiasis	Not defined	3, 4	Breeder option	
D.	Exposure/pigmentary keratitis	Not defined	1	Breeder option	
E.	Persistent pupillary membranes				
	- iris to iris	Not defined	3, 4	Breeder option	
	- iris sheets	Not defined	5	NO	
	- iris to lens	Not defined	6	NO	
F.	Cataract	Not defined	1	NO	
G.	Persistent hyperplastic primary vitreous /persistent hyperplastic tunica vasculosa lentis (PHPV/PHTVL)	Not defined	5	NO	
H.	Persistent hyaloid artery	Not defined	1	Breeder option	
I.	Vitreous degeneration	Not defined	4	Breeder option	
J.	Retinal atrophy – generalized (*prcd*)	Autosomal recessive	7	NO	Mutation of the *prcd* gene

Description and Comments

A. Entropion

A conformational defect resulting in an "in-rolling" of one or more of the eyelids which may cause ocular irritation. It is likely that entropion is influenced by several genes (polygenic), defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

B. Eury/macroblepharon

Defined as an exceptionally large palpebral fissure, macroblepharon in conjunction with laxity of the lateral canthal structures may lead to lower lid ectropion and upper lid entropion. Either of these conditions may lead to severe ocular irritation.

A specific designation does not exist on the CAER form for this condition. We ask examiners to mark other – unlisted conditions suspected as inherited. Then in the comments box please write eury/macroblepharon.

C. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

D. Exposure keratopathy/pigmentary keratitis

A condition characterized by variable degrees of superficial vascularization, fibrosis and/or pigmentation of the cornea. May be associated with excessive exposure/irritation of the globe due to shallow orbits, lower eyelid medial entropion, lagophthalmos and macropalpebral fissure.

E. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or from sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

F. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

G. Persistent hyperplastic primary vitreous (PHPV)/persistent hyperplastic tunica vasculosa lentis (PHTVL)

Persistent hyperplastic primary vitreous is a congenital defect resulting from abnormalities in the development and regression of the hyaloid artery (the primary vitreous) and the interaction of this blood vessel with the posterior lens capsule/cortex during embryogenesis. This condition is often associated with persistent hyperplastic tunica vasculosa lentis which results from failure of regression of the embryologic vascular network which surrounds the developing lens.

H. Persistent hyaloid artery (PHA)

Congenital defect resulting from abnormalities in the development and regression of the hyaloid artery. The blood vessel remnant can be present in the vitreous as a small patent vascular strand (PHA) or as a non-vascular strand that appears gray-white (persistent hyaloid remnant).

I. Vitreous degeneration

A liquefaction of the vitreous gel which may predispose to retinal detachment.

J. Retinal atrophy - generalized (*prcd)*

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

Studies have shown that one form of PRA in the Japanese Chin is *prcd* which is a late-onset form of PRA inherited as autosomal recessive. The mutation is allelic to that present in Miniature Poodles, Labrador Retrievers, English and American Cocker Spaniels, and others. The locus is termed the progressive rod-cone degeneration (*prcd*) gene and at least 30+ breeds are affected. In most affected dogs to date, the disease is recognized clinically in dogs 3-6 years of age or older. This photoreceptor degeneration is characterized by slow death of visual cells following their normal development. The disease begins clinically with signs of night blindness followed by day blindness. A DNA test is available.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Japanese Chin breed. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

2. ACVO Genetics Committee, 2017 and/or DATA from CERF/OFA All-Breeds Report, 2010-2016.

3. ACVO Genetics Committee, 2002-2003 and/or Data from CERF All-Breeds Report, 2002-2003.

4. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

5. ACVO Genetics Committee, 2008 and/or Data from CERF All Breeds Report, 2003-2007.

6. ACVO Genetics Committee, 2009 and/or Data from CERF All-Breeds Report, 2008.

7. ACVO Genetics Committee, 2018 and/or Data from OFA All-Breeds Report, 2013-2017.

OCULAR DISORDERS REPORT
JAPANESE CHIN

		1991-2013		2014-2018	
	TOTAL DOGS EXAMINED	987		333	
Diagnostic Name		#	%	#	%
EYELIDS					
20.160	macropalpebral fissure	13	1.3%	0	
21.000	entropion, unspecified	83	8.4%	19	5.7%
22.000	ectropion, unspecified	0		1	0.3%
25.110	distichiasis	47	4.8%	11	3.3%
NASOLACRIMAL					
32.110	imperforate lower nasolacrimal punctum	0		1	0.3%
40.910	keratoconjunctivitis sicca	1	0.1%	0	
NICTITANS					
52.110	prolapsed gland of the third eyelid	2	0.2%	0	
CORNEA					
70.210	corneal pannus	9	0.9%	2	0.6%
70.220	pigmentary keratitis	39	4.0%	8	2.4%
70.700	corneal dystrophy	2	0.2%	1	0.3%
70.730	corneal endothelial degeneration	2	0.2%	1	0.3%
UVEA					
93.150	iris coloboma	1	0.1%	0	
93.710	persistent pupillary membranes, iris to iris	115	11.7%	22	6.6%
93.720	persistent pupillary membranes, iris to lens	6	0.6%	0	
93.730	persistent pupillary membranes, iris to cornea	7	0.7%	0	
93.740	persistent pupillary membranes, iris sheets	6	0.6%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	1	0.1%	0	
93.999	uveal cysts	0		1	0.3%
LENS					
100.200	cataract, unspecified	1	0.1%	0	
100.210	cataract. suspect not inherited/significance unknown	46	4.7%	17	5.1%
100.301	punctate cataract, anterior cortex	16	1.6%	6	1.8%
100.302	punctate cataract, posterior cortex	7	0.7%	1	0.3%
100.303	punctate cataract, equatorial cortex	6	0.6%	1	0.3%
100.304	punctate cataract, anterior sutures	4	0.4%	1	0.3%
100.305	punctate cataract, posterior sutures	4	0.4%	2	0.6%
100.306	punctate cataract, nucleus	1	0.1%	1	0.3%
100.307	punctate cataract, capsular	2	0.2%	0	
100.311	incipient cataract, anterior cortex	34	3.4%	9	2.7%
100.312	incipient cataract, posterior cortex	23	2.3%	8	2.4%
100.313	incipient cataract, equatorial cortex	23	2.3%	3	0.9%
100.314	incipient cataract, anterior sutures	0		2	0.6%
100.315	incipient cataract, posterior sutures	7	0.7%	1	0.3%
100.316	incipient cataract, nucleus	4	0.4%	3	0.9%
100.317	incipient cataract, capsular	10	1.0%	2	0.6%
100.321	incomplete cataract, anterior cortex	1	0.1%	3	0.9%
100.328	posterior suture tip opacities	0		2	0.6%
100.330	generalized/complete cataract	7	0.7%	1	0.3%
100.375	subluxation/luxation, unspecified	6	0.6%	0	
100.999	*significant cataracts (summary)*	*150*	*15.2%*	*44*	*13.2%*

		1991-2013		2014-2018	
VITREOUS					
110.120	persistent hyaloid artery/remnant	15	1.5%	1	0.3%
110.135	PHPV/PTVL	13	1.3%	0	
110.200	vitritis	1	0.1%	4	1.2%
110.320	vitreal degeneration	43	4.4%	20	6.0%
FUNDUS					
97.120	coloboma	1	0.1%	0	
RETINA					
120.170	retinal dysplasia, folds	1	0.1%	0	
120.180	retinal dysplasia, geographic	2	0.2%	0	
120.310	generalized progressive retinal atrophy (PRA)	15	1.5%	1	0.3%
120.910	retinal detachment without dialysis	1	0.1%	0	
120.920	retinal detachment with dialysis	1	0.1%	0	
OPTIC NERVE					
130.110	micropapilla	1	0.1%	0	
130.150	optic disc coloboma	2	0.2%	0	
OTHER					
900.000	other, unspecified	28	2.8%	0	
900.100	other, not inherited	46	4.7%	32	9.6%
900.110	other. suspect not inherited/significance unknown	12	1.2%	7	2.1%
NORMAL					
0.000	normal globe	639	64.7%	193	58.0%

OCULAR DISORDERS REPORT
JINDO

There are insufficient breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the JINDO breed. Therefore, there are no conditions listed with breeding advice.

OCULAR DISORDERS REPORT
JINDO

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2013 2 #	%	2014-2018 8 #	%
LENS						
100.301	punctate cataract, anterior cortex		1	50.0%	0	
100.313	incipient cataract, equatorial cortex		1	50.0%	0	
100.999	*significant cataracts (summary)*		*2*	*100.0%*	*0*	
NORMAL						
0.000	normal globe		1	50.0%	8	100.0%

KAI KEN

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Persistent pupillary membranes - lens pigment foci/no strands	Not defined	1	Passes with no notation

Description and Comments

A. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

References

1. ACVO Genetics Committee, 2018 and/or Data from OFA All-Breeds Report, 2013-2017.

OCULAR DISORDERS REPORT
KAI KEN

Diagnostic Name	TOTAL DOGS EXAMINED	1991-2013 2 #	 %	2014-2018 14 #	 %
UVEA					
93.710	persistent pupillary membranes, iris to iris	0		1	7.1%
93.750	persistent pupillary membranes, lens pigment foci/no strands	1	50.0%	5	35.7%
RETINA					
120.960	retinopathy	0		1	7.1%
NORMAL					
0.000	normal globe	1	50.0%	8	57.1%

KARELIAN BEAR DOG

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TEST AVAILABLE
A.	Retinal atrophy - generalized (*prcd)*	Autosomal recessive	1-3	NO	Mutation of the *prcd* gene

Description and Comments

A. Retinal atrophy- generalized (*prcd*)

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited. A genetic test is available to detect the progressive rod cone degeneration form of PRA caused by a mutation in the *prcd*-gene. A second form of PRA is also present in the Karelian Bear Dog for which the causative mutation is not yet known.

References

1. Ahonen S, Lohi H, editors. Progressive retinal atrophy in the Karelian Bear Dog: A large animal model for retinitis pigmentosa. ARVO 2014 Annual Meeting; 2014; Orlando, FL. Program number: 3270.

2. ACVO Genetics Committee, 2013-2014 and Data from OFA All-Breeds Report, 2013-2014.

3. Zangerl B, Goldstein O, Philp AR, et al. Identical mutation in a novel retinal gene causes progressive rod-cone degeneration in dogs and retinitis pigmentosa in humans. *Genomics*. 2006;88:551-563. Epub 2006/08/30.

OCULAR DISORDERS REPORT
KARELIAN BEAR DOG

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2013 99 #	1991-2013 99 %	2014-2018 11 #	2014-2018 11 %
EYELIDS						
25.110	distichiasis		2	2.0%	0	
CORNEA						
70.700	corneal dystrophy		4	4.0%	0	
70.730	corneal endothelial degeneration		1	1.0%	0	
UVEA						
93.710	persistent pupillary membranes, iris to iris		10	10.1%	0	
93.730	persistent pupillary membranes, iris to cornea		3	3.0%	0	
LENS						
100.210	cataract. suspect not inherited/significance unknown		1	1.0%	1	9.1%
100.307	punctate cataract, capsular		2	2.0%	0	
100.311	incipient cataract, anterior cortex		3	3.0%	0	
100.312	incipient cataract, posterior cortex		2	2.0%	2	18.2%
100.314	incipient cataract, anterior sutures		0		1	9.1%
100.317	incipient cataract, capsular		1	1.0%	1	9.1%
100.999	*significant cataracts (summary)*		*8*	*8.1%*	*4*	*36.4%*
RETINA						
120.170	retinal dysplasia, folds		4	4.0%	0	
120.310	generalized progressive retinal atrophy (PRA)		1	1.0%	0	
120.960	retinopathy		1	1.0%	0	
OTHER						
900.000	other, unspecified		1	1.0%	0	
900.100	other, not inherited		1	1.0%	1	9.1%
NORMAL						
0.000	normal globe		77	77.8%	6	54.5%

KEESHOND

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Distichiasis	Not defined	1	Breeder option
B.	Persistent pupillary membranes - iris to iris	Not defined	2	Breeder option
C.	Cataract	Not defined	1	NO

Description and Comments

A. Distichiasis

Eyelashes abnormally located in the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

C. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Keeshond breed. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

2. ACVO Genetics Committee, 2008 and/or Data from CERF All-Breeds Report, 2003-2007.

OCULAR DISORDERS REPORT
KEESHOND

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2013 2863 #	%	2014-2018 712 #	%
GLOBE						
0.110	microphthalmia		1	0.0%	0	
EYELIDS						
21.000	entropion, unspecified		9	0.3%	0	
25.110	distichiasis		168	5.9%	40	5.6%
NASOLACRIMAL						
32.110	imperforate lower nasolacrimal punctum		1	0.0%	0	
CORNEA						
70.220	pigmentary keratitis		0		1	0.1%
70.700	corneal dystrophy		8	0.3%	4	0.6%
70.730	corneal endothelial degeneration		2	0.1%	0	
UVEA						
93.150	iris coloboma		1	0.0%	0	
93.710	persistent pupillary membranes, iris to iris		23	0.8%	10	1.4%
93.720	persistent pupillary membranes, iris to lens		2	0.1%	0	
93.730	persistent pupillary membranes, iris to cornea		2	0.1%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands		0		2	0.3%
93.760	persistent pupillary membranes, endothelial opacity/no strands		1	0.0%	0	
93.999	uveal cysts		2	0.1%	0	
LENS						
100.200	cataract, unspecified		18	0.6%	0	
100.210	cataract. suspect not inherited/significance unknown		219	7.6%	106	14.9%
100.301	punctate cataract, anterior cortex		12	0.4%	0	
100.302	punctate cataract, posterior cortex		16	0.6%	1	0.1%
100.303	punctate cataract, equatorial cortex		10	0.3%	1	0.1%
100.304	punctate cataract, anterior sutures		1	0.0%	1	0.1%
100.305	punctate cataract, posterior sutures		45	1.6%	24	3.4%
100.306	punctate cataract, nucleus		1	0.0%	1	0.1%
100.307	punctate cataract, capsular		1	0.0%	5	0.7%
100.311	incipient cataract, anterior cortex		7	0.2%	1	0.1%
100.312	incipient cataract, posterior cortex		32	1.1%	4	0.6%
100.313	incipient cataract, equatorial cortex		9	0.3%	0	
100.314	incipient cataract, anterior sutures		1	0.0%	0	
100.315	incipient cataract, posterior sutures		18	0.6%	4	0.6%
100.316	incipient cataract, nucleus		12	0.4%	1	0.1%
100.317	incipient cataract, capsular		2	0.1%	2	0.3%
100.325	incomplete cataract, posterior sutures		1	0.0%	0	
100.326	incomplete cataract, nucleus		0		1	0.1%
100.327	incomplete cataract, capsular		0		1	0.1%
100.328	posterior suture tip opacities		9	0.3%	86	12.1%
100.330	generalized/complete cataract		7	0.2%	1	0.1%
100.375	subluxation/luxation, unspecified		1	0.0%	0	
100.999	*significant cataracts (summary)*		*193*	*6.7%*	*48*	*6.7%*

		1991-2013		2014-2018	
VITREOUS					
110.120	persistent hyaloid artery/remnant	1	0.0%	0	
110.320	vitreal degeneration	5	0.2%	6	0.8%
FUNDUS					
97.120	coloboma	1	0.0%	0	
RETINA					
120.170	retinal dysplasia, folds	6	0.2%	0	
120.180	retinal dysplasia, geographic	2	0.1%	0	
120.190	retinal dysplasia, detached	1	0.0%	0	
120.310	generalized progressive retinal atrophy (PRA)	9	0.3%	1	0.1%
120.400	retinal hemorrhage	1	0.0%	0	
120.910	retinal detachment without dialysis	2	0.1%	0	
120.960	retinopathy	2	0.1%	3	0.4%
OPTIC NERVE					
130.110	micropapilla	5	0.2%	5	0.7%
130.120	optic nerve hypoplasia	11	0.4%	2	0.3%
130.150	optic disc coloboma	1	0.0%	0	
OTHER					
900.000	other, unspecified	21	0.7%	0	
900.100	other, not inherited	51	1.8%	27	3.8%
900.110	other. suspect not inherited/significance unknown	7	0.2%	2	0.3%
NORMAL					
0.000	normal globe	2352	82.2%	483	67.8%

KERRY BLUE TERRIER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Distichiasis	Not defined	1	Breeder option
B.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder option
C.	Cataract	Not defined	2	NO
D.	Vitreous degeneration	Not defined	3	Breeder option

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

C. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

D. Vitreous degeneration

A liquefaction of the vitreous gel which may predispose to retinal detachment.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Kerry Blue Terrier breed. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 2006 and/or Data from CERF All-Breeds Report, 2001-2005.

2. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

3. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

OCULAR DISORDERS REPORT
KERRY BLUE TERRIER

Diagnostic Name		1991-2013 TOTAL DOGS EXAMINED 705 #	%	2014-2018 72 #	%
EYELIDS					
25.110	distichiasis	10	1.4%	2	2.8%
CORNEA					
70.210	corneal pannus	1	0.1%	0	
70.700	corneal dystrophy	2	0.3%	2	2.8%
UVEA					
93.710	persistent pupillary membranes, iris to iris	9	1.3%	2	2.8%
93.720	persistent pupillary membranes, iris to lens	2	0.3%	0	
93.730	persistent pupillary membranes, iris to cornea	1	0.1%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		2	2.8%
LENS					
100.200	cataract, unspecified	6	0.9%	0	
100.210	cataract. suspect not inherited/significance unknown	26	3.7%	4	5.6%
100.301	punctate cataract, anterior cortex	15	2.1%	0	
100.302	punctate cataract, posterior cortex	3	0.4%	0	
100.306	punctate cataract, nucleus	2	0.3%	1	1.4%
100.312	incipient cataract, posterior cortex	4	0.6%	0	
100.313	incipient cataract, equatorial cortex	3	0.4%	0	
100.330	generalized/complete cataract	6	0.9%	0	
100.999	*significant cataracts (summary)*	*39*	*5.5%*	*1*	*1.4%*
VITREOUS					
110.320	vitreal degeneration	10	1.4%	0	
RETINA					
120.310	generalized progressive retinal atrophy (PRA)	2	0.3%	0	
OTHER					
900.000	other, unspecified	1	0.1%	0	
900.100	other, not inherited	21	3.0%	2	2.8%
900.110	other. suspect not inherited/significance unknown	2	0.3%	0	
NORMAL					
0.000	normal globe	627	88.9%	59	81.9%

OCULAR DISORDERS REPORT
KISHU KEN

There are insufficient breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the KISHU KEN breed. Therefore, there are no conditions listed with breeding advice.

OCULAR DISORDERS REPORT
KISHU KEN

Diagnostic Name	TOTAL DOGS EXAMINED	1991-2013 0 #	% 	2014-2018 2 #	%
NORMAL					
0.000 normal globe		0		2	100.0%

KOMONDOR

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Cataract	Not defined	1	NO

Description and Comments

A. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

Appears to be relatively young age for onset in the Komondor (<4yr) and mainly anterior cortical.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Komondor breed. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

OCULAR DISORDERS REPORT
KOMONDOR

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2013 311 #	 %	2014-2018 70 #	 %
EYELIDS						
21.000	entropion, unspecified		1	0.3%	0	
22.000	ectropion, unspecified		1	0.3%	0	
25.110	distichiasis		0		1	1.4%
NICTITANS						
51.100	third eyelid cartilage anomaly		1	0.3%	0	
CORNEA						
70.700	corneal dystrophy		0		1	1.4%
UVEA						
93.710	persistent pupillary membranes, iris to iris		4	1.3%	1	1.4%
93.760	persistent pupillary membranes, endothelial opacity/no strands		1	0.3%	1	1.4%
LENS						
100.200	cataract, unspecified		14	4.5%	0	
100.210	cataract. suspect not inherited/significance unknown		26	8.4%	3	4.3%
100.303	punctate cataract, equatorial cortex		2	0.6%	0	
100.306	punctate cataract, nucleus		3	1.0%	1	1.4%
100.307	punctate cataract, capsular		2	0.6%	0	
100.312	incipient cataract, posterior cortex		3	1.0%	1	1.4%
100.313	incipient cataract, equatorial cortex		5	1.6%	0	
100.314	incipient cataract, anterior sutures		1	0.3%	0	
100.315	incipient cataract, posterior sutures		3	1.0%	1	1.4%
100.316	incipient cataract, nucleus		5	1.6%	0	
100.326	incomplete cataract, nucleus		0		1	1.4%
100.328	posterior suture tip opacities		0		1	1.4%
100.330	generalized/complete cataract		1	0.3%	0	
100.999	*significant cataracts (summary)*		*39*	*12.5%*	*4*	*5.7%*
RETINA						
120.170	retinal dysplasia, folds		1	0.3%	0	
OTHER						
900.000	other, unspecified		7	2.3%	0	
900.100	other, not inherited		6	1.9%	0	
900.110	other. suspect not inherited/significance unknown		1	0.3%	0	
NORMAL						
0.000	normal globe		254	81.7%	60	85.7%

OCULAR DISORDERS REPORT
KOREAN POONGSAN

There are insufficient breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the KOREAN POONGSAN breed. Therefore, there are no conditions listed with breeding advice.

OCULAR DISORDERS REPORT
KOREAN POONGSAN

Diagnostic Name	TOTAL DOGS EXAMINED	1991-2013 1 #	 %	2014-2018 0 #	 %
NORMAL					
0.000 normal globe		1	100.0%	0	

OCULAR DISORDERS REPORT
KROMFOHRLANDER

There are insufficient breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the KROMFOHRLANDER breed. Therefore, there are no conditions listed with breeding advice.

OCULAR DISORDERS REPORT
KROMFOHRLANDER

Diagnostic Name	TOTAL DOGS EXAMINED	1991-2013 0 # %	2014-2018 9 # %
NORMAL			
0.000 normal globe		0	9 100.0%

KUVASZ

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Distichiasis	Not defined	1	Breeder option	
B.	Corneal dystrophy - epithelial/stromal	Not defined	2	Breeder option	
C.	Corneal dystrophy - endothelial	Not defined	3	NO	
D.	Persistent pupillary membranes - iris to iris	Not defined	1, 4	Breeder option	
E.	Cataract	Not defined	1	NO	
F.	Retinal atrophy - generalized (*prcd*)	Autosomal recessive	1, 5	NO	Mutation of the *prcd* gene

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Corneal dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

C. Corneal dystrophy - endothelial

Corneal endothelial dystrophy is an abnormal loss of the inner lining of the cornea that causes progressive fluid retention (edema). With time the edema results in keratitis and decreased vision. This usually does not occur until the animal is older.

D. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress

normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

E. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region. In the Kuvasz, cataracts reported are predominantly posterior cortical, punctate.

F. Retinal atrophy, generalized *(prcd)*

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

Studies have shown that the form of PRA in the Kuvasz is *prcd*, which is a late-onset form of PRA inherited as autosomal recessive. The mutation is allelic to that present in Miniature Poodles, Labrador Retrievers, English and American Cocker Spaniels and others. The locus is termed the progressive rod-cone degeneration (*prcd*) gene and at least 30+ breeds are affected. In most affected dogs to date, the disease is recognized clinically in dogs 3-6 years of age or older. This photoreceptor degeneration is characterized by slow death of visual cells following their normal development. The disease begins clinically with signs of night blindness followed by day blindness. A DNA test is available.

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OCULAR DISORDERS REPORT
KUVASZ

Diagnostic Name		1991-2013 TOTAL DOGS EXAMINED 533 #	 %	2014-2018 18 #	 %
GLOBE					
0.110	microphthalmia	2	0.4%	0	
EYELIDS					
20.140	ectopic cilia	1	0.2%	0	
20.160	macropalpebral fissure	1	0.2%	0	
22.000	ectropion, unspecified	2	0.4%	0	
25.110	distichiasis	21	3.9%	0	
NICTITANS					
51.100	third eyelid cartilage anomaly	1	0.2%	0	
CORNEA					
70.700	corneal dystrophy	6	1.1%	0	
70.730	corneal endothelial degeneration	1	0.2%	0	
UVEA					
93.150	iris coloboma	2	0.4%	0	
93.710	persistent pupillary membranes, iris to iris	23	4.3%	0	
93.720	persistent pupillary membranes, iris to lens	3	0.6%	0	
93.730	persistent pupillary membranes, iris to cornea	3	0.6%	0	
LENS					
100.200	cataract, unspecified	2	0.4%	0	
100.210	cataract. suspect not inherited/significance unknown	15	2.8%	0	
100.301	punctate cataract, anterior cortex	1	0.2%	0	
100.302	punctate cataract, posterior cortex	1	0.2%	0	
100.303	punctate cataract, equatorial cortex	1	0.2%	0	
100.305	punctate cataract, posterior sutures	1	0.2%	0	
100.312	incipient cataract, posterior cortex	1	0.2%	0	
100.313	incipient cataract, equatorial cortex	1	0.2%	0	
100.316	incipient cataract, nucleus	3	0.6%	0	
100.330	generalized/complete cataract	5	0.9%	0	
100.999	*significant cataracts (summary)*	*16*	*3.0%*	*0*	
VITREOUS					
110.320	vitreal degeneration	1	0.2%	0	
RETINA					
120.310	generalized progressive retinal atrophy (PRA)	4	0.8%	0	
OTHER					
900.000	other, unspecified	1	0.2%	0	
900.100	other, not inherited	13	2.4%	1	5.6%
900.110	other. suspect not inherited/significance unknown	2	0.4%	0	
NORMAL					
0.000	normal globe	445	83.5%	17	94.4%

LABRADOR RETRIEVER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Glaucoma	Not defined	1	NO	
B.	Entropion	Not defined	2-4	Breeder option	
C.	Ectropion	Not defined	2	Breeder option	
D.	Distichiasis	Not defined	2	Breeder option	
E.	Corneal dystrophy				
	- epithelial/stromal	Not defined	2, 5	Breeder option	
	- macular	Autosomal recessive	6	NO	Mutation of the *CHST6* gene
F.	Uveal cysts	Not defined	7	Breeder option	
G.	Persistent pupillary membranes				
	- iris to iris	Not defined	2, 7	Breeder option	
	- iris to cornea	Not defined	8	NO	
	- iris sheets	Not defined	6	NO	
H.	Cataract				
		Presumed dominant with incomplete penetrance	2-4, 9-11	NO	
		Autosomal recessive	12	NO	
		Not defined	13	NO	
I.	Persistent hyperplastic primary vitreous/ persistent hyperplastic tunica vasculosa lentis (PHPV/PHTVL)	Not defined	2	NO	
J.	Persistent hyaloid artery	Not defined	2	Breeder option	

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	
K.	Vitreous degeneration	Not defined	1, 14	Breeder option	
L.	Retinal atrophy - generalized (*prcd*)	Autosomal recessive	2, 15-19	NO	Mutation of the *prcd* gene
M.	Achromatopsia Type 2 (ACHM - Type 2)	Autosomal recessive	20, 21	NO	Causative mutation not yet published
N.	Retinal dysplasia - folds	Presumed autosomal recessive	2, 22-30	NO (Breeder option with Normal DNA test for folds)	Mutation in the *COL9A3* gene
O.	Retinal dysplasia - geographic/ detached (without skeletal defects)	Presumed autosomal recessive	2, 22-30	NO	
P.	Retinal dysplasia - folds/geographic/ detached (with skeletal defects)	Autosomal recessive with incomplete dominance for the eyes	2, 22-31	NO	Mutation in the *COL9A3* gene
Q.	Limbal melanoma	Not defined	32	NO	

Description and Comments

A. Glaucoma

Glaucoma is characterized by an elevation of intraocular pressure which, when sustained even for a brief period of time, causes intraocular damage resulting in blindness. The elevated intraocular pressure occurs because the fluid cannot leave through the iridocorneal angle. Diagnosis and classification of glaucoma requires measurement of IOP (tonometry) and examination of the iridocorneal angle (gonioscopy). Neither of these tests is part of a routine breed eye screening examination.

B. Entropion

A conformational defect resulting in an "in-rolling" of one or both of the eyelids which may cause ocular irritation. It is likely that entropion is influenced by several genes (polygenic), defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull. Selection should be directed against entropion and toward a head conformation that reduces or eliminates the

likelihood of the defect.

C. Ectropion

A conformational defect resulting in eversion of the eyelid(s), which may cause ocular irritation due to exposure. It is likely that ectropion is influenced by several genes (polygenic) defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

D. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established, although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

E. Corneal dystrophy - epithelial/stromal/macular

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

In Labrador Retrievers in Europe, macular corneal dystrophy (MCD) has been shown to be caused by accumulations of glycosaminoglycans in the corneal stroma. This form of corneal dystrophy is caused by a mutation in the *CHST6* gene.

F. Uveal cysts

Fluid filled sacs arising from the posterior surface of the iris, to which they may remain attached or break free and float into the anterior chamber. Usually occur in mature dogs.

This disorder may be observed in any breed but retriever breeds tend to be predisposed. There is usually no effect on vision unless the cysts are heavily clustered and impinge on the pupillary area. Less frequently, the cysts may rupture and adhere to the cornea or anterior lens capsule. Multiple cysts may occlude the iridocorneal angle and cause glaucoma.

G. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

In the Labrador Retriever, this is a potentially serious problem as many of the PPMs identified on routine screening examinations bridge from the iris to the cornea and/or from iris sheets bridging the pupils. These forms may cause vision impairment.

H. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be

hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

The most frequently reported cataracts in the Labrador Retriever are bilateral or unilateral, focal, posterior polar (posterior cortical)/subcapsular cataracts which usually present between 1-3 years of age. These are generally stationary or very slowly progressive and generally do not interfere with vision. It has been suggested that these cataracts are inherited as dominant with incomplete penetrance, but definitive breeding studies are still required to verify this hypothesis.

A second type of cataract is a progressive cortical cataract which may involve the entire lens. It is not clear whether this is a distinct entity, or an aberrant form of the posterior polar cataract.

I. Persistent hyperplastic primary vitreous (PHPV)/Persistent hyperplastic tunica vasculosa lentis (PHTVL)

A congenital defect resulting from abnormalities in the development and regression of the hyaloid artery (the primary vitreous) and the interaction of this blood vessel with the posterior lens capsule/cortex during embryogenesis. This condition is often associated with **persistent hyperplastic tunica vasculosa lentis (PHTVL)** which results from failure of regression of the embryologic vascular network which surrounds the developing lens.

The majority of affected dogs have a retrolental fibrovascular plaque and variable lenticular defects which include posterior lenticonus/globus, colobomata, intralenticular hemorrhage and/or secondary cataracts. Vision impairment may result.

J. Persistent hyaloid artery (PHA)

A congenital defect resulting from abnormalities in the development and regression of the hyaloid artery. The blood vessel remnant can be present in the vitreous as a small vascular strand (PHA) or as a non-vascular strand that appears gray-white (**persistent hyaloid remnant**).

K. Vitreous degeneration

Liquefaction of the vitreous gel, which may predispose to retinal detachment.

L. Retinal atrophy - generalized (*prcd*)

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

Studies have shown that the principal form of PRA in the Labrador Retriever is *prcd* which is a late-onset form of PRA inherited as autosomal recessive. The mutation is allelic to that present in Miniature Poodles, English and American Cocker Spaniels, and others. The locus is termed the progressive rod-cone degeneration (*prcd*) gene and at least 30+ breeds are affected. In most affected dogs to date, the disease is recognized clinically in dogs 3-6 years of age or older. This photoreceptor degeneration is characterized by slow death of visual cells following their normal

development. The disease begins clinically with signs of night blindness followed by day blindness. A DNA test is available.

M. Achromatopsia Type 2 (ACHM – Type 2)

A congenital form of day blindness. Visual deficits become apparent between 8-10 weeks of age. Normal vision is present in low light conditions. Clinical examination is normal. Cone responses are absent on an electroretinogram. The causative genetic mutation has been determined, but not yet published. A DNA test is available.

N. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness.

In the Labrador Retriever, the presence of retinal folds may be seen in the heterozygous state described in "R" below, thus the recommendation against breeding.

The breeding advice for Labrador Retrievers and Samoyeds diagnosed with "retinal dysplasia - folds" will be changed from "No" to "Breeder option" if the owner of the dog provides the registering office with results of the DNA test for the affected dog, showing that it is not a carrier of the *COL9A3* mutation.

O. Retinal dysplasia - geographic, detached without skeletal defects

Abnormal development of the retina present at birth; however, in the Golden Retriever, Labrador Retriever, and German Shepherd it has been demonstrated that the geographic form of retinal dysplasia may not be apparent before dogs are 10 weeks of age.

Retinal dysplasia - geographic: Any irregularly shaped area of abnormal retinal development containing both areas of thinning and areas of elevation representing folds and retinal disorganization.

Retinal dysplasia - detached: Severe retinal disorganization associated with separation (detachment) of the retina.

These two forms are associated with vision impairment or blindness. Retinal dysplasia is known to be inherited in many breeds. The genetic relationship among the three forms of retinal dysplasia is not known for all breeds

In Europe, this condition has been documented as an autosomal recessive condition and results in early retinal detachment and blindness. Lens and corneal opacities can also be present, but skeletal abnormalities (see below) are not present. The condition of generalized retinal dysplasia with retinal detachment but without skeletal abnormalities has been reported primarily in Europe, and is rarely if ever seen in the United States.

In the United States, the milder forms of retinal dysplasia (folds/geographic) are seen in Labradors. These may represent the heterozygous form of the condition in which the homozygote also displays skeletal malformations (see "R" below) or it may represent a genetically distinct

entity with an undetermined mode of inheritance. It is not possible clinically to make this distinction. Thus, Labradors with any form of retinal dysplasia should not be used for breeding.

P. Retinal dysplasia - folds or detachment with skeletal defects

This condition is also known as oculo-skeletal dysplasia (OSD) or dwarfism with retinal dysplasia type 1 (DRD1) in the Labrador Retriever. A similar condition, DRD2, occurs in the Samoyed. The condition is autosomal recessive and homozygous affected dogs have shortened forelimbs ("downhill" conformation) with valgus deformity. They have severe ocular defects including cataract, retinal folds/multifocal retinal dysplasia, vitreal degeneration and retinal detachment. The ocular abnormalities result in blindness in most dogs. Heterozygous dogs can have either a normal ocular exam or have multiple retinal folds, vitreal membranes, or vitreal degeneration suggesting a semi-dominant mechanism with respect to the eyes. It is important to note that generally the retinal folds present in heterozygous dogs tend to cluster around the major superior blood vessels of the central tapetal region. The condition is caused by a 1 base pair insertion of *COL9A3.* A DNA test is available.

Q. Limbal melanoma

Most limbal melanomas are really epibulbar melanocytomas, but there is a possibility of an extension of an intraocular melanoma extending outward and presenting as a limbal melanoma. An epibulbar melanocytoma originates from the superficial pigment lining the limbus and the lesion may eventually extend into the eye. Metastasis has not been documented and the mass is characterized by large epithelioid cells. The lesion presents as a subconjunctival smooth mass most commonly in the dorsolateral limbal region and extends later into the cornea and posterior on the sclera. Breed predisposition have been noted in the German Shepherd, Labrador and Golden Retriever.

Historical Note:

Central progressive retinal atrophy was previously a condition listed for Labrador Retriever. However as the condition is no longer identified in the breed, the condition has been removed. Central progressive retinal atrophy was a progressive retinal degeneration in which photoreceptor death occurred secondary to disease of the underlying pigment epithelium. Progression was slow and some animals never lost vision. CPRA occurred in England, but was uncommon elsewhere.

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32. Donaldson D, Sansom J, Scase T, et al. Canine limbal melanoma: 30 cases (1992-2004). Part 1. Signalment, clinical and histological features and pedigree analysis. *Vet Ophthalmol*. 2006;9:115-119.

OCULAR DISORDERS REPORT
LABRADOR RETRIEVER

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2013 213337 #	%	2014-2018 41142 #	%
GLOBE						
0.110	microphthalmia		58	0.0%	4	0.0%
10.000	glaucoma		27	0.0%	1	0.0%
EYELIDS						
20.140	ectopic cilia		16	0.0%	2	0.0%
20.160	macropalpebral fissure		86	0.0%	0	
21.000	entropion, unspecified		916	0.4%	202	0.5%
22.000	ectropion, unspecified		459	0.2%	66	0.2%
25.110	distichiasis		2139	1.0%	341	0.8%
NASOLACRIMAL						
32.110	imperforate lower nasolacrimal punctum		15	0.0%	20	0.0%
40.910	keratoconjunctivitis sicca		5	0.0%	4	0.0%
NICTITANS						
51.100	third eyelid cartilage anomaly		10	0.0%	2	0.0%
52.110	prolapsed gland of the third eyelid		37	0.0%	2	0.0%
CORNEA						
70.210	corneal pannus		9	0.0%	0	
70.220	pigmentary keratitis		14	0.0%	9	0.0%
70.700	corneal dystrophy		2063	1.0%	426	1.0%
70.730	corneal endothelial degeneration		79	0.0%	7	0.0%
UVEA						
90.200	uveitis		0		1	0.0%
90.250	pigmentary uveitis		1	0.0%	0	
93.110	iris hypoplasia		1	0.0%	8	0.0%
93.140	corneal endothelial pigment without PPM		12	0.0%	0	
93.150	iris coloboma		11	0.0%	1	0.0%
93.710	persistent pupillary membranes, iris to iris		6191	2.9%	1569	3.8%
93.720	persistent pupillary membranes, iris to lens		138	0.1%	21	0.1%
93.730	persistent pupillary membranes, iris to cornea		153	0.1%	11	0.0%
93.740	persistent pupillary membranes, iris sheets		175	0.1%	1	0.0%
93.750	persistent pupillary membranes, lens pigment foci/no strands		142	0.1%	351	0.9%
93.760	persistent pupillary membranes, endothelial opacity/no strands		25	0.0%	9	0.0%
93.810	uveal melanoma		33	0.0%	39	0.1%
93.999	uveal cysts		355	0.2%	120	0.3%
97.150	chorioretinal coloboma, congenital		0		1	0.0%
LENS						
100.200	cataract, unspecified		728	0.3%	0	
100.210	cataract. suspect not inherited/significance unknown		9083	4.3%	2082	5.1%
100.301	punctate cataract, anterior cortex		824	0.4%	252	0.6%
100.302	punctate cataract, posterior cortex		1215	0.6%	173	0.4%
100.303	punctate cataract, equatorial cortex		162	0.1%	28	0.1%
100.304	punctate cataract, anterior sutures		106	0.0%	24	0.1%
100.305	punctate cataract, posterior sutures		644	0.3%	162	0.4%
100.306	punctate cataract, nucleus		158	0.1%	39	0.1%

LENS CONTINUED		1991-2013		2014-2018	
100.307	punctate cataract, capsular	189	0.1%	131	0.3%
100.311	incipient cataract, anterior cortex	662	0.3%	92	0.2%
100.312	incipient cataract, posterior cortex	1745	0.8%	326	0.8%
100.313	incipient cataract, equatorial cortex	473	0.2%	61	0.1%
100.314	incipient cataract, anterior sutures	59	0.0%	9	0.0%
100.315	incipient cataract, posterior sutures	427	0.2%	76	0.2%
100.316	incipient cataract, nucleus	284	0.1%	36	0.1%
100.317	incipient cataract, capsular	206	0.1%	75	0.2%
100.321	incomplete cataract, anterior cortex	4	0.0%	21	0.1%
100.322	incomplete cataract, posterior cortex	16	0.0%	69	0.2%
100.323	incomplete cataract, equatorial cortex	4	0.0%	17	0.0%
100.324	incomplete cataract, anterior sutures	0		1	0.0%
100.325	incomplete cataract, posterior sutures	3	0.0%	10	0.0%
100.326	incomplete cataract, nucleus	1	0.0%	15	0.0%
100.327	incomplete cataract, capsular	1	0.0%	11	0.0%
100.328	posterior suture tip opacities	56	0.0%	393	1.0%
100.330	generalized/complete cataract	339	0.2%	18	0.0%
100.340	resorbing/hypermature cataract	0		5	0.0%
100.375	subluxation/luxation, unspecified	48	0.0%	7	0.0%
100.999	*significant cataracts (summary)*	*8250*	*3.9%*	*1651*	*4.0%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	525	0.2%	132	0.3%
110.135	PHPV/PTVL	143	0.1%	19	0.0%
110.200	vitritis	3	0.0%	24	0.1%
110.320	vitreal degeneration	764	0.4%	138	0.3%
FUNDUS					
97.110	choroidal hypoplasia	14	0.0%	0	
97.120	coloboma	11	0.0%	0	
RETINA					
120.170	retinal dysplasia, folds	4795	2.2%	494	1.2%
120.180	retinal dysplasia, geographic	1890	0.9%	212	0.5%
120.190	retinal dysplasia, detached	178	0.1%	13	0.0%
120.310	generalized progressive retinal atrophy (PRA)	973	0.5%	22	0.1%
120.400	retinal hemorrhage	34	0.0%	0	
120.910	retinal detachment without dialysis	73	0.0%	0	
120.920	retinal detachment with dialysis	2	0.0%	7	0.0%
120.960	retinopathy	25	0.0%	55	0.1%
OPTIC NERVE					
130.110	micropapilla	90	0.0%	22	0.1%
130.120	optic nerve hypoplasia	85	0.0%	5	0.0%
130.150	optic disc coloboma	40	0.0%	7	0.0%
OTHER					
900.000	other, unspecified	1697	0.8%	0	
900.100	other, not inherited	4629	2.2%	1584	3.9%
900.110	other. suspect not inherited/significance unknown	923	0.4%	62	0.2%

	1991-2013	2014-2018
NORMAL		
0.000 normal globe	184925 86.7%	32899 80.0%

LAGOTTO ROMAGNOLO

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Distichiasis	Not defined	1	Breeder option	
B.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder option	
C.	Cataract	Not defined	1	NO	
D	Progressive retinal atrophy – generalized (*prcd*)	Autosomal recessive	2	NO	Mutation of the *prcd* gene

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established, although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

C. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

B. Retinal atrophy – generalized (prcd)

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

Studies have shown that the principal form of PRA in the Lagotto Romagnolo is *prcd* which is a late-onset form of PRA inherited as autosomal recessive. The mutation is allelic to that present in Miniature Poodles, English and American Cocker Spaniels, and others. The locus is termed the progressive rod-cone degeneration (*prcd*) gene and at least 30+ breeds are affected. In most affected dogs to date, the disease is recognized clinically in dogs 3-6 years of age or older. This photoreceptor degeneration is characterized by slow death of visual cells following their normal development. The disease begins clinically with signs of night blindness followed by day blindness. A DNA test is available.

References

There are no references providing detailed descriptions of hereditary conditions of the Lagotto Romagnolo breed. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

2. ACVO Genetics Committee, 2018 and/or Data from OFA All-Breeds Report, 2013-2017.

OCULAR DISORDERS REPORT
LAGOTTO ROMAGNOLO

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2013 157 #	 %	2014-2018 520 #	 %
EYELIDS						
25.110	distichiasis		14	8.9%	44	8.5%
NICTITANS						
51.100	third eyelid cartilage anomaly		1	0.6%	0	
52.110	prolapsed gland of the third eyelid		1	0.6%	0	
UVEA						
93.710	persistent pupillary membranes, iris to iris		5	3.2%	12	2.3%
93.750	persistent pupillary membranes, lens pigment foci/no strands		1	0.6%	4	0.8%
93.999	uveal cysts		0		1	0.2%
LENS						
100.210	cataract. suspect not inherited/significance unknown		4	2.5%	15	2.9%
100.301	punctate cataract, anterior cortex		1	0.6%	2	0.4%
100.302	punctate cataract, posterior cortex		0		1	0.2%
100.303	punctate cataract, equatorial cortex		0		3	0.6%
100.305	punctate cataract, posterior sutures		1	0.6%	0	
100.306	punctate cataract, nucleus		0		1	0.2%
100.313	incipient cataract, equatorial cortex		1	0.6%	1	0.2%
100.315	incipient cataract, posterior sutures		0		1	0.2%
100.321	incomplete cataract, anterior cortex		1	0.6%	2	0.4%
100.322	incomplete cataract, posterior cortex		1	0.6%	1	0.2%
100.323	incomplete cataract, equatorial cortex		0		2	0.4%
100.326	incomplete cataract, nucleus		1	0.6%	0	
100.328	posterior suture tip opacities		0		2	0.4%
100.999	*significant cataracts (summary)*		*6*	*3.8%*	*14*	*2.7%*
VITREOUS						
110.120	persistent hyaloid artery/remnant		0		2	0.4%
RETINA						
120.170	retinal dysplasia, folds		2	1.3%	3	0.6%
OPTIC NERVE						
130.110	micropapilla		0		2	0.4%
OTHER						
900.000	other, unspecified		3	1.9%	0	
900.100	other, not inherited		1	0.6%	16	3.1%
NORMAL						
0.000	normal globe		138	87.9%	422	81.2%

LAKELAND TERRIER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Distichiasis	Not defined	1	Breeder option	
B.	Persistent pupillary membranes				
	- iris to iris	Not defined	2	Breeder Option	
	- lens pigment foci/no strands	Not defined	3	Passes with no notation	
C.	Lens luxation	Not defined	4	NO	Mutation of the *ADAMTS17* gene

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established, although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

C. Lens luxation

Partial (subluxation) or complete displacement of the lens from the normal anatomic site behind the pupil. Lens luxation not associated with trauma or inflammation is presumed to be inherited. Lens luxation may result in elevated intraocular pressure (glaucoma), causing vision impairment or blindness. A mutation in *ADAMTS17* has been associated with primary lens luxation. A DNA test is available.

References

1. ACVO Genetics Committee, 2017 and/or Data from CERF/OFA All-Breeds Report, 2010-2016.

2. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

3. ACVO Genetics Committee, 2016 and/or Data from CERF/OFA All-Breeds Report, 2010-2015.

4. Gould D, Pettitt L, McLaughlin B, et al. ADAMTS17 mutation associated with primary lens luxation is widespread among breeds. *Vet Ophthalmol*. 2011; 14: 378-384.

OCULAR DISORDERS REPORT
LAKELAND TERRIER

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2013 207 #	 %	2014-2018 46 #	 %
EYELIDS						
25.110	distichiasis		8	3.9%	2	4.3%
CORNEA						
70.700	corneal dystrophy		0		1	2.2%
70.730	corneal endothelial degeneration		2	1.0%	0	
UVEA						
93.710	persistent pupillary membranes, iris to iris		31	15.0%	6	13.0%
93.720	persistent pupillary membranes, iris to lens		2	1.0%	0	
93.730	persistent pupillary membranes, iris to cornea		4	1.9%	0	
93.740	persistent pupillary membranes, iris sheets		1	0.5%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands		5	2.4%	4	8.7%
LENS						
100.210	cataract. suspect not inherited/significance unknown		4	1.9%	1	2.2%
100.311	incipient cataract, anterior cortex		2	1.0%	1	2.2%
100.312	incipient cataract, posterior cortex		3	1.4%	1	2.2%
100.330	generalized/complete cataract		1	0.5%	2	4.3%
100.999	*significant cataracts (summary)*		*6*	*2.9%*	*4*	*8.7%*
RETINA						
120.180	retinal dysplasia, geographic		1	0.5%	0	
OTHER						
900.000	other, unspecified		2	1.0%	0	
900.100	other, not inherited		6	2.9%	0	
NORMAL						
0.000	normal globe		159	76.8%	34	73.9%

LANCASHIRE HEELER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Persistent pupillary membrane - iris to iris	Not defined	1	Breeder option	
B.	Lens luxation	Autosomal recessive	2-4	NO	Mutation of the *ADAMTS17* gene
C.	Choroidal hypoplasia (Collie Eye Anomaly) - staphyloma/coloboma - retinal detachment - retinal hemorrhage - optic nerve coloboma	Autosomal recessive	5-7	NO	Deletion in the *NHEJ1* gene
D.	Retinal atrophy – generalized (*prcd*)	Autosomal recessive	8	NO	Mutation of the *prcd* gene

Description and Comments

A. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or from sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

B. Lens luxation

Partial (subluxation) or complete displacement of the lens from the normal anatomic site behind the pupil. Lens luxation not associated with trauma or inflammation is presumed to be inherited. Lens luxation may result in elevated intraocular pressure (glaucoma) causing vision impairment or blindness. A mutation in *ADAMTS17* has been associated with primary lens luxation. A DNA test is available.

C. Choroidal hypoplasia (Collie Eye Anomaly)
- staphyloma/coloboma
- retinal detachment
- retinal hemorrhage
- optic nerve coloboma

A spectrum of malformations present at birth and ranging from inadequate development of the choroid (choroidal hypoplasia) to defects of the choroid, sclera, and/or optic nerve

(coloboma/staphyloma) to complete retinal detachment (with or without hemorrhage). Mildly affected animals will have no detectable vision deficit.

This disorder is collectively referred to as "Collie Eye Anomaly." The choroidal hypoplasia component is caused by a 7799 base pair deletion with the gene *NHEJ1.* The mutation is a recessive trait. A DNA test is available and is diagnostic only for the choroidal hypoplasia component of CEA. For colobomas to develop, an additional mutation in a second gene has to be present; that gene is still unknown.

D. A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

Studies have shown that the principal form of PRA in the Lancashire Heeler is *prcd* which is a late-onset form of PRA inherited as autosomal recessive. The mutation is allelic to that present in Miniature Poodles, English and American Cocker Spaniels, and others. The locus is termed the progressive rod-cone degeneration (*prcd*) gene and at least 30+ breeds are affected. In most affected dogs to date, the disease is recognized clinically in dogs 3-6 years of age or older. This photoreceptor degeneration is characterized by slow death of visual cells following their normal development. The disease begins clinically with signs of night blindness followed by day blindness. A DNA test is available.

References

1. ACVO Genetics Committee, 2006 and/or Data from CERF All-Breeds Report, 2001-2005.

2. Sargan DR, Withers D, Pettitt L, et al. Mapping the mutation causing lens luxation in several terrier breeds. *J Hered*. 2007;98:534-538.

3. Farias FH, Johnson GS, Taylor JF, et al. An ADAMTS17 splice donor site mutation in dogs with primary lens luxation. *Invest Ophthalmol Vis Sci*. 2010;51:4716-4721.

4. Gould D, Pettitt L, McLaughlin B, et al. ADAMTS17 mutation associated with primary lens luxation is widespread among breeds. *Vet Ophthalmol*. 2011;14:378-384.

5. Bedford PG. Collie eye anomaly in the Lancashire Heeler. *Vet Rec*. 1998;143:354-356.

6. Parker HG, Kukekova AV, Akey DT, et al. Breed relationships facilitate fine-mapping studies: a 7.8-kb deletion cosegregates with Collie eye anomaly across multiple dog breeds. *Gen Res*. 2007;17:1562-1571.

7. Lowe JK, Kukekova AV, Kirkness EF, et al. Linkage mapping of the primary disease locus for Collie eye anomaly. *Genomics*. 2003;82:86-95.

8. ACVO Genetics Committee, 2018 and/or Data from OFA All-Breeds Report, 2013-2017.

OCULAR DISORDERS REPORT
LANCASHIRE HEELER

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2013 141 #	 %	2014-2018 10 #	 %
EYELIDS						
25.110	distichiasis		1	0.7%	0	
CORNEA						
70.700	corneal dystrophy		0		1	10.0%
UVEA						
93.710	persistent pupillary membranes, iris to iris		58	41.1%	1	10.0%
93.720	persistent pupillary membranes, iris to lens		1	0.7%	0	
93.730	persistent pupillary membranes, iris to cornea		2	1.4%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands		0		1	10.0%
LENS						
100.210	cataract. suspect not inherited/significance unknown		1	0.7%	0	
100.317	incipient cataract, capsular		1	0.7%	0	
100.375	subluxation/luxation, unspecified		1	0.7%	0	
100.999	*significant cataracts (summary)*		*1*	*0.7%*	*0*	
VITREOUS						
110.120	persistent hyaloid artery/remnant		2	1.4%	0	
110.200	vitritis		1	0.7%	0	
110.320	vitreal degeneration		4	2.8%	0	
RETINA						
120.170	retinal dysplasia, folds		1	0.7%	0	
120.310	generalized progressive retinal atrophy (PRA)		1	0.7%	0	
OTHER						
900.100	other, not inherited		0		1	10.0%
NORMAL						
0.000	normal globe		93	66.0%	7	70.0%

LAPPONIAN HERDER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Retinal atrophy - generalized (*prcd*)	Autosomal recessive	1	NO	Mutation of the *prcd* gene
B.	Multifocal retinopathy - *cmr3*	Autosomal recessive	2	NO	Mutation of the *BEST1* gene

Description and Comments

A. Retinal atrophy – generalized (*prcd*)

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

Studies have shown that the principal form of PRA in the Lapponian Herder is *prcd* which is a late-onset form of PRA inherited as autosomal recessive. The mutation is allelic to that present in Miniature Poodles, English and American Cocker Spaniels, and others. The locus is termed the progressive rod-cone degeneration (*prcd*) gene and at least 30+ breeds are affected. In most affected dogs to date, the disease is recognized clinically in dogs 3-6 years of age or older. This photoreceptor degeneration is characterized by slow death of visual cells following their normal development. The disease begins clinically with signs of night blindness followed by day blindness. A DNA test is available.

B. Multifocal retinopathy (*cmr3*)

Canine Multifocal Retinopathy type 3 (*cmr3*) is characterized by numerous distinct (i.e. multifocal), roughly circular patches of elevated retina (multifocal bullous retinal detachments). There may be a serous subretinal fluid, or accumulation of subretinal material that produces gray-tan-pink colored lesions. These lesions, looking somewhat like blisters, vary in location and size, although typically they are present in both eyes of the affected dog.

The disease generally develops in young dogs between 11-20 weeks of age and there is minimal progression after 1 year of age. The lesions may flatten, leaving areas of retinal thinning and RPE hypertrophy, hyperplasia, and pigmentation. Discrete areas of tapetal hyper-reflectivity may be seen in areas of previous retinal and RPE detachments. Most dogs exhibit no noticeable problem with vision or electroretinographic abnormalities despite their abnormal appearing retinas.

Clinically the disease is similar to that seen in the Bullmastiff and Coton deTulear, but the mutation in the Bestrophin 1 gene (*BEST1* alias *VMD2*) is different. The multifocal retinopathy seen in the Lapponian Herder is caused by a deletion at position 1,388 and a

substitution at position 1,466 and is therefore called cmr3. A DNA test is available.

References

There are no breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the Lapponian Herder. The conditions listed above are currently noted solely due to the availability of a genetic test for the disease.

1. Zangerl B, Goldstein O, Philp AR, et al. Identical mutation in a novel retinal gene causes progressive rod-cone degeneration in dogs and retinitis pigmentosa in humans. *Genomics*. 2006;88:551-563.

2. Zangerl B, Wickstrom K, Slavik J, et al. Assessment of canine BEST1 variations identifies new mutations and establishes an independent bestrophinopathy model (cmr3). *Mol Vis*. 2010;16:2791-2804.

LEONBERGER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Distichiasis	Not defined	1	Breeder option
B.	Ectropion	Not defined	2	Breeder option
C.	Entropion	Not defined	1-3	Breeder option
D.	Eury/Macroblepharon	Not defined	1, 3	Breeder option
E.	Nictitans cartilage anomaly/eversion	Not defined	4	Breeder option
F.	Uveal cysts	Not defined	5	Breeder option
G.	Persistent pupillary membranes			
	- iris to iris	Not defined	2, 3	Breeder option
	- lens pigment foci/no strands	Not defined		Passes with no notation
H.	Cataract	Not defined	6	NO

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Ectropion

A conformational defect resulting in eversion of the eyelid(s), which may cause ocular irritation due to exposure. It is likely that ectropion is influenced by several genes (polygenic) defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

C. Entropion

A conformational defect resulting in an "in-rolling" of one or both of the eyelids which may cause ocular irritation. It is likely that entropion is influenced by several genes (polygenic), defining the skin and other structures which make up the eyelids, the amount and weight of

the skin covering the head and face, the orbital contents, and the conformation of the skull.

D. Eury/Macroblepharon

Defined as an exceptionally large palpebral fissure, macroblepharon in conjunction with laxity of the lateral canthal structures may lead to lower lid ectropion and upper lid entropion. Either of these conditions may lead to severe ocular irritation.

E. Nictitans cartilage anomaly/eversion

A scroll-like curling of the cartilage of the third eyelid, usually everting the margin. This condition may occur in one or both eyes and may cause mild ocular irritation.

F. Uveal cysts

Fluid filled sacs arising from the posterior surface of the iris, to which they may remain attached or break free and float into the anterior chamber. Usually occur in mature dogs.

There is usually no effect on vision unless the cysts are heavily clustered and impinge on the pupillary area. Less frequently, the cysts may rupture and adhere to the cornea or anterior lens capsule. Multiple cysts may occlude the iridocorneal angle and cause glaucoma.

G. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

H. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

References

1. ACVO Genetics Committee, 2002-2003 and/or Data from CERF All-Breeds Report, 2002-2003.

2. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

3. Heinrich CL, Lakhani KH, Featherstone HJ, et al. Cataract in the UK Leonberger population. *Vet Ophthalmol.* 2006 Sep-Oct;9:350-356.

4. ACVO Genetics Committee, 2006 and/or Data from CERF All-Breeds Report, 2001-2005.

5. ACVO Genetics Committee, 2017 and/or Data from CERF/OFA All-Breeds Report, 2010-2016.

6. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

OCULAR DISORDERS REPORT
LEONBERGER

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2013 1607 #	%	2014-2018 612 #	%
EYELIDS						
20.160	macropalpebral fissure		35	2.2%	0	
21.000	entropion, unspecified		52	3.2%	24	3.9%
22.000	ectropion, unspecified		23	1.4%	12	2.0%
25.110	distichiasis		38	2.4%	15	2.5%
NASOLACRIMAL						
32.110	imperforate lower nasolacrimal punctum		0		1	0.2%
NICTITANS						
51.100	third eyelid cartilage anomaly		14	0.9%	19	3.1%
52.110	prolapsed gland of the third eyelid		1	0.1%	1	0.2%
CORNEA						
70.700	corneal dystrophy		5	0.3%	0	
UVEA						
93.110	iris hypoplasia		1	0.1%	1	0.2%
93.710	persistent pupillary membranes, iris to iris		338	21.0%	149	24.3%
93.720	persistent pupillary membranes, iris to lens		2	0.1%	0	
93.730	persistent pupillary membranes, iris to cornea		1	0.1%	0	
93.740	persistent pupillary membranes, iris sheets		1	0.1%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands		1	0.1%	15	2.5%
93.760	persistent pupillary membranes, endothelial opacity/no strands		1	0.1%	0	
93.810	uveal melanoma		1	0.1%	0	
93.999	uveal cysts		12	0.7%	9	1.5%
LENS						
100.200	cataract, unspecified		2	0.1%	0	
100.210	cataract. suspect not inherited/significance unknown		124	7.7%	53	8.7%
100.301	punctate cataract, anterior cortex		21	1.3%	7	1.1%
100.302	punctate cataract, posterior cortex		21	1.3%	7	1.1%
100.303	punctate cataract, equatorial cortex		3	0.2%	0	
100.304	punctate cataract, anterior sutures		3	0.2%	0	
100.305	punctate cataract, posterior sutures		12	0.7%	4	0.7%
100.306	punctate cataract, nucleus		5	0.3%	8	1.3%
100.307	punctate cataract, capsular		3	0.2%	7	1.1%
100.311	incipient cataract, anterior cortex		9	0.6%	6	1.0%
100.312	incipient cataract, posterior cortex		24	1.5%	12	2.0%
100.313	incipient cataract, equatorial cortex		1	0.1%	0	
100.314	incipient cataract, anterior sutures		5	0.3%	2	0.3%
100.315	incipient cataract, posterior sutures		8	0.5%	1	0.2%
100.316	incipient cataract, nucleus		17	1.1%	5	0.8%
100.317	incipient cataract, capsular		3	0.2%	5	0.8%
100.322	incomplete cataract, posterior cortex		0		1	0.2%
100.326	incomplete cataract, nucleus		0		1	0.2%
100.328	posterior suture tip opacities		3	0.2%	5	0.8%
100.330	generalized/complete cataract		4	0.2%	0	
100.375	subluxation/luxation, unspecified		4	0.2%	4	0.7%
100.999	*significant cataracts (summary)*		*141*	*8.8%*	*66*	*10.8%*

		1991-2013		2014-2018	
VITREOUS					
110.120	persistent hyaloid artery/remnant	2	0.1%	3	0.5%
110.135	PHPV/PTVL	3	0.2%	2	0.3%
110.200	vitritis	0		1	0.2%
110.320	vitreal degeneration	6	0.4%	0	
RETINA					
120.170	retinal dysplasia, folds	8	0.5%	6	1.0%
120.180	retinal dysplasia, geographic	2	0.1%	2	0.3%
120.310	generalized progressive retinal atrophy (PRA)	5	0.3%	0	
120.960	retinopathy	1	0.1%	0	
OPTIC NERVE					
130.110	micropapilla	1	0.1%	0	
130.120	optic nerve hypoplasia	2	0.1%	0	
130.150	optic disc coloboma	1	0.1%	0	
OTHER					
900.000	other, unspecified	32	2.0%	0	
900.100	other, not inherited	56	3.5%	25	4.1%
900.110	other. suspect not inherited/significance unknown	9	0.6%	2	0.3%
NORMAL					
0.000	normal globe	1086	67.6%	317	51.8%

LHASA APSO

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Keratoconjunctivitis sicca	Not defined	1	NO
B.	Distichiasis	Not defined	1	Breeder option
C.	Prolapsed gland of third eyelid	Not defined	1, 2	Breeder option
D.	Exposure/pigmentary keratitis	Not defined	1	Breeder option
E.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder option
F.	Cataract	Not defined	3	NO

Description and Comments

A. Keratoconjunctivitis sicca

An abnormality of the tear film, most commonly a deficiency of the aqueous portion, although the mucin and/or lipid layers may be affected; results in ocular irritation and/or vision impairment.

B. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

C. Prolapsed gland of the third eyelid

Protrusion of the tear gland associated with the third eyelid. The mode of inheritance of this disorder is unknown. The exposed gland may become irritated. Commonly referred to as "cherry eye."

D. Exposure/pigmentary keratitis

A condition characterized by variable degrees of superficial vascularization, fibrosis

and/or pigmentation of the cornea. May be associated with excessive exposure/irritation of the globe due to shallow orbits, lower eyelid medial entropion, lagophthalmos and macropalpebral fissure.

E. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

F. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

References

1. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

2. Morgan RV, Duddy JM, McClurg K. Prolapse of the gland of the third eyelid in the dog: A retrospective study of 89 cases (1980-1990). *J Am Anim Hosp Assoc*. 1993;29:56-60.

3. Gelatt KN, Mackay EO. Prevalence of primary breed-related cataracts in the dog in North America. *Vet Ophthalmol*. 2005;8:101-111.

OCULAR DISORDERS REPORT
LHASA APSO

		1991-2013		2014-2018	
	TOTAL DOGS EXAMINED	**782**		**55**	
Diagnostic Name		**#**	**%**	**#**	**%**
GLOBE					
0.110	microphthalmia	1	0.1%	0	
EYELIDS					
20.160	macropalpebral fissure	3	0.4%	0	
21.000	entropion, unspecified	10	1.3%	2	3.6%
25.110	distichiasis	30	3.8%	3	5.5%
NASOLACRIMAL					
32.110	imperforate lower nasolacrimal punctum	1	0.1%	0	
40.910	keratoconjunctivitis sicca	3	0.4%	0	
NICTITANS					
51.100	third eyelid cartilage anomaly	1	0.1%	0	
52.110	prolapsed gland of the third eyelid	4	0.5%	0	
CORNEA					
70.210	corneal pannus	8	1.0%	0	
70.220	pigmentary keratitis	18	2.3%	3	5.5%
70.700	corneal dystrophy	16	2.0%	0	
UVEA					
93.110	iris hypoplasia	1	0.1%	0	
93.710	persistent pupillary membranes, iris to iris	10	1.3%	0	
93.730	persistent pupillary membranes, iris to cornea	1	0.1%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		2	3.6%
93.999	uveal cysts	1	0.1%	0	
LENS					
100.200	cataract, unspecified	6	0.8%	0	
100.210	cataract. suspect not inherited/significance unknown	26	3.3%	2	3.6%
100.301	punctate cataract, anterior cortex	6	0.8%	0	
100.302	punctate cataract, posterior cortex	4	0.5%	1	1.8%
100.303	punctate cataract, equatorial cortex	3	0.4%	0	
100.306	punctate cataract, nucleus	1	0.1%	0	
100.311	incipient cataract, anterior cortex	12	1.5%	1	1.8%
100.312	incipient cataract, posterior cortex	14	1.8%	0	
100.313	incipient cataract, equatorial cortex	3	0.4%	1	1.8%
100.314	incipient cataract, anterior sutures	4	0.5%	0	
100.315	incipient cataract, posterior sutures	2	0.3%	0	
100.316	incipient cataract, nucleus	3	0.4%	0	
100.328	posterior suture tip opacities	0		1	1.8%
100.330	generalized/complete cataract	18	2.3%	0	
100.375	subluxation/luxation, unspecified	1	0.1%	0	
100.999	*significant cataracts (summary)*	*76*	*9.7%*	*3*	*5.5%*
VITREOUS					
110.200	vitritis	1	0.1%	0	
110.320	vitreal degeneration	9	1.2%	0	

	1991-2013		2014-2018	
FUNDUS				
97.110 choroidal hypoplasia	1	0.1%	0	
RETINA				
120.170 retinal dysplasia, folds	4	0.5%	1	1.8%
120.180 retinal dysplasia, geographic	3	0.4%	0	
120.310 generalized progressive retinal atrophy (PRA)	7	0.9%	0	
OPTIC NERVE				
130.110 micropapilla	1	0.1%	0	
130.120 optic nerve hypoplasia	2	0.3%	0	
130.150 optic disc coloboma	1	0.1%	0	
OTHER				
900.100 other, not inherited	12	1.5%	3	5.5%
900.110 other. suspect not inherited/significance unknown	19	2.4%	0	
NORMAL				
0.000 normal globe	602	77.0%	41	74.5%

OCULAR DISORDERS REPORT
LLEWELLIN SETTER

There are insufficient breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the LLEWELLIN SETTER breed. Therefore, there are no conditions listed with breeding advice.

OCULAR DISORDERS REPORT
LLEWELLIN SETTER

Diagnostic Name	TOTAL DOGS EXAMINED	1991-2013 0 #	 %	2014-2018 2 #	 %
NORMAL					
0.000 normal globe		0		2	100.0%

LOUISIANA CATAHOULA LEOPARD DOG

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder option
B.	Iris coloboma	Not defined	2	NO

It is recommended that this breed be examined prior to pharmacological dilation to best facilitate identification of iris coloboma and persistent pupillary membranes.

Description and Comments

A. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

B. Iris coloboma

A congenital abnormality in iris development usually characterized by a full-thickness defect in iris tissue, commonly (though not exclusively) located at the 6 o'clock position associated with failure of closure of the optic fissure. A partial-thickness defect in iris tissue should be recorded as iris hypoplasia on the OFA form.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Louisiana Catahoula Leopard Dog breed. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

2. ACVO Genetics Committee, 2014 and/or Data from OFA All-Breeds Report, 2013-2104.

OCULAR DISORDERS REPORT
LOUISIANA CATAHOULA LEOPARD DOG

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2013 315 #	1991-2013 315 %	2014-2018 96 #	2014-2018 96 %
GLOBE						
0.110	microphthalmia		4	1.3%	1	1.0%
EYELIDS						
25.110	distichiasis		3	1.0%	1	1.0%
CORNEA						
70.700	corneal dystrophy		1	0.3%	0	
UVEA						
93.110	iris hypoplasia		2	0.6%	1	1.0%
93.150	iris coloboma		10	3.2%	3	3.1%
93.710	persistent pupillary membranes, iris to iris		23	7.3%	18	18.8%
93.720	persistent pupillary membranes, iris to lens		1	0.3%	0	
93.730	persistent pupillary membranes, iris to cornea		0		1	1.0%
97.150	chorioretinal coloboma, congenital		0		1	1.0%
LENS						
100.200	cataract, unspecified		1	0.3%	0	
100.210	cataract. suspect not inherited/significance unknown		5	1.6%	1	1.0%
100.302	punctate cataract, posterior cortex		1	0.3%	1	1.0%
100.306	punctate cataract, nucleus		0		1	1.0%
100.311	incipient cataract, anterior cortex		4	1.3%	1	1.0%
100.312	incipient cataract, posterior cortex		2	0.6%	0	
100.313	incipient cataract, equatorial cortex		0		2	2.1%
100.316	incipient cataract, nucleus		0		1	1.0%
100.322	incomplete cataract, posterior cortex		0		1	1.0%
100.330	generalized/complete cataract		0		1	1.0%
100.999	*significant cataracts (summary)*		*8*	*2.5%*	*8*	*8.3%*
VITREOUS						
110.120	persistent hyaloid artery/remnant		2	0.6%	0	
110.320	vitreal degeneration		2	0.6%	0	
FUNDUS						
97.110	choroidal hypoplasia		1	0.3%	1	1.0%
97.120	coloboma		2	0.6%	0	
RETINA						
120.170	retinal dysplasia, folds		9	2.9%	0	
120.910	retinal detachment without dialysis		2	0.6%	0	
120.920	retinal detachment with dialysis		0		1	1.0%
OPTIC NERVE						
130.150	optic disc coloboma		2	0.6%	1	1.0%
OTHER						
900.100	other, not inherited		4	1.3%	4	4.2%
900.110	other. suspect not inherited/significance unknown		10	3.2%	0	

	1991-2013	2014-2018
NORMAL		
0.000 normal globe	267 84.8%	63 65.6%

LOWCHEN

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Distichiasis	Not defined	1	Breeder option
B.	Exposure/Pigmentary keratitis	Not defined	2	NO
C.	Persistent pupillary membranes			
	- iris to iris	Not defined	1	Breeder option
	- lens pigment foci/no strands	Not defined	3	Passes with no notation
D.	Cataract	Not defined	1	NO
E.	Vitreous degeneration	Not defined	1	Breeder option
F.	Retinal atrophy - generalized	Not defined	1	NO

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Exposure/pigmentary keratitis

A condition characterized by variable degrees of superficial vascularization, fibrosis and/or pigmentation of the cornea. May be associated with excessive exposure/irritation of the globe due to shallow orbits, lower eyelid medial entropion, lagophthalmos and macropalpebral fissure.

C. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

D. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

E. Vitreous degeneration

A liquefaction of the vitreous gel which may predispose to retinal detachment and/or glaucoma.

F. Retinal atrophy - generalized

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Lowchen breed. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

2. ACVO Genetics Committee, 2000-2002 and/or Data from CERF All-Breeds Report, 2000-2002.

3. ACVO Genetics Committee, 2016 and/or Data from CERF/OFA All-Breeds Report, 2010-2015.

OCULAR DISORDERS REPORT
LOWCHEN

Diagnostic Name		1991-2013 TOTAL DOGS EXAMINED 1562 #	 %	2014-2018 298 #	 %
EYELIDS					
20.140	ectopic cilia	1	0.1%	0	
21.000	entropion, unspecified	1	0.1%	0	
25.110	distichiasis	71	4.5%	16	5.4%
NASOLACRIMAL					
40.910	keratoconjunctivitis sicca	0		1	0.3%
CORNEA					
70.210	corneal pannus	1	0.1%	0	
70.730	corneal endothelial degeneration	2	0.1%	0	
UVEA					
93.150	iris coloboma	1	0.1%	0	
93.710	persistent pupillary membranes, iris to iris	116	7.4%	28	9.4%
93.720	persistent pupillary membranes, iris to lens	3	0.2%	0	
93.730	persistent pupillary membranes, iris to cornea	2	0.1%	1	0.3%
93.750	persistent pupillary membranes, lens pigment foci/no strands	3	0.2%	8	2.7%
93.760	persistent pupillary membranes, endothelial opacity/no strands	1	0.1%	0	
93.999	uveal cysts	1	0.1%	1	0.3%
LENS					
100.200	cataract, unspecified	21	1.3%	0	
100.210	cataract. suspect not inherited/significance unknown	51	3.3%	11	3.7%
100.301	punctate cataract, anterior cortex	7	0.4%	2	0.7%
100.302	punctate cataract, posterior cortex	12	0.8%	0	
100.303	punctate cataract, equatorial cortex	4	0.3%	0	
100.304	punctate cataract, anterior sutures	1	0.1%	0	
100.305	punctate cataract, posterior sutures	5	0.3%	1	0.3%
100.306	punctate cataract, nucleus	2	0.1%	0	
100.307	punctate cataract, capsular	1	0.1%	0	
100.311	incipient cataract, anterior cortex	20	1.3%	2	0.7%
100.312	incipient cataract, posterior cortex	23	1.5%	2	0.7%
100.313	incipient cataract, equatorial cortex	5	0.3%	2	0.7%
100.314	incipient cataract, anterior sutures	2	0.1%	0	
100.315	incipient cataract, posterior sutures	4	0.3%	0	
100.316	incipient cataract, nucleus	1	0.1%	1	0.3%
100.317	incipient cataract, capsular	2	0.1%	0	
100.321	incomplete cataract, anterior cortex	0		1	0.3%
100.322	incomplete cataract, posterior cortex	0		1	0.3%
100.323	incomplete cataract, equatorial cortex	1	0.1%	0	
100.328	posterior suture tip opacities	0		2	0.7%
100.330	generalized/complete cataract	15	1.0%	1	0.3%
100.375	subluxation/luxation, unspecified	2	0.1%	0	
100.999	*significant cataracts (summary)*	*126*	*8.1%*	*13*	*4.4%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	3	0.2%	0	
110.135	PHPV/PTVL	1	0.1%	0	
110.200	vitritis	0		1	0.3%

VITREOUS CONTINUED		1991-2013		2014-2018	
110.320	vitreal degeneration	48	3.1%	5	1.7%
FUNDUS					
97.110	choroidal hypoplasia	2	0.1%	0	
RETINA					
120.170	retinal dysplasia, folds	3	0.2%	0	
120.180	retinal dysplasia, geographic	0		1	0.3%
120.190	retinal dysplasia, detached	1	0.1%	0	
120.310	generalized progressive retinal atrophy (PRA)	37	2.4%	4	1.3%
120.910	retinal detachment without dialysis	2	0.1%	0	
120.960	retinopathy	1	0.1%	4	1.3%
OPTIC NERVE					
130.110	micropapilla	1	0.1%	0	
130.150	optic disc coloboma	1	0.1%	0	
OTHER					
900.000	other, unspecified	13	0.8%	0	
900.100	other, not inherited	38	2.4%	11	3.7%
900.110	other. suspect not inherited/significance unknown	4	0.3%	0	
NORMAL					
0.000	normal globe	1262	80.8%	217	72.8%

LUCAS TERRIER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Lens luxation	Autosomal recessive	1	NO	Mutation of the *ADAMTS17* gene

Description and Comments

A. Lens luxation

Partial (subluxation) or complete displacement of the lens from the normal anatomic site behind the pupil. Lens luxation not associated with trauma or inflammation is presumed to be inherited. Lens luxation may result in elevated intraocular pressure (glaucoma), causing vision impairment or blindness. A mutation in *ADAMTS17* has been associated with primary lens luxation. A DNA test is available.

References

There are no breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the Lucas Terrier. The condition listed above is currently noted solely due to the availability of a genetic test for the disease.

1. Gould D, Pettitt L, McLaughlin B, et al. ADAMTS17 mutation associated with primary lens luxation is widespread among breeds. *Vet Ophthalmol*. 2011; 14: 378-384.

OCULAR DISORDERS REPORT
MAGYAR AGAR

There are insufficient breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the MAGYAR AGAR breed. Therefore, there are no conditions listed with breeding advice.

OCULAR DISORDERS REPORT
MAGYAR AGAR

Diagnostic Name	TOTAL DOGS EXAMINED	1991-2013 0 #	%	2014-2018 5 #	%
NORMAL					
0.000 normal globe		0		5	100.0%

MALTESE

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Distichiasis	Not defined	1	Breeder option
B.	Persistent pupillary membranes - iris to iris	Not defined	2	Breeder option
C.	Cataract	Not defined	3, 4	NO
D.	Vitreous degeneration	Not defined	5	Breeder option

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

C. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

D. Vitreous degeneration

A liquefaction of the vitreous gel which may predispose to retinal detachment.

References

1. ACVO Genetics Committee, 2014, and/or Data from OFA All-Breeds Report, 2013-2104.

2. ACVO Genetics Committee, 2006 and/or Data from CERF All-Breeds Report, 2001-2005.

3. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

4. Gelatt KN and Mackay EO. Prevalence of primary breed-related cataracts in the dog in North America. *Vet Ophthalmol*. 2005 Mar-Apr;8:101-111.

5. ACVO Genetics Committee, 2016 and/or Data from CERF/OFA All-Breeds Report, 2010-2015.

OCULAR DISORDERS REPORT
MALTESE

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2013 254 #	 %	2014-2018 177 #	 %
GLOBE						
0.110	microphthalmia		1	0.4%	0	
EYELIDS						
21.000	entropion, unspecified		4	1.6%	2	1.1%
25.110	distichiasis		9	3.5%	4	2.3%
NASOLACRIMAL						
32.110	imperforate lower nasolacrimal punctum		1	0.4%	0	
40.910	keratoconjunctivitis sicca		2	0.8%	0	
NICTITANS						
52.110	prolapsed gland of the third eyelid		2	0.8%	1	0.6%
CORNEA						
70.220	pigmentary keratitis		0		3	1.7%
70.700	corneal dystrophy		1	0.4%	1	0.6%
UVEA						
93.710	persistent pupillary membranes, iris to iris		15	5.9%	5	2.8%
93.999	uveal cysts		0		1	0.6%
LENS						
100.210	cataract. suspect not inherited/significance unknown		13	5.1%	4	2.3%
100.301	punctate cataract, anterior cortex		1	0.4%	2	1.1%
100.302	punctate cataract, posterior cortex		3	1.2%	2	1.1%
100.303	punctate cataract, equatorial cortex		2	0.8%	0	
100.304	punctate cataract, anterior sutures		1	0.4%	0	
100.305	punctate cataract, posterior sutures		2	0.8%	0	
100.306	punctate cataract, nucleus		0		1	0.6%
100.307	punctate cataract, capsular		1	0.4%	0	
100.311	incipient cataract, anterior cortex		6	2.4%	4	2.3%
100.312	incipient cataract, posterior cortex		8	3.1%	2	1.1%
100.313	incipient cataract, equatorial cortex		2	0.8%	0	
100.315	incipient cataract, posterior sutures		1	0.4%	0	
100.316	incipient cataract, nucleus		2	0.8%	0	
100.317	incipient cataract, capsular		1	0.4%	0	
100.321	incomplete cataract, anterior cortex		0		1	0.6%
100.322	incomplete cataract, posterior cortex		0		1	0.6%
100.323	incomplete cataract, equatorial cortex		0		1	0.6%
100.328	posterior suture tip opacities		1	0.4%	1	0.6%
100.330	generalized/complete cataract		3	1.2%	1	0.6%
100.999	*significant cataracts (summary)*		*33*	*13.0%*	*15*	*8.5%*
VITREOUS						
110.120	persistent hyaloid artery/remnant		1	0.4%	0	
110.200	vitritis		0		1	0.6%
110.320	vitreal degeneration		6	2.4%	7	4.0%

		1991-2013		2014-2018	
RETINA					
120.170	retinal dysplasia, folds	2	0.8%	2	1.1%
120.180	retinal dysplasia, geographic	1	0.4%	4	2.3%
120.190	retinal dysplasia, detached	0		1	0.6%
120.310	generalized progressive retinal atrophy (PRA)	4	1.6%	1	0.6%
120.920	retinal detachment with dialysis	0		1	0.6%
OTHER					
900.000	other, unspecified	8	3.1%	0	
900.100	other, not inherited	5	2.0%	9	5.1%
900.110	other. suspect not inherited/significance unknown	0		1	0.6%
NORMAL					
0.000	normal globe	195	76.8%	132	74.6%

MANCHESTER TERRIER

Standard & Toy Varieties

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder option	
B.	Cataract	Not defined	1	NO	
C.	Retinal atrophy – generalized (*prcd*)	Autosomal recessive	2	NO	Mutation of the *prcd* gene

Description and Comments

A. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

B. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

C. A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

Studies have shown that the principal form of PRA in the Manchester Terrier is *prcd* which is a late-onset form of PRA inherited as autosomal recessive. The mutation is allelic to that present in Miniature Poodles, English and American Cocker Spaniels, and others. The locus is termed the progressive rod-cone degeneration (*prcd*) gene and at least 30+ breeds are affected. In most affected dogs to date, the disease is recognized clinically in dogs 3-6 years of age or older. This photoreceptor degeneration is characterized by slow death of visual cells following their normal development. The disease begins clinically with signs of night blindness followed by day blindness. A DNA test is available.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Manchester Terrier breed. The conditions listed above are generally recognized to exist in the breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 2017 and/or Data from CERF/OFA All-Breeds Report, 2010-2016.

2. ACVO Genetics Committee, 2018 and/or Data from OFA All-Breeds Report, 2013-2017.

OCULAR DISORDERS REPORT
MANCHESTER TERRIER

		1991-2013		2014-2018	
	TOTAL DOGS EXAMINED	**143**		**142**	
Diagnostic Name		**#**	**%**	**#**	**%**
EYELIDS					
25.110	distichiasis	1	0.7%	0	
UVEA					
93.710	persistent pupillary membranes, iris to iris	10	7.0%	7	4.9%
93.730	persistent pupillary membranes, iris to cornea	1	0.7%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	3	2.1%	2	1.4%
93.760	persistent pupillary membranes, endothelial opacity/no strands	1	0.7%	1	0.7%
93.999	uveal cysts	1	0.7%	0	
LENS					
100.210	cataract. suspect not inherited/significance unknown	5	3.5%	6	4.2%
100.301	punctate cataract, anterior cortex	1	0.7%	2	1.4%
100.302	punctate cataract, posterior cortex	2	1.4%	2	1.4%
100.303	punctate cataract, equatorial cortex	1	0.7%	0	
100.305	punctate cataract, posterior sutures	1	0.7%	1	0.7%
100.307	punctate cataract, capsular	0		1	0.7%
100.311	incipient cataract, anterior cortex	2	1.4%	0	
100.312	incipient cataract, posterior cortex	2	1.4%	3	2.1%
100.313	incipient cataract, equatorial cortex	1	0.7%	0	
100.317	incipient cataract, capsular	1	0.7%	2	1.4%
100.328	posterior suture tip opacities	1	0.7%	1	0.7%
100.999	*significant cataracts (summary)*	*11*	*7.7%*	*11*	*7.7%*
VITREOUS					
110.135	PHPV/PTVL	2	1.4%	1	0.7%
110.320	vitreal degeneration	6	4.2%	1	0.7%
RETINA					
120.170	retinal dysplasia, folds	0		2	1.4%
120.960	retinopathy	1	0.7%	0	
OTHER					
900.000	other, unspecified	6	4.2%	0	
900.100	other, not inherited	0		6	4.2%
NORMAL					
0.000	normal globe	124	86.7%	110	77.5%

MAREMMA SHEEPDOG

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Entropion	Not defined	1	Breeder option
B.	Corneal dystrophy	Not defined	1	Breeder option
C.	Chronic superficial keratitis/pannus	Not defined	1	NO
D.	Cataract	Not defined	1	NO
E.	Retinal dysplasia - folds	Not defined	1	Breeder option

Description and Comments

A. Entropion

A conformational defect resulting in an "in-rolling" of one or both of the eyelids which may cause ocular irritation. It is likely that entropion is influenced by several genes (polygenic), defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

B. Corneal dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

C. Chronic superficial keratitis/pannus

A bilateral inflammatory disease of the cornea which usually starts as a grayish haze to the ventral or ventrolateral cornea, followed by the formation of a vascularized subepithelial growth that begins to spread toward the central cornea; pigmentation follows the vascularization. If severe, vision impairment occurs. Pannus may be associated with plasma cell infiltration of the nictitans. This has been reported in the Italian population of the breed.

D. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region. This has been reported in the Italian population of the breed.

E. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined. This has been reported in the Italian population of the breed.

References

1. Guandalini A, Di Girolamo N, Santillo D, Andreani V, Corvi R, Bandini M, and Peruccio C. (2017) Epidemiology of ocular disorders presumed to be inherited in three large Italian dog breeds in Italy. *Vet Ophthalmol*, 20: 420-426. doi:10.1111/vop.12442.

OCULAR DISORDERS REPORT
MAREMMA SHEEPDOG

Diagnostic Name	TOTAL DOGS EXAMINED	1991-2013 10 #	%	2014-2018 17 #	%
UVEA					
93.710	persistent pupillary membranes, iris to iris	2	20.0%	0	
LENS					
100.210	cataract. suspect not inherited/significance unknown	2	20.0%	1	5.9%
100.301	punctate cataract, anterior cortex	0		1	5.9%
100.999	*significant cataracts (summary)*	*0*		*1*	*5.9%*
VITREOUS					
110.320	vitreal degeneration	0		1	5.9%
OTHER					
900.000	other, unspecified	1	10.0%	0	
NORMAL					
0.000	normal globe	7	70.0%	14	82.4%

MARKIESJE

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Retinal atrophy - generalized (*prcd*)	Autosomal recessive	1	NO	Mutation of the *prcd* gene

Description and Comments

A. Retinal atrophy - generalized (*prcd*)

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

Studies have shown that the principal form of PRA in the Markiesje is *prcd*, which is a late-onset form of PRA inherited as autosomal recessive. The mutation is allelic to that present in Miniature Poodles, Labrador Retrievers, English and American Cocker Spaniels and others. The locus is termed the progressive rod-cone degeneration (*prcd*) gene and at least 30+ breeds are affected. In most affected dogs to date, the disease is recognized clinically in dogs 3-6 years of age or older. This photoreceptor degeneration is characterized by slow death of visual cells following their normal development. The disease begins clinically with signs of night blindness followed by day blindness. A DNA test is available.

References

There are no breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the Markiesje breed. The condition listed above is currently noted solely due to the availability of a genetic test for the disease.

1. Zangerl B, Goldstein O, Philp AR, et al. Identical mutation in a novel retinal gene causes progressive rod-cone degeneration in dogs and retinitis pigmentosa in humans. *Genomics*. 2006 Nov;88:551-563.

MASTIFF

(English)

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Entropion	Not defined	1, 2	Breeder option	
B.	Ectropion	Not defined	1	Breeder option	
C.	Macroblepharon/ macropalpebral fissure	Not defined	1	Breeder option	
D.	Distichiasis	Not defined	3	Breeder option	
E.	Uveal cysts	Not defined	4	Breeder option	
F.	Persistent pupillary membranes				
	- iris to iris	Not defined	1, 3, 4	Breeder option	
	- iris to cornea	Not defined	3	NO	
	- endothelial opacity/no strands	Not defined	8	NO	
G.	Cataract	Not defined	1	NO	
H.	Retinal atrophy - generalized	Autosomal dominant	1, 5, 6	NO	Mutation of the *RHO* gene
I.	Multifocal retinopathy - *cmr1*	Autosomal recessive	7	Breeder option	Mutation of the *BEST1* gene
J.	Retinal dysplasia - folds	Not defined	1	Breeder option	

Description and Comments

A. Entropion

A conformational defect resulting in an "in-rolling" of one or both of the eyelids which may cause ocular irritation. It is likely that entropion is influenced by several genes (polygenic), defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull. Entropion in the Mastiff is severe and may require multiple surgical corrections.

B. Ectropion

A conformational defect resulting in eversion of the eyelids, which may cause ocular irritation due to exposure. It is likely that ectropion is influenced by several genes (polygenic), defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

C. Macroblepharon/macropalpebral fissure

Defined as an exceptionally large palpebral fissure, macroblepharon in conjunction with laxity of the lateral canthal structures may lead to lower lid ectropion and upper lid entropion. Either of these conditions may lead to severe ocular irritation.

D. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

E. Uveal cysts

Fluid filled sacs arising from the posterior surface of the iris, to which they may remain attached or break free and float into the anterior chamber. Usually occur in mature dogs.

There is usually no effect on vision unless the cysts are heavily clustered and impinge on the pupillary area. Less frequently, the cysts may rupture and adhere to the cornea or anterior lens capsule. Multiple cysts may occlude the iridocorneal angle and cause glaucoma.

F. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

In the Mastiff, the strands most often bridge from the iris to the cornea and may potentially cause vision impairment. Thus, the strong recommendations against breeding animals with any form of this abnormality.

G. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

H. Retinal atrophy - generalized

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. The ERG is normal at 3-6 months of age, but abnormal by 13 months of age. Increased exposure to bright light causes more rapid loss of neurons. PRA in the Mastiff is inherited as an autosomal dominant trait. The mutation is a single nucleotide transversion of the *RHO* gene. A DNA test is available.

I. Multifocal retinopathy

Canine Multifocal Retinopathy type 1 (cmr1) is characterized by numerous distinct (i.e. multifocal), roughly circular patches of elevated retina (multifocal bullous retinal detachments). There may be a serous subretinal fluid, or accumulation of subretinal material that produces gray-tan-pink colored lesions. These lesions, looking somewhat like blisters, vary in location and size, although typically they are present in both eyes of the affected dog.

The disease generally develops in young dogs between 11-20 weeks of age and there is minimal progression after 1 year of age. The lesions may flatten, leaving areas of retinal thinning and RPE hypertrophy, hyperplasia, and pigmentation. Discrete areas of tapetal hyper-reflectivity may be seen in areas of previous retinal and RPE detachments. Most dogs exhibit no noticeable problem with vision or electroretinographic abnormalities despite their abnormal appearing retinas.

Canine Multifocal Retinopathy type 1 is caused by a mutation in the Bestrophin 1 gene (*BEST1*) and is described to be recessively inherited in the Great Pyrenees, Dogue de Bordeaux, Bullmastiff, and Mastiff. A DNA test is available.

J. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined

References

1. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

2. ACVO Genetics Committee, 2001 and/or Data from CERF All-Breeds Report, 2001.

3. ACVO Genetics Committee, 2000-2002 and/or Data from CERF All-Breeds Report, 2000-2002.

4. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

5. Kijas JW, Miller BJ, Pearce-Kelling SE, et al. Canine models of ocular disease: outcross breedings define a dominant disorder present in the English mastiff and bull mastiff dog breeds. *J Hered*. 2003;94:27-30.

6. Miyadera K, Acland GM, Aguirre GD. Genetic and phenotypic variations of inherited retinal diseases in dogs: the power of within- and across-breed studies. *Mamm Genome*. 2012;23:40-61.

7. Guziewicz KE, Zangerl B, Lindauer SJ, et al. Bestrophin gene mutations cause canine multifocal retinopathy: a novel animal model for best disease. *Invest Ophthalmol Vis Sci*. 2007;48:1959-1967.

8. ACVO Genetics Committee, 2017 and/or Data from CERF/OFA All-Breeds Report, 2010-2016.

OCULAR DISORDERS REPORT
MASTIFF

		1991-2013 8364		2014-2018 1035	
	TOTAL DOGS EXAMINED				
Diagnostic Name		#	%	#	%
GLOBE					
0.110	microphthalmia	19	0.2%	3	0.3%
10.000	glaucoma	2	0.0%	0	
EYELIDS					
20.160	macropalpebral fissure	344	4.1%	0	
21.000	entropion, unspecified	367	4.4%	57	5.5%
22.000	ectropion, unspecified	596	7.1%	70	6.8%
25.110	distichiasis	86	1.0%	7	0.7%
NASOLACRIMAL					
40.910	keratoconjunctivitis sicca	4	0.0%	1	0.1%
NICTITANS					
51.100	third eyelid cartilage anomaly	10	0.1%	2	0.2%
52.110	prolapsed gland of the third eyelid	18	0.2%	1	0.1%
CORNEA					
70.210	corneal pannus	3	0.0%	0	
70.220	pigmentary keratitis	3	0.0%	1	0.1%
70.700	corneal dystrophy	35	0.4%	4	0.4%
70.730	corneal endothelial degeneration	49	0.6%	3	0.3%
UVEA					
90.200	uveitis	0		1	0.1%
93.140	corneal endothelial pigment without PPM	7	0.1%	0	
93.150	iris coloboma	3	0.0%	0	
93.710	persistent pupillary membranes, iris to iris	255	3.0%	41	4.0%
93.720	persistent pupillary membranes, iris to lens	56	0.7%	6	0.6%
93.730	persistent pupillary membranes, iris to cornea	439	5.2%	35	3.4%
93.740	persistent pupillary membranes, iris sheets	19	0.2%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	5	0.1%	3	0.3%
93.760	persistent pupillary membranes, endothelial opacity/no strands	34	0.4%	18	1.7%
93.810	uveal melanoma	2	0.0%	1	0.1%
93.999	uveal cysts	84	1.0%	19	1.8%
LENS					
100.200	cataract, unspecified	19	0.2%	0	
100.210	cataract. suspect not inherited/significance unknown	375	4.5%	55	5.3%
100.301	punctate cataract, anterior cortex	61	0.7%	9	0.9%
100.302	punctate cataract, posterior cortex	12	0.1%	2	0.2%
100.303	punctate cataract, equatorial cortex	6	0.1%	0	
100.304	punctate cataract, anterior sutures	11	0.1%	1	0.1%
100.305	punctate cataract, posterior sutures	10	0.1%	0	
100.306	punctate cataract, nucleus	12	0.1%	2	0.2%
100.307	punctate cataract, capsular	14	0.2%	4	0.4%
100.311	incipient cataract, anterior cortex	68	0.8%	7	0.7%
100.312	incipient cataract, posterior cortex	41	0.5%	1	0.1%
100.313	incipient cataract, equatorial cortex	20	0.2%	3	0.3%
100.314	incipient cataract, anterior sutures	8	0.1%	0	

LENS CONTINUED		1991-2013		2014-2018	
100.315	incipient cataract, posterior sutures	6	0.1%	0	
100.316	incipient cataract, nucleus	34	0.4%	8	0.8%
100.317	incipient cataract, capsular	10	0.1%	1	0.1%
100.321	incomplete cataract, anterior cortex	1	0.0%	2	0.2%
100.322	incomplete cataract, posterior cortex	0		1	0.1%
100.326	incomplete cataract, nucleus	1	0.0%	1	0.1%
100.327	incomplete cataract, capsular	0		1	0.1%
100.328	posterior suture tip opacities	2	0.0%	5	0.5%
100.330	generalized/complete cataract	40	0.5%	1	0.1%
100.340	resorbing/hypermature cataract	0		1	0.1%
100.375	subluxation/luxation, unspecified	5	0.1%	0	
100.999	*significant cataracts (summary)*	*374*	*4.5%*	*45*	*4.3%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	9	0.1%	0	
110.135	PHPV/PTVL	5	0.1%	0	
110.320	vitreal degeneration	11	0.1%	0	
FUNDUS					
97.110	choroidal hypoplasia	1	0.0%	0	
RETINA					
120.170	retinal dysplasia, folds	632	7.6%	45	4.3%
120.180	retinal dysplasia, geographic	48	0.6%	4	0.4%
120.190	retinal dysplasia, detached	5	0.1%	0	
120.310	generalized progressive retinal atrophy (PRA)	151	1.8%	0	
120.910	retinal detachment without dialysis	4	0.0%	0	
120.920	retinal detachment with dialysis	0		2	0.2%
120.960	retinopathy	8	0.1%	1	0.1%
OPTIC NERVE					
130.110	micropapilla	4	0.0%	0	
130.120	optic nerve hypoplasia	2	0.0%	0	
130.150	optic disc coloboma	4	0.0%	0	
OTHER					
900.000	other, unspecified	59	0.7%	0	
900.100	other, not inherited	170	2.0%	37	3.6%
900.110	other. suspect not inherited/significance unknown	68	0.8%	7	0.7%
NORMAL					
0.000	normal globe	5698	68.1%	689	66.6%

OCULAR DISORDERS REPORT
MC NAB

There are insufficient breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the MC NAB breed. Therefore, there are no conditions listed with breeding advice.

OCULAR DISORDERS REPORT
MC NAB

Diagnostic Name	TOTAL DOGS EXAMINED	1991-2013 0 #	%	2014-2018 3 #	%
UVEA					
93.710	persistent pupillary membranes, iris to iris	0		1	33.3%
FUNDUS					
97.110	choroidal hypoplasia	0		1	33.3%
NORMAL					
0.000	normal globe	0		2	66.7%

MI-KI

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Entropion	Not defined	1	Breeder option	
B.	Distichiasis	Not defined	2, 3	Breeder option	
C.	Corneal dystrophy - epithelial/stromal	Not defined	1, 3	Breeder option	
D.	Persistent pupillary membranes - iris to iris	Not defined	3, 4	Breeder option	
E.	Cataract	Not defined	3, 4	NO	
F.	Vitreous degeneration	Not defined	3, 4, 5	Breeder option	
G.	Retinal atrophy – generalized (*prcd*)	Autosomal recessive	6	NO	Mutation in the *prcd* gene
H.	Retinal dysplasia - folds	Not defined	7	Breeder option	

Description and Comments

A. Entropion

A conformational defect resulting in an "in-rolling" of one or both of the eyelids which may cause ocular irritation. It is likely that entropion is influenced by several genes (polygenic), defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

B. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make strong recommendations with regard to breeding dogs with this entity. The hereditary basis has not been established, although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

C. Corneal dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral. In the Mi-Ki, lesions are circular or semicircular central crystalline deposits in the anterior corneal stroma that appear between 2 and 5 years of age. It may be associated with exophthalmos and lagophthalmos common in these dogs.

D. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

E. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

F. Vitreous degeneration

Liquefaction of the vitreous gel which may predispose to retinal detachment.

G. Retinal atrophy – generalized (prcd)

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

Studies have shown that the principal form of PRA in the Mi-Ki is *prcd* which is a late-onset form of PRA inherited as autosomal recessive. The mutation is allelic to that present in Miniature Poodles, English and American Cocker Spaniels, and others. The locus is termed the progressive rod-cone degeneration (*prcd*) gene and at least 30+ breeds are affected. In most affected dogs to date, the disease is recognized clinically in dogs 3-6 years of age or older. This photoreceptor degeneration is characterized by slow death of visual cells following their normal development. The disease begins clinically with signs of night blindness followed by day blindness. A DNA test is available.

H. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and,

in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Mi-Ki breed. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 2008 and/or Data from CERF All-Breeds Report, 2003-2007.

2. ACVO Genetics Committee, 2006 and/or Data from CERF All-Breeds Report, 2001-2005.

3. ACVO Genetics Committee, 2017 and/or Data from CERF/OFA All-Breeds Report, 2010-2016.

4. ACVO Genetics Committee, 2002-2003 and/or Data from CERF All-Breeds Report, 2002-2003.

5. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

6. ACVO Genetics Committee, 2018 and/or Data from OFA All-Breeds Report 2013-2017.

7. ACVO Genetics Committee, 2014 and/or Data from OFA All-Breeds Report, 2013-2014.

OCULAR DISORDERS REPORT
MI-KI

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2013 1190 #	1991-2013 1190 %	2014-2018 473 #	2014-2018 473 %
EYELIDS						
20.140	ectopic cilia		0		1	0.2%
20.160	macropalpebral fissure		2	0.2%	0	
21.000	entropion, unspecified		9	0.8%	2	0.4%
25.110	distichiasis		159	13.4%	75	15.9%
NASOLACRIMAL						
40.910	keratoconjunctivitis sicca		4	0.3%	0	
NICTITANS						
52.110	prolapsed gland of the third eyelid		1	0.1%	2	0.4%
CORNEA						
70.210	corneal pannus		1	0.1%	0	
70.220	pigmentary keratitis		3	0.3%	1	0.2%
70.700	corneal dystrophy		22	1.8%	5	1.1%
70.730	corneal endothelial degeneration		1	0.1%	0	
UVEA						
93.710	persistent pupillary membranes, iris to iris		144	12.1%	46	9.7%
93.750	persistent pupillary membranes, lens pigment foci/no strands		2	0.2%	1	0.2%
LENS						
100.200	cataract, unspecified		1	0.1%	0	
100.210	cataract. suspect not inherited/significance unknown		98	8.2%	40	8.5%
100.301	punctate cataract, anterior cortex		5	0.4%	1	0.2%
100.302	punctate cataract, posterior cortex		4	0.3%	1	0.2%
100.303	punctate cataract, equatorial cortex		0		1	0.2%
100.305	punctate cataract, posterior sutures		18	1.5%	8	1.7%
100.306	punctate cataract, nucleus		0		1	0.2%
100.311	incipient cataract, anterior cortex		3	0.3%	2	0.4%
100.312	incipient cataract, posterior cortex		4	0.3%	2	0.4%
100.313	incipient cataract, equatorial cortex		10	0.8%	2	0.4%
100.314	incipient cataract, anterior sutures		0		1	0.2%
100.315	incipient cataract, posterior sutures		17	1.4%	4	0.8%
100.316	incipient cataract, nucleus		0		2	0.4%
100.317	incipient cataract, capsular		0		1	0.2%
100.322	incomplete cataract, posterior cortex		0		1	0.2%
100.327	incomplete cataract, capsular		0		1	0.2%
100.328	posterior suture tip opacities		1	0.1%	12	2.5%
100.330	generalized/complete cataract		1	0.1%	0	
100.999	*significant cataracts (summary)*		*63*	*5.3%*	*28*	*5.9%*
VITREOUS						
110.120	persistent hyaloid artery/remnant		1	0.1%	0	
110.135	PHPV/PTVL		1	0.1%	0	
110.200	vitritis		0		9	1.9%
110.320	vitreal degeneration		117	9.8%	23	4.9%

		1991-2013		2014-2018	
FUNDUS					
97.110	choroidal hypoplasia	1	0.1%	0	
RETINA					
120.170	retinal dysplasia, folds	8	0.7%	5	1.1%
120.180	retinal dysplasia, geographic	5	0.4%	4	0.8%
120.310	generalized progressive retinal atrophy (PRA)	5	0.4%	2	0.4%
120.920	retinal detachment with dialysis	0		2	0.4%
120.960	retinopathy	2	0.2%	10	2.1%
OPTIC NERVE					
130.110	micropapilla	2	0.2%	0	
130.120	optic nerve hypoplasia	2	0.2%	0	
130.150	optic disc coloboma	2	0.2%	0	
OTHER					
900.000	other, unspecified	24	2.0%	0	
900.100	other, not inherited	59	5.0%	44	9.3%
900.110	other. suspect not inherited/significance unknown	7	0.6%	2	0.4%
NORMAL					
0.000	normal globe	789	66.3%	261	55.2%

MINIATURE AMERICAN SHEPHERD (AKC)/ MINIATURE AUSTRALIAN SHEPHERD

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Microphthalmia with multiple ocular defects	Presumed autosomal recessive with incomplete penetrance	1-6	NO	
B.	Distichiasis	Not defined	1, 7, 21	Breeder option	
C.	Corneal dystrophy - epithelial/stromal	Not defined	21	Breeder option	
D.	Iris coloboma	Not defined	1, 21, 22	NO	
E.	Iris hypoplasia	Not defined		Breeder option	
F.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder option	
G.	Cataract	Autosomal co-dominant	1, 10, 11	NO	Mutation of the *HSF4* gene
H.	Persistent hyaloid artery	Not defined	8	Breeder option	
I.	Retinal atrophy - generalized (*prcd*)	Autosomal recessive	1, 9, 12, 13	NO	Mutation of the *prcd* gene
J.	Cone degeneration - day blindness	Autosomal recessive	14	NO	Mutation of the *CNGB3* gene
K.	Multifocal retinopathy - *cmr1*	Autosomal recessive	15	Breeder option	Mutation of the *BEST1* gene
L.	Retinal dysplasia - folds	Not defined		Breeder option	

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
M.	Choroidal hypoplasia (Collie Eye Anomaly) - optic nerve coloboma - retinal detachment - retinal hemorrhage - staphyloma/coloboma	Autosomal recessive	1, 7, 16-19	NO	Mutation of the *NHEJ1* gene
N.	Coloboma/staphyloma without microphthalmia	Not defined	1	NO	
O.	Micropapilla	Not defined	20	Breeder option	

It is recommended that this breed be examined prior to pharmacological dilation to best facilitate identification of iris coloboma.

Description and Comments

A. Microphthalmia with multiple ocular defects

Microphthalmia is a congenital defect characterized by a small eye with associated defects of the cornea, iris (coloboma), anterior chamber, lens (cataract) and/or retina (dysplasia). In the Australian Shepherd, microphthalmia has long been suspected to be associated with merled coat coloration but a definitive genetic relationship has not been established. The eyes of affected homozygous merle (usually white) dogs have extreme forms of this entity and are usually blind at birth. Affected heterozygous merle-coated dogs demonstrate less severe manifestations.

B. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

C. Corneal Dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

D. Iris coloboma

A congenital abnormality in iris development usually characterized by a full-thickness defect in iris tissue, commonly (though not exclusively) located at the 6 o'clock position associated with failure of closure of the optic fissure. A partial-thickness defect in iris

tissue should be recorded as iris hypoplasia on the OFA form.

E. Iris hypoplasia

A congenital abnormality in iris development usually characterized by a reduced quantity of tissue identified as a partial-thickness defect in iris tissue. Full-thickness iris hypoplasia is rare and should be recorded as an iris coloboma on the OFA form.

F. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

G. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

In the Australian Shepherd, a mutation in *HSF4* (heat shock transcription factor 4), the HSF4-2 mutation, has been shown to increase the likelihood of cataract formation. The mutation is inherited in a co-dominant manner. Dogs with one copy of the mutation develop bilateral posterior cataracts and homozygotes develop a nuclear cataract that typically progresses to a mature cataract. A DNA test is available for this mutation. Other genetic factors can contribute to cataract formation in this breed and will not be detected by this test.

H. Persistent hyaloid artery (PHA)

Congenital defect resulting from abnormalities in the development and regression of the hyaloid artery. The blood vessel remnant can be present in the vitreous as a small patent vascular strand (PHA) or as a non-vascular strand that appears gray-white (persistent hyaloid remnant).

I. Retinal atrophy - generalized (*prcd*)

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

Studies have shown that the principal form of PRA in the Miniature American/Australian Shepherd is *prcd* which is a late-onset form of PRA inherited as autosomal recessive. The mutation is allelic to that present in Miniature Poodles, Labrador Retrievers, English and American Cocker Spaniels, and others. The locus is termed the progressive rod-

cone degeneration (*prcd*) gene and at least 30+ breeds are affected. In most affected dogs to date, the disease is recognized clinically in dogs 3-6 years of age or older. This photoreceptor degeneration is characterized by slow death of visual cells following their normal development. The disease begins clinically with signs of night blindness followed by day blindness. A DNA test is available.

J. Cone degeneration - day blindness or hemeralopia

Autosomal recessively inherited early degeneration of the cone photoreceptors. Affected puppies develop day blindness, color blindness, and photophobia between 8 and 12 weeks of age. Affected dogs remain ophthalmoscopically normal their entire life. Electroretinography is required to definitively diagnose the disorder. Genetically, the condition results from a mutation in the *CNGB3* gene. A DNA test is available.

K. Multifocal retinopathy

Canine Multifocal Retinopathy type 1 (*cmr1*) is characterized by numerous distinct (i.e. multifocal), roughly circular patches of elevated retina (multifocal bullous retinal detachments). There may be a serous subretinal fluid, or accumulation of subretinal material that produces gray-tan-pink colored lesions. These lesions, looking somewhat like blisters, vary in location and size, although typically they are present in both eyes of the affected dog.

The disease generally develops in young dogs between 11-20 weeks of age and there is minimal progression after 1 year of age. The lesions may flatten, leaving areas of retinal thinning and RPE hypertrophy, hyperplasia, and pigmentation. Discrete areas of tapetal hyper-reflectivity may be seen in areas of previous retinal and RPE detachments. Most dogs exhibit no noticeable problem with vision or electroretinographic abnormalities despite their abnormal appearing retinas.

Canine Multifocal Retinopathy type 1 is caused by a mutation in the Bestrophin 1 gene (*BEST1*) and is described to be recessively inherited in the Great Pyrenees, Dogue de Bordeaux, Bullmastiff, and Mastiff.

L. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

M. Choroidal hypoplasia (Collie Eye Anomaly)
- staphyloma/coloboma
- retinal detachment
- retinal hemorrhage
- optic nerve coloboma

A spectrum of malformations present at birth and ranging from inadequate development

of the choroid (choroidal hypoplasia) to defects of the choroid, sclera, and/or optic nerve (coloboma/staphyloma) to complete retinal detachment (with or without hemorrhage). Mildly affected animals will have no detectable vision deficit.

This disorder is collectively referred to as "Collie Eye Anomaly." The choroidal hypoplasia component is caused by a 7799 base pair deletion with the gene *NHEJ1.* The mutation is a recessive trait. A DNA test is available and is diagnostic only for the choroidal hypoplasia component of CEA. For colobomas to develop, an additional mutation in a second gene has to be present; that gene is still unknown.

N. Coloboma/staphyloma (unassociated with microphthalmia)

A coloboma is a congenital defect which may affect the iris, choroid or optic disc. Iris colobomas are seen as notches in the pupillary margin. Scleral ectasia is defined as a congenital thinning and secondary distention of the sclera; when lined by uveal tissue it is called a staphyloma. These may be anteriorly located, apparent as a bulge beneath the upper eyelid or posteriorly located, requiring visualization with an ophthalmoscope. These conditions may or may not be genetically related to the same anomalies seen associated with microphthalmia (entity "A" above).

O. Micropapilla

Micropapilla refers to a small optic disc which is not associated with vision impairment. Optic nerve hypoplasia refers to a congenital defect of the optic nerve which causes blindness and abnormal pupil response in the affected eye. It may be difficult to differentiate between micropapilla and optic nerve hypoplasia on a routine (dilated) screening ophthalmoscopic exam.

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OCULAR DISORDERS REPORT
MINIATURE AMERICAN(AKC)/MINIATURE AUSTRALIAN SHEPHERD

		1991-2013		2014-2018	
	TOTAL DOGS EXAMINED	11547		4932	
Diagnostic Name		#	%	#	%
GLOBE					
0.110	microphthalmia	17	0.1%	7	0.1%
10.000	glaucoma	0		1	0.0%
EYELIDS					
25.110	distichiasis	566	4.9%	155	3.1%
NASOLACRIMAL					
32.110	imperforate lower nasolacrimal punctum	0		1	0.0%
40.910	keratoconjunctivitis sicca	1	0.0%	1	0.0%
NICTITANS					
51.100	third eyelid cartilage anomaly	1	0.0%	1	0.0%
CORNEA					
70.220	pigmentary keratitis	2	0.0%	0	
70.700	corneal dystrophy	64	0.6%	115	2.3%
70.730	corneal endothelial degeneration	5	0.0%	0	
UVEA					
90.200	uveitis	0		1	0.0%
93.110	iris hypoplasia	37	0.3%	67	1.4%
93.150	iris coloboma	221	1.9%	97	2.0%
93.710	persistent pupillary membranes, iris to iris	993	8.6%	639	13.0%
93.720	persistent pupillary membranes, iris to lens	16	0.1%	9	0.2%
93.730	persistent pupillary membranes, iris to cornea	6	0.1%	1	0.0%
93.740	persistent pupillary membranes, iris sheets	9	0.1%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	1	0.0%	1	0.0%
93.760	persistent pupillary membranes, endothelial opacity/no strands	2	0.0%	2	0.0%
93.810	uveal melanoma	0		1	0.0%
97.150	chorioretinal coloboma, congenital	1	0.0%	5	0.1%
LENS					
100.210	cataract. suspect not inherited/significance unknown	129	1.1%	62	1.3%
100.301	punctate cataract, anterior cortex	17	0.1%	6	0.1%
100.302	punctate cataract, posterior cortex	7	0.1%	1	0.0%
100.303	punctate cataract, equatorial cortex	5	0.0%	1	0.0%
100.304	punctate cataract, anterior sutures	3	0.0%	0	
100.305	punctate cataract, posterior sutures	7	0.1%	8	0.2%
100.306	punctate cataract, nucleus	4	0.0%	5	0.1%
100.307	punctate cataract, capsular	6	0.1%	3	0.1%
100.311	incipient cataract, anterior cortex	19	0.2%	8	0.2%
100.312	incipient cataract, posterior cortex	24	0.2%	4	0.1%
100.313	incipient cataract, equatorial cortex	7	0.1%	3	0.1%
100.315	incipient cataract, posterior sutures	1	0.0%	2	0.0%
100.316	incipient cataract, nucleus	4	0.0%	2	0.0%
100.317	incipient cataract, capsular	5	0.0%	5	0.1%
100.322	incomplete cataract, posterior cortex	1	0.0%	1	0.0%
100.323	incomplete cataract, equatorial cortex	0		2	0.0%
100.327	incomplete cataract, capsular	1	0.0%	0	

LENS CONTINUED		1991-2013		2014-2018	
100.328	posterior suture tip opacities	0		12	0.2%
100.330	generalized/complete cataract	4	0.0%	2	0.0%
100.375	subluxation/luxation, unspecified	1	0.0%	0	
100.999	*significant cataracts (summary)*	*115*	*1.0%*	*53*	*1.1%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	27	0.2%	37	0.8%
110.135	PHPV/PTVL	13	0.1%	2	0.0%
110.200	vitritis	1	0.0%	6	0.1%
110.320	vitreal degeneration	66	0.6%	10	0.2%
FUNDUS					
97.110	choroidal hypoplasia	17	0.1%	15	0.3%
97.120	coloboma	8	0.1%	0	
RETINA					
120.170	retinal dysplasia, folds	39	0.3%	14	0.3%
120.180	retinal dysplasia, geographic	1	0.0%	0	
120.190	retinal dysplasia, detached	1	0.0%	0	
120.310	generalized progressive retinal atrophy (PRA)	28	0.2%	1	0.0%
120.910	retinal detachment without dialysis	1	0.0%	0	
120.920	retinal detachment with dialysis	0		1	0.0%
120.960	retinopathy	0		5	0.1%
OPTIC NERVE					
130.110	micropapilla	52	0.5%	24	0.5%
130.120	optic nerve hypoplasia	17	0.1%	4	0.1%
130.150	optic disc coloboma	19	0.2%	11	0.2%
OTHER					
900.000	other, unspecified	129	1.1%	0	
900.100	other, not inherited	208	1.8%	135	2.7%
900.110	other. suspect not inherited/significance unknown	10	0.1%	4	0.1%
NORMAL					
0.000	normal globe	9959	86.2%	3676	74.5%

MINIATURE BULL TERRIER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Corneal dystrophy - endothelial	Not defined	1	Breeder option	
B.	Persistent pupillary membranes				
	- iris to iris	Not defined	2, 3	Breeder option	
	- iris to lens	Not defined	4	NO	
	- iris to cornea	Not defined	4	NO	
	- iris sheets	Not defined	2	NO	
	- lens pigment foci/no strands	Not defined	9	Passes with no notation	
	- endothelial opacity/no strands	Not defined	4	NO	
C.	Cataract	Not defined	3	NO	
D.	Lens luxation	Autosomal recessive	8, 10	NO	Mutation of the *ADAMTS17* gene
E.	Vitreous degeneration	Not defined	1, 3, 4	Breeder option	
F.	Retinal atrophy - generalized -	Not defined	4	NO	

Description and Comments

A. Corneal dystrophy - endothelial

Corneal endothelial dystrophy is an abnormal loss of the inner lining of the cornea that causes progressive fluid retention (edema). With time the edema results in keratitis and decreased vision. This usually does not occur until the animal is older.

B. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

Although the total number of Miniature Bull Terriers presented for OFA/CERF examination is not large, the incidence of PPM in this breed is approximately 10% in recent years. Some of these PPM's have been iris to cornea and iris to lens. Considerable discretion should be used before breeding a dog with the latter more severe forms of PPM.

C. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

D. Lens luxation

Partial (subluxation) or complete displacement of the lens from the normal anatomic site behind the pupil. Lens luxation not associated with trauma or inflammation is presumed to be inherited. Lens luxation may result in elevated intraocular pressure (glaucoma) causing vision impairment or blindness. A mutation in *ADAMTS17* has been associated with primary lens luxation. A DNA test is available.

Two loci with potentially enhancing effects on the ADAMTS17 mutation are associated with primary lens luxation (PLL) in Australian Miniature Bull Terriers. PLL associated allele of the BICF2G630420272 SNP increases the risk of PLL in the presence of the ADAMTS17 mutation. Candidate genes in the two regions of interest included CPE on chromosome 15 and CTCF on chromosome 1. The ADAMTS17 mutation is also associated with abnormal foot and nail shapes, pedal hyperkeratosis, and persistent pupillary membranes. Association of the ADAMTS17 mutation with possible pedal skeletal abnormalities in the Miniature Bull Terriers supports primary lens luxation in this breed and Marchesani syndrome-like disease in humans as being homologous diseases.

E. Vitreous degeneration

Liquefaction of the vitreous gel which may predispose to retinal detachment.

F. Retinal atrophy - generalized

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

References

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OCULAR DISORDERS REPORT
MINIATURE BULL TERRIER

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2013 1191 #	 %	2014-2018 115 #	 %
GLOBE						
0.110	microphthalmia		3	0.3%	0	
10.000	glaucoma		1	0.1%	0	
EYELIDS						
22.000	ectropion, unspecified		1	0.1%	0	
25.110	distichiasis		0		1	0.9%
NASOLACRIMAL						
40.910	keratoconjunctivitis sicca		5	0.4%	1	0.9%
CORNEA						
70.700	corneal dystrophy		2	0.2%	3	2.6%
70.730	corneal endothelial degeneration		13	1.1%	0	
UVEA						
93.140	corneal endothelial pigment without PPM		4	0.3%	0	
93.710	persistent pupillary membranes, iris to iris		79	6.6%	1	0.9%
93.720	persistent pupillary membranes, iris to lens		52	4.4%	0	
93.730	persistent pupillary membranes, iris to cornea		81	6.8%	1	0.9%
93.740	persistent pupillary membranes, iris sheets		8	0.7%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands		4	0.3%	5	4.3%
93.760	persistent pupillary membranes, endothelial opacity/no strands		11	0.9%	4	3.5%
LENS						
100.200	cataract, unspecified		2	0.2%	0	
100.210	cataract. suspect not inherited/significance unknown		47	3.9%	7	6.1%
100.301	punctate cataract, anterior cortex		11	0.9%	0	
100.302	punctate cataract, posterior cortex		1	0.1%	0	
100.305	punctate cataract, posterior sutures		1	0.1%	0	
100.307	punctate cataract, capsular		4	0.3%	0	
100.311	incipient cataract, anterior cortex		14	1.2%	1	0.9%
100.312	incipient cataract, posterior cortex		5	0.4%	0	
100.313	incipient cataract, equatorial cortex		1	0.1%	0	
100.314	incipient cataract, anterior sutures		1	0.1%	0	
100.317	incipient cataract, capsular		12	1.0%	0	
100.330	generalized/complete cataract		4	0.3%	0	
100.375	subluxation/luxation, unspecified		50	4.2%	1	0.9%
100.999	*significant cataracts (summary)*		*56*	*4.7%*	*1*	*0.9%*
VITREOUS						
110.120	persistent hyaloid artery/remnant		1	0.1%	0	
110.320	vitreal degeneration		22	1.8%	2	1.7%
RETINA						
120.170	retinal dysplasia, folds		3	0.3%	0	
120.180	retinal dysplasia, geographic		1	0.1%	0	
120.310	generalized progressive retinal atrophy (PRA)		13	1.1%	0	
120.960	retinopathy		0		2	1.7%

	1991-2013		2014-2018	
OPTIC NERVE				
130.110 micropapilla	12	1.0%	0	
130.120 optic nerve hypoplasia	3	0.3%	0	
130.150 optic disc coloboma	1	0.1%	0	
OTHER				
900.000 other, unspecified	9	0.8%	0	
900.100 other, not inherited	33	2.8%	5	4.3%
900.110 other. suspect not inherited/significance unknown	19	1.6%	0	
NORMAL				
0.000 normal globe	883	74.1%	91	79.1%

MINIATURE PINSCHER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Corneal dystrophy - epithelial/stromal	Not defined	1	Breeder option
B.	Persistent pupillary membranes			
	- iris to iris	Not defined	1, 2	Breeder option
	- lens pigment foci/no strands	Not defined	4	Passes with no notation
C.	Cataract	Not defined	1	NO
D.	Vitreous degeneration	Not defined	5	Breeder option
E.	Retinal atrophy - generalized	Presumed autosomal recessive	2	NO
F.	Optic nerve hypoplasia	Not defined	2	NO

Description and Comments

A. Corneal dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

B. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

C. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely

(diffuse) or in a localized region.

D. Vitreous degeneration

A liquefaction of the vitreous gel which may predispose to retinal detachment.

E. Retinal atrophy - generalized

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as Progressive Retinal Atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

F. Optic nerve hypoplasia

A congenital defect of the optic nerve which causes blindness and abnormal pupil response in the affected eye. May be unable to differentiate from micropapilla on a routine (dilated) screening ophthalmoscopic exam.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Miniature Pinscher. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

2. ACVO Genetics Committee, 2000-2002 and/or Data from CERF All-Breeds Report, 2000-2002.

3. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

4. ACVO Genetics Committee, 2016 and/or Data from CERF/OFA All-Breeds, Report 2010-2015.

5. ACVO Genetics Committee, 2009 and/or Data from CERF All-Breeds Report, 2008.

OCULAR DISORDERS REPORT
MINIATURE PINSCHER

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2013 683 #	%	2014-2018 209 #	%
GLOBE						
0.110	microphthalmia		3	0.4%	0	
EYELIDS						
20.140	ectopic cilia		0		1	0.5%
21.000	entropion, unspecified		3	0.4%	0	
22.000	ectropion, unspecified		1	0.1%	0	
25.110	distichiasis		5	0.7%	0	
NASOLACRIMAL						
40.910	keratoconjunctivitis sicca		0		1	0.5%
NICTITANS						
52.110	prolapsed gland of the third eyelid		2	0.3%	0	
CORNEA						
70.210	corneal pannus		2	0.3%	0	
70.220	pigmentary keratitis		2	0.3%	2	1.0%
70.700	corneal dystrophy		40	5.9%	14	6.7%
70.730	corneal endothelial degeneration		1	0.1%	1	0.5%
UVEA						
93.140	corneal endothelial pigment without PPM		1	0.1%	0	
93.710	persistent pupillary membranes, iris to iris		25	3.7%	2	1.0%
93.720	persistent pupillary membranes, iris to lens		1	0.1%	0	
93.730	persistent pupillary membranes, iris to cornea		0		1	0.5%
93.740	persistent pupillary membranes, iris sheets		1	0.1%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands		2	0.3%	8	3.8%
93.760	persistent pupillary membranes, endothelial opacity/no strands		1	0.1%	3	1.4%
LENS						
100.210	cataract. suspect not inherited/significance unknown		27	4.0%	7	3.3%
100.301	punctate cataract, anterior cortex		6	0.9%	2	1.0%
100.302	punctate cataract, posterior cortex		5	0.7%	0	
100.303	punctate cataract, equatorial cortex		0		2	1.0%
100.304	punctate cataract, anterior sutures		1	0.1%	0	
100.305	punctate cataract, posterior sutures		3	0.4%	0	
100.306	punctate cataract, nucleus		0		1	0.5%
100.307	punctate cataract, capsular		1	0.1%	1	0.5%
100.311	incipient cataract, anterior cortex		15	2.2%	5	2.4%
100.312	incipient cataract, posterior cortex		9	1.3%	2	1.0%
100.313	incipient cataract, equatorial cortex		3	0.4%	0	
100.314	incipient cataract, anterior sutures		0		1	0.5%
100.315	incipient cataract, posterior sutures		1	0.1%	0	
100.317	incipient cataract, capsular		1	0.1%	0	
100.321	incomplete cataract, anterior cortex		1	0.1%	1	0.5%
100.322	incomplete cataract, posterior cortex		1	0.1%	0	
100.323	incomplete cataract, equatorial cortex		0		1	0.5%
100.330	generalized/complete cataract		7	1.0%	0	
100.375	subluxation/luxation, unspecified		3	0.4%	0	

LENS CONTINUED	1991-2013		2014-2018	
100.999 significant cataracts (summary)	*54*	*7.9%*	*16*	*7.7%*
VITREOUS				
110.120 persistent hyaloid artery/remnant	4	0.6%	1	0.5%
110.135 PHPV/PTVL	2	0.3%	0	
110.200 vitritis	1	0.1%	2	1.0%
110.320 vitreal degeneration	39	5.7%	4	1.9%
FUNDUS				
97.120 coloboma	1	0.1%	0	
RETINA				
120.170 retinal dysplasia, folds	2	0.3%	1	0.5%
120.310 generalized progressive retinal atrophy (PRA)	12	1.8%	0	
120.910 retinal detachment without dialysis	3	0.4%	0	
OPTIC NERVE				
130.110 micropapilla	0		3	1.4%
130.120 optic nerve hypoplasia	9	1.3%	0	
OTHER				
900.000 other, unspecified	12	1.8%	0	
900.100 other, not inherited	26	3.8%	14	6.7%
900.110 other. suspect not inherited/significance unknown	7	1.0%	1	0.5%
NORMAL				
0.000 normal globe	513	75.1%	145	69.4%

MINIATURE SCHNAUZER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Microphthalmia with congenital cataract	Autosomal recessive	1-4	NO
B.	Distichiasis	Not defined	1, 18	Breeder option
C.	Corneal dystrophy - epithelial/stromal	Not defined	17	Breeder option
D.	Persistent pupillary membranes - iris to iris - lens pigment foci/no strands	Not defined Not defined	6 7	Breeder option Passes with no notation
E.	Cataract	Autosomal recessive	1, 8-11	NO
F.	Vitreous degeneration	Not defined	17	Breeder option
G.	Retinal dysplasia with Persistent hyperplastic primary vitreous (PHPV)	Autosomal recessive	14	NO
H.	Retinal atrophy-generalized	Autosomal recessive	1, 12, 13	NO
I.	Ceroid lipofuscinosis	Presumed autosomal recessive	15, 16	NO

Description and Comments

A. Microphthalmia with congenital cataract

Congenital nuclear and posterior cortical lens opacities that progress slowly. In some cases, these cataracts appear similar to the congenital cataracts described in "E" below. An associated abnormality in this defect is microphthalmia that is often mild and is accompanied by a 1-3 mm reduction in the axial length of the globe as determined by ultrasonography. The cataracts often do not become mature and cause blindness until the dogs reach 3-5 years of age. Congenital cataracts and microphthalmia are inherited as an autosomal recessive disorder.

B. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

C. Corneal dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

D. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

E. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

Congenital cataracts in the Miniature Schnauzer are bilateral and appear prior to 6 weeks of age. At this time they may already involve the entire lens. Others will first appear as posterior subcapsular opacities and usually progress to complete cataracts. These congenital cataracts are inherited as an autosomal recessive trait. Later-onset cataracts may represent a genetically distinct entity. There are other types of cataract in the breed which are also likely hereditary.

Note: It is not certain whether A and F are genetically distinct, or different manifestations of the same entity, as eyes affected with cataracts are often smaller than normal.

F. Vitreous degeneration

Liquefaction of the vitreous gel which may predispose to retinal detachment.

G. Retinal dysplasia with persistent hyperplastic primary vitreous (PHPV)

In the Miniature Schnauzer PHPV is associated with retinal dysplasia in some dogs. In this association it may be unilateral or bilateral and most often manifests as small white

posterior lens capsule plaques accompanied by white primary vitreous mass extending to the optic disc. Patent hyaloid arteries and posterior lens capsule vessels may also be present.

H. Retinal atrophy - generalized

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most forms of PRA are inherited as recessive traits.

A form of PRA in the Miniature Schnauzer was previously characterized and called photoreceptor dysplasia (now called Type A PRA). The dysplasia results from the abnormal development of visual cells followed by their degeneration. The disorder appears to affect the generation of an electrical signal within the retinal photoreceptor cells. Although fundus abnormalities usually are not present until 2-3 years of age, abnormalities of the electroretinogram can be demonstrated by 8-10 weeks of age. Clinical signs include mildly impaired night vision and variable rate of progression.

Initial studies suggested a mutation in phosducin was responsible, but this was disproven. This disease is extremely rare. The causative gene for Type A PRA has not been published although a DNA test is available. Another more common autosomal recessive form of PRA appears to be present in the Miniature Schnauzer, but the causative gene has not yet been determined; it also affects dogs ~2-4 years of age. Lastly, cases of late-onset PRA in the breed are recognized clinically but the inheritance pattern is unknown. (G. Aguirre personal communication 2016).

I. Ceroid lipofuscinosis

An inherited disease of man and animals characterized by the accumulation of lipopigment in various tissues of the body including the eye. It results in progressive neurologic disease including blindness. (Also called Batten's disease). This disease is very rare.

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OCULAR DISORDERS REPORT
MINIATURE SCHNAUZER

Diagnostic Name		1991-2013 TOTAL DOGS EXAMINED 26274 #	%	2014-2018 5843 #	%
GLOBE					
0.110	microphthalmia	20	0.1%	3	0.1%
EYELIDS					
21.000	entropion, unspecified	4	0.0%	1	0.0%
25.110	distichiasis	555	2.1%	100	1.7%
NASOLACRIMAL					
32.110	imperforate lower nasolacrimal punctum	0		2	0.0%
40.910	keratoconjunctivitis sicca	4	0.0%	3	0.1%
NICTITANS					
51.100	third eyelid cartilage anomaly	1	0.0%	0	
52.110	prolapsed gland of the third eyelid	4	0.0%	0	
CORNEA					
70.210	corneal pannus	2	0.0%	1	0.0%
70.220	pigmentary keratitis	7	0.0%	1	0.0%
70.700	corneal dystrophy	137	0.5%	25	0.4%
70.730	corneal endothelial degeneration	16	0.1%	1	0.0%
UVEA					
90.250	pigmentary uveitis	2	0.0%	0	
93.110	iris hypoplasia	0		2	0.0%
93.140	corneal endothelial pigment without PPM	10	0.0%	0	
93.150	iris coloboma	0		1	0.0%
93.710	persistent pupillary membranes, iris to iris	425	1.6%	110	1.9%
93.720	persistent pupillary membranes, iris to lens	47	0.2%	5	0.1%
93.730	persistent pupillary membranes, iris to cornea	77	0.3%	5	0.1%
93.740	persistent pupillary membranes, iris sheets	12	0.0%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	48	0.2%	76	1.3%
93.760	persistent pupillary membranes, endothelial opacity/no strands	12	0.0%	1	0.0%
93.999	uveal cysts	1	0.0%	1	0.0%
LENS					
100.200	cataract, unspecified	61	0.2%	0	
100.210	cataract. suspect not inherited/significance unknown	524	2.0%	136	2.3%
100.301	punctate cataract, anterior cortex	86	0.3%	16	0.3%
100.302	punctate cataract, posterior cortex	40	0.2%	10	0.2%
100.303	punctate cataract, equatorial cortex	25	0.1%	11	0.2%
100.304	punctate cataract, anterior sutures	15	0.1%	0	
100.305	punctate cataract, posterior sutures	48	0.2%	21	0.4%
100.306	punctate cataract, nucleus	12	0.0%	5	0.1%
100.307	punctate cataract, capsular	17	0.1%	15	0.3%
100.311	incipient cataract, anterior cortex	91	0.3%	22	0.4%
100.312	incipient cataract, posterior cortex	127	0.5%	26	0.4%
100.313	incipient cataract, equatorial cortex	50	0.2%	19	0.3%
100.314	incipient cataract, anterior sutures	8	0.0%	0	
100.315	incipient cataract, posterior sutures	31	0.1%	6	0.1%
100.316	incipient cataract, nucleus	18	0.1%	17	0.3%

LENS CONTINUED		1991-2013		2014-2018	
100.317	incipient cataract, capsular	18	0.1%	11	0.2%
100.321	incomplete cataract, anterior cortex	2	0.0%	14	0.2%
100.322	incomplete cataract, posterior cortex	2	0.0%	18	0.3%
100.323	incomplete cataract, equatorial cortex	0		1	0.0%
100.325	incomplete cataract, posterior sutures	0		2	0.0%
100.326	incomplete cataract, nucleus	6	0.0%	20	0.3%
100.327	incomplete cataract, capsular	0		2	0.0%
100.328	posterior suture tip opacities	5	0.0%	21	0.4%
100.330	generalized/complete cataract	146	0.6%	7	0.1%
100.340	resorbing/hypermature cataract	0		1	0.0%
100.375	subluxation/luxation, unspecified	7	0.0%	0	
100.999	*significant cataracts (summary)*	*803*	*3.1%*	*244*	*4.2%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	33	0.1%	14	0.2%
110.135	PHPV/PTVL	21	0.1%	3	0.1%
110.200	vitritis	3	0.0%	13	0.2%
110.320	vitreal degeneration	158	0.6%	18	0.3%
FUNDUS					
97.110	choroidal hypoplasia	1	0.0%	3	0.1%
97.120	coloboma	1	0.0%	0	
RETINA					
120.170	retinal dysplasia, folds	64	0.2%	5	0.1%
120.180	retinal dysplasia, geographic	48	0.2%	1	0.0%
120.190	retinal dysplasia, detached	31	0.1%	1	0.0%
120.310	generalized progressive retinal atrophy (PRA)	145	0.6%	8	0.1%
120.400	retinal hemorrhage	6	0.0%	0	
120.910	retinal detachment without dialysis	14	0.1%	0	
120.920	retinal detachment with dialysis	0		2	0.0%
120.960	retinopathy	1	0.0%	5	0.1%
OPTIC NERVE					
130.110	micropapilla	42	0.2%	10	0.2%
130.120	optic nerve hypoplasia	14	0.1%	2	0.0%
130.150	optic disc coloboma	1	0.0%	1	0.0%
OTHER					
900.000	other, unspecified	158	0.6%	0	
900.100	other, not inherited	372	1.4%	130	2.2%
900.110	other. suspect not inherited/significance unknown	62	0.2%	2	0.0%
NORMAL					
0.000	normal globe	24066	91.6%	5102	87.3%

MUDI

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder option

Description and Comments

A. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Mudi breed. The conditions listed above are generally recognized to exist in the breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 2017 and/or Data from CERF/OFA All-Breeds Report, 2010-2016.

OCULAR DISORDERS REPORT
MUDI

Diagnostic Name		1991-2013 TOTAL DOGS EXAMINED 44 #	%	2014-2018 82 #	%
EYELIDS					
25.110	distichiasis	1	2.3%	1	1.2%
UVEA					
93.710	persistent pupillary membranes, iris to iris	4	9.1%	8	9.8%
LENS					
100.210	cataract. suspect not inherited/significance unknown	2	4.5%	2	2.4%
100.301	punctate cataract, anterior cortex	0		1	1.2%
100.305	punctate cataract, posterior sutures	0		3	3.7%
100.316	incipient cataract, nucleus	1	2.3%	0	
100.328	posterior suture tip opacities	1	2.3%	3	3.7%
100.999	*significant cataracts (summary)*	*1*	*2.3%*	*4*	*4.9%*
OTHER					
900.000	other, unspecified	1	2.3%	0	
900.100	other, not inherited	1	2.3%	6	7.3%
NORMAL					
0.000	normal globe	38	86.4%	62	75.6%

OCULAR DISORDERS REPORT
MUNSTERLANDER

There are insufficient breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the MUNSTERLANDER breed. Therefore, there are no conditions listed with breeding advice.

OCULAR DISORDERS REPORT
MUNSTERLANDER

Diagnostic Name	TOTAL DOGS EXAMINED	1991-2013 0 #	%	2014-2018 1 #	%
NORMAL					
0.000 normal globe		0		1	100.0%

OCULAR DISORDERS REPORT
NATIVE AM. INDIAN DOG

There are insufficient breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the NATIVE AM. INDIAN DOG breed. Therefore, there are no conditions listed with breeding advice.

OCULAR DISORDERS REPORT
NATIVE AM. INDIAN DOG

Diagnostic Name	TOTAL DOGS EXAMINED	1991-2013 0 #	%	2014-2018 1 #	%
LENS					
100.326	incomplete cataract, nucleus	0		1	100.0%
100.999	*significant cataracts (summary)*	*0*		*1*	*100.0%*

OCULAR DISORDERS REPORT
NATIVE AM. VILLAGE DOG

There are insufficient breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the NATIVE AM. VILLAGE DOG breed. Therefore, there are no conditions listed with breeding advice.

OCULAR DISORDERS REPORT
NATIVE AM. VILLAGE DOG

Diagnostic Name	TOTAL DOGS EXAMINED	1991-2013 1 #	%	2014-2018 1 #	%
OTHER					
900.100 other, not inherited		1	100.0%	0	
NORMAL					
0.000 normal globe		0		1	100.0%

NEAPOLITAN MASTIFF

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Entropion	Not defined	1	Breeder option
B.	Ectropion	Not defined	1	Breeder option
C.	Macroblepharon/ macropalpebral fissure	Not defined	1	Breeder option
D.	Distichiasis	Not defined	1	Breeder option
E.	Prolapsed gland of the third eyelid	Not defined	2	Breeder option
F.	Cataract	Not defined	3	NO

Description and Comments

A. Entropion

A conformational defect resulting in an "in-rolling" of one or both of the eyelids which may cause ocular irritation. It is likely that entropion is influenced by several genes (polygenic), defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

B. Ectropion

A conformational defect resulting in eversion of the eyelid(s), which may cause ocular irritation due to exposure. It is likely that ectropion is influenced by several genes (polygenic) defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

C. Macroblepharon/macropalpebral fissure

Defined as an exceptionally large palpebral fissure, macroblepharon in conjunction with laxity of the lateral canthal structures may lead to lower lid ectropion and upper lid entropion. Either of these conditions may lead to severe ocular irritation.

D. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has

not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

E. Prolapsed gland of the third eyelid

Protrusion of the tear gland associated with the third eyelid. The mode of inheritance of this disorder is unknown. The exposed gland may become irritated and cause tear film anomalies. Commonly referred to as "cherry eye."

F. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Neapolitan Mastiff breed. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 2017 and/or Data from CERF/OFA All-Breeds Report, 2010-2016.

2. ACVO Genetics Committee, consensus agreed/supportive vote.

3. ACVO Genetics Committee, 2000-2002 and/or Data from CERF All-Breeds Report, 2000-2002.

OCULAR DISORDERS REPORT
NEAPOLITAN MASTIFF

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2013 51 #	%	2014-2018 34 #	%
EYELIDS						
20.160	macropalpebral fissure		14	27.5%	0	
21.000	entropion, unspecified		8	15.7%	11	32.4%
22.000	ectropion, unspecified		14	27.5%	17	50.0%
25.110	distichiasis		7	13.7%	1	2.9%
NASOLACRIMAL						
40.910	keratoconjunctivitis sicca		0		1	2.9%
NICTITANS						
51.100	third eyelid cartilage anomaly		1	2.0%	0	
52.110	prolapsed gland of the third eyelid		2	3.9%	3	8.8%
CORNEA						
70.220	pigmentary keratitis		1	2.0%	2	5.9%
70.700	corneal dystrophy		1	2.0%	0	
UVEA						
93.730	persistent pupillary membranes, iris to cornea		1	2.0%	0	
LENS						
100.210	cataract. suspect not inherited/significance unknown		1	2.0%	0	
100.306	punctate cataract, nucleus		0		1	2.9%
100.313	incipient cataract, equatorial cortex		1	2.0%	0	
100.316	incipient cataract, nucleus		1	2.0%	0	
100.330	generalized/complete cataract		3	5.9%	0	
100.999	*significant cataracts (summary)*		*5*	*9.8%*	*1*	*2.9%*
RETINA						
120.170	retinal dysplasia, folds		2	3.9%	0	
120.960	retinopathy		1	2.0%	0	
OTHER						
900.000	other, unspecified		1	2.0%	0	
900.100	other, not inherited		0		6	17.6%
900.110	other. suspect not inherited/significance unknown		1	2.0%	1	2.9%
NORMAL						
0.000	normal globe		18	35.3%	11	32.4%

NEDERLANDSE KOOIKERHONDJE

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Cataract	Not defined	1	NO

Description and Comments

A. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Nederlandse Kooikerhondje breed. The conditions listed above are generally recognized to exist in the breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 2017 and/or Data from CERF/OFA All-Breeds Report, 2010-2016.

OCULAR DISORDERS REPORT
NEDERLANDSE KOOIKERHONDJE

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2013 20 #	%	2014-2018 143 #	%
UVEA						
93.710	persistent pupillary membranes, iris to iris		0		4	2.8%
93.730	persistent pupillary membranes, iris to cornea		0		1	0.7%
LENS						
100.210	cataract. suspect not inherited/significance unknown		0		10	7.0%
100.328	posterior suture tip opacities		0		1	0.7%
VITREOUS						
110.120	persistent hyaloid artery/remnant		0		1	0.7%
110.320	vitreal degeneration		0		2	1.4%
RETINA						
120.960	retinopathy		0		1	0.7%
OTHER						
900.000	other, unspecified		2	10.0%	0	
900.100	other, not inherited		1	5.0%	9	6.3%
NORMAL						
0.000	normal globe		18	90.0%	120	83.9%

OCULAR DISORDERS REPORT
NEW ZEALAND HUNTAWAY

There are insufficient breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the NEW ZEALAND HUNTAWAY breed. Therefore, there are no conditions listed with breeding advice.

OCULAR DISORDERS REPORT
NEW ZEALAND HUNTAWAY

Diagnostic Name	TOTAL DOGS EXAMINED	1991-2013 2 #	 %	2014-2018 0 #	 %
UVEA					
93.750	persistent pupillary membranes, lens pigment foci/no strands	1	50.0%	0	
NORMAL					
0.000	normal globe	2	100.0%	0	

NEWFOUNDLAND

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Glaucoma	Not defined	1	NO
B.	Entropion	Not defined	2	Breeder option
C.	Ectropion	Not defined	2	Breeder option
D.	Macroblepharon/ macropalpebral fissure	Not defined	2	Breeder option
E.	Distichiasis	Not defined	3	Breeder option
F.	Persistent pupillary membranes - iris to iris	Not defined	4	Breeder option
G.	Uveal cysts	Not defined	2	Breeder option
H.	Cataract	Not defined	2	NO
I.	Retinal dysplasia - folds	Not defined	1, 2, 5	Breeder option
J.	Retinal atrophy - generalized	Not defined	6	NO

Description and Comments

A. Glaucoma

Glaucoma is characterized by an elevation of intraocular pressure which, when sustained even for a brief period of time, causes intraocular damage resulting in blindness. The elevated intraocular pressure occurs because the fluid cannot leave through the iridocorneal angle. Diagnosis and classification of glaucoma requires measurement of IOP (tonometry) and examination of the iridocorneal angle (gonioscopy). Neither of these tests is part of a routine breed eye screening examination.

Some Newfoundlands have an abnormality of the iridocorneal angle termed goniodysgenesis. This abnormality is not visible during routine ophthalmic examination using a slitlamp biomicroscope and an indirect ophthalmoscope. There appears to be an association between goniodysgenesis and glaucoma, but the mechanism by which the angle defect results in glaucoma has not been determined. The inheritance of goniodysgenesis in the Newfoundland is not known. Until the inheritance is determined, control should be directed towards removing dogs from breeding that have glaucoma and have

goniodysgenesis, as well as those dogs that produce progeny afflicted with glaucoma.

B. Entropion

A conformational defect resulting in an "in-rolling" of one or both of the eyelids which may cause ocular irritation. It is likely that entropion is influenced by several genes (polygenic), defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

C. Ectropion

A conformational defect resulting in eversion of the eyelids, which may cause ocular irritation due to exposure. It is likely that ectropion is influenced by several genes (polygenic), defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

D. Macroblepharon/macropalpebral fissure

Abnormally large eyelid opening; may lead to secondary conditions associated with corneal exposure. In the Newfoundland, ectropion is associated with an exceptionally large palpebral fissure and laxity of the canthal structures. Central lower lid ectropion is often associated with entropion of the adjacent lid. This causes severe ocular irritation.

E. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established, although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

F. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

G. Uveal cysts

A pigmented, fluid-filled epithelial-lined structure arising from the posterior iris or ciliary body epithelium. Cysts may remain attached to the pupil margin, iris, or ciliary body, or may detach and be free-floating within the anterior chamber. They may rupture and adhere to the cornea or anterior lens capsule. Uveal cysts may occur in any breed. Uveal cysts are commonly benign, although they may be associated with other pathologic conditions is various breeds.

H. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

I. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

J. Retinal atrophy - generalized

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as Progressive Retinal Atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

References

1. Strom AR, Hassig M, Iburg TM, et al. Epidemiology of canine glaucoma presented to University of Zurich from 1995 to 2009. Part 1: Congenital and primary glaucoma (4 and 123 cases). *Vet Ophthalmol*. 2011 Mar;14:121-126.

2. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

3. ACVO Genetics Committee, 2014 and/or Data from OFA All-Breeds Report, 2013-2014.

4. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

5. ACVO Genetics Committee, 2000-2002 and/or Data from CERF All-Breeds Report, 2000-2002.

6. Dekomien G and Epplen JT. Evaluation of the canine RPE65 gene in affected dogs with generalized progressive retinal atrophy. *Mol Vis*. 2003 Nov 11;9:601-605.

OCULAR DISORDERS REPORT
NEWFOUNDLAND

		1991-2013		2014-2018	
	TOTAL DOGS EXAMINED	2816		560	
Diagnostic Name		#	%	#	%
GLOBE					
0.110	microphthalmia	5	0.2%	1	0.2%
10.000	glaucoma	0		1	0.2%
EYELIDS					
20.160	macropalpebral fissure	128	4.5%	0	
21.000	entropion, unspecified	187	6.6%	40	7.1%
22.000	ectropion, unspecified	202	7.2%	34	6.1%
25.110	distichiasis	20	0.7%	2	0.4%
NASOLACRIMAL					
40.910	keratoconjunctivitis sicca	1	0.0%	0	
NICTITANS					
51.100	third eyelid cartilage anomaly	13	0.5%	3	0.5%
52.110	prolapsed gland of the third eyelid	8	0.3%	1	0.2%
CORNEA					
70.210	corneal pannus	1	0.0%	0	
70.220	pigmentary keratitis	2	0.1%	0	
70.700	corneal dystrophy	1	0.0%	0	
UVEA					
93.140	corneal endothelial pigment without PPM	1	0.0%	0	
93.710	persistent pupillary membranes, iris to iris	18	0.6%	5	0.9%
93.720	persistent pupillary membranes, iris to lens	5	0.2%	0	
93.730	persistent pupillary membranes, iris to cornea	5	0.2%	0	
93.740	persistent pupillary membranes, iris sheets	1	0.0%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	2	0.1%	0	
93.810	uveal melanoma	1	0.0%	0	
93.999	uveal cysts	45	1.6%	10	1.8%
LENS					
100.200	cataract, unspecified	11	0.4%	0	
100.210	cataract. suspect not inherited/significance unknown	91	3.2%	19	3.4%
100.301	punctate cataract, anterior cortex	6	0.2%	2	0.4%
100.302	punctate cataract, posterior cortex	11	0.4%	3	0.5%
100.303	punctate cataract, equatorial cortex	4	0.1%	4	0.7%
100.305	punctate cataract, posterior sutures	5	0.2%	2	0.4%
100.306	punctate cataract, nucleus	3	0.1%	0	
100.307	punctate cataract, capsular	2	0.1%	2	0.4%
100.311	incipient cataract, anterior cortex	16	0.6%	2	0.4%
100.312	incipient cataract, posterior cortex	84	3.0%	9	1.6%
100.313	incipient cataract, equatorial cortex	15	0.5%	5	0.9%
100.314	incipient cataract, anterior sutures	3	0.1%	0	
100.315	incipient cataract, posterior sutures	12	0.4%	2	0.4%
100.316	incipient cataract, nucleus	9	0.3%	4	0.7%
100.317	incipient cataract, capsular	6	0.2%	2	0.4%
100.321	incomplete cataract, anterior cortex	0		1	0.2%
100.322	incomplete cataract, posterior cortex	1	0.0%	5	0.9%
100.323	incomplete cataract, equatorial cortex	0		1	0.2%

LENS CONTINUED		1991-2013		2014-2018	
100.326	incomplete cataract, nucleus	0		1	0.2%
100.328	posterior suture tip opacities	1	0.0%	2	0.4%
100.330	generalized/complete cataract	38	1.3%	0	
100.375	subluxation/luxation, unspecified	1	0.0%	0	
100.999	*significant cataracts (summary)*	*226*	*8.0%*	*45*	*8.0%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	2	0.1%	3	0.5%
110.135	PHPV/PTVL	4	0.1%	0	
110.320	vitreal degeneration	5	0.2%	0	
RETINA					
120.170	retinal dysplasia, folds	26	0.9%	2	0.4%
120.180	retinal dysplasia, geographic	2	0.1%	0	
120.190	retinal dysplasia, detached	1	0.0%	0	
120.310	generalized progressive retinal atrophy (PRA)	1	0.0%	0	
120.910	retinal detachment without dialysis	1	0.0%	0	
120.960	retinopathy	0		1	0.2%
OPTIC NERVE					
130.120	optic nerve hypoplasia	7	0.2%	0	
130.150	optic disc coloboma	1	0.0%	0	
OTHER					
900.000	other, unspecified	29	1.0%	0	
900.100	other, not inherited	76	2.7%	17	3.0%
900.110	other. suspect not inherited/significance unknown	27	1.0%	3	0.5%
NORMAL					
0.000	normal globe	2142	76.1%	411	73.4%

NORFOLK TERRIER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Corneal dystrophy - epithelial/stromal	Not defined	1	Breeder option	
B.	Persistent pupillary membranes - iris to iris - lens pigment foci/no strands	Not defined Not defined	2-4 5	Breeder option Passes with no notation	
C.	Cataract	Not defined	4	NO	
D.	Lens luxation	Autosomal recessive	6, 7	NO	Mutation in the *ADAMTS17* gene

Description and Comments

A. Corneal dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

B. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

C. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

D. Lens luxation

Partial (subluxation) or complete displacement of the lens from the normal anatomic site

behind the pupil. Lens luxation not associated with trauma or inflammation is presumed to be inherited. Lens luxation may result in elevated intraocular pressure (glaucoma), causing vision impairment or blindness. A mutation in *ADAMTS17* has been associated with primary lens luxation. A DNA test is available.

References

1. ACVO Genetics Committee, 2018 and/or Data from OFA All-Breeds Report, 2013-2017.

2. ACVO Genetics Committee, 2017 and/or Data from CERF All-Breeds Report, 1991-1999.

3. ACVO Genetics Committee, 2017 and/or Data from CERF All-Breeds Report, 2000-2009.

4. ACVO Genetics Committee, 2017 and/or Data from CERF/OFA All-Breeds Report, 2010-2016.

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6. Gould D, Pettitt L, McLaughlin B, et al. ADAMTS17 mutation associated with primary lens luxation is widespread among breeds. *Vet Ophthalmol*. 2011; 14: 378-384.

7. Komaromy A. Genetics of canine primary glaucomas. Vet Clin Small Anim. 2015; 45: 1159-1182.

OCULAR DISORDERS REPORT
NORFOLK TERRIER

		1991-2013		2014-2018	
	TOTAL DOGS EXAMINED	1185		364	
Diagnostic Name		#	%	#	%
EYELIDS					
20.160	macropalpebral fissure	1	0.1%	0	
25.110	distichiasis	6	0.5%	0	
NICTITANS					
52.110	prolapsed gland of the third eyelid	1	0.1%	1	0.3%
CORNEA					
70.700	corneal dystrophy	9	0.8%	7	1.9%
70.730	corneal endothelial degeneration	1	0.1%	2	0.5%
UVEA					
93.140	corneal endothelial pigment without PPM	1	0.1%	0	
93.710	persistent pupillary membranes, iris to iris	233	19.7%	101	27.7%
93.720	persistent pupillary membranes, iris to lens	1	0.1%	1	0.3%
93.730	persistent pupillary membranes, iris to cornea	3	0.3%	2	0.5%
93.750	persistent pupillary membranes, lens pigment foci/no strands	4	0.3%	5	1.4%
93.760	persistent pupillary membranes, endothelial opacity/no strands	0		5	1.4%
LENS					
100.200	cataract, unspecified	1	0.1%	0	
100.210	cataract. suspect not inherited/significance unknown	42	3.5%	3	0.8%
100.301	punctate cataract, anterior cortex	4	0.3%	2	0.5%
100.302	punctate cataract, posterior cortex	4	0.3%	1	0.3%
100.305	punctate cataract, posterior sutures	8	0.7%	1	0.3%
100.306	punctate cataract, nucleus	1	0.1%	0	
100.307	punctate cataract, capsular	2	0.2%	0	
100.311	incipient cataract, anterior cortex	6	0.5%	4	1.1%
100.312	incipient cataract, posterior cortex	14	1.2%	4	1.1%
100.313	incipient cataract, equatorial cortex	4	0.3%	1	0.3%
100.315	incipient cataract, posterior sutures	2	0.2%	0	
100.317	incipient cataract, capsular	4	0.3%	0	
100.322	incomplete cataract, posterior cortex	0		2	0.5%
100.330	generalized/complete cataract	4	0.3%	0	
100.999	*significant cataracts (summary)*	*54*	*4.6%*	*15*	*4.1%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	6	0.5%	2	0.5%
110.135	PHPV/PTVL	1	0.1%	0	
110.320	vitreal degeneration	8	0.7%	0	
FUNDUS					
97.120	coloboma	1	0.1%	0	
RETINA					
120.170	retinal dysplasia, folds	5	0.4%	2	0.5%
120.180	retinal dysplasia, geographic	2	0.2%	0	
120.310	generalized progressive retinal atrophy (PRA)	10	0.8%	1	0.3%
120.910	retinal detachment without dialysis	1	0.1%	0	

		1991-2013		2014-2018	
OPTIC NERVE					
130.110	micropapilla	8	0.7%	4	1.1%
130.120	optic nerve hypoplasia	16	1.4%	6	1.6%
130.150	optic disc coloboma	18	1.5%	1	0.3%
OTHER					
900.000	other, unspecified	14	1.2%	0	
900.100	other, not inherited	43	3.6%	19	5.2%
900.110	other. suspect not inherited/significance unknown	6	0.5%	0	
NORMAL					
0.000	normal globe	878	74.1%	217	59.6%

NORBOTTENSPETS

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Cataract	Not defined	1	NO	
B.	Retinal atrophy – generalized (*prcd*)	Autosomal recessive	2	NO	Mutation of the *prcd* gene

Description and Comments

A. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

B. Retinal atrophy – generalized (prcd)

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

Studies have shown that the principal form of PRA in the Norbottenspets is *prcd* which is a late-onset form of PRA inherited as autosomal recessive. The mutation is allelic to that present in Miniature Poodles, English and American Cocker Spaniels, and others. The locus is termed the progressive rod-cone degeneration (*prcd*) gene and at least 30+ breeds are affected. In most affected dogs to date, the disease is recognized clinically in dogs 3-6 years of age or older. This photoreceptor degeneration is characterized by slow death of visual cells following their normal development. The disease begins clinically with signs of night blindness followed by day blindness. A DNA test is available.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Norbottenspets. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

2. ACVO Genetics Committee, 2018 and/or Data from OFA All-Breeds Report 2013-2017.

OCULAR DISORDERS REPORT
NORRBOTTENSPETS

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2013 97 #	1991-2013 97 %	2014-2018 16 #	2014-2018 16 %
EYELIDS						
25.110	distichiasis		1	1.0%	1	6.2%
CORNEA						
70.700	corneal dystrophy		1	1.0%	0	
UVEA						
93.710	persistent pupillary membranes, iris to iris		5	5.2%	2	12.5%
93.720	persistent pupillary membranes, iris to lens		1	1.0%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands		0		2	12.5%
LENS						
100.210	cataract. suspect not inherited/significance unknown		5	5.2%	1	6.2%
100.302	punctate cataract, posterior cortex		2	2.1%	0	
100.305	punctate cataract, posterior sutures		1	1.0%	0	
100.306	punctate cataract, nucleus		1	1.0%	0	
100.311	incipient cataract, anterior cortex		7	7.2%	0	
100.312	incipient cataract, posterior cortex		9	9.3%	0	
100.315	incipient cataract, posterior sutures		1	1.0%	0	
100.316	incipient cataract, nucleus		3	3.1%	0	
100.330	generalized/complete cataract		1	1.0%	0	
100.999	*significant cataracts (summary)*		*25*	*25.8%*	*0*	
RETINA						
120.170	retinal dysplasia, folds		1	1.0%	1	6.2%
120.310	generalized progressive retinal atrophy (PRA)		2	2.1%	0	
OTHER						
900.100	other, not inherited		3	3.1%	1	6.2%
NORMAL						
0.000	normal globe		74	76.3%	11	68.8%

OCULAR DISORDERS REPORT
NORTH AMERICAN SHEPHERD

There are insufficient breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the NORTH AMERICAN SHEPHERD breed. Therefore, there are no conditions listed with breeding advice.

OCULAR DISORDERS REPORT
NORTH AMERICAN SHEPHERD

Diagnostic Name	TOTAL DOGS EXAMINED	1991-2013 6 #	%	2014-2018 0 #	%
VITREOUS					
110.200 vitritis		1	16.7%	0	
NORMAL					
0.000 normal globe		5	83.3%	0	

NORTHERN INUIT

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Retinal dysplasia - folds/geographic/ detached (with skeletal defects)	Autosomal recessive	1	NO	Mutation in the *COL9A3* gene

Description and Comments

A. Retinal dysplasia - folds or detachment with skeletal defects

This condition is also known as oculo-skeletal dysplasia (OSD) or dwarfism with retinal dysplasia type 1 (DRD1)also occurs in the Labrador Retriever. A similar condition, DRD2, occurs in the Samoyed. The condition is autosomal recessive and homozygous affected dogs have shortened forelimbs ("downhill" conformation) with valgus deformity. They have severe ocular defects including cataract, retinal folds/multifocal retinal dysplasia, vitreal degeneration and retinal detachment. The ocular abnormalities result in blindness in most dogs. Heterozygous dogs can have either a normal ocular exam or have multiple retinal folds, vitreal membranes, or vitreal degeneration suggesting a semi-dominant mechanism with respect to the eyes. It is important to note that generally the retinal folds present in heterozygous dogs tend to cluster around the major superior blood vessels of the central tapetal region. The condition is caused by a 1 base pair insertion of *COL9A3.* A DNA test is available.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Northern Inuit. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 2018 and/or Data from OFA All-Breeds Report, 2013-2017.

OCULAR DISORDERS REPORT
NORTHERN INUIT

Diagnostic Name	TOTAL DOGS EXAMINED	1991-2013 0 #	%	2014-2018 9 #	%
LENS					
100.210	cataract. suspect not inherited/significance unknown	0		1	11.1%
NORMAL					
0.000	normal globe	0		8	88.9%

NORWEGIAN BUHUND

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Cataract	Not defined	1, 3	NO
B.	Cataract - pulverulent	Presumed autosomal dominant	2, 3	Breeder option
C.	Retinal dysplasia - folds	Not defined	4	Breeder option

Description and Comments

A. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

B. Cataract - pulverulent

With the pulverulent cataract in the Norwegian Buhund, initial lens changes may be visible as early as 6.5 weeks of age as small dots parallel to the suture lines behind the nucleus. By the age of 4 to 5.5 years, the opacities progress to involve the fetal nucleus which then resembles a ball of candy floss. The adult nucleus and the cortex remain clear. An autosomal dominant mode of inheritance with a high degree of penetrance has been suggested.

Rates of progression of these cataracts can vary, and have been noted to develop in older animals (over the age of 7) that were previously documented to be free from this condition.

C. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

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OCULAR DISORDERS REPORT
NORWEGIAN BUHUND

Diagnostic Name		1991-2013 TOTAL DOGS EXAMINED 558 #	%	2014-2018 231 #	%
GLOBE					
10.000	glaucoma	0		1	0.4%
EYELIDS					
25.110	distichiasis	1	0.2%	1	0.4%
CORNEA					
70.700	corneal dystrophy	4	0.7%	3	1.3%
UVEA					
93.110	iris hypoplasia	0		1	0.4%
93.710	persistent pupillary membranes, iris to iris	2	0.4%	0	
93.740	persistent pupillary membranes, iris sheets	1	0.2%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		1	0.4%
LENS					
100.210	cataract. suspect not inherited/significance unknown	61	10.9%	33	14.3%
100.301	punctate cataract, anterior cortex	5	0.9%	1	0.4%
100.302	punctate cataract, posterior cortex	7	1.3%	3	1.3%
100.303	punctate cataract, equatorial cortex	1	0.2%	0	
100.305	punctate cataract, posterior sutures	4	0.7%	4	1.7%
100.306	punctate cataract, nucleus	9	1.6%	3	1.3%
100.307	punctate cataract, capsular	1	0.2%	0	
100.311	incipient cataract, anterior cortex	3	0.5%	3	1.3%
100.312	incipient cataract, posterior cortex	17	3.0%	4	1.7%
100.313	incipient cataract, equatorial cortex	0		2	0.9%
100.315	incipient cataract, posterior sutures	10	1.8%	2	0.9%
100.316	incipient cataract, nucleus	13	2.3%	4	1.7%
100.321	incomplete cataract, anterior cortex	0		1	0.4%
100.322	incomplete cataract, posterior cortex	1	0.2%	0	
100.323	incomplete cataract, equatorial cortex	0		1	0.4%
100.325	incomplete cataract, posterior sutures	1	0.2%	0	
100.328	posterior suture tip opacities	0		7	3.0%
100.330	generalized/complete cataract	6	1.1%	0	
100.999	*significant cataracts (summary)*	*78*	*14.0%*	*28*	*12.1%*
RETINA					
120.170	retinal dysplasia, folds	8	1.4%	2	0.9%
120.310	generalized progressive retinal atrophy (PRA)	3	0.5%	0	
120.960	retinopathy	0		5	2.2%
OTHER					
900.000	other, unspecified	14	2.5%	0	
900.100	other, not inherited	18	3.2%	16	6.9%
900.110	other. suspect not inherited/significance unknown	7	1.3%	3	1.3%
NORMAL					
0.000	normal globe	426	76.3%	154	66.7%

NORWEGIAN ELKHOUND

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Glaucoma	Not defined	1-6	NO	
B.	Ectropion	Not defined	7	Breeder option	
C.	Macroblepharon	Not defined	7	Breeder option	
D.	Distichiasis	Not defined	4	Breeder option	
E.	Corneal dystrophy - epithelial/stromal	Not defined	8	Breeder option	
F.	Uveal cysts	Not defined	9	Breeder option	
G.	Persistent pupillary membranes - iris to iris	Not defined	4	Breeder option	
H.	Cataract	Not defined	4	NO	
I.	Retinal atrophy - generalized (*prcd)*	Autosomal recessive	10	NO	Mutation of the *prcd* gene
J.	Retinal atrophy - generalized				
	1. Rod dysplasia (*rd*)	Autosomal recessive	11-14	NO	
	2. Early retinal degeneration (*erd*)	Autosomal recessive	15-19	NO	Mutation of the *STK38L* gene
K.	Retinal dysplasia - folds	Not defined	4	Breeder option	

Description and Comments

A. Glaucoma

Glaucoma is characterized by an elevation of intraocular pressure (IOP) which, when sustained, causes intraocular damage resulting in blindness. The elevated intraocular pressure occurs because the fluid cannot leave through the iridocorneal angle. Diagnosis and classification of glaucoma requires measurement of the IOP (tonometry) and examination of the iridocorneal angle (gonioscopy). Neither of these tests is part of a routine

screening exam for certification.

In the Norwegian Elkhound, glaucoma appears to be familial. In most cases the drainage angle is reported to be open. A mutation has been found in *ADAMTS10* in some Norwegian Elkhounds with glaucoma, but a genetic test is not yet available.

B. Ectropion

A conformational defect resulting in eversion of the eyelid(s), which may cause ocular irritation due to exposure. It is likely that ectropion is influenced by several genes (polygenic) defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

C. Macroblepharon

Defined as an exceptionally large palpebral fissure, macroblepharon in conjunction with laxity of the lateral canthal structures may lead to lower lid ectropion and upper lid entropion. Either of these conditions may lead to severe ocular irritation.

D. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established, although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

E. Corneal Dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

F. Uveal cysts

A pigmented, fluid-filled epithelial-lined structure arising from the posterior iris or ciliary body epithelium. Cysts may remain attached to the pupil margin, iris, or ciliary body, or may detach and be free-floating within the anterior chamber. They may rupture and adhere to the cornea or anterior lens capsule. Uveal cysts may occur in any breed. Uveal cysts are commonly benign, although they may be associated with other pathologic conditions is various breeds.

G. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

H. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

I. Retinal atrophy - generalized (*prcd)*

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

Studies have shown that PRA in the Norwegian Elkhound is *prcd* which is a late-onset form of PRA inherited as autosomal recessive. The mutation is allelic to that present in Miniature Poodles, Labrador Retrievers, English and American Cocker Spaniels, and others. The locus is termed the progressive rod-cone degeneration (*prcd*) gene and at least 30+ breeds are affected. In most affected dogs to date, the disease is recognized clinically in dogs 3-6 years of age or older. This photoreceptor degeneration is characterized by slow death of visual cells following their normal development. The disease begins clinically with signs of night blindness followed by day blindness. A DNA test is available.

J. Retinal atrophy - generalized

1. **Rod dysplasia (*rd*)**: Inappropriate development of the visual cells resulting in vision impairment in dim light by 6 months and total blindness at 3-5 years. Ophthalmoscopic signs may be evident after 5 months of age, with signs of retinal vascular thinning after 2 years. An ERG can provide a diagnosis as early as 6 weeks of age. In the Norwegian Elkhound, this is an autosomal recessive trait.

2. **Early retinal degeneration (*erd*)**: Another form of PRA reported in the Norwegian Elkhound. Animals are night blind at 6 weeks and blind by 1 year of age. Clinical signs are evident by 6 months. On histopathologic examination there is an abnormal structural development of the photoreceptors followed by rapid rod/cone degeneration. The mutation is found in the *STK38L* gene and is inherited as an autosomal recessive trait. While a DNA test is available, no Norwegian Elkhounds are thought to exist with this mutation anymore.

K. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

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OCULAR DISORDERS REPORT
NORWEGIAN ELKHOUND

Diagnostic Name		1991-2013 2452 #	%	2014-2018 256 #	%
GLOBE					
0.110	microphthalmia	4	0.2%	0	
10.000	glaucoma	2	0.1%	0	
EYELIDS					
20.160	macropalpebral fissure	16	0.7%	0	
21.000	entropion, unspecified	5	0.2%	0	
22.000	ectropion, unspecified	14	0.6%	0	
25.110	distichiasis	43	1.8%	3	1.2%
NASOLACRIMAL					
32.110	imperforate lower nasolacrimal punctum	1	0.0%	0	
NICTITANS					
51.100	third eyelid cartilage anomaly	1	0.0%	0	
52.110	prolapsed gland of the third eyelid	1	0.0%	0	
CORNEA					
70.210	corneal pannus	2	0.1%	0	
70.700	corneal dystrophy	7	0.3%	3	1.2%
UVEA					
93.710	persistent pupillary membranes, iris to iris	31	1.3%	6	2.3%
93.720	persistent pupillary membranes, iris to lens	10	0.4%	1	0.4%
93.730	persistent pupillary membranes, iris to cornea	5	0.2%	2	0.8%
93.750	persistent pupillary membranes, lens pigment foci/no strands	2	0.1%	2	0.8%
93.999	uveal cysts	7	0.3%	0	
LENS					
100.200	cataract, unspecified	23	0.9%	0	
100.210	cataract. suspect not inherited/significance unknown	102	4.2%	12	4.7%
100.301	punctate cataract, anterior cortex	8	0.3%	0	
100.302	punctate cataract, posterior cortex	7	0.3%	3	1.2%
100.303	punctate cataract, equatorial cortex	4	0.2%	0	
100.304	punctate cataract, anterior sutures	1	0.0%	0	
100.305	punctate cataract, posterior sutures	9	0.4%	2	0.8%
100.306	punctate cataract, nucleus	3	0.1%	0	
100.307	punctate cataract, capsular	2	0.1%	1	0.4%
100.311	incipient cataract, anterior cortex	11	0.4%	0	
100.312	incipient cataract, posterior cortex	37	1.5%	1	0.4%
100.313	incipient cataract, equatorial cortex	21	0.9%	3	1.2%
100.314	incipient cataract, anterior sutures	3	0.1%	0	
100.315	incipient cataract, posterior sutures	7	0.3%	1	0.4%
100.316	incipient cataract, nucleus	8	0.3%	1	0.4%
100.317	incipient cataract, capsular	9	0.4%	0	
100.321	incomplete cataract, anterior cortex	1	0.0%	0	
100.326	incomplete cataract, nucleus	0		1	0.4%
100.327	incomplete cataract, capsular	0		1	0.4%
100.328	posterior suture tip opacities	1	0.0%	3	1.2%
100.330	generalized/complete cataract	7	0.3%	0	
100.375	subluxation/luxation, unspecified	4	0.2%	0	

LENS CONTINUED		1991-2013		2014-2018	
100.999	*significant cataracts (summary)*	*161*	*6.6%*	*14*	*5.5%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	6	0.2%	1	0.4%
110.135	PHPV/PTVL	2	0.1%	0	
110.320	vitreal degeneration	6	0.2%	2	0.8%
RETINA					
120.170	retinal dysplasia, folds	40	1.6%	10	3.9%
120.180	retinal dysplasia, geographic	2	0.1%	0	
120.310	generalized progressive retinal atrophy (PRA)	10	0.4%	0	
120.400	retinal hemorrhage	3	0.1%	0	
120.910	retinal detachment without dialysis	1	0.0%	0	
OPTIC NERVE					
130.120	optic nerve hypoplasia	2	0.1%	1	0.4%
OTHER					
900.000	other, unspecified	22	0.9%	0	
900.100	other, not inherited	35	1.4%	17	6.6%
900.110	other. suspect not inherited/significance unknown	10	0.4%	0	
NORMAL					
0.000	normal globe	2119	86.4%	194	75.8%

NORWEGIAN LUNDEHUND

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder option
B.	Cataract	Not defined	2	NO

Description and Comments

A. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

B. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

References

There are no references providing detailed descriptions of hereditary conditions of the Norwegian Lundehund breed. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 2008 and/or Data from CERF All-Breeds Report, 2003-2007.

2. ACVO Genetics Committee, 2017 and/or Data from CERF/OFA All-Breeds Report, 2010-2016.

OCULAR DISORDERS REPORT
NORWEGIAN LUNDEHUND

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2013 48 #	%	2014-2018 2 #	%
UVEA						
93.710	persistent pupillary membranes, iris to iris		13	27.1%	0	
93.720	persistent pupillary membranes, iris to lens		1	2.1%	0	
LENS						
100.210	cataract. suspect not inherited/significance unknown		8	16.7%	0	
100.301	punctate cataract, anterior cortex		1	2.1%	0	
100.302	punctate cataract, posterior cortex		2	4.2%	0	
100.311	incipient cataract, anterior cortex		2	4.2%	0	
100.313	incipient cataract, equatorial cortex		1	2.1%	0	
100.315	incipient cataract, posterior sutures		2	4.2%	0	
100.330	generalized/complete cataract		3	6.2%	0	
100.999	*significant cataracts (summary)*		*11*	*22.9%*	*0*	
VITREOUS						
110.320	vitreal degeneration		2	4.2%	0	
OTHER						
900.000	other, unspecified		1	2.1%	0	
NORMAL						
0.000	normal globe		29	60.4%	2	100.0%

NORWICH TERRIER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Distichiasis	Not defined	1	Breeder option	
B.	Persistent pupillary membranes - iris to iris	Not defined	2	Breeder option	
C.	Cataract	Not defined	2	NO	
D.	Lens luxation	Autosomal recessive	3, 4	NO	Mutation in the *ADAMTS17* gene

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

C. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

D. Lens luxation

Partial (subluxation) or complete displacement of the lens from the normal anatomic site behind the pupil. Lens luxation not associated with trauma or inflammation is presumed to

be inherited. Lens luxation may result in elevated intraocular pressure (glaucoma) causing vision impairment or blindness. A mutation in *ADAMTS17* has been associated with primary lens luxation. A DNA test is available.

References

1. ACVO Genetics Committee, 2017 and/or Data from CERF/OFA All-Breeds Report, 2010-2016.

2. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

3. Farias FH, Johnson GS, Taylor JF, et al. An ADAMTS17 splice donor site mutation in dogs with primary lens luxation. *Invest Ophthalmol Vis Sci*. 2010;51:4716-4721.

4. Gould D, Pettitt L, McLaughlin B, et al. ADAMTS17 mutation associated with primary lens luxation is widespread among breeds. *Vet Ophthalmol*. 2011;14:378-384.

OCULAR DISORDERS REPORT
NORWICH TERRIER

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2013 2748 #	%	2014-2018 726 #	%
EYELIDS						
20.160	macropalpebral fissure		1	0.0%	0	
22.000	ectropion, unspecified		1	0.0%	0	
25.110	distichiasis		13	0.5%	14	1.9%
NASOLACRIMAL						
32.110	imperforate lower nasolacrimal punctum		0		2	0.3%
NICTITANS						
52.110	prolapsed gland of the third eyelid		4	0.1%	0	
CORNEA						
70.700	corneal dystrophy		14	0.5%	6	0.8%
70.730	corneal endothelial degeneration		4	0.1%	0	
UVEA						
93.150	iris coloboma		1	0.0%	0	
93.710	persistent pupillary membranes, iris to iris		171	6.2%	21	2.9%
93.720	persistent pupillary membranes, iris to lens		4	0.1%	0	
93.730	persistent pupillary membranes, iris to cornea		8	0.3%	0	
93.740	persistent pupillary membranes, iris sheets		1	0.0%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands		3	0.1%	3	0.4%
93.760	persistent pupillary membranes, endothelial opacity/no strands		5	0.2%	0	
93.999	uveal cysts		1	0.0%	0	
LENS						
100.200	cataract, unspecified		5	0.2%	0	
100.210	cataract. suspect not inherited/significance unknown		66	2.4%	13	1.8%
100.301	punctate cataract, anterior cortex		9	0.3%	1	0.1%
100.302	punctate cataract, posterior cortex		8	0.3%	2	0.3%
100.303	punctate cataract, equatorial cortex		2	0.1%	0	
100.305	punctate cataract, posterior sutures		5	0.2%	1	0.1%
100.306	punctate cataract, nucleus		3	0.1%	0	
100.307	punctate cataract, capsular		1	0.0%	2	0.3%
100.311	incipient cataract, anterior cortex		14	0.5%	5	0.7%
100.312	incipient cataract, posterior cortex		16	0.6%	2	0.3%
100.313	incipient cataract, equatorial cortex		13	0.5%	0	
100.314	incipient cataract, anterior sutures		1	0.0%	0	
100.315	incipient cataract, posterior sutures		6	0.2%	0	
100.316	incipient cataract, nucleus		11	0.4%	3	0.4%
100.317	incipient cataract, capsular		1	0.0%	2	0.3%
100.321	incomplete cataract, anterior cortex		0		1	0.1%
100.322	incomplete cataract, posterior cortex		1	0.0%	1	0.1%
100.323	incomplete cataract, equatorial cortex		0		1	0.1%
100.328	posterior suture tip opacities		0		1	0.1%
100.330	generalized/complete cataract		12	0.4%	0	
100.375	subluxation/luxation, unspecified		1	0.0%	0	
100.999	*significant cataracts (summary)*		*108*	*3.9%*	*21*	*2.9%*

		1991-2013		2014-2018	
VITREOUS					
110.120	persistent hyaloid artery/remnant	3	0.1%	0	
110.135	PHPV/PTVL	1	0.0%	0	
110.320	vitreal degeneration	11	0.4%	0	
FUNDUS					
97.120	coloboma	2	0.1%	0	
RETINA					
120.170	retinal dysplasia, folds	6	0.2%	0	
120.180	retinal dysplasia, geographic	4	0.1%	0	
120.310	generalized progressive retinal atrophy (PRA)	14	0.5%	0	
120.960	retinopathy	4	0.1%	3	0.4%
OPTIC NERVE					
130.110	micropapilla	1	0.0%	0	
130.120	optic nerve hypoplasia	8	0.3%	0	
130.150	optic disc coloboma	3	0.1%	0	
OTHER					
900.000	other, unspecified	28	1.0%	0	
900.100	other, not inherited	58	2.1%	11	1.5%
900.110	other. suspect not inherited/significance unknown	8	0.3%	2	0.3%
NORMAL					
0.000	normal globe	2447	89.0%	644	88.7%

NOVA SCOTIA DUCK TOLLING RETRIEVER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Distichiasis	Not defined	1	Breeder option	
B.	Corneal dystrophy - epithelial/stromal	Not defined	1	Breeder option	
C.	Persistent pupillary membranes - iris to iris - iris to lens - lens pigment foci/no strands	 Not defined Not defined Not defined	 1, 2 1, 2 3	 Breeder option NO Passes with no notation	
D.	Cataract	Not defined	1	NO	
E.	Retinal atrophy - generalized (*prcd)*	Autosomal recessive	1, 4	NO	Mutation of the *prcd* gene
F.	Retinal dysplasia - folds	Not defined	5	Breeder option	
G.	Choroidal hypoplasia (Collie eye anomaly) - staphyloma/coloboma - retinal detachment - retinal hemorrhage - optic nerve coloboma	Autosomal recessive	6-8	NO	Mutation of the *NHEJ1* gene

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established, although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Corneal dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

C. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

In the Nova Scotia Duck Tolling Retriever, many of the PPMs identified on routine screening examinations bridge from the iris to the lens where they are associated with focal cataract. This may result in vision impairment.

D. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

E. Retinal atrophy - generalized (*prcd*)

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

Studies have shown that the principal form of PRA in the Nova Scotia Duck Tolling Retriever is *prcd* which is a late-onset form of PRA inherited as autosomal recessive. The mutation is allelic to that present in Miniature Poodles, Labrador Retrievers, English and American Cocker Spaniels, and others. The locus is termed the progressive rod-cone degeneration (*prcd*) gene and at least 30+ breeds are affected. In most affected dogs to date, the disease is recognized clinically in dogs 3-6 years of age or older. This photoreceptor degeneration is characterized by slow death of visual cells following their normal development. The disease begins clinically with signs of night blindness followed by day blindness. A DNA test is available.

F. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

G. Choroidal hypoplasia (Collie eye anomaly)
- staphyloma/coloboma
- retinal detachment
- retinal hemorrhage
- optic nerve coloboma

A spectrum of malformations present at birth and ranging from inadequate development of the choroid (choroidal hypoplasia) to defects of the choroid, sclera, and/or optic nerve (coloboma/staphyloma) to complete retinal detachment (with or without hemorrhage). Mildly affected animals will have no detectable vision deficit.

This disorder is collectively referred to as "Collie eye anomaly." The choroidal hypoplasia component is caused by a 7799 base pair deletion with the gene *NHEJ1.* The mutation is a recessive trait. A DNA test is available and is diagnostic only for the choroidal hypoplasia component of CEA. For colobomas to develop, an additional mutation in a second gene has to be present; that gene is still unknown.

References

1. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

2. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

3. ACVO Genetics Committee, 2017 and/or Data from CERF All-Breeds Report, 2010-2016.

4. Zangerl B, Goldstein O, Philp AR, et al. Identical mutation in a novel retinal gene causes progressive rod-cone degeneration in dogs and retinitis pigmentosa in humans. *Genomics.* 2006 Nov;88:551-563.

5. ACVO Genetics Committee, 2007 and/or Data from CERF All-Breeds Report, 2002-2006.

6. Parker HG, Kukekova AV, Akey DT, et al. Breed relationships facilitate fine-mapping studies: a 7.8-kb deletion cosegregates with Collie eye anomaly across multiple dog breeds. *Genome Res*. 2007 Nov;17:1562-1571.

7. Lowe JK, Kukekova AV, Kirkness EF, et al. Linkage mapping of the primary disease locus for Collie eye anomaly. *Genomics*. 2003;82:86-95.

8. ACVO Genetics Committee, 2016 and/or Data from CERF/OFA All-Breeds Report, 2010-2015.

OCULAR DISORDERS REPORT
NOVA SCOTIA DUCK TOLLING RETRIEVER

		1991-2013 4768		2014-2018 1489	
	TOTAL DOGS EXAMINED				
	Diagnostic Name	**#**	**%**	**#**	**%**
GLOBE					
0.110	microphthalmia	1	0.0%	0	
10.000	glaucoma	1	0.0%	0	
EYELIDS					
20.140	ectopic cilia	0		1	0.1%
25.110	distichiasis	581	12.2%	191	12.8%
NASOLACRIMAL					
32.110	imperforate lower nasolacrimal punctum	2	0.0%	10	0.7%
40.910	keratoconjunctivitis sicca	1	0.0%	0	
NICTITANS					
51.100	third eyelid cartilage anomaly	2	0.0%	3	0.2%
52.110	prolapsed gland of the third eyelid	5	0.1%	0	
CORNEA					
70.700	corneal dystrophy	128	2.7%	41	2.8%
70.730	corneal endothelial degeneration	2	0.0%	2	0.1%
UVEA					
93.140	corneal endothelial pigment without PPM	1	0.0%	0	
93.710	persistent pupillary membranes, iris to iris	95	2.0%	41	2.8%
93.720	persistent pupillary membranes, iris to lens	53	1.1%	0	
93.730	persistent pupillary membranes, iris to cornea	2	0.0%	0	
93.740	persistent pupillary membranes, iris sheets	8	0.2%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	83	1.7%	82	5.5%
93.760	persistent pupillary membranes, endothelial opacity/no strands	2	0.0%	0	
93.999	uveal cysts	19	0.4%	4	0.3%
LENS					
100.200	cataract, unspecified	18	0.4%	0	
100.210	cataract. suspect not inherited/significance unknown	262	5.5%	106	7.1%
100.301	punctate cataract, anterior cortex	18	0.4%	4	0.3%
100.302	punctate cataract, posterior cortex	23	0.5%	4	0.3%
100.303	punctate cataract, equatorial cortex	9	0.2%	2	0.1%
100.305	punctate cataract, posterior sutures	4	0.1%	4	0.3%
100.306	punctate cataract, nucleus	5	0.1%	5	0.3%
100.307	punctate cataract, capsular	8	0.2%	5	0.3%
100.311	incipient cataract, anterior cortex	16	0.3%	3	0.2%
100.312	incipient cataract, posterior cortex	31	0.7%	5	0.3%
100.313	incipient cataract, equatorial cortex	16	0.3%	1	0.1%
100.314	incipient cataract, anterior sutures	0		2	0.1%
100.315	incipient cataract, posterior sutures	3	0.1%	1	0.1%
100.316	incipient cataract, nucleus	8	0.2%	1	0.1%
100.317	incipient cataract, capsular	7	0.1%	0	
100.321	incomplete cataract, anterior cortex	1	0.0%	2	0.1%
100.322	incomplete cataract, posterior cortex	0		2	0.1%
100.328	posterior suture tip opacities	1	0.0%	15	1.0%
100.330	generalized/complete cataract	6	0.1%	1	0.1%

LENS CONTINUED		1991-2013		2014-2018	
100.999	*significant cataracts (summary)*	*173*	*3.6%*	*42*	*2.8%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	9	0.2%	13	0.9%
110.135	PHPV/PTVL	7	0.1%	1	0.1%
110.320	vitreal degeneration	13	0.3%	0	
FUNDUS					
97.110	choroidal hypoplasia	2	0.0%	0	
RETINA					
120.170	retinal dysplasia, folds	42	0.9%	9	0.6%
120.180	retinal dysplasia, geographic	12	0.3%	1	0.1%
120.310	generalized progressive retinal atrophy (PRA)	97	2.0%	0	
120.920	retinal detachment with dialysis	0		1	0.1%
120.960	retinopathy	0		2	0.1%
OPTIC NERVE					
130.110	micropapilla	9	0.2%	4	0.3%
130.120	optic nerve hypoplasia	11	0.2%	2	0.1%
130.150	optic disc coloboma	3	0.1%	0	
OTHER					
900.000	other, unspecified	98	2.1%	0	
900.100	other, not inherited	304	6.4%	101	6.8%
900.110	other. suspect not inherited/significance unknown	16	0.3%	1	0.1%
NORMAL					
0.000	normal globe	3676	77.1%	948	63.7%

OLD ENGLISH SHEEPDOG

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Microphthalmia with multiple ocular anomalies	Not defined	1, 2	NO
B.	Distichiasis	Not defined	3	Breeder option
C.	Corneal dystrophy - epithelial/stromal	Not defined	4	Breeder option
D.	Persistent pupillary membranes - iris to iris	Not defined	1, 5	Breeder option
E.	Cataract	Not defined	1, 2, 6	NO
F.	Retinal dysplasia - folds	Not defined	1	Breeder option

Description and Comments

A. Microphthalmia with multiple congenital ocular defects

Microphthalmia is a developmental anomaly in which the eyeball is abnormally small. This is often associated with other ocular malformations, including defects of the cornea, anterior chamber, lens and/or retina.

Microphthalmia with cataract and retinal abnormalities including retinal detachment, has been reported in litters of Old English Sheepdogs. Lesions were non-progressive. However, blindness did result in some dogs. The mode of inheritance is unknown, but affected dogs should not be bred.

B. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established, although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

C. Corneal dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

D. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

E. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region. In one study of 66 interrelated Old English Sheepdogs, an autosomal recessive mode of inheritance was suggested. Retinal detachment was an associated finding in 5/43 affected dogs in this study. The location of the opacity within the lens and the age of onset was highly variable.

F. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

References

1. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

2. Barrie K. Posterior lenticonus, microphthalmia, cataracts and retinal folds in Old English Sheepdogs. *J Am Anim Hosp Assoc*. 1979;15:715.

3. ACVO Genetics Committee, 2002-2003 and/or Data from CERF All-Breeds Report, 2002-2003.

4. ACVO Genetics Committee, 2018 and/or Data from OFA All-Breeds Report, 2013-2017.

5. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

6. Koch SA. Cataracts in interrelated Old English Sheepdogs. *J Am Vet Med Assoc*. 1972 Feb 1;160:299-301.

OCULAR DISORDERS REPORT
OLD ENGLISH SHEEPDOG

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2013 4523 #	%	2014-2018 1083 #	%
GLOBE						
0.110	microphthalmia		10	0.2%	0	
10.000	glaucoma		4	0.1%	0	
EYELIDS						
20.140	ectopic cilia		0		1	0.1%
20.160	macropalpebral fissure		1	0.0%	0	
21.000	entropion, unspecified		12	0.3%	1	0.1%
22.000	ectropion, unspecified		2	0.0%	0	
25.110	distichiasis		69	1.5%	26	2.4%
NASOLACRIMAL						
32.110	imperforate lower nasolacrimal punctum		1	0.0%	2	0.2%
NICTITANS						
51.100	third eyelid cartilage anomaly		1	0.0%	0	
52.110	prolapsed gland of the third eyelid		1	0.0%	0	
CORNEA						
70.700	corneal dystrophy		9	0.2%	12	1.1%
UVEA						
93.140	corneal endothelial pigment without PPM		1	0.0%	0	
93.150	iris coloboma		1	0.0%	0	
93.710	persistent pupillary membranes, iris to iris		389	8.6%	126	11.6%
93.720	persistent pupillary membranes, iris to lens		7	0.2%	1	0.1%
93.730	persistent pupillary membranes, iris to cornea		9	0.2%	0	
93.740	persistent pupillary membranes, iris sheets		10	0.2%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands		0		3	0.3%
93.760	persistent pupillary membranes, endothelial opacity/no strands		3	0.1%	0	
93.810	uveal melanoma		0		1	0.1%
93.999	uveal cysts		0		2	0.2%
LENS						
100.200	cataract, unspecified		35	0.8%	0	
100.210	cataract. suspect not inherited/significance unknown		241	5.3%	64	5.9%
100.301	punctate cataract, anterior cortex		31	0.7%	10	0.9%
100.302	punctate cataract, posterior cortex		8	0.2%	1	0.1%
100.303	punctate cataract, equatorial cortex		4	0.1%	5	0.5%
100.304	punctate cataract, anterior sutures		5	0.1%	1	0.1%
100.305	punctate cataract, posterior sutures		4	0.1%	2	0.2%
100.306	punctate cataract, nucleus		12	0.3%	3	0.3%
100.307	punctate cataract, capsular		5	0.1%	3	0.3%
100.311	incipient cataract, anterior cortex		44	1.0%	5	0.5%
100.312	incipient cataract, posterior cortex		43	1.0%	6	0.6%
100.313	incipient cataract, equatorial cortex		15	0.3%	3	0.3%
100.314	incipient cataract, anterior sutures		11	0.2%	1	0.1%
100.315	incipient cataract, posterior sutures		13	0.3%	0	
100.316	incipient cataract, nucleus		29	0.6%	4	0.4%
100.317	incipient cataract, capsular		5	0.1%	0	

LENS CONTINUED		1991-2013		2014-2018	
100.321	incomplete cataract, anterior cortex	1	0.0%	2	0.2%
100.322	incomplete cataract, posterior cortex	0		4	0.4%
100.326	incomplete cataract, nucleus	0		2	0.2%
100.328	posterior suture tip opacities	0		3	0.3%
100.330	generalized/complete cataract	60	1.3%	1	0.1%
100.340	resorbing/hypermature cataract	1	0.0%	1	0.1%
100.375	subluxation/luxation, unspecified	6	0.1%	0	
100.999	*significant cataracts (summary)*	*326*	*7.2%*	*54*	*5.0%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	16	0.4%	2	0.2%
110.135	PHPV/PTVL	3	0.1%	0	
110.200	vitritis	1	0.0%	2	0.2%
110.320	vitreal degeneration	25	0.6%	1	0.1%
FUNDUS					
97.110	choroidal hypoplasia	2	0.0%	1	0.1%
97.120	coloboma	1	0.0%	0	
RETINA					
120.170	retinal dysplasia, folds	83	1.8%	11	1.0%
120.180	retinal dysplasia, geographic	8	0.2%	0	
120.190	retinal dysplasia, detached	2	0.0%	0	
120.310	generalized progressive retinal atrophy (PRA)	13	0.3%	0	
120.400	retinal hemorrhage	1	0.0%	0	
120.910	retinal detachment without dialysis	9	0.2%	0	
120.960	retinopathy	0		5	0.5%
OPTIC NERVE					
130.110	micropapilla	12	0.3%	10	0.9%
130.120	optic nerve hypoplasia	15	0.3%	0	
130.150	optic disc coloboma	4	0.1%	0	
OTHER					
900.000	other, unspecified	35	0.8%	0	
900.100	other, not inherited	84	1.9%	41	3.8%
900.110	other. suspect not inherited/significance unknown	19	0.4%	2	0.2%
NORMAL					
0.000	normal globe	3651	80.7%	773	71.4%

OLDE ENGLISH BULLDOGGE

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Distichiasis	Not defined	1	Breeder option

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Olde English Bulldogge breed. The conditions listed above are generally recognized to exist in the breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 2017 and/or Data from CERF/OFA All-Breeds Report, 2010-2016.

OCULAR DISORDERS REPORT
OLDE ENGLISH BULLDOGGE

Diagnostic Name	TOTAL DOGS EXAMINED	1991-2013 1 #	%	2014-2018 26 #	%
EYELIDS					
21.000	entropion, unspecified	0		2	7.7%
25.110	distichiasis	0		8	30.8%
UVEA					
93.110	iris hypoplasia	0		1	3.8%
93.710	persistent pupillary membranes, iris to iris	1	100.0%	0	
93.720	persistent pupillary membranes, iris to lens	1	100.0%	0	
93.999	uveal cysts	0		1	3.8%
LENS					
100.210	cataract. suspect not inherited/significance unknown	0		1	3.8%
RETINA					
120.170	retinal dysplasia, folds	0		1	3.8%
120.180	retinal dysplasia, geographic	0		1	3.8%
OTHER					
900.100	other, not inherited	0		2	7.7%
NORMAL					
0.000	normal globe	0		12	46.2%

OCULAR DISORDERS REPORT
OTTERHOUND

There are insufficient breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the OTTERHOUND breed. Therefore, there are no conditions listed with breeding advice.

OCULAR DISORDERS REPORT
OTTERHOUND

Diagnostic Name		1991-2013 TOTAL DOGS EXAMINED 5 #	 %	2014-2018 3 #	 %
UVEA					
93.710	persistent pupillary membranes, iris to iris	1	20.0%	0	
93.999	uveal cysts	0		1	33.3%
NORMAL					
0.000	normal globe	5	100.0%	2	66.7%

PAPILLON

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Distichiasis	Not defined	1, 2, 3, 4	Breeder option	
B.	Corneal dystrophy - epithelial/stromal	Not defined	4, 5	Breeder option	
C.	Persistent pupillary membranes - iris to iris	Not defined	2, 3, 4	Breeder option	
D.	Cataract	Not defined	3, 4	NO	
E.	Vitreous degeneration	Not defined	3, 4	Breeder option	
F.	Retinal atrophy - generalized	Autosomal recessive	3, 7-10	NO	Mutation in the *CNGB1* gene

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Corneal dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

C. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur

D. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

Nuclear and posterior cortical cataracts have been reported in the Papillon.

E. Vitreous degeneration

A liquefaction of the vitreous gel, which may predispose to retinal detachment resulting in blindness.

F. Retinal atrophy - generalized

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. In one study of 707 dogs in Sweden, an autosomal recessive mode of inheritance was suggested. Clinical onset is reported at 5-6 years of age. In approximately 70% of cases of PRA in the Papillon, a *CNGB1* mutation is present, leading to an abnormal *CNGA1* protein in the rod outer segments. The mode of transmission is autosomal recessive. A genetic test is available.

References

1. ACVO Genetics Committee, 2002-2003 and/or Data from CERF All-Breeds Report, 2002-2003.

2. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

3. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

4. ACVO Genetics Committee, 2000-2002 and/or Data from CERF All-Breeds Report, 2000-2002.

5. ACVO Genetics Committee, 2008 and/or Data from CERF All-Breeds Report, 2003-2007.

6. ACVO Genetics Committee, 2017 and/or Data from CERF/OFA All-Breeds Report, 2010-2016.

7. Haakanson N, Narfstrom K. Progressive retinal atrophy in Papillon dogs in Sweden: A clinical survey. *Prog Vet Comp Ophthal*. 1995;5:83.

8. Narfstrom K, Ekesten B. Electroretinographic evaluation of Papillons with and without hereditary retinal degeneration. *Am J Vet Res.* 1998;59:221-226.

9. Ahonen SJ, Arumilli M, Lohi H. A CNGB1 frameshift mutation in Papillon and Phalene dogs with progressive retinal atrophy. *PLoS One.* 2013;8:e72122.

10. Winkler PA, Ekenstedt KJ, Occelli LM, et al. A large animal model for CNGB1 autosomal recessive retinitis pigmentosa. *PLoS One*. 2013;8:e72229.

OCULAR DISORDERS REPORT
PAPILLON

Diagnostic Name	TOTAL DOGS EXAMINED	1991-2013 9768 #	%	2014-2018 1714 #	%
GLOBE					
0.110	microphthalmia	8	0.1%	1	0.1%
10.000	glaucoma	1	0.0%	0	
EYELIDS					
21.000	entropion, unspecified	15	0.2%	5	0.3%
25.110	distichiasis	136	1.4%	30	1.8%
NASOLACRIMAL					
32.110	imperforate lower nasolacrimal punctum	1	0.0%	7	0.4%
40.910	keratoconjunctivitis sicca	0		1	0.1%
NICTITANS					
52.110	prolapsed gland of the third eyelid	3	0.0%	0	
CORNEA					
70.210	corneal pannus	5	0.1%	0	
70.220	pigmentary keratitis	1	0.0%	1	0.1%
70.700	corneal dystrophy	92	0.9%	31	1.8%
70.730	corneal endothelial degeneration	3	0.0%	1	0.1%
UVEA					
93.110	iris hypoplasia	0		2	0.1%
93.140	corneal endothelial pigment without PPM	1	0.0%	0	
93.710	persistent pupillary membranes, iris to iris	268	2.7%	85	5.0%
93.720	persistent pupillary membranes, iris to lens	7	0.1%	1	0.1%
93.730	persistent pupillary membranes, iris to cornea	7	0.1%	2	0.1%
93.740	persistent pupillary membranes, iris sheets	6	0.1%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	8	0.1%	10	0.6%
93.760	persistent pupillary membranes, endothelial opacity/no strands	5	0.1%	2	0.1%
93.810	uveal melanoma	0		1	0.1%
93.999	uveal cysts	4	0.0%	1	0.1%
LENS					
100.200	cataract, unspecified	19	0.2%	0	
100.210	cataract. suspect not inherited/significance unknown	304	3.1%	76	4.4%
100.301	punctate cataract, anterior cortex	50	0.5%	7	0.4%
100.302	punctate cataract, posterior cortex	17	0.2%	0	
100.303	punctate cataract, equatorial cortex	10	0.1%	2	0.1%
100.304	punctate cataract, anterior sutures	4	0.0%	2	0.1%
100.305	punctate cataract, posterior sutures	7	0.1%	4	0.2%
100.306	punctate cataract, nucleus	14	0.1%	4	0.2%
100.307	punctate cataract, capsular	7	0.1%	3	0.2%
100.311	incipient cataract, anterior cortex	78	0.8%	9	0.5%
100.312	incipient cataract, posterior cortex	49	0.5%	6	0.4%
100.313	incipient cataract, equatorial cortex	28	0.3%	4	0.2%
100.314	incipient cataract, anterior sutures	6	0.1%	0	
100.315	incipient cataract, posterior sutures	10	0.1%	0	
100.316	incipient cataract, nucleus	18	0.2%	4	0.2%
100.317	incipient cataract, capsular	5	0.1%	6	0.4%

LENS CONTINUED		1991-2013		2014-2018	
100.321	incomplete cataract, anterior cortex	0		3	0.2%
100.322	incomplete cataract, posterior cortex	0		5	0.3%
100.323	incomplete cataract, equatorial cortex	0		1	0.1%
100.326	incomplete cataract, nucleus	0		3	0.2%
100.328	posterior suture tip opacities	1	0.0%	6	0.4%
100.330	generalized/complete cataract	45	0.5%	0	
100.340	resorbing/hypermature cataract	0		1	0.1%
100.375	subluxation/luxation, unspecified	5	0.1%	0	
100.999	*significant cataracts (summary)*	*367*	*3.8%*	*64*	*3.7%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	33	0.3%	9	0.5%
110.135	PHPV/PTVL	14	0.1%	0	
110.200	vitritis	1	0.0%	13	0.8%
110.320	vitreal degeneration	289	3.0%	27	1.6%
FUNDUS					
97.120	coloboma	2	0.0%	0	
RETINA					
120.170	retinal dysplasia, folds	62	0.6%	7	0.4%
120.180	retinal dysplasia, geographic	10	0.1%	4	0.2%
120.190	retinal dysplasia, detached	2	0.0%	1	0.1%
120.310	generalized progressive retinal atrophy (PRA)	107	1.1%	7	0.4%
120.400	retinal hemorrhage	1	0.0%	0	
120.910	retinal detachment without dialysis	8	0.1%	0	
120.920	retinal detachment with dialysis	0		2	0.1%
120.960	retinopathy	1	0.0%	2	0.1%
OPTIC NERVE					
130.110	micropapilla	8	0.1%	0	
130.120	optic nerve hypoplasia	10	0.1%	2	0.1%
130.150	optic disc coloboma	3	0.0%	0	
OTHER					
900.000	other, unspecified	77	0.8%	0	
900.100	other, not inherited	220	2.3%	67	3.9%
900.110	other. suspect not inherited/significance unknown	23	0.2%	3	0.2%
NORMAL					
0.000	normal globe	8520	87.2%	1334	77.8%

PARSON RUSSELL TERRIER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Distichiasis	Not defined	1, 2	Breeder option	
B.	Persistent pupillary membranes - iris to iris	Not define	1, 2	Breeder options	
C.	Cataract	Not defined	1, 2, 3	NO	
D.	Lens luxation	Autosomal recessive	4, 5	NO	Mutation in the *ADAMTS17* gene
E.	Vitreous degeneration	Not defined	6	Breeder option	
F.	Retinal atrophy - generalized	Not defined	7	NO	

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

C. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

D. Lens luxation

Partial (subluxation) or complete displacement of the lens from the normal anatomic site behind the pupil. Lens luxation may result in blinding retinal detachment and/or elevated intraocular pressure (glaucoma) causing vision impairment, pain, and blindness. A mutation in *ADAMTS17* has been associated with primary lens luxation. A DNA test is available.

E. Vitreous degeneration

Liquefaction of the vitreous gel which may predispose to retinal detachment resulting in blindness.

F. Retinal atrophy - generalized

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as Progressive Retinal Atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

References

1. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

2. ACVO Genetics Committee, 2017 and/or Data from CERF/OFA All-Breeds Report 2010-2016.

3. Oberbauer AM, Hollingsworth SR, Belanger JM, et al. Inheritance of cataracts and primary lens luxation in Jack Russell Terriers. *Am J Vet Res*. 2008;69:222-227.

4. Farias FH, Johnson GS, Taylor JF, et al. An ADAMTS17 splice donor site mutation in dogs with primary lens luxation. *Invest Ophthalmol Vis Sci*. 2010;51:4716-4721.

5. Gould D, Pettitt L, McLaughlin B, et al. ADAMTS17 mutation associated with primary lens luxation is widespread among breeds. *Vet Ophthalmol*. 2011;14:378-384.

6. ACVO Genetics Committee, 2007 and/or Data from CERF All-Breeds Report, 2002-2006.

7. ACVO Genetics Committee, 2013-2014 and Data from OFA All-Breeds Report, 2013-2014.

OCULAR DISORDERS REPORT
PARSON RUSSELL TERRIER

		TOTAL DOGS EXAMINED	1991-2013 2432		2014-2018 387	
		Diagnostic Name	**#**	**%**	**#**	**%**
EYELIDS						
25.110	distichiasis		60	2.5%	10	2.6%
NICTITANS						
52.110	prolapsed gland of the third eyelid		0		1	0.3%
CORNEA						
70.700	corneal dystrophy		12	0.5%	2	0.5%
70.730	corneal endothelial degeneration		2	0.1%	0	
UVEA						
93.710	persistent pupillary membranes, iris to iris		141	5.8%	43	11.1%
93.720	persistent pupillary membranes, iris to lens		1	0.0%	0	
93.730	persistent pupillary membranes, iris to cornea		3	0.1%	0	
93.740	persistent pupillary membranes, iris sheets		1	0.0%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands		5	0.2%	1	0.3%
93.760	persistent pupillary membranes, endothelial opacity/no strands		3	0.1%	2	0.5%
93.999	uveal cysts		2	0.1%	0	
LENS						
100.210	cataract. suspect not inherited/significance unknown		72	3.0%	19	4.9%
100.301	punctate cataract, anterior cortex		7	0.3%	1	0.3%
100.302	punctate cataract, posterior cortex		7	0.3%	1	0.3%
100.303	punctate cataract, equatorial cortex		4	0.2%	0	
100.304	punctate cataract, anterior sutures		0		1	0.3%
100.305	punctate cataract, posterior sutures		4	0.2%	2	0.5%
100.306	punctate cataract, nucleus		2	0.1%	0	
100.307	punctate cataract, capsular		1	0.0%	1	0.3%
100.311	incipient cataract, anterior cortex		15	0.6%	2	0.5%
100.312	incipient cataract, posterior cortex		39	1.6%	2	0.5%
100.313	incipient cataract, equatorial cortex		6	0.2%	1	0.3%
100.314	incipient cataract, anterior sutures		1	0.0%	0	
100.315	incipient cataract, posterior sutures		13	0.5%	2	0.5%
100.316	incipient cataract, nucleus		1	0.0%	0	
100.317	incipient cataract, capsular		9	0.4%	0	
100.321	incomplete cataract, anterior cortex		0		1	0.3%
100.322	incomplete cataract, posterior cortex		2	0.1%	1	0.3%
100.328	posterior suture tip opacities		0		2	0.5%
100.330	generalized/complete cataract		11	0.5%	0	
100.375	subluxation/luxation, unspecified		1	0.0%	0	
100.999	*significant cataracts (summary)*		*122*	*5.0%*	*15*	*3.9%*
VITREOUS						
110.120	persistent hyaloid artery/remnant		4	0.2%	1	0.3%
110.135	PHPV/PTVL		1	0.0%	0	
110.320	vitreal degeneration		43	1.8%	2	0.5%
FUNDUS						
97.120	coloboma		1	0.0%	0	

		1991-2013		2014-2018	
RETINA					
120.170	retinal dysplasia, folds	5	0.2%	4	1.0%
120.180	retinal dysplasia, geographic	2	0.1%	0	
120.310	generalized progressive retinal atrophy (PRA)	24	1.0%	1	0.3%
120.910	retinal detachment without dialysis	1	0.0%	0	
120.920	retinal detachment with dialysis	0		1	0.3%
120.960	retinopathy	1	0.0%	0	
OPTIC NERVE					
130.110	micropapilla	2	0.1%	0	
130.120	optic nerve hypoplasia	2	0.1%	0	
OTHER					
900.000	other, unspecified	39	1.6%	0	
900.100	other, not inherited	109	4.5%	23	5.9%
900.110	other. suspect not inherited/significance unknown	2	0.1%	0	
NORMAL					
0.000	normal globe	2136	87.8%	280	72.4%

PATTERDALE TERRIER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Lens luxation	Autosomal recessive	1	NO	Mutation in the *ADAMTS17* gene

Description and Comments

A. Lens Luxation

Partial (subluxation) or complete displacement of the lens from the normal anatomic site behind the pupil. Lens luxation not associated with trauma or inflammation is presumed to be inherited. Lens luxation may result in elevated intraocular pressure (glaucoma), causing vision impairment or blindness. A mutation in *ADAMTS17* has been associated with primary lens luxation. A DNA test is available.

References

There are no breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the Patterdale Terrier. The condition listed above is currently noted solely due to the availability of a genetic test for the disease.

1. Gould D, Pettitt L, McLaughlin B, et al. ADAMTS17 mutation associated with primary lens luxation is widespread among breeds. *Vet Ophthalmol*. 2011; 14: 378-384.

OCULAR DISORDERS REPORT
PATTERDALE TERRIER

Diagnostic Name	TOTAL DOGS EXAMINED	1991-2013 8 #	 %	2014-2018 8 #	 %
EYELIDS					
25.110	distichiasis	1	12.5%	0	
RETINA					
120.170	retinal dysplasia, folds	0		1	12.5%
120.180	retinal dysplasia, geographic	0		1	12.5%
NORMAL					
0.000	normal globe	7	87.5%	7	87.5%

PEKINGESE

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Distichiasis	Not defined	1-3, 5, 6	Breeder option
B.	Entropion	Not defined	1, 6	Breeder option
C.	Exposure keratopathy syndrome/ macroblepharon	Not defined	1, 5, 6	Breeder option
D.	Cataract	Not defined	1	NO

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Entropion

A conformational defect resulting in an "in-rolling" of one or both of the eyelids which may cause ocular irritation. It is likely that entropion is influenced by several genes (polygenic), defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

C. Exposure keratopathy syndrome/macroblepharon

A corneal disease involving all or part of the cornea, resulting from inadequate blinking. This results from a combination of anatomic features including shallow orbits, exophthalmos, macroblepharon and lagophthalmos. Macroblepharon is defined as an exceptionally large palpebral fissure, macroblepharon in conjunction with laxity of the lateral canthal structures may lead to lower lid ectropion and upper lid entropion. Either of these conditions may lead to severe ocular irritation.

D. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely

(diffuse) or in a localized region.

References

1. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

2. Barnett KC. Comparative aspects of canine hereditary eye disease. *Adv Vet Sci Comp Med.* 1976;20:39-67.

3. Gelatt KN. Pediatric ophthalmology in small animal practice. *Vet Clin North Am.* 1973;3:321.

4. Priester W. Canine progressive retinal atrophy: Occurrence by age, breed, and sex. *American Journal of Veterinary Research.* 1974;35:571-574.

5. ACVO Genetics Committee, 2017 and/or Data from CERF All-Breeds Report, 2000-2009.

6. ACVO Genetics Committee, 2017 and/or Data from CERF/OFA All-Breeds Report, 2010-2016.

OCULAR DISORDERS REPORT
PEKINGESE

		1991-2013		2014-2018	
	TOTAL DOGS EXAMINED	185		49	
Diagnostic Name		#	%	#	%
GLOBE					
0.110	microphthalmia	0		1	2.0%
EYELIDS					
20.140	ectopic cilia	2	1.1%	0	
20.160	macropalpebral fissure	12	6.5%	0	
21.000	entropion, unspecified	10	5.4%	11	22.4%
22.000	ectropion, unspecified	1	0.5%	1	2.0%
25.110	distichiasis	21	11.4%	3	6.1%
NASOLACRIMAL					
40.910	keratoconjunctivitis sicca	0		1	2.0%
CORNEA					
70.210	corneal pannus	7	3.8%	0	
70.220	pigmentary keratitis	25	13.5%	10	20.4%
UVEA					
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		1	2.0%
LENS					
100.200	cataract, unspecified	3	1.6%	0	
100.210	cataract. suspect not inherited/significance unknown	3	1.6%	2	4.1%
100.301	punctate cataract, anterior cortex	3	1.6%	0	
100.302	punctate cataract, posterior cortex	2	1.1%	0	
100.305	punctate cataract, posterior sutures	1	0.5%	0	
100.311	incipient cataract, anterior cortex	5	2.7%	0	
100.312	incipient cataract, posterior cortex	3	1.6%	0	
100.313	incipient cataract, equatorial cortex	4	2.2%	0	
100.315	incipient cataract, posterior sutures	3	1.6%	0	
100.316	incipient cataract, nucleus	1	0.5%	0	
100.330	generalized/complete cataract	2	1.1%	0	
100.375	subluxation/luxation, unspecified	2	1.1%	0	
100.999	*significant cataracts (summary)*	*27*	*14.6%*	*0*	
RETINA					
120.170	retinal dysplasia, folds	0		1	2.0%
120.190	retinal dysplasia, detached	1	0.5%	0	
120.310	generalized progressive retinal atrophy (PRA)	3	1.6%	0	
OPTIC NERVE					
130.110	micropapilla	0		1	2.0%
130.120	optic nerve hypoplasia	1	0.5%	0	
OTHER					
900.000	other, unspecified	6	3.2%	0	
900.100	other, not inherited	13	7.0%	3	6.1%
900.110	other. suspect not inherited/significance unknown	4	2.2%	1	2.0%

	1991-2013	2014-2018
NORMAL		
0.000 normal globe	102 55.1%	25 51.0%

PEMBROKE WELSH CORGI

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Distichiasis	Not defined	1, 2, 3	Breeder option
B.	Persistent pupillary membranes			
	- iris to iris	Not defined	1, 3, 4	Breeder option
	- iris to cornea	Not defined	1, 3, 5	NO
	- endothelial pigment/no strands	Not defined	6	NO
C.	Cataract	Not defined	1, 2, 3	NO
D.	Retinal dysplasia - folds	Not defined	1, 2, 3	Breeder option
E.	Retinal dysplasia - geographic - detached	Not defined	1, 2	NO

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.
Persistent pupillary membranes are a significant problem in this breed with frequent documentation of strands bridging from the iris to the cornea noted on routine screening eye examinations. These may be associated with corneal opacity which may result in vision impairment, thus the recommendation against breeding Pembroke Welsh Corgis with PPM.

C. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume

cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

D. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

E. Retinal dysplasia - geographic, detached

Abnormal development of the retina present at birth.

Retinal dysplasia - geographic: Any irregularly shaped area of abnormal retinal development containing both areas of thinning and areas of elevation representing folds and retinal disorganization.

Retinal dysplasia - detached: Severe retinal disorganization associated with separation (detachment) of the retina.

These two forms are associated with vision impairment or blindness. Retinal dysplasia is known to be inherited in many breeds. The genetic relationship among the three forms of retinal dysplasia is not known for all breeds.

References

There are no specific references providing detailed descriptions of hereditary ocular conditions of the Pembroke Welsh Corgi. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

2. ACVO Genetics Committee, 2017, and/or Data from CERF All-Breeds Report, 2000-2009.

3. ACVO Genetics Committee 2017, and/or Data from CERF/OFA All-Breeds Report, 2010-2016.

4. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

5. ACVO Genetics Committee, 2009 and/or Data from CERF All-Breeds Report, 2008.

6. ACVO Genetics Committee, 2016 and/or Data from CERF/OFA All-Breeds Report, 2010-2015.

OCULAR DISORDERS REPORT
PEMBROKE WELSH CORGI

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2013 17678 #	%	2014-2018 3663 #	%
GLOBE						
0.110	microphthalmia		17	0.1%	2	0.1%
10.000	glaucoma		1	0.0%	0	
EYELIDS						
20.140	ectopic cilia		3	0.0%	0	
22.000	ectropion, unspecified		1	0.0%	0	
25.110	distichiasis		314	1.8%	45	1.2%
NASOLACRIMAL						
32.110	imperforate lower nasolacrimal punctum		1	0.0%	6	0.2%
40.910	keratoconjunctivitis sicca		4	0.0%	3	0.1%
NICTITANS						
51.100	third eyelid cartilage anomaly		1	0.0%	0	
52.110	prolapsed gland of the third eyelid		2	0.0%	0	
CORNEA						
70.210	corneal pannus		3	0.0%	0	
70.220	pigmentary keratitis		1	0.0%	1	0.0%
70.700	corneal dystrophy		57	0.3%	11	0.3%
70.730	corneal endothelial degeneration		66	0.4%	5	0.1%
UVEA						
93.110	iris hypoplasia		2	0.0%	3	0.1%
93.140	corneal endothelial pigment without PPM		8	0.0%	0	
93.150	iris coloboma		5	0.0%	0	
93.710	persistent pupillary membranes, iris to iris		3073	17.4%	905	24.7%
93.720	persistent pupillary membranes, iris to lens		59	0.3%	13	0.4%
93.730	persistent pupillary membranes, iris to cornea		377	2.1%	46	1.3%
93.740	persistent pupillary membranes, iris sheets		15	0.1%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands		2	0.0%	1	0.0%
93.760	persistent pupillary membranes, endothelial opacity/no strands		37	0.2%	32	0.9%
93.999	uveal cysts		8	0.0%	3	0.1%
LENS						
100.200	cataract, unspecified		79	0.4%	0	
100.210	cataract. suspect not inherited/significance unknown		394	2.2%	95	2.6%
100.301	punctate cataract, anterior cortex		59	0.3%	11	0.3%
100.302	punctate cataract, posterior cortex		50	0.3%	12	0.3%
100.303	punctate cataract, equatorial cortex		25	0.1%	3	0.1%
100.304	punctate cataract, anterior sutures		3	0.0%	0	
100.305	punctate cataract, posterior sutures		18	0.1%	6	0.2%
100.306	punctate cataract, nucleus		51	0.3%	10	0.3%
100.307	punctate cataract, capsular		19	0.1%	9	0.2%
100.311	incipient cataract, anterior cortex		85	0.5%	30	0.8%
100.312	incipient cataract, posterior cortex		162	0.9%	26	0.7%
100.313	incipient cataract, equatorial cortex		58	0.3%	10	0.3%
100.314	incipient cataract, anterior sutures		6	0.0%	1	0.0%
100.315	incipient cataract, posterior sutures		17	0.1%	4	0.1%

LENS CONTINUED		1991-2013		2014-2018	
100.316	incipient cataract, nucleus	177	1.0%	27	0.7%
100.317	incipient cataract, capsular	16	0.1%	10	0.3%
100.321	incomplete cataract, anterior cortex	3	0.0%	6	0.2%
100.322	incomplete cataract, posterior cortex	2	0.0%	11	0.3%
100.323	incomplete cataract, equatorial cortex	0		5	0.1%
100.325	incomplete cataract, posterior sutures	0		1	0.0%
100.326	incomplete cataract, nucleus	6	0.0%	14	0.4%
100.327	incomplete cataract, capsular	2	0.0%	0	
100.328	posterior suture tip opacities	0		8	0.2%
100.330	generalized/complete cataract	75	0.4%	2	0.1%
100.340	resorbing/hypermature cataract	0		1	0.0%
100.375	subluxation/luxation, unspecified	6	0.0%	3	0.1%
100.999	*significant cataracts (summary)*	*913*	*5.2%*	*199*	*5.4%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	56	0.3%	20	0.5%
110.135	PHPV/PTVL	18	0.1%	6	0.2%
110.200	vitritis	1	0.0%	4	0.1%
110.320	vitreal degeneration	77	0.4%	17	0.5%
FUNDUS					
97.110	choroidal hypoplasia	3	0.0%	2	0.1%
RETINA					
120.170	retinal dysplasia, folds	1078	6.1%	172	4.7%
120.180	retinal dysplasia, geographic	165	0.9%	11	0.3%
120.190	retinal dysplasia, detached	3	0.0%	0	
120.310	generalized progressive retinal atrophy (PRA)	34	0.2%	2	0.1%
120.400	retinal hemorrhage	7	0.0%	0	
120.910	retinal detachment without dialysis	3	0.0%	0	
120.920	retinal detachment with dialysis	1	0.0%	5	0.1%
120.960	retinopathy	4	0.0%	6	0.2%
OPTIC NERVE					
130.110	micropapilla	5	0.0%	1	0.0%
130.120	optic nerve hypoplasia	8	0.0%	1	0.0%
130.150	optic disc coloboma	2	0.0%	0	
OTHER					
900.000	other, unspecified	125	0.7%	0	
900.100	other, not inherited	338	1.9%	143	3.9%
900.110	other. suspect not inherited/significance unknown	101	0.6%	5	0.1%
NORMAL					
0.000	normal globe	12857	72.7%	2240	61.2%

PERRO DE PRESA CANARIO

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Multifocal retinopathy - *cmr1*	Autosomal recessive	1	Breeder option	Mutation in the *BEST1* gene

Description and Comments

A. Multifocal retinopathy

Canine Multifocal Retinopathy type 1 (*cmr1*) is characterized by numerous distinct (i.e. multifocal), roughly circular patches of elevated retina (multifocal bullous retinal detachments). There may be a serous subretinal fluid, or accumulation of subretinal material that produces gray-tan-pink colored lesions. These lesions, looking somewhat like blisters, vary in location and size, although typically they are present in both eyes of the affected dog.

The disease generally develops in young dogs between 11-20 weeks of age and there is minimal progression after 1 year of age. The lesions may flatten, leaving areas of retinal thinning and RPE hypertrophy, hyperplasia, and pigmentation. Discrete areas of tapetal hyper-reflectivity may be seen in areas of previous retinal and RPE detachments. Most dogs exhibit no noticeable problem with vision or electroretinographic abnormalities despite their abnormal appearing retinas.

Canine Multifocal Retinopathy type 1 is caused by a mutation in the Bestrophin 1 gene (BEST1) and is described to be recessively inherited in the Great Pyrenees, Dogue de Bordeaux, Bullmastiff, and Mastiff. A DNA test is available.

References

1. Zangerl B, Wickstrom K, Slavik J, et al. Assessment of canine BEST1 variations identifies new mutations and establishes an independent bestrophinopathy model (cmr3). *Mol Vis*. 2010;16:2791-2804.

OCULAR DISORDERS REPORT
PERRO DE PRESA CANARIO

Diagnostic Name	TOTAL DOGS EXAMINED	1991-2013 4 #	%	2014-2018 6 #	%
GLOBE					
10.000	glaucoma	0		1	16.7%
LENS					
100.210	cataract. suspect not inherited/significance unknown	1	25.0%	1	16.7%
100.302	punctate cataract, posterior cortex	0		1	16.7%
100.328	posterior suture tip opacities	1	25.0%	0	
100.999	*significant cataracts (summary)*	*0*		*1*	*16.7%*
OTHER					
900.110	other. suspect not inherited/significance unknown	0		1	16.7%
NORMAL					
0.000	normal globe	3	75.0%	4	66.7%

PERUVIAN INCA ORCHID

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Cataract	Not defined	1	NO

Description and Comments

A. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Peruvian Inca Orchid breed. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 2018 and/or Data from OFA All-Breeds Report 2013-2017.

OCULAR DISORDERS REPORT
PERUVIAN INCEA ORCHID

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2013 17 #	%	2014-2018 37 #	%
GLOBE						
0.110	microphthalmia		1	5.9%	1	2.7%
UVEA						
93.710	persistent pupillary membranes, iris to iris		0		2	5.4%
LENS						
100.210	cataract. suspect not inherited/significance unknown		1	5.9%	0	
100.305	punctate cataract, posterior sutures		0		1	2.7%
100.306	punctate cataract, nucleus		0		1	2.7%
100.311	incipient cataract, anterior cortex		0		3	8.1%
100.312	incipient cataract, posterior cortex		0		1	2.7%
100.315	incipient cataract, posterior sutures		0		1	2.7%
100.316	incipient cataract, nucleus		0		1	2.7%
100.321	incomplete cataract, anterior cortex		0		1	2.7%
100.322	incomplete cataract, posterior cortex		0		1	2.7%
100.326	incomplete cataract, nucleus		0		1	2.7%
100.999	*significant cataracts (summary)*		*0*		*11*	*29.7%*
RETINA						
120.180	retinal dysplasia, geographic		0		1	2.7%
120.310	generalized progressive retinal atrophy (PRA)		0		3	8.1%
120.960	retinopathy		0		2	5.4%
OTHER						
900.000	other, unspecified		1	5.9%	0	
900.100	other, not inherited		0		1	2.7%
900.110	other. suspect not inherited/significance unknown		0		1	2.7%
NORMAL						
0.000	normal globe		18	105.9%	26	70.3%

PETIT BASSET GRIFFON VENDEEN

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Glaucoma – POAG	Autosomal recessive	1, 2	NO	Mutation in the *ADAMTS17* gene
B.	Corneal dystrophy - endothelial	Not defined	3	Breeder option	
C.	Persistent pupillary membranes				
	- iris to iris	Not defined	3-6	Breeder option	
	- lens pigment foci/ no strands	Not defined	6	Passes with no notation	
	- all other forms	Not defined	6	NO	
D.	Cataract	Not defined	3, 5, 6	NO	
E.	Persistent hyaloid artery	Not defined	6	Breeder option	
F.	Vitreous degeneration	Not defined	3	Breeder option	
G.	Retinal dysplasia - folds	Not defined	1, 3, 6	Breeder option	

Description and Comments

A. Glaucoma

An elevation of intraocular pressure (IOP) which, when sustained, causes intraocular damage resulting in blindness. The elevated IOP occurs because the fluid cannot leave through the iridocorneal angle. Diagnosis and classification of glaucoma requires measurement of IOP (tonometry) and examination of the iridocorneal angle (gonioscopy). Neither of these tests are part of a routine breed eye screening exam.

Primary Open Angle Glaucoma (POAG) in the Petit Basset Griffon Vendeen is caused by an inversion with a breakpoint disrupting the *ADAMTS17* gene. Pectinate ligament abnormalities are not present on gonioscopy and the iridocorneal angle remains open. The initial clinical features are noted around 3-4 years and include a small rise in intraocular pressure accompanied by lens subluxation. Retinal degeneration and optic nerve cupping noted in late stages when globe enlargement and vision disruption has occurred. A DNA test is available.

B. Corneal dystrophy - endothelial

Corneal endothelial dystrophy is an abnormal loss of the inner lining of the cornea that causes progressive fluid retention (edema). With time the edema results in keratitis and decreased vision. This usually does not occur until the animal is older.

C. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

D. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

E. Persistent hyaloid artery (PHA)

Congenital defect resulting from abnormalities in the development and regression of the hyaloid artery. The blood vessel remnant can be present in the vitreous as a small patent vascular strand (PHA) or as a non-vascular strand that appears gray-white (persistent hyaloid remnant).

F. Vitreous degeneration

A liquefaction of the vitreous gel which may predispose to retinal detachment resulting in blindness.

G. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

References

1. Forman OP, Pettitt L, Komaromy AM, et al. A Novel Genome-Wide Association Study Approach Using Genotyping by Exome Sequqncing Leads to the Indentification of a Primary Open Angle Glaucoma Association Inversion Disrupting ADAMTS17; PLoS one, 2015: 10(12):e0143546.

2. Bedford, PGC (2017), Open-angle glaucoma in the Petit Basset Griffon Vendeen. Vet Ophthalmol, 20: 98-102. doi.10.1111/vop.12369.

3. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

4. ACVO Genetics Committee, 2007 and/or Data from CERF All-Breeds Report, 2002-2006.

5. ACVO Genetics Committee, 2015 and Data from OFA All-Breeds Report, 2014-2015.

6. ACVO Genetics Committee, 2017 and/or Data from CERF/OFA All-Breeds Report, 2010-2016.

OCULAR DISORDERS REPORT
PETIT BASSET GRIFFON VENDEEN

		1991-2013 2232		2014-2018 338	
TOTAL DOGS EXAMINED					
Diagnostic Name		#	%	#	%
GLOBE					
10.000	glaucoma	3	0.1%	0	
EYELIDS					
21.000	entropion, unspecified	3	0.1%	0	
25.110	distichiasis	9	0.4%	2	0.6%
NICTITANS					
52.110	prolapsed gland of the third eyelid	1	0.0%	0	
CORNEA					
70.220	pigmentary keratitis	1	0.0%	0	
70.700	corneal dystrophy	16	0.7%	1	0.3%
70.730	corneal endothelial degeneration	26	1.2%	0	
UVEA					
93.140	corneal endothelial pigment without PPM	2	0.1%	0	
93.150	iris coloboma	1	0.0%	0	
93.710	persistent pupillary membranes, iris to iris	434	19.4%	64	18.9%
93.720	persistent pupillary membranes, iris to lens	31	1.4%	5	1.5%
93.730	persistent pupillary membranes, iris to cornea	205	9.2%	17	5.0%
93.740	persistent pupillary membranes, iris sheets	15	0.7%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	10	0.4%	9	2.7%
93.760	persistent pupillary membranes, endothelial opacity/no strands	41	1.8%	30	8.9%
93.999	uveal cysts	3	0.1%	1	0.3%
LENS					
100.200	cataract, unspecified	2	0.1%	0	
100.210	cataract. suspect not inherited/significance unknown	91	4.1%	22	6.5%
100.301	punctate cataract, anterior cortex	24	1.1%	4	1.2%
100.302	punctate cataract, posterior cortex	5	0.2%	0	
100.303	punctate cataract, equatorial cortex	3	0.1%	1	0.3%
100.304	punctate cataract, anterior sutures	4	0.2%	0	
100.305	punctate cataract, posterior sutures	4	0.2%	2	0.6%
100.306	punctate cataract, nucleus	2	0.1%	0	
100.307	punctate cataract, capsular	12	0.5%	4	1.2%
100.311	incipient cataract, anterior cortex	19	0.9%	6	1.8%
100.312	incipient cataract, posterior cortex	7	0.3%	0	
100.313	incipient cataract, equatorial cortex	5	0.2%	0	
100.315	incipient cataract, posterior sutures	5	0.2%	1	0.3%
100.316	incipient cataract, nucleus	3	0.1%	0	
100.317	incipient cataract, capsular	10	0.4%	3	0.9%
100.326	incomplete cataract, nucleus	0		1	0.3%
100.328	posterior suture tip opacities	1	0.0%	3	0.9%
100.330	generalized/complete cataract	12	0.5%	0	
100.375	subluxation/luxation, unspecified	8	0.4%	2	0.6%
100.999	*significant cataracts (summary)*	*117*	*5.2%*	*22*	*6.5%*

		1991-2013		2014-2018	
VITREOUS					
110.120	persistent hyaloid artery/remnant	6	0.3%	7	2.1%
110.320	vitreal degeneration	13	0.6%	0	
RETINA					
120.170	retinal dysplasia, folds	105	4.7%	8	2.4%
120.180	retinal dysplasia, geographic	9	0.4%	2	0.6%
120.310	generalized progressive retinal atrophy (PRA)	3	0.1%	0	
120.400	retinal hemorrhage	2	0.1%	0	
OPTIC NERVE					
130.110	micropapilla	3	0.1%	1	0.3%
130.150	optic disc coloboma	1	0.0%	0	
OTHER					
900.000	other, unspecified	38	1.7%	0	
900.100	other, not inherited	79	3.5%	7	2.1%
900.110	other. suspect not inherited/significance unknown	36	1.6%	7	2.1%
NORMAL					
0.000	normal globe	1448	64.9%	196	58.0%

PHARAOH HOUND

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Persistent pupillary membranes			
	- iris to iris	Not defined	1, 2, 3	Breeder option
	- lens pigment foci/no strands	Not defined	3	Passes with no notation
B.	Cataract	Not defined	4	NO

Description and Comments

A. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

B. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Pharaoh Hound breed. The conditions listed above are generally recognized to exist in the breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 2007 and/or Data from CERF All-Breeds Report, 2002-2006.

2. ACVO Genetics Committee, 2008 and/or Data from CERF All-Breeds Report, 2003-2007.

3. ACVO Genetics Committee, 2017 and/or Data from CERF/OFA All-Breeds Report, 2010-2016.

4. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

OCULAR DISORDERS REPORT
PHARAOH HOUND

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2013 340 #	%	2014-2018 118 #	%
EYELIDS						
25.110	distichiasis		7	2.1%	0	
NICTITANS						
52.110	prolapsed gland of the third eyelid		1	0.3%	0	
CORNEA						
70.700	corneal dystrophy		3	0.9%	0	
UVEA						
93.140	corneal endothelial pigment without PPM		1	0.3%	0	
93.710	persistent pupillary membranes, iris to iris		26	7.6%	8	6.8%
93.720	persistent pupillary membranes, iris to lens		1	0.3%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands		5	1.5%	8	6.8%
93.760	persistent pupillary membranes, endothelial opacity/no strands		1	0.3%	0	
93.999	uveal cysts		1	0.3%	0	
LENS						
100.200	cataract, unspecified		1	0.3%	0	
100.210	cataract. suspect not inherited/significance unknown		18	5.3%	9	7.6%
100.301	punctate cataract, anterior cortex		0		3	2.5%
100.302	punctate cataract, posterior cortex		0		1	0.8%
100.305	punctate cataract, posterior sutures		2	0.6%	0	
100.306	punctate cataract, nucleus		1	0.3%	0	
100.307	punctate cataract, capsular		1	0.3%	0	
100.311	incipient cataract, anterior cortex		1	0.3%	0	
100.312	incipient cataract, posterior cortex		2	0.6%	1	0.8%
100.313	incipient cataract, equatorial cortex		2	0.6%	0	
100.315	incipient cataract, posterior sutures		3	0.9%	1	0.8%
100.316	incipient cataract, nucleus		1	0.3%	0	
100.328	posterior suture tip opacities		1	0.3%	1	0.8%
100.330	generalized/complete cataract		1	0.3%	0	
100.999	*significant cataracts (summary)*		*15*	*4.4%*	*6*	*5.1%*
RETINA						
120.170	retinal dysplasia, folds		3	0.9%	0	
120.180	retinal dysplasia, geographic		2	0.6%	0	
120.310	generalized progressive retinal atrophy (PRA)		3	0.9%	0	
120.960	retinopathy		0		3	2.5%
OTHER						
900.000	other, unspecified		4	1.2%	0	
900.100	other, not inherited		10	2.9%	1	0.8%
NORMAL						
0.000	normal globe		286	84.1%	83	70.3%

OCULAR DISORDERS REPORT
PICARDY SPANIEL

There are insufficient breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the PICARDY SPANIEL breed. Therefore, there are no conditions listed with breeding advice.

OCULAR DISORDERS REPORT
PICARDY SPANIEL

Diagnostic Name	TOTAL DOGS EXAMINED	1991-2013 0 #	%	2014-2018 1 #	%
NORMAL					
0.000 normal globe		0		1	100.0%

PLOTT

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Retinal atrophy - generalized (*prcd*)	Autosomal recessive	1	NO	Mutation in the *prcd* gene

Description and Comments

A. Retinal atrophy – generalized (*prcd*)

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

Studies have shown that the principal form of PRA in the Plott is *prcd* which is a late-onset form of PRA inherited as autosomal recessive. The mutation is allelic to that present in Miniature Poodles, English and American Cocker Spaniels, and others. The locus is termed the progressive rod-cone degeneration (*prcd*) gene and at least 30+ breeds are affected. In most affected dogs to date, the disease is recognized clinically in dogs 3-6 years of age or older. This photoreceptor degeneration is characterized by slow death of visual cells following their normal development. The disease begins clinically with signs of night blindness followed by day blindness. A DNA test is available.

References

There are no breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the Plott. The condition listed above is currently noted solely due to the availability of a genetic test for the disease.

1. ACVO Genetics Committee, 2018 and/or Data from OFA All-Breeds Report, 2013-2017.

OCULAR DISORDERS REPORT
PLOTT

Diagnostic Name	TOTAL DOGS EXAMINED	1991-2013 0 #	%	2014-2018 7 #	%
NORMAL					
0.000 normal globe		0		7	100.0%

POINTER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Corneal dystrophy - epithelial/stromal	Not defined	1	Breeder option
B.	Persistent pupillary membranes - iris to iris	Not defined	2	Breeder options
C.	Cataract	Not defined	3	NO

Description and Comments

A. Corneal Dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

B. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

C. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Pointer breed. The conditions listed above are generally recognized to exist in the breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 2018 and/or Data from OFA All-Breeds Report, 2013-2017.

2. ACVO Genetics Committee, 2017 and/or Data from CERF/OFA All-Breeds Report, 2010-2016.

3. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

OCULAR DISORDERS REPORT
POINTER

Diagnostic Name	TOTAL DOGS EXAMINED	1991-2013 580 #	1991-2013 580 %	2014-2018 196 #	2014-2018 196 %
EYELIDS					
21.000	entropion, unspecified	4	0.7%	1	0.5%
22.000	ectropion, unspecified	1	0.2%	0	
25.110	distichiasis	4	0.7%	0	
NICTITANS					
52.110	prolapsed gland of the third eyelid	1	0.2%	0	
CORNEA					
70.700	corneal dystrophy	4	0.7%	6	3.1%
UVEA					
93.710	persistent pupillary membranes, iris to iris	9	1.6%	3	1.5%
93.720	persistent pupillary membranes, iris to lens	1	0.2%	0	
93.730	persistent pupillary membranes, iris to cornea	1	0.2%	0	
93.760	persistent pupillary membranes, endothelial opacity/no strands	0		1	0.5%
LENS					
100.210	cataract. suspect not inherited/significance unknown	17	2.9%	4	2.0%
100.302	punctate cataract, posterior cortex	1	0.2%	0	
100.303	punctate cataract, equatorial cortex	1	0.2%	0	
100.306	punctate cataract, nucleus	1	0.2%	1	0.5%
100.312	incipient cataract, posterior cortex	3	0.5%	0	
100.313	incipient cataract, equatorial cortex	1	0.2%	0	
100.315	incipient cataract, posterior sutures	1	0.2%	0	
100.317	incipient cataract, capsular	0		1	0.5%
100.321	incomplete cataract, anterior cortex	0		1	0.5%
100.322	incomplete cataract, posterior cortex	0		1	0.5%
100.326	incomplete cataract, nucleus	0		1	0.5%
100.328	posterior suture tip opacities	0		1	0.5%
100.999	*significant cataracts (summary)*	*8*	*1.4%*	*5*	*2.6%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	1	0.2%	0	
RETINA					
120.170	retinal dysplasia, folds	5	0.9%	2	1.0%
120.180	retinal dysplasia, geographic	3	0.5%	0	
120.310	generalized progressive retinal atrophy (PRA)	2	0.3%	0	
OPTIC NERVE					
130.110	micropapilla	3	0.5%	1	0.5%
130.120	optic nerve hypoplasia	1	0.2%	0	
OTHER					
900.000	other, unspecified	7	1.2%	0	
900.100	other, not inherited	8	1.4%	14	7.1%
900.110	other. suspect not inherited/significance unknown	1	0.2%	0	

	1991-2013	2014-2018
NORMAL		
0.000 normal globe	533 91.9%	160 81.6%

POLISH LOWLAND SHEEPDOG
(Polski Owczarek Nizinny)

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Distichiasis	Not defined	1-4	Breeder option	
B.	Corneal dystrophy - epithelial/stromal	Not defined	1-4	Breeder option	
C.	Persistent pupillary membranes - iris to iris	Not defined	2-4	Breeder option	
D.	Cataract	Not defined	3-5	NO	
E.	Retinal atrophy - rod-cone dysplasia type 1 (*rcd4*)	Autosomal recessive	6	NO	Mutation in the *C2orf71* or *C17H2orf71* genes
F.	Ceroid lipofuscinosis	Not defined	7	NO	

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Corneal Dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

C. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

D. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

E. Rod-cone dysplasia, type 4 (*rcd4*)

A form of PRA identified in the Gordon and Irish Setter breeds. Clinical night blindness is observed on average as late as 10 years of age and progresses to total blindness. This form of PRA has been referred to as late-onset PRA (LOPRA). The disorder is caused by a mutation present in the *C2orf71* gene. A DNA test is available.

A form of PRA, similar to that found in Gordon and Irish setters, has also been found in the the Polish Lowland Sheepdog. This form of PRA has been referred to as late-onset, slowly progressive PRA (LOPRA). Slight vascular attenuation, first seen between 4.5 -6 years of age precedes tapetal hyperreflectivity. All fundic changes were bilaterally symmetric and progressed slowly eventually causing clinical blindness, bilateral complete vascular attenuation, and tapetal hyperreflectivity by 12 years of age, on average. Almost all affected dogs were homozygous for the rcd4 mutation in *C17H2orf71* gene. A DNA test is available.

F. Ceroid lipofuscinosis

A systemic metabolic disorder that affects the retina and retinal pigment epithelium with accumulation of lipopigments resulting in retinal degeneration.

Historical Note:

Central progressive retinal atrophy was previously a condition listed for this breed. However as the condition is no longer identified in the breed, the condition has been removed. Central progressive retinal atrophy was a progressive retinal degeneration in which photoreceptor death occurred secondary to disease of the underlying pigment epithelium. Progression was slow and some animals never lost vision. CPRA occurred in England, but was uncommon elsewhere.

References

1. ACVO Genetics Committee, 2002-2003 and/or Data from CERF All-Breeds Report, 2002-2003.

2. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

3. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

4. ACVO Genetics Committee, 2017 and/or DATA from CERF/OFA All-Breeds Report, 2010-2016.

5. ACVO Genetics Committee, 2000-2002 and/or Data from CERF All-Breeds Report, 2000-2002.

6. Downs LM, Bell JS, Freeman J, et al. Late-onset progressive retinal atrophy in the Gordon and Irish Setter breeds is associated with a frameshift mutation in C2orf71. *Anim Genet*. 2012;44:169-177.

7. Narfstrom K, Wrigstad A, Ekesten B, et al. Neuronal ceroid lipofuscinosis: clinical and morphologic findings in nine affected Polish Owczarek Nizinny (PON) dogs. *Vet Ophthalmol*. 2007;10:111-120.

OCULAR DISORDERS REPORT
POLISH LOWLAND SHEEPDOG

Diagnostic Name	TOTAL DOGS EXAMINED	1991-2013 969 #	1991-2013 969 %	2014-2018 231 #	2014-2018 231 %
EYELIDS					
25.110	distichiasis	15	1.5%	3	1.3%
NASOLACRIMAL					
32.110	imperforate lower nasolacrimal punctum	0		2	0.9%
CORNEA					
70.700	corneal dystrophy	28	2.9%	5	2.2%
70.730	corneal endothelial degeneration	1	0.1%	0	
UVEA					
93.710	persistent pupillary membranes, iris to iris	64	6.6%	22	9.5%
93.999	uveal cysts	2	0.2%	0	
LENS					
100.210	cataract. suspect not inherited/significance unknown	39	4.0%	11	4.8%
100.301	punctate cataract, anterior cortex	5	0.5%	6	2.6%
100.302	punctate cataract, posterior cortex	7	0.7%	3	1.3%
100.303	punctate cataract, equatorial cortex	1	0.1%	0	
100.305	punctate cataract, posterior sutures	1	0.1%	0	
100.306	punctate cataract, nucleus	0		1	0.4%
100.307	punctate cataract, capsular	1	0.1%	1	0.4%
100.311	incipient cataract, anterior cortex	3	0.3%	2	0.9%
100.312	incipient cataract, posterior cortex	3	0.3%	0	
100.313	incipient cataract, equatorial cortex	1	0.1%	1	0.4%
100.315	incipient cataract, posterior sutures	1	0.1%	2	0.9%
100.316	incipient cataract, nucleus	0		2	0.9%
100.317	incipient cataract, capsular	1	0.1%	1	0.4%
100.321	incomplete cataract, anterior cortex	0		2	0.9%
100.328	posterior suture tip opacities	0		1	0.4%
100.330	generalized/complete cataract	1	0.1%	0	
100.999	*significant cataracts (summary)*	*25*	*2.6%*	*21*	*9.1%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	0		1	0.4%
110.320	vitreal degeneration	2	0.2%	0	
RETINA					
120.170	retinal dysplasia, folds	10	1.0%	0	
120.310	generalized progressive retinal atrophy (PRA)	15	1.5%	5	2.2%
120.960	retinopathy	1	0.1%	0	
OTHER					
900.000	other, unspecified	5	0.5%	0	
900.100	other, not inherited	24	2.5%	5	2.2%
900.110	other. suspect not inherited/significance unknown	0		1	0.4%
NORMAL					
0.000	normal globe	830	85.7%	165	71.4%

OCULAR DISORDERS REPORT
POLISH TATRA SHEEPDOG

There are insufficient breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the POLISH TATRA SHEEPDOG breed. Therefore, there are no conditions listed with breeding advice.

OCULAR DISORDERS REPORT
POLISH TATRA SHEEPDOG

Diagnostic Name	TOTAL DOGS EXAMINED	1991-2013 0 #	 %	2014-2018 2 #	 %
LENS					
100.301	punctate cataract, anterior cortex	0		1	50.0%
100.302	punctate cataract, posterior cortex	0		1	50.0%
100.999	*significant cataracts (summary)*	*0*		*2*	*100.0%*
NORMAL					
0.000	normal globe	0		1	50.0%

POMERANIAN

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Distichiasis	Not defined	1, 2	Breeder option	
B.	Entropion	Not defined	1	Breeder option	
C.	Persistent pupillary membranes				
	- iris to iris	Not defined	3	Breeder option	
	- lens pigmentfoci/no strands	Not defined	4	Passes with no notation	
D.	Cataract	Not defined	5	NO	
F.	Vitreous degeneration	Not defined	7	Breeder option	
G.	Retinal atrophy - rod-cone dysplasia type 3 (*rcd3*)	Autosomal recessive	6	NO	Mutation in the *PDE6A* gene
H.	Retinal atrophy - generalized (*prcd*)	Autosomal recessive	4	NO	Mutation in the *prcd* gene

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established, although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Entropion

A conformational defect resulting in an "in-rolling" of one or both of the eyelids which may cause ocular irritation. It is likely that entropion is influenced by several genes (polygenic), defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull. Selection should be directed against entropion and toward head conformation that minimizes or eliminates the likelihood of the defect.

C. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or from sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

D. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

E. Retinal atrophy - rod-cone dysplasia type 3 (*rcd3*)

PRA is an autosomal recessive trait caused by a one base pair deletion in the gene encoding the alpha subunit of cyclic GMP phosphodiesterase (rcd3). PRA begins early in life with clinical signs of night blindness and a lack of rod ERG responses is seen at 6-8 weeks of age. Dogs are completely blind by 2-3 years of age when ophthalmoscopic signs are first visible. The mutation is found in the *PDE6A* gene. A DNA test is available.

F. Retinal atrophy – generalized (prcd)

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

Studies have shown that the principal form of PRA in the Pomeranian is *prcd* which is a late-onset form of PRA inherited as autosomal recessive. The mutation is allelic to that present in Miniature Poodles, English and American Cocker Spaniels, and others. The locus is termed the progressive rod-cone degeneration (*prcd*) gene and at least 30+ breeds are affected. In most affected dogs to date, the disease is recognized clinically in dogs 3-6 years of age or older. This photoreceptor degeneration is characterized by slow death of visual cells following their normal development. The disease begins clinically with signs of night blindness followed by day blindness. A DNA test is available.

G. Vitreous degeneration

A liquefaction of the vitreous gel which may predispose to retinal detachment resulting in blindness.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Pomeranian breed. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

2. ACVO Genetics Committee, 2002-2003 and/or Data from CERF All-Breeds Report, 2002-2003.

3. ACVO Genetics Committee, 2006 and/or Data from CERF All-Breeds Report, 2001-2005.

4. ACVO Genetics Committee, 2017 and/or Data from OFA All-Breeds Report, 2013-2017.

5. ACVO Genetics Committee, 2000-2002 and/or Data from CERF All-Breeds Report, 2000-2002.

6. ACVO Genetics Committee, 2016 and/or Data from OFA All-Breeds Report, 2016.

7. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

OCULAR DISORDERS REPORT
POMERANIAN

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2013 868 #	%	2014-2018 580 #	%
GLOBE						
0.110	microphthalmia		2	0.2%	1	0.2%
EYELIDS						
20.140	ectopic cilia		1	0.1%	0	
21.000	entropion, unspecified		1	0.1%	8	1.4%
22.000	ectropion, unspecified		1	0.1%	0	
25.110	distichiasis		47	5.4%	12	2.1%
NASOLACRIMAL						
32.110	imperforate lower nasolacrimal punctum		1	0.1%	0	
40.910	keratoconjunctivitis sicca		1	0.1%	0	
CORNEA						
70.210	corneal pannus		1	0.1%	0	
70.220	pigmentary keratitis		2	0.2%	0	
70.700	corneal dystrophy		3	0.3%	0	
70.730	corneal endothelial degeneration		2	0.2%	0	
UVEA						
93.150	iris coloboma		0		1	0.2%
93.710	persistent pupillary membranes, iris to iris		50	5.8%	41	7.1%
93.720	persistent pupillary membranes, iris to lens		3	0.3%	0	
93.730	persistent pupillary membranes, iris to cornea		4	0.5%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands		2	0.2%	6	1.0%
93.760	persistent pupillary membranes, endothelial opacity/no strands		1	0.1%	1	0.2%
93.810	uveal melanoma		1	0.1%	0	
97.150	chorioretinal coloboma, congenital		0		1	0.2%
LENS						
100.200	cataract, unspecified		1	0.1%	0	
100.210	cataract. suspect not inherited/significance unknown		24	2.8%	9	1.6%
100.301	punctate cataract, anterior cortex		2	0.2%	1	0.2%
100.302	punctate cataract, posterior cortex		2	0.2%	0	
100.303	punctate cataract, equatorial cortex		1	0.1%	0	
100.304	punctate cataract, anterior sutures		1	0.1%	0	
100.305	punctate cataract, posterior sutures		3	0.3%	0	
100.306	punctate cataract, nucleus		1	0.1%	0	
100.307	punctate cataract, capsular		1	0.1%	1	0.2%
100.311	incipient cataract, anterior cortex		9	1.0%	2	0.3%
100.312	incipient cataract, posterior cortex		5	0.6%	3	0.5%
100.313	incipient cataract, equatorial cortex		3	0.3%	1	0.2%
100.316	incipient cataract, nucleus		2	0.2%	0	
100.317	incipient cataract, capsular		0		2	0.3%
100.322	incomplete cataract, posterior cortex		0		1	0.2%
100.330	generalized/complete cataract		10	1.2%	1	0.2%
100.340	resorbing/hypermature cataract		0		1	0.2%
100.999	*significant cataracts (summary)*		*41*	*4.7%*	*13*	*2.2%*

		1991-2013		2014-2018	
VITREOUS					
110.120	persistent hyaloid artery/remnant	3	0.3%	1	0.2%
110.135	PHPV/PTVL	1	0.1%	0	
110.200	vitritis	1	0.1%	3	0.5%
110.320	vitreal degeneration	10	1.2%	6	1.0%
RETINA					
120.170	retinal dysplasia, folds	2	0.2%	4	0.7%
120.180	retinal dysplasia, geographic	3	0.3%	0	
120.310	generalized progressive retinal atrophy (PRA)	16	1.8%	1	0.2%
120.400	retinal hemorrhage	1	0.1%	0	
120.910	retinal detachment without dialysis	2	0.2%	0	
120.920	retinal detachment with dialysis	0		1	0.2%
120.960	retinopathy	0		2	0.3%
OPTIC NERVE					
130.120	optic nerve hypoplasia	2	0.2%	0	
130.150	optic disc coloboma	2	0.2%	0	
OTHER					
900.000	other, unspecified	10	1.2%	0	
900.100	other, not inherited	27	3.1%	15	2.6%
900.110	other. suspect not inherited/significance unknown	5	0.6%	2	0.3%
NORMAL					
0.000	normal globe	718	82.7%	465	80.2%

POODLE

(Toy, Miniature, and Standard varieties)

* All varieties of the Poodle are basically the same genetic makeup, having their size governed by differences in an "insulin-like growth factor." (See Reference 2.)

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Glaucoma	Not defined	1-4	NO	
B.	Distichiasis	Not defined	1	Breeder option	
C.	Corneal dystrophy - epithelial/stromal	Not defined	5	Breeder option	
D.	Persistent pupillary membranes - iris to iris - lens pigment foci/no strands	Not defined Not defined	1, 6 7	Breeder option Passes with no notation	
E.	Cataract	Not defined	1, 8-10	NO	
F.	Vitreous degeneration	Not defined	1, 11	Breeder option	
G.	Retinal atrophy - generalized (*prcd*)	Autosomal recessive	1, 11-27	NO	Mutation in the *prcd* gene
H.	Retinal atrophy - rod-cone dysplasia type 4 (*rcd4*)	Autosomal recessive	28	NO	Mutation in the *C2orf71* gene *only in Miniatures
I.	Cone degeneration (achromatopsia)	Autosomal recessive	7, 31	NO	Mutation has not been published *only in Standards
J.	Optic nerve hypoplasia	Not defined	1, 29, 30	NO	
K.	Micropapilla	Not defined	1	Breeder option	

Description and Comments

A. Glaucoma

An elevation of intraocular pressure (IOP) which, when sustained, causes intraocular damage resulting in blindness. The elevated IOP occurs because the fluid cannot leave through the

iridocorneal angle. Diagnosis and classification of glaucoma requires measurement of IOP (tonometry) and examination of the iridocorneal angle (gonioscopy). Neither of these tests are part of a routine breed eye screening exam.

The Poodle form is usually a narrow angle variety and often associated with a condition of goniodysgenesis (a condition of incomplete formation and development of the iridocorneal angle).

B. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

C. Corneal Dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

D. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

E. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

The Poodle cataract can involve the lens cortex and lens nucleus. The rate and degree of progression are variable. A familial form of cataract has been described in the Standard Poodle, beginning with an equatorial opacity initially observed in dogs prior to 2 years of age.

F. Vitreous degeneration

A liquefaction of the vitreous gel which may predispose to retinal detachment and/or glaucoma. Either condition may cause blindness.

G. Retinal atrophy - generalized (*prcd*)

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of

a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

Studies have shown that PRA in the Poodle is *prcd* which is a late-onset form of PRA inherited as autosomal recessive. The mutation is allelic to that present in Labrador Retrievers, English and American Cocker Spaniels, and others. The locus is termed the progressive rod-cone degeneration (*prcd*) gene and at least 30+ breeds are affected. In most affected dogs to date, the disease is recognized clinically in dogs 3-6 years of age or older. This photoreceptor degeneration is characterized by slow death of visual cells following their normal development. The disease begins clinically with signs of night blindness followed by day blindness. A DNA test is available. It is important to note that in all breeds in which a molecular diagnostic test for the disease is available, it is possible to have dogs diagnosed clinically as affected, yet the DNA test results are normal. This suggests that other genetic causes of PRA exist or that the diagnosed affected dog has an acquired disease that mimics the inherited disorder.

H. Rod-cone dysplasia, type 4 (*rcd4*)

A form of PRA identified in the Gordon and Irish Setter breeds. Clinical night blindness is observed on average as late as 10 years of age and progresses to total blindness. This form of PRA has been referred to as late-onset PRA (LOPRA). The disorder is caused by a mutation present in the *C2orf71* gene. A DNA test is now available that will unequivocally identify genetically normal, affected and carrier dogs. The test is accurate only for this mutation and will not identify other forms of PRA.

I. Cone degeneration: Day Blindness/Retinal degeneration:

An autosomal recessive disorder of standard poodles and 'Doodles' (where the mix-bred dogs are backcrossed to standard poodles that carry the genetic defect); the disease also has been referred to as achromatopsia. The salient clinical findings is profound visual difficulty in bright light, day blindness, with subjective normal night vision. In the early stages of the disease, fundus examination is normal with some dogs showing focal hyperreflectivity of the cone-rich fovea like region of the retina; the photopic ERG is not recordable. In some older dogs, there is progression resulting in poor/absent vision under both dim and bright light conditions, markedly abnormal or non-recordable ERG, and a fundus appearance indicative of late stage retinal degeneration and indistinguishable from progressive retinal atrophy.

J. Optic nerve hypoplasia

Hypoplasia of the optic nerve is seen in the Poodle. In this condition, the optic nerve fails to develop completely. The signs have a variety of expression and degrees of hypoplasia can be found. One or both eyes may be affected. Affected eyes may retain some function or be blind. The mode of inheritance is not clear.

K. Micropapilla

Micropapilla refers to a small optic disc which is not associated with vision impairment. Optic nerve hypoplasia refers to a congenital defect of the optic nerve which causes blindness and abnormal pupil response in the affected eye. May be difficult to differentiate between micropapilla and optic nerve hypoplasia on a routine (dilated) screening ophthalmoscopic exam.

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OCULAR DISORDERS REPORT
POODLE

	TOTAL DOGS EXAMINED	1991-2013 44336		2014-2018 9865	
Diagnostic Name		#	%	#	%
GLOBE					
0.110	microphthalmia	20	0.0%	3	0.0%
10.000	glaucoma	5	0.0%	1	0.0%
EYELIDS					
20.110	eyelid dermoid	1	0.0%	0	
20.140	ectopic cilia	33	0.1%	9	0.1%
20.160	macropalpebral fissure	1	0.0%	0	
21.000	entropion, unspecified	114	0.3%	24	0.2%
22.000	ectropion, unspecified	5	0.0%	2	0.0%
25.110	distichiasis	2788	6.3%	550	5.6%
NASOLACRIMAL					
32.110	imperforate lower nasolacrimal punctum	6	0.0%	9	0.1%
40.910	keratoconjunctivitis sicca	8	0.0%	3	0.0%
NICTITANS					
50.210	pannus of third eyelid	1	0.0%	0	
51.100	third eyelid cartilage anomaly	33	0.1%	11	0.1%
52.110	prolapsed gland of the third eyelid	18	0.0%	0	
CORNEA					
70.210	corneal pannus	39	0.1%	0	
70.220	pigmentary keratitis	24	0.1%	8	0.1%
70.700	corneal dystrophy	243	0.5%	62	0.6%
70.730	corneal endothelial degeneration	9	0.0%	3	0.0%
UVEA					
90.200	uveitis	0		1	0.0%
90.250	pigmentary uveitis	2	0.0%	0	
93.110	iris hypoplasia	1	0.0%	1	0.0%
93.140	corneal endothelial pigment without PPM	5	0.0%	0	
93.150	iris coloboma	5	0.0%	1	0.0%
93.710	persistent pupillary membranes, iris to iris	1302	2.9%	557	5.6%
93.720	persistent pupillary membranes, iris to lens	77	0.2%	26	0.3%
93.730	persistent pupillary membranes, iris to cornea	32	0.1%	4	0.0%
93.740	persistent pupillary membranes, iris sheets	38	0.1%	1	0.0%
93.750	persistent pupillary membranes, lens pigment foci/no strands	92	0.2%	197	2.0%
93.760	persistent pupillary membranes, endothelial opacity/no strands	3	0.0%	3	0.0%
93.810	uveal melanoma	2	0.0%	2	0.0%
93.999	uveal cysts	7	0.0%	3	0.0%
97.150	chorioretinal coloboma, congenital	1	0.0%	1	0.0%
LENS					
100.200	cataract, unspecified	384	0.9%	0	
100.210	cataract. suspect not inherited/significance unknown	2316	5.2%	552	5.6%
100.301	punctate cataract, anterior cortex	415	0.9%	73	0.7%
100.302	punctate cataract, posterior cortex	179	0.4%	32	0.3%
100.303	punctate cataract, equatorial cortex	112	0.3%	25	0.3%
100.304	punctate cataract, anterior sutures	51	0.1%	11	0.1%

LENS CONTINUED		1991-2013		2014-2018	
100.305	punctate cataract, posterior sutures	107	0.2%	48	0.5%
100.306	punctate cataract, nucleus	35	0.1%	11	0.1%
100.307	punctate cataract, capsular	35	0.1%	30	0.3%
100.311	incipient cataract, anterior cortex	456	1.0%	52	0.5%
100.312	incipient cataract, posterior cortex	379	0.9%	46	0.5%
100.313	incipient cataract, equatorial cortex	243	0.5%	40	0.4%
100.314	incipient cataract, anterior sutures	36	0.1%	1	0.0%
100.315	incipient cataract, posterior sutures	83	0.2%	14	0.1%
100.316	incipient cataract, nucleus	61	0.1%	14	0.1%
100.317	incipient cataract, capsular	34	0.1%	12	0.1%
100.321	incomplete cataract, anterior cortex	2	0.0%	18	0.2%
100.322	incomplete cataract, posterior cortex	3	0.0%	22	0.2%
100.323	incomplete cataract, equatorial cortex	4	0.0%	10	0.1%
100.324	incomplete cataract, anterior sutures	0		1	0.0%
100.325	incomplete cataract, posterior sutures	0		1	0.0%
100.326	incomplete cataract, nucleus	2	0.0%	3	0.0%
100.327	incomplete cataract, capsular	0		2	0.0%
100.328	posterior suture tip opacities	10	0.0%	80	0.8%
100.330	generalized/complete cataract	418	0.9%	15	0.2%
100.340	resorbing/hypermature cataract	1	0.0%	4	0.0%
100.375	subluxation/luxation, unspecified	24	0.1%	5	0.1%
100.999	*significant cataracts (summary)*	*3040*	*6.9%*	*485*	*4.9%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	63	0.1%	43	0.4%
110.135	PHPV/PTVL	23	0.1%	8	0.1%
110.200	vitritis	3	0.0%	16	0.2%
110.320	vitreal degeneration	288	0.6%	63	0.6%
FUNDUS					
97.110	choroidal hypoplasia	3	0.0%	0	
97.120	coloboma	11	0.0%	0	
RETINA					
120.170	retinal dysplasia, folds	120	0.3%	29	0.3%
120.180	retinal dysplasia, geographic	19	0.0%	3	0.0%
120.190	retinal dysplasia, detached	9	0.0%	1	0.0%
120.310	generalized progressive retinal atrophy (PRA)	575	1.3%	17	0.2%
120.400	retinal hemorrhage	3	0.0%	0	
120.910	retinal detachment without dialysis	27	0.1%	0	
120.920	retinal detachment with dialysis	1	0.0%	4	0.0%
120.960	retinopathy	7	0.0%	10	0.1%
OPTIC NERVE					
130.110	micropapilla	119	0.3%	76	0.8%
130.120	optic nerve hypoplasia	196	0.4%	42	0.4%
130.150	optic disc coloboma	48	0.1%	5	0.1%
OTHER					
900.000	other, unspecified	433	1.0%	0	
900.100	other, not inherited	954	2.2%	432	4.4%
900.110	other. suspect not inherited/significance unknown	198	0.4%	36	0.4%

	1991-2013	2014-2018
NORMAL		
0.000 normal globe	36169 81.6%	7206 73.0%

OCULAR DISORDERS REPORT
PORCELAINE HOUND

There are insufficient breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the PORCELAINE HOUND breed. Therefore, there are no conditions listed with breeding advice.

OCULAR DISORDERS REPORT
PORCELAINE HOUND

Diagnostic Name	TOTAL DOGS EXAMINED	1991-2013 0 #	%	2014-2018 24 #	%
OTHER					
900.100	other, not inherited	0		1	4.2%
NORMAL					
0.000	normal globe	0		23	95.8%

PORTUGUESE PODENGO PEQUENO

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Distichiasis	Not defined	1	Breeder option	
B.	Persistent pupillary membranes - iris to iris	Not defined	2	Breeder option	
C.	Cataract	Not defined	3	NO	
D.	Vitreous degeneration	Not defined	1	Breeder option	
E.	Retinal atrophy - rod-cone dysplasia type 3 (*rcd3*)	Autosomal recessive	4	NO	Mutation in the *PDE6A* gene
F.	Retinal atrophy - generalized (*prcd*)	Autosomal recessive	5	NO	Mutation in the *prcd* gene

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

C. Cataracts

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary

membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

D. Vitreous degeneration

A liquefaction of the vitreous gel which may predispose to retinal detachment.

E. Retinal atrophy - rod-cone dysplasia type 3 (*rcd3*)

PRA in the Protuguese Podengo Pequeno is an autosomal recessive trait caused by a one base pair deletion in the gene encoding the alpha subunit of cyclic GMP phosphodiesterase (rcd3). PRA begins early in life with clinical signs of night blindness and a lack of rod ERG responses is seen at 6-8 weeks of age. Dogs are completely blind by 2-3 years of age when ophthalmoscopic signs are first visible. The mutation is found in the *PDE6A* gene. A DNA test is available.

F. Retinal atrophy - generalized (*prcd)*

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

Other forms of retinal degeneration that are not *prcd* are recognized in the Portuguese Podengo Pequeno. The currently available genetic test will not detect these other forms of PRA.

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OCULAR DISORDERS REPORT
PORTUGUESE PODENGO PEQUENO

		1991-2013		2014-2018	
	TOTAL DOGS EXAMINED	**39**		**287**	
Diagnostic Name		**#**	**%**	**#**	**%**
EYELIDS					
25.110	distichiasis	1	2.6%	13	4.5%
CORNEA					
70.700	corneal dystrophy	0		3	1.0%
UVEA					
93.710	persistent pupillary membranes, iris to iris	2	5.1%	12	4.2%
93.730	persistent pupillary membranes, iris to cornea	0		1	0.3%
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		1	0.3%
LENS					
100.210	cataract. suspect not inherited/significance unknown	1	2.6%	7	2.4%
100.301	punctate cataract, anterior cortex	0		1	0.3%
100.302	punctate cataract, posterior cortex	0		1	0.3%
100.303	punctate cataract, equatorial cortex	0		2	0.7%
100.306	punctate cataract, nucleus	0		1	0.3%
100.311	incipient cataract, anterior cortex	0		5	1.7%
100.312	incipient cataract, posterior cortex	1	2.6%	1	0.3%
100.313	incipient cataract, equatorial cortex	0		1	0.3%
100.315	incipient cataract, posterior sutures	0		2	0.7%
100.316	incipient cataract, nucleus	0		2	0.7%
100.317	incipient cataract, capsular	1	2.6%	0	
100.325	incomplete cataract, posterior sutures	0		1	0.3%
100.328	posterior suture tip opacities	0		1	0.3%
100.330	generalized/complete cataract	0		1	0.3%
100.340	resorbing/hypermature cataract	0		1	0.3%
100.375	subluxation/luxation, unspecified	0		3	1.0%
100.999	*significant cataracts (summary)*	*2*	*5.1%*	*19*	*6.6%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	0		2	0.7%
110.200	vitritis	0		6	2.1%
110.320	vitreal degeneration	1	2.6%	10	3.5%
RETINA					
120.310	generalized progressive retinal atrophy (PRA)	0		5	1.7%
120.960	retinopathy	1	2.6%	2	0.7%
OTHER					
900.100	other, not inherited	0		12	4.2%
NORMAL					
0.000	normal globe	32	82.1%	216	75.3%

OCULAR DISORDERS REPORT
PORTUGUESE PODENGO

There are insufficient breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the PORTUGUESE PODENGO breed. Therefore, there are no conditions listed with breeding advice.

OCULAR DISORDERS REPORT
PORTUGUESE PODENGO

Diagnostic Name	TOTAL DOGS EXAMINED	1991-2013 43 #	 %	2014-2018 6 #	 %
EYELIDS					
20.140	ectopic cilia	1	2.3%	0	
25.110	distichiasis	1	2.3%	0	
UVEA					
93.710	persistent pupillary membranes, iris to iris	2	4.7%	1	16.7%
LENS					
100.210	cataract. suspect not inherited/significance unknown	2	4.7%	0	
100.301	punctate cataract, anterior cortex	1	2.3%	0	
100.999	*significant cataracts (summary)*	*1*	*2.3%*	*0*	
VITREOUS					
110.320	vitreal degeneration	1	2.3%	0	
RETINA					
120.170	retinal dysplasia, folds	1	2.3%	0	
120.960	retinopathy	1	2.3%	0	
OTHER					
900.000	other, unspecified	1	2.3%	0	
900.100	other, not inherited	0		2	33.3%
NORMAL					
0.000	normal globe	40	93.0%	3	50.0%

OCULAR DISORDERS REPORT
PORTUGUESE POINTER

There are insufficient breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the PORTUGUESE POINTER breed. Therefore, there are no conditions listed with breeding advice.

OCULAR DISORDERS REPORT
PORTUGUESE POINTER

Diagnostic Name	TOTAL DOGS EXAMINED	1991-2013 9 #	 %	2014-2018 2 #	 %
LENS					
100.311	incipient cataract, anterior cortex	1	11.1%	0	
100.316	incipient cataract, nucleus	1	11.1%	0	
100.999	*significant cataracts (summary)*	*2*	*22.2%*	*0*	
NORMAL					
0.000	normal globe	7	77.8%	2	100.0%

PORTUGUESE WATER DOG

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Microphthalmia with multiple ocular defects	Not defined	1, 2	NO	
B.	Distichiasis	Not defined	1	Breeder option	
C.	Corneal dystrophy - epithelial/stromal	Not defined	3	Breeder option	
D.	Persistent pupillary membranes - iris to iris - lens pigment foci/no strands	Not defined Not defined	1 4	Breeder option Passes with no notation	
E.	Cataract	Not defined	1	NO	
F.	Retinal atrophy - generalized (*prcd*)	Autosomal recessive	1, 5, 6	NO	Mutation in the *prcd* gene
G.	Retinal dysplasia - folds	Not defined	7, 8	Breeder option	

Description and Comments

A. Microphthalmia with multiple congenital ocular defects

This is a congenital abnormality present bilaterally and characterized by a small globe and associated ocular defects which can affect the cornea, anterior chamber, lens and/or retina. These associated defects may be variable in severity. Several cases have been identified, all of which appeared to have a common ancestry. All affected animals so far identified have been the progeny of dogs that were phenotypically normal, suggesting that the defect is not dominantly inherited.

B. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established, although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

C. Corneal dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

D. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

E. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

F. Retinal atrophy - generalized (*prcd*)

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

Studies have shown that the principal form of PRA in the Portuguese Water Dog is *prcd* which is a late-onset form of PRA inherited as autosomal recessive. The mutation is allelic to that present in Miniature Poodles, Labrador Retrievers, English and American Cocker Spaniels and others. The locus is termed the progressive rod-cone degeneration (*prcd*) gene and at least 30+ breeds are affected. In most affected dogs to date, the disease is recognized clinically in dogs 3-6 years of age or older. This photoreceptor degeneration is characterized by slow death of visual cells following their normal development. The disease begins clinically with signs of night blindness followed by day blindness. A DNA test is available.

A second, earlier onset form of PRA has also been identified recently in the Portuguese Water Dog. The onset of visual deficits occurs at 2-3 years of age, and, dogs show advanced retinal degeneration at the time visual deficits are recognized. The condition appears inherited as autosomal recessive. A DNA test is available.

G. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic,

detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

References

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OCULAR DISORDERS REPORT
PORTUGUESE WATER DOG

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2013 25617 #	%	2014-2018 9046 #	%
GLOBE						
0.110	microphthalmia		15	0.1%	13	0.1%
10.000	glaucoma		5	0.0%	1	0.0%
EYELIDS						
20.140	ectopic cilia		3	0.0%	0	
20.160	macropalpebral fissure		1	0.0%	0	
21.000	entropion, unspecified		43	0.2%	20	0.2%
22.000	ectropion, unspecified		3	0.0%	0	
25.110	distichiasis		947	3.7%	299	3.3%
NASOLACRIMAL						
32.110	imperforate lower nasolacrimal punctum		0		1	0.0%
40.910	keratoconjunctivitis sicca		6	0.0%	2	0.0%
NICTITANS						
51.100	third eyelid cartilage anomaly		0		1	0.0%
52.110	prolapsed gland of the third eyelid		1	0.0%	0	
CORNEA						
70.210	corneal pannus		4	0.0%	0	
70.220	pigmentary keratitis		3	0.0%	4	0.0%
70.700	corneal dystrophy		153	0.6%	140	1.5%
70.730	corneal endothelial degeneration		4	0.0%	3	0.0%
UVEA						
93.110	iris hypoplasia		2	0.0%	2	0.0%
93.140	corneal endothelial pigment without PPM		2	0.0%	0	
93.150	iris coloboma		1	0.0%	0	
93.710	persistent pupillary membranes, iris to iris		1461	5.7%	763	8.4%
93.720	persistent pupillary membranes, iris to lens		34	0.1%	13	0.1%
93.730	persistent pupillary membranes, iris to cornea		29	0.1%	6	0.1%
93.740	persistent pupillary membranes, iris sheets		42	0.2%	1	0.0%
93.750	persistent pupillary membranes, lens pigment foci/no strands		12	0.0%	65	0.7%
93.760	persistent pupillary membranes, endothelial opacity/no strands		5	0.0%	5	0.1%
93.810	uveal melanoma		6	0.0%	0	
93.999	uveal cysts		9	0.0%	6	0.1%
LENS						
100.200	cataract, unspecified		69	0.3%	0	
100.210	cataract. suspect not inherited/significance unknown		1621	6.3%	661	7.3%
100.301	punctate cataract, anterior cortex		127	0.5%	50	0.6%
100.302	punctate cataract, posterior cortex		53	0.2%	20	0.2%
100.303	punctate cataract, equatorial cortex		53	0.2%	6	0.1%
100.304	punctate cataract, anterior sutures		15	0.1%	9	0.1%
100.305	punctate cataract, posterior sutures		23	0.1%	18	0.2%
100.306	punctate cataract, nucleus		11	0.0%	7	0.1%
100.307	punctate cataract, capsular		21	0.1%	9	0.1%
100.311	incipient cataract, anterior cortex		90	0.4%	21	0.2%
100.312	incipient cataract, posterior cortex		76	0.3%	23	0.3%

LENS CONTINUED		1991-2013		2014-2018	
100.313	incipient cataract, equatorial cortex	77	0.3%	19	0.2%
100.314	incipient cataract, anterior sutures	8	0.0%	5	0.1%
100.315	incipient cataract, posterior sutures	13	0.1%	4	0.0%
100.316	incipient cataract, nucleus	18	0.1%	7	0.1%
100.317	incipient cataract, capsular	18	0.1%	8	0.1%
100.321	incomplete cataract, anterior cortex	3	0.0%	9	0.1%
100.322	incomplete cataract, posterior cortex	3	0.0%	9	0.1%
100.323	incomplete cataract, equatorial cortex	1	0.0%	5	0.1%
100.324	incomplete cataract, anterior sutures	0		1	0.0%
100.326	incomplete cataract, nucleus	1	0.0%	1	0.0%
100.328	posterior suture tip opacities	14	0.1%	67	0.7%
100.330	generalized/complete cataract	66	0.3%	14	0.2%
100.340	resorbing/hypermature cataract	0		2	0.0%
100.375	subluxation/luxation, unspecified	10	0.0%	2	0.0%
100.999	*significant cataracts (summary)*	*746*	*2.9%*	*247*	*2.7%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	35	0.1%	22	0.2%
110.135	PHPV/PTVL	16	0.1%	4	0.0%
110.200	vitritis	0		3	0.0%
110.320	vitreal degeneration	37	0.1%	11	0.1%
FUNDUS					
97.110	choroidal hypoplasia	2	0.0%	0	
RETINA					
120.170	retinal dysplasia, folds	193	0.8%	100	1.1%
120.180	retinal dysplasia, geographic	19	0.1%	0	
120.190	retinal dysplasia, detached	2	0.0%	0	
120.310	generalized progressive retinal atrophy (PRA)	171	0.7%	6	0.1%
120.400	retinal hemorrhage	8	0.0%	0	
120.910	retinal detachment without dialysis	3	0.0%	0	
120.920	retinal detachment with dialysis	1	0.0%	2	0.0%
120.960	retinopathy	0		4	0.0%
OPTIC NERVE					
130.110	micropapilla	9	0.0%	10	0.1%
130.120	optic nerve hypoplasia	11	0.0%	0	
130.150	optic disc coloboma	6	0.0%	0	
OTHER					
900.000	other, unspecified	313	1.2%	0	
900.100	other, not inherited	599	2.3%	373	4.1%
900.110	other. suspect not inherited/significance unknown	70	0.3%	5	0.1%
NORMAL					
0.000	normal globe	21939	85.6%	6661	73.6%

OCULAR DISORDERS REPORT
PUDELPOINTER

There are insufficient breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the PUDELPOINTER breed. Therefore, there are no conditions listed with breeding advice.

OCULAR DISORDERS REPORT
PUDELPOINTER

Diagnostic Name	TOTAL DOGS EXAMINED	1991-2013 2 #	1991-2013 2 %	2014-2018 3 #	2014-2018 3 %
OTHER					
900.100 other, not inherited		0		1	33.3%
NORMAL					
0.000 normal globe		2	100.0%	2	66.7%

PUG

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Keratoconjunctivitis sicca	Not defined	1	NO
B.	Entropion	Not defined	2	Breeder option
C.	Distichiasis	Not defined	2	Breeder option
D.	Exposure/Pigmentary Keratitis/Pigmentary Keratopathy	Not defined	2, 3	Breeder option
E.	Persistent pupillary membranes - iris to iris	Not defined	4	Breeder option
F.	Cataract	Not defined	4, 5	NO
G.	Vitreous degeneration	Not defined	4	Breeder option
H.	Retinal dysplasia – folds	Presumed autosomal recessive	6	Breeder option

Description and Comments

A. Keratoconjunctivitis sicca (KCS)

An abnormality of the tear film, most commonly a deficiency of the aqueous portion, although the mucin and/or lipid layers may be affected; results in ocular irritation and/or vision impairment.

B. Entropion

A conformational defect resulting in an "in-rolling" of one or both of the eyelids which may cause ocular irritation. It is likely that entropion is influenced by several genes (polygenic), defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull. In the Pug, entropion usually involves the medial canthal margin of the lower eyelid(s).

C. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

D. Exposure/Pigmentary keratitis/Pigmentary keratopathy

A condition characterized by variable degrees of superficial vascularization, fibrosis and/or pigmentation of the cornea. May be associated with excessive exposure/irritation of the globe due to shallow orbits, lower eyelid medial entropion, lagophthalmos and macropalpebral fissure.

The breed standard indicates the Pug should have a "large massive round head with very large, bold and prominent eyes." These characteristics give rise to the ocular exposure and irritative problems common in the breed.

Pigmentary keratopathy is a condition reported in Pugs in which the cornea becomes pigmented, often resulting in vision impairment. Development of pigmentary keratopathy is associated with congenital uveal pathology - iris hypoplasia and the presence of persistent pupillary membranes - but not with other factors such as Schirmer tear test values or medial canthal entropion.

E. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally in the neonatal period. These strands may bridge from iris to iris, iris to cornea, iris to lens, or from sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

F. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

G. Vitreous degeneration

Liquefaction of the vitreous gel which may predispose to retinal detachment.

H. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

References

1. ACVO Genetics Committee, 2017 and/or Data from OFA All-Breeds Report, 2013-2017.

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OCULAR DISORDERS REPORT
PUG

		1991-2013 2309		2014-2018 639	
	TOTAL DOGS EXAMINED				
Diagnostic Name		#	%	#	%
GLOBE					
0.110	microphthalmia	3	0.1%	0	
EYELIDS					
20.110	eyelid dermoid	1	0.0%	0	
20.140	ectopic cilia	14	0.6%	1	0.2%
20.160	macropalpebral fissure	67	2.9%	0	
21.000	entropion, unspecified	457	19.8%	67	10.5%
22.000	ectropion, unspecified	10	0.4%	1	0.2%
25.110	distichiasis	201	8.7%	57	8.9%
NASOLACRIMAL					
40.910	keratoconjunctivitis sicca	2	0.1%	6	0.9%
NICTITANS					
50.210	pannus of third eyelid	0		1	0.2%
CORNEA					
70.210	corneal pannus	80	3.5%	0	
70.220	pigmentary keratitis	639	27.7%	337	52.7%
70.700	corneal dystrophy	12	0.5%	2	0.3%
70.730	corneal endothelial degeneration	4	0.2%	0	
UVEA					
90.200	uveitis	0		1	0.2%
93.150	iris coloboma	2	0.1%	1	0.2%
93.710	persistent pupillary membranes, iris to iris	213	9.2%	106	16.6%
93.720	persistent pupillary membranes, iris to lens	6	0.3%	2	0.3%
93.730	persistent pupillary membranes, iris to cornea	14	0.6%	2	0.3%
93.740	persistent pupillary membranes, iris sheets	1	0.0%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		1	0.2%
93.760	persistent pupillary membranes, endothelial opacity/no strands	3	0.1%	5	0.8%
93.999	uveal cysts	2	0.1%	0	
LENS					
100.200	cataract, unspecified	4	0.2%	0	
100.210	cataract. suspect not inherited/significance unknown	42	1.8%	21	3.3%
100.301	punctate cataract, anterior cortex	4	0.2%	1	0.2%
100.302	punctate cataract, posterior cortex	4	0.2%	0	
100.303	punctate cataract, equatorial cortex	5	0.2%	0	
100.304	punctate cataract, anterior sutures	1	0.0%	1	0.2%
100.305	punctate cataract, posterior sutures	6	0.3%	0	
100.306	punctate cataract, nucleus	4	0.2%	0	
100.307	punctate cataract, capsular	1	0.0%	3	0.5%
100.311	incipient cataract, anterior cortex	16	0.7%	3	0.5%
100.312	incipient cataract, posterior cortex	16	0.7%	4	0.6%
100.313	incipient cataract, equatorial cortex	7	0.3%	1	0.2%
100.315	incipient cataract, posterior sutures	5	0.2%	3	0.5%
100.316	incipient cataract, nucleus	4	0.2%	0	
100.317	incipient cataract, capsular	5	0.2%	0	

LENS CONTINUED		1991-2013		2014-2018	
100.321	incomplete cataract, anterior cortex	1	0.0%	2	0.3%
100.322	incomplete cataract, posterior cortex	1	0.0%	2	0.3%
100.324	incomplete cataract, anterior sutures	0		1	0.2%
100.325	incomplete cataract, posterior sutures	1	0.0%	1	0.2%
100.326	incomplete cataract, nucleus	1	0.0%	0	
100.330	generalized/complete cataract	12	0.5%	1	0.2%
100.999	*significant cataracts (summary)*	*98*	*4.2%*	*23*	*3.6%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	9	0.4%	7	1.1%
110.135	PHPV/PTVL	2	0.1%	1	0.2%
110.200	vitritis	1	0.0%	0	
110.320	vitreal degeneration	26	1.1%	4	0.6%
FUNDUS					
97.120	coloboma	1	0.0%	0	
RETINA					
120.170	retinal dysplasia, folds	17	0.7%	4	0.6%
120.180	retinal dysplasia, geographic	9	0.4%	3	0.5%
120.310	generalized progressive retinal atrophy (PRA)	3	0.1%	0	
120.400	retinal hemorrhage	1	0.0%	0	
120.910	retinal detachment without dialysis	1	0.0%	0	
OPTIC NERVE					
130.120	optic nerve hypoplasia	1	0.0%	0	
130.150	optic disc coloboma	1	0.0%	0	
OTHER					
900.000	other, unspecified	36	1.6%	0	
900.100	other, not inherited	164	7.1%	46	7.2%
900.110	other. suspect not inherited/significance unknown	67	2.9%	7	1.1%
NORMAL					
0.000	normal globe	1002	43.4%	174	27.2%

PULI

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Corneal dystrophy - epithelial/stromal	Not defined	1, 2	Breeder option	
B.	Persistent pupillary membranes				
	- iris to iris	Not defined	2	Breeder option	
	- iris to lens	Not defined	2	NO	
	- lens pigment foci/no strands	Not defined	3	Passes with no notation	
C.	Cataract	Not defined	4	NO	
D.	Lens luxation	Autosomal recessive	5	NO	Mutation in the *ADAMTS17* gene
E.	Retinal atrophy - generalized (*prcd*)	Autosomal recessive	3	NO	Mutation in the *prcd* gene
F.	Retinal dysplasia - folds	Not defined	6	Breeder option	

Description and Comments

A. Corneal Dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

B. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

C. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume

cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

D. Lens luxation

Partial (subluxation) or complete displacement of the lens from the normal anatomic site behind the pupil. Lens luxation may result in blinding retinal detachment and/or elevated intraocular pressure (glaucoma) causing vision impairment, pain, and blindness. A mutation in *ADAMTS17* has been associated with primary lens luxation. A DNA test is available.

E. Retinal atrophy – generalized (prcd)

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

Studies have shown that the principal form of PRA in the Puli is *prcd* which is a late-onset form of PRA inherited as autosomal recessive. The mutation is allelic to that present in Miniature Poodles, English and American Cocker Spaniels, and others. The locus is termed the progressive rod-cone degeneration (*prcd*) gene and at least 30+ breeds are affected. In most affected dogs to date, the disease is recognized clinically in dogs 3-6 years of age or older. This photoreceptor degeneration is characterized by slow death of visual cells following their normal development. The disease begins clinically with signs of night blindness followed by day blindness. A DNA test is available.

F. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

References

1. ACVO Genetics Committee, 2002-2003 and/or Data from CERF All-Breeds Report, 2002-2003.

2. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

3. ACVO Genetics Committee, 2017 and/or Data from OFA All-Breeds Report, 2013-2017.

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6. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

OCULAR DISORDERS REPORT
PULI

		1991-2013		2014-2018	
	TOTAL DOGS EXAMINED	999		193	
Diagnostic Name		#	%	#	%
EYELIDS					
20.110	eyelid dermoid	1	0.1%	0	
20.140	ectopic cilia	1	0.1%	0	
20.160	macropalpebral fissure	1	0.1%	0	
21.000	entropion, unspecified	7	0.7%	1	0.5%
25.110	distichiasis	6	0.6%	1	0.5%
CORNEA					
70.220	pigmentary keratitis	5	0.5%	0	
70.700	corneal dystrophy	18	1.8%	0	
70.730	corneal endothelial degeneration	1	0.1%	0	
UVEA					
93.710	persistent pupillary membranes, iris to iris	234	23.4%	37	19.2%
93.720	persistent pupillary membranes, iris to lens	13	1.3%	1	0.5%
93.730	persistent pupillary membranes, iris to cornea	8	0.8%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	1	0.1%	6	3.1%
93.760	persistent pupillary membranes, endothelial opacity/no strands	1	0.1%	0	
93.999	uveal cysts	1	0.1%	0	
LENS					
100.200	cataract, unspecified	3	0.3%	0	
100.210	cataract. suspect not inherited/significance unknown	59	5.9%	11	5.7%
100.301	punctate cataract, anterior cortex	5	0.5%	2	1.0%
100.302	punctate cataract, posterior cortex	2	0.2%	1	0.5%
100.305	punctate cataract, posterior sutures	6	0.6%	2	1.0%
100.306	punctate cataract, nucleus	3	0.3%	0	
100.307	punctate cataract, capsular	1	0.1%	1	0.5%
100.311	incipient cataract, anterior cortex	8	0.8%	3	1.6%
100.312	incipient cataract, posterior cortex	3	0.3%	1	0.5%
100.313	incipient cataract, equatorial cortex	7	0.7%	0	
100.315	incipient cataract, posterior sutures	1	0.1%	0	
100.316	incipient cataract, nucleus	3	0.3%	0	
100.317	incipient cataract, capsular	1	0.1%	0	
100.321	incomplete cataract, anterior cortex	0		1	0.5%
100.322	incomplete cataract, posterior cortex	0		2	1.0%
100.328	posterior suture tip opacities	0		3	1.6%
100.330	generalized/complete cataract	7	0.7%	0	
100.375	subluxation/luxation, unspecified	1	0.1%	0	
100.999	*significant cataracts (summary)*	*50*	*5.0%*	*13*	*6.7%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	1	0.1%	1	0.5%
110.135	PHPV/PTVL	0		1	0.5%
110.200	vitritis	0		1	0.5%
110.320	vitreal degeneration	1	0.1%	0	
RETINA					
120.170	retinal dysplasia, folds	42	4.2%	9	4.7%
120.180	retinal dysplasia, geographic	3	0.3%	0	

RETINA CONTINUED	1991-2013		2014-2018	
120.310 generalized progressive retinal atrophy (PRA)	4	0.4%	0	
120.400 retinal hemorrhage	1	0.1%	0	
120.910 retinal detachment without dialysis	2	0.2%	0	
OPTIC NERVE				
130.110 micropapilla	2	0.2%	0	
130.120 optic nerve hypoplasia	3	0.3%	0	
OTHER				
900.000 other, unspecified	13	1.3%	0	
900.100 other, not inherited	47	4.7%	4	2.1%
900.110 other. suspect not inherited/significance unknown	4	0.4%	0	
NORMAL				
0.000 normal globe	675	67.6%	121	62.7%

OCULAR DISORDERS REPORT
PUMI

There are insufficient breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the PUMI breed. Therefore, there are no conditions listed with breeding advice.

OCULAR DISORDERS REPORT
PUMI

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2013 53 #	 %	2014-2018 58 #	 %
CORNEA						
70.700	corneal dystrophy		0		1	1.7%
UVEA						
93.710	persistent pupillary membranes, iris to iris		3	5.7%	3	5.2%
93.750	persistent pupillary membranes, lens pigment foci/no strands		2	3.8%	1	1.7%
LENS						
100.210	cataract. suspect not inherited/significance unknown		3	5.7%	1	1.7%
100.315	incipient cataract, posterior sutures		0		1	1.7%
100.999	*significant cataracts (summary)*		*0*		*1*	*1.7%*
VITREOUS						
110.120	persistent hyaloid artery/remnant		1	1.9%	1	1.7%
110.320	vitreal degeneration		0		1	1.7%
OTHER						
900.000	other, unspecified		1	1.9%	0	
900.100	other, not inherited		1	1.9%	1	1.7%
NORMAL						
0.000	normal globe		53	100.0%	50	86.2%

OCULAR DISORDERS REPORT
PYRENEAN MASTIFF

There are insufficient breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the PYRENEAN MASTIFF breed. Therefore, there are no conditions listed with breeding advice.

OCULAR DISORDERS REPORT
PYRENEAN MASTIFF

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2013 0 #	%	2014-2018 6 #	%
EYELIDS						
21.000	entropion, unspecified		0		1	16.7%
22.000	ectropion, unspecified		0		2	33.3%
25.110	distichiasis		0		1	16.7%
UVEA						
93.710	persistent pupillary membranes, iris to iris		0		2	33.3%
LENS						
100.316	incipient cataract, nucleus		0		1	16.7%
100.999	*significant cataracts (summary)*		*0*		*1*	*16.7%*
OTHER						
900.100	other, not inherited		0		1	16.7%

PYRENEAN SHEPHERD

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder option
B.	Cataract	Not defined	1	NO
C.	Retinal dysplasia - folds	Not defined	2	Breeder option
D.	Choroidal hypoplasia	Not defined	1, 2	NO

Description and Comments

A. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

B. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

C. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

D. Choroidal hypoplasia

Inadequate development of the choroid present at birth and non-progressive. This condition is more commonly identified in the Collie breed where it is a manifestation of "Collie Eye Anomaly."

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Pyrenean Shepherd. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 2000-2002 and/or Data from CERF All-Breeds Report, 2000-2002.

2. ACVO Genetics Committee, 2014 and/or Data from OFA All-Breeds Report, 2013-2014.

OCULAR DISORDERS REPORT
PYRENEAN SHEPHERD

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2013 350 #	%	2014-2018 241 #	%
EYELIDS						
25.110	distichiasis		0		2	0.8%
NASOLACRIMAL						
32.110	imperforate lower nasolacrimal punctum		1	0.3%	0	
NICTITANS						
52.110	prolapsed gland of the third eyelid		1	0.3%	0	
CORNEA						
70.700	corneal dystrophy		1	0.3%	1	0.4%
UVEA						
93.110	iris hypoplasia		1	0.3%	1	0.4%
93.150	iris coloboma		1	0.3%	0	
93.710	persistent pupillary membranes, iris to iris		25	7.1%	3	1.2%
93.740	persistent pupillary membranes, iris sheets		1	0.3%	0	
LENS						
100.210	cataract. suspect not inherited/significance unknown		8	2.3%	5	2.1%
100.301	punctate cataract, anterior cortex		2	0.6%	1	0.4%
100.302	punctate cataract, posterior cortex		1	0.3%	1	0.4%
100.303	punctate cataract, equatorial cortex		1	0.3%	0	
100.305	punctate cataract, posterior sutures		1	0.3%	2	0.8%
100.311	incipient cataract, anterior cortex		5	1.4%	0	
100.312	incipient cataract, posterior cortex		1	0.3%	0	
100.313	incipient cataract, equatorial cortex		2	0.6%	0	
100.315	incipient cataract, posterior sutures		0		1	0.4%
100.316	incipient cataract, nucleus		1	0.3%	6	2.5%
100.322	incomplete cataract, posterior cortex		0		4	1.7%
100.326	incomplete cataract, nucleus		0		2	0.8%
100.328	posterior suture tip opacities		0		1	0.4%
100.375	subluxation/luxation, unspecified		1	0.3%	0	
100.999	*significant cataracts (summary)*		*14*	*4.0%*	*17*	*7.1%*
VITREOUS						
110.120	persistent hyaloid artery/remnant		4	1.1%	1	0.4%
110.320	vitreal degeneration		0		1	0.4%
FUNDUS						
97.110	choroidal hypoplasia		10	2.9%	11	4.6%
RETINA						
120.170	retinal dysplasia, folds		9	2.6%	3	1.2%
120.180	retinal dysplasia, geographic		1	0.3%	0	
120.310	generalized progressive retinal atrophy (PRA)		0		1	0.4%
OTHER						
900.000	other, unspecified		9	2.6%	0	
900.100	other, not inherited		13	3.7%	11	4.6%

	1991-2013	2014-2018
NORMAL		
0.000 normal globe	294 84.0%	198 82.2%

RAT TERRIER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder option	
B.	Cataract	Not defined	1	NO	
C.	Retinal atrophy - generalized (*prcd*)	Autosomal recessive	2	NO	Mutation in the *prcd* gene
D.	Lens luxation	Autosomal recessive	3, 4	NO	Mutation in the *ADAMTS17* gene

Description and Comments

A. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

B. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

C. Retinal atrophy - generalized (*prcd*)

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

D. Lens luxation

Partial (subluxation) or complete displacement of the lens from the normal anatomic site behind the pupil. Lens luxation not associated with trauma or inflammation is presumed to be inherited. Lens luxation may result in elevated intraocular pressure (glaucoma),

causing vision impairment or blindness. A mutation in *ADAMTS17* has been associated with primary lens luxation. A DNA test is available.

References

1. ACVO Genetics Committee, 2000-2002 and/or Data from CERF All-Breeds Report, 2000-2002.

2. ACVO Genetics Committee, 2016 and/or Data from CERF/OFA All-Breeds Report, 2010-2015.

3. Farias FH, Johnson GS, Taylor JF, et al. An ADAMTS17 splice donor site mutation in dogs with primary lens luxation. *Invest Ophthalmol Vis Sci*. 2010;51:4716-4721.

4. Gould D, Pettitt L, McLaughlin B, et al. ADAMTS17 mutation associated with primary lens luxation is widespread among breeds. *Vet Ophthalmol*. 2011;14:378-384.

OCULAR DISORDERS REPORT
RAT TERRIER

Diagnostic Name		1991-2013 TOTAL DOGS EXAMINED 230 #	 %	2014-2018 83 #	 %
EYELIDS					
25.110	distichiasis	3	1.3%	2	2.4%
UVEA					
93.710	persistent pupillary membranes, iris to iris	6	2.6%	3	3.6%
93.730	persistent pupillary membranes, iris to cornea	1	0.4%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		2	2.4%
LENS					
100.210	cataract. suspect not inherited/significance unknown	3	1.3%	2	2.4%
100.303	punctate cataract, equatorial cortex	0		1	1.2%
100.311	incipient cataract, anterior cortex	3	1.3%	0	
100.312	incipient cataract, posterior cortex	2	0.9%	1	1.2%
100.313	incipient cataract, equatorial cortex	1	0.4%	1	1.2%
100.315	incipient cataract, posterior sutures	1	0.4%	0	
100.316	incipient cataract, nucleus	1	0.4%	0	
100.330	generalized/complete cataract	4	1.7%	0	
100.375	subluxation/luxation, unspecified	3	1.3%	0	
100.999	*significant cataracts (summary)*	*12*	*5.2%*	*3*	*3.6%*
VITREOUS					
110.200	vitritis	1	0.4%	1	1.2%
110.320	vitreal degeneration	3	1.3%	0	
RETINA					
120.190	retinal dysplasia, detached	1	0.4%	0	
120.310	generalized progressive retinal atrophy (PRA)	1	0.4%	0	
OTHER					
900.000	other, unspecified	3	1.3%	0	
900.100	other, not inherited	0		2	2.4%
900.110	other. suspect not inherited/significance unknown	1	0.4%	0	
NORMAL					
0.000	normal globe	210	91.3%	72	86.7%

OCULAR DISORDERS REPORT
REDBONE COONHOUND

There are insufficient breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the REDBONE COONHOUND breed. Therefore, there are no conditions listed with breeding advice.

OCULAR DISORDERS REPORT
REDBONE COONHOUND

Diagnostic Name		1991-2013 TOTAL DOGS EXAMINED 5 #	 %	2014-2018 40 #	 %
EYELIDS					
21.000	entropion, unspecified	0		1	2.5%
25.110	distichiasis	0		1	2.5%
NICTITANS					
52.110	prolapsed gland of the third eyelid	0		1	2.5%
UVEA					
93.750	persistent pupillary membranes, lens pigment foci/no strands	1	20.0%	0	
LENS					
100.210	cataract. suspect not inherited/significance unknown	0		1	2.5%
RETINA					
120.310	generalized progressive retinal atrophy (PRA)	0		1	2.5%
120.960	retinopathy	0		1	2.5%
OTHER					
900.100	other, not inherited	1	20.0%	0	
NORMAL					
0.000	normal globe	4	80.0%	35	87.5%

RHODESIAN RIDGEBACK

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Distichiasis	Not defined	1	Breeder option
B.	Entropion	Not defined	2	NO
C.	Persistent pupillary membranes			
	- iris to iris	Not defined	3	Breeder option
	- lens pigment foci/no strands	Not defined	4	Passes with no notation
D.	Cataract	Not defined	1	NO

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Entropion

A conformational defect resulting in an "in-rolling" of one or both of the eyelids which may cause ocular irritation. It is likely that entropion is influenced by several genes (polygenic), defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

C. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

D. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Rhodesian Ridgeback breed. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

2. Breed club request to ACVO Genetics Committee, 2008.

3. ACVO Genetics Committee, 2000-2002 and/or Data from CERF All-Breeds Report, 2000-2002.

4. ACVO Genetics Committee, 2017 and/or Data from OFA All-Breeds Report 2013-2017.

OCULAR DISORDERS REPORT
RHODESIAN RIDGEBACK

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2013 3851 #	%	2014-2018 1492 #	%
GLOBE						
0.110	microphthalmia		2	0.1%	0	
EYELIDS						
21.000	entropion, unspecified		13	0.3%	2	0.1%
22.000	ectropion, unspecified		1	0.0%	0	
25.110	distichiasis		115	3.0%	29	1.9%
NICTITANS						
51.100	third eyelid cartilage anomaly		3	0.1%	2	0.1%
52.110	prolapsed gland of the third eyelid		3	0.1%	0	
CORNEA						
70.210	corneal pannus		6	0.2%	0	
70.700	corneal dystrophy		21	0.5%	8	0.5%
UVEA						
93.110	iris hypoplasia		1	0.0%	0	
93.140	corneal endothelial pigment without PPM		4	0.1%	0	
93.710	persistent pupillary membranes, iris to iris		227	5.9%	80	5.4%
93.720	persistent pupillary membranes, iris to lens		6	0.2%	1	0.1%
93.730	persistent pupillary membranes, iris to cornea		2	0.1%	0	
93.740	persistent pupillary membranes, iris sheets		1	0.0%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands		28	0.7%	69	4.6%
93.760	persistent pupillary membranes, endothelial opacity/no strands		3	0.1%	2	0.1%
93.810	uveal melanoma		1	0.0%	2	0.1%
93.999	uveal cysts		2	0.1%	4	0.3%
97.150	chorioretinal coloboma, congenital		0		1	0.1%
LENS						
100.200	cataract, unspecified		4	0.1%	0	
100.210	cataract. suspect not inherited/significance unknown		182	4.7%	66	4.4%
100.301	punctate cataract, anterior cortex		10	0.3%	4	0.3%
100.302	punctate cataract, posterior cortex		38	1.0%	14	0.9%
100.303	punctate cataract, equatorial cortex		2	0.1%	0	
100.304	punctate cataract, anterior sutures		0		1	0.1%
100.305	punctate cataract, posterior sutures		18	0.5%	6	0.4%
100.307	punctate cataract, capsular		9	0.2%	4	0.3%
100.311	incipient cataract, anterior cortex		4	0.1%	6	0.4%
100.312	incipient cataract, posterior cortex		78	2.0%	15	1.0%
100.313	incipient cataract, equatorial cortex		7	0.2%	3	0.2%
100.315	incipient cataract, posterior sutures		12	0.3%	6	0.4%
100.316	incipient cataract, nucleus		4	0.1%	1	0.1%
100.317	incipient cataract, capsular		15	0.4%	5	0.3%
100.322	incomplete cataract, posterior cortex		0		3	0.2%
100.324	incomplete cataract, anterior sutures		1	0.0%	0	
100.325	incomplete cataract, posterior sutures		0		1	0.1%
100.328	posterior suture tip opacities		6	0.2%	21	1.4%
100.330	generalized/complete cataract		3	0.1%	0	
100.375	subluxation/luxation, unspecified		3	0.1%	0	

LENS CONTINUED		1991-2013		2014-2018	
100.999	*significant cataracts (summary)*	*205*	*5.3%*	*69*	*4.6%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	1	0.0%	4	0.3%
110.135	PHPV/PTVL	1	0.0%	0	
110.200	vitritis	0		4	0.3%
110.320	vitreal degeneration	10	0.3%	3	0.2%
RETINA					
120.170	retinal dysplasia, folds	5	0.1%	2	0.1%
120.180	retinal dysplasia, geographic	1	0.0%	0	
120.190	retinal dysplasia, detached	1	0.0%	0	
120.310	generalized progressive retinal atrophy (PRA)	4	0.1%	1	0.1%
120.910	retinal detachment without dialysis	2	0.1%	0	
OPTIC NERVE					
130.110	micropapilla	1	0.0%	0	
130.120	optic nerve hypoplasia	1	0.0%	0	
130.150	optic disc coloboma	5	0.1%	0	
OTHER					
900.000	other, unspecified	51	1.3%	0	
900.100	other, not inherited	101	2.6%	55	3.7%
900.110	other. suspect not inherited/significance unknown	10	0.3%	2	0.1%
NORMAL					
0.000	normal globe	3281	85.2%	1151	77.1%

ROTTWEILER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Entropion	Not defined	1, 2	Breeder option
B.	Corneal dystrophy - epithelial/stromal	Not defined	1	Breeder option
C.	Uveal cysts	Not defined	1, 3, 4	Breeder option
D.	Persistent pupillary membranes - iris to iris - lens pigment foci/no strands	Not defined Not defined	5 6	Breeder option Passes with no notation
E.	Cataract	Not defined	1, 3	NO
F.	Retinal atrophy - generalized	Not defined	1	NO
G.	Retinal dysplasia - folds	Not defined	1, 4	Breeder option

Description and Comments

A. Entropion

A conformational defect resulting in an "in-rolling" of one or both of the eyelids which may cause ocular irritation. It is likely that entropion is influenced by several genes (polygenic), defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

Entropion in the Rottweiler has been observed with increasing frequency in the past few years. Selection should be directed against entropion and toward a head conformation that minimizes or eliminates the likelihood of the defect. The entropion usually involves the lower eyelids in this breed and requires surgical correction.

B. Corneal dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

C. Uveal cysts

A pigmented, fluid-filled epithelial-lined structure arising from the posterior iris or ciliary body epithelium. Cysts may remain attached to the pupil margin, iris, or ciliary body, or may detach and be free-floating within the anterior chamber. They may rupture and adhere to the cornea or anterior lens capsule. Uveal cysts may occur in any breed. Uveal cysts are commonly benign, although they may be associated with other pathologic conditions is various breeds.

D. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

E. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

A variety of cataracts have been observed in this breed ranging from the posterior polar cataract similar to that in the Golden Retriever and cataracts involving multiple areas of the nucleus and cortex. Further studies need to be performed as to the exact mode of inheritance, but it is our recommendation that the individually afflicted dog should not be bred.

F. Retinal atrophy - generalized

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. Except for X-linked PRA in the Siberian Husky, in all breeds studied to date, PRA is inherited as an autosomal recessive trait.

G. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

References

1. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

2. ACVO Genetics Committee, 2001 and/or Data from CERF All-Breeds Report, 2001.

3. Bjerkas E. Progressive retinal atrophy in dogs in Norway. *Norsk Veterinaertidsskrift.* 1991;103:601-610.

4. Bedford PG. Multifocal retinal dysplasia in the Rottweiler. *Vet Rec.* 1982 Sep 25;111:304-305.

5. ACVO Genetics Committee, 2006 and/or Data from CERF All-Breeds Report, 2001-2005.

6. ACVO Genetics Committee, 2017 and/or Data from OFA All-Breeds Report, 2013-2017.

OCULAR DISORDERS REPORT
ROTTWEILER

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2013 13450 #	%	2014-2018 3162 #	%
GLOBE						
0.110	microphthalmia		3	0.0%	0	
EYELIDS						
20.140	ectopic cilia		1	0.0%	0	
20.160	macropalpebral fissure		10	0.1%	0	
21.000	entropion, unspecified		112	0.8%	20	0.6%
22.000	ectropion, unspecified		29	0.2%	2	0.1%
25.110	distichiasis		76	0.6%	25	0.8%
NASOLACRIMAL						
32.110	imperforate lower nasolacrimal punctum		0		1	0.0%
40.910	keratoconjunctivitis sicca		2	0.0%	1	0.0%
NICTITANS						
51.100	third eyelid cartilage anomaly		3	0.0%	1	0.0%
52.110	prolapsed gland of the third eyelid		14	0.1%	3	0.1%
CORNEA						
70.210	corneal pannus		3	0.0%	0	
70.220	pigmentary keratitis		2	0.0%	0	
70.700	corneal dystrophy		122	0.9%	33	1.0%
70.730	corneal endothelial degeneration		7	0.1%	0	
UVEA						
93.110	iris hypoplasia		10	0.1%	2	0.1%
93.140	corneal endothelial pigment without PPM		1	0.0%	0	
93.150	iris coloboma		46	0.3%	10	0.3%
93.710	persistent pupillary membranes, iris to iris		111	0.8%	19	0.6%
93.720	persistent pupillary membranes, iris to lens		37	0.3%	3	0.1%
93.730	persistent pupillary membranes, iris to cornea		49	0.4%	9	0.3%
93.740	persistent pupillary membranes, iris sheets		8	0.1%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands		54	0.4%	146	4.6%
93.760	persistent pupillary membranes, endothelial opacity/no strands		10	0.1%	6	0.2%
93.810	uveal melanoma		3	0.0%	1	0.0%
93.999	uveal cysts		209	1.6%	126	4.0%
LENS						
100.200	cataract, unspecified		229	1.7%	0	
100.210	cataract. suspect not inherited/significance unknown		777	5.8%	225	7.1%
100.301	punctate cataract, anterior cortex		90	0.7%	44	1.4%
100.302	punctate cataract, posterior cortex		241	1.8%	47	1.5%
100.303	punctate cataract, equatorial cortex		9	0.1%	2	0.1%
100.304	punctate cataract, anterior sutures		13	0.1%	3	0.1%
100.305	punctate cataract, posterior sutures		75	0.6%	16	0.5%
100.306	punctate cataract, nucleus		27	0.2%	6	0.2%
100.307	punctate cataract, capsular		28	0.2%	30	0.9%
100.311	incipient cataract, anterior cortex		97	0.7%	23	0.7%
100.312	incipient cataract, posterior cortex		478	3.6%	88	2.8%
100.313	incipient cataract, equatorial cortex		36	0.3%	6	0.2%

LENS CONTINUED		1991-2013		2014-2018	
100.314	incipient cataract, anterior sutures	10	0.1%	2	0.1%
100.315	incipient cataract, posterior sutures	69	0.5%	12	0.4%
100.316	incipient cataract, nucleus	52	0.4%	7	0.2%
100.317	incipient cataract, capsular	30	0.2%	16	0.5%
100.321	incomplete cataract, anterior cortex	0		7	0.2%
100.322	incomplete cataract, posterior cortex	4	0.0%	10	0.3%
100.323	incomplete cataract, equatorial cortex	0		1	0.0%
100.325	incomplete cataract, posterior sutures	0		1	0.0%
100.327	incomplete cataract, capsular	1	0.0%	3	0.1%
100.328	posterior suture tip opacities	0		23	0.7%
100.330	generalized/complete cataract	48	0.4%	2	0.1%
100.375	subluxation/luxation, unspecified	2	0.0%	1	0.0%
100.999	*significant cataracts (summary)*	*1537*	*11.4%*	*326*	*10.3%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	19	0.1%	12	0.4%
110.135	PHPV/PTVL	7	0.1%	1	0.0%
110.200	vitritis	0		2	0.1%
110.320	vitreal degeneration	63	0.5%	7	0.2%
RETINA					
120.170	retinal dysplasia, folds	114	0.8%	28	0.9%
120.180	retinal dysplasia, geographic	41	0.3%	9	0.3%
120.190	retinal dysplasia, detached	1	0.0%	0	
120.310	generalized progressive retinal atrophy (PRA)	172	1.3%	10	0.3%
120.910	retinal detachment without dialysis	1	0.0%	0	
120.920	retinal detachment with dialysis	0		1	0.0%
120.960	retinopathy	11	0.1%	13	0.4%
OPTIC NERVE					
130.110	micropapilla	10	0.1%	7	0.2%
130.120	optic nerve hypoplasia	17	0.1%	0	
130.150	optic disc coloboma	2	0.0%	0	
OTHER					
900.000	other, unspecified	137	1.0%	0	
900.100	other, not inherited	344	2.6%	171	5.4%
900.110	other. suspect not inherited/significance unknown	143	1.1%	13	0.4%
NORMAL					
0.000	normal globe	10829	80.5%	2197	69.5%

RUSSELL TERRIER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Distichiasis	Not defined	1	Breeder option	
B.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder option	
C.	Cataract	Not defined	1	NO	
D.	Lens luxation	Not defined	2	NO	Mutation in the *ADAMTS17* gene

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

C. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

D. Lens luxation

Partial (subluxation) or complete displacement of the lens from the normal anatomic site behind the pupil. Lens luxation not associated with trauma or inflammation is presumed to be inherited. Lens luxation may result in elevated intraocular pressure (glaucoma), causing

vision impairment or blindness. A mutation in *ADAMTS17* has been associated with primary lens luxation. A DNA test is available.

References

1. ACVO Genetics Committee, 2016 and/or Data from CERF/OFA All-Breeds Report, 2010-2015.

2. Gould D, Pettitt L, McLaughlin B, et al. ADAMTS17 mutation associated with primary lens luxation is widespread among breeds. *Vet Ophthalmol*. 2011; 14: 378-384.

OCULAR DISORDERS REPORT
RUSSELL TERRIER

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2013 119 #	%	2014-2018 366 #	%
EYELIDS						
25.110	distichiasis		4	3.4%	12	3.3%
NASOLACRIMAL						
32.110	imperforate lower nasolacrimal punctum		0		1	0.3%
40.910	keratoconjunctivitis sicca		0		1	0.3%
CORNEA						
70.700	corneal dystrophy		0		1	0.3%
UVEA						
93.110	iris hypoplasia		0		1	0.3%
93.150	iris coloboma		0		1	0.3%
93.710	persistent pupillary membranes, iris to iris		3	2.5%	23	6.3%
93.720	persistent pupillary membranes, iris to lens		0		1	0.3%
93.750	persistent pupillary membranes, lens pigment foci/no strands		1	0.8%	1	0.3%
93.999	uveal cysts		1	0.8%	0	
LENS						
100.210	cataract. suspect not inherited/significance unknown		2	1.7%	20	5.5%
100.305	punctate cataract, posterior sutures		0		1	0.3%
100.307	punctate cataract, capsular		0		1	0.3%
100.321	incomplete cataract, anterior cortex		0		1	0.3%
100.322	incomplete cataract, posterior cortex		0		4	1.1%
100.323	incomplete cataract, equatorial cortex		0		1	0.3%
100.325	incomplete cataract, posterior sutures		0		1	0.3%
100.328	posterior suture tip opacities		0		1	0.3%
100.999	*significant cataracts (summary)*		*0*		*9*	*2.5%*
VITREOUS						
110.120	persistent hyaloid artery/remnant		0		2	0.5%
RETINA						
120.170	retinal dysplasia, folds		1	0.8%	2	0.5%
120.180	retinal dysplasia, geographic		0		1	0.3%
120.310	generalized progressive retinal atrophy (PRA)		1	0.8%	0	
OPTIC NERVE						
130.110	micropapilla		0		1	0.3%
OTHER						
900.000	other, unspecified		2	1.7%	0	
900.100	other, not inherited		1	0.8%	19	5.2%
NORMAL						
0.000	normal globe		110	92.4%	290	79.2%

RUSSIAN TOY

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Persistent pupillary membranes - lens pigment foci/no strands	Not defined	1	Passes with no notation

Description and Comments

A. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Russian Toy breed. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 2017 and/or Data from OFA All-Breeds Report, 2013-2017.

OCULAR DISORDERS REPORT
RUSSIAN TOY TERRIER

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2013 38 #	 %	2014-2018 44 #	 %
EYELIDS						
25.110	distichiasis		1	2.6%	0	
CORNEA						
70.700	corneal dystrophy		0		1	2.3%
UVEA						
93.710	persistent pupillary membranes, iris to iris		1	2.6%	4	9.1%
93.750	persistent pupillary membranes, lens pigment foci/no strands		0		5	11.4%
93.760	persistent pupillary membranes, endothelial opacity/no strands		1	2.6%	0	
97.150	chorioretinal coloboma, congenital		1	2.6%	0	
LENS						
100.210	cataract. suspect not inherited/significance unknown		1	2.6%	2	4.5%
100.301	punctate cataract, anterior cortex		3	7.9%	0	
100.303	punctate cataract, equatorial cortex		0		1	2.3%
100.305	punctate cataract, posterior sutures		0		1	2.3%
100.307	punctate cataract, capsular		0		2	4.5%
100.328	posterior suture tip opacities		0		1	2.3%
100.999	*significant cataracts (summary)*		*3*	*7.9%*	*4*	*9.1%*
VITREOUS						
110.120	persistent hyaloid artery/remnant		0		1	2.3%
110.200	vitritis		0		1	2.3%
110.320	vitreal degeneration		4	10.5%	2	4.5%
RETINA						
120.960	retinopathy		0		1	2.3%
OTHER						
900.000	other, unspecified		2	5.3%	0	
900.100	other, not inherited		1	2.6%	2	4.5%
NORMAL						
0.000	normal globe		33	86.8%	25	56.8%

Russian Tsvetnaya Bolonka
(Bolonka Zwetna)

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TEST
A.	Vitreous degeneration	Not defined	1	Breeder Option	
B.	Retinal atrophy - generalized	Autosomal recessive	2	NO	Mutation in *prcd* gene

Description and Comments

A. Vitreous degeneration

Liquefaction of the vitreous gel which may predispose to retinal detachment.

B. Retinal atrophy - generalized (*prcd)*

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

Studies have shown that the principal form of PRA in the Russian Tsvetnaya Bolonka is *prcd* which is a late-onset form of PRA inherited as autosomal recessive. The mutation is allelic to that present in Miniature Poodles, Labrador Retrievers, English and American Cocker Spaniels, and others. The locus is termed the progressive rod-cone degeneration (*prcd*) gene and at least 30+ breeds are affected. In most affected dogs to date, the disease is recognized clinically in dogs 3-6 years of age or older. However in the American Eskimo Dog the phenotype can be very variable in the age of onset. This photoreceptor degeneration is characterized by slow death of visual cells following their normal development. The disease begins clinically with signs of night blindness followed by day blindness. A DNA test is available.

Other forms of retinal degeneration that are not *prcd* are recognized in the breed. The currently available genetic test will not detect these other forms of PRA.

References

1. ACVO Genetics Committee 2018 and/or Data from OFA All-Breed Report 2013-2017.

2. Zangerl B, Goldstein O, Philp AR, et al. Identical mutation in a novel retinal gene causes progressive rod-cone degeneration in dogs and retinitis pigmentosa in humans. *Genomics*. 2006 Nov;88:551-

563.

OCULAR DISORDERS REPORT
RUSSIAN TSVETNAYA BOLONKA

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2013 77 #	 %	2014-2018 39 #	 %
EYELIDS						
25.110	distichiasis		1	1.3%	0	
NASOLACRIMAL						
40.910	keratoconjunctivitis sicca		0		1	2.6%
CORNEA						
70.220	pigmentary keratitis		0		2	5.1%
UVEA						
93.750	persistent pupillary membranes, lens pigment foci/no strands		1	1.3%	0	
LENS						
100.210	cataract. suspect not inherited/significance unknown		3	3.9%	2	5.1%
100.313	incipient cataract, equatorial cortex		1	1.3%	0	
100.315	incipient cataract, posterior sutures		0		3	7.7%
100.328	posterior suture tip opacities		1	1.3%	4	10.3%
100.375	subluxation/luxation, unspecified		1	1.3%	0	
100.999	*significant cataracts (summary)*		*1*	*1.3%*	*3*	*7.7%*
VITREOUS						
110.135	PHPV/PTVL		1	1.3%	0	
110.200	vitritis		2	2.6%	2	5.1%
110.320	vitreal degeneration		10	13.0%	3	7.7%
OTHER						
900.000	other, unspecified		1	1.3%	0	
900.100	other, not inherited		2	2.6%	3	7.7%
NORMAL						
0.000	normal globe		67	87.0%	26	66.7%

RUSSO-EUROPEAN LAIKA

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Retinal atrophy - generalized (*prcd*)	Autosomal recessive	1	NO	Mutation in the *prcd* gene

Description and Comments

A. Retinal atrophy – generalized (prcd)

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

Studies have shown that the principal form of PRA in the Russo-European Laika is *prcd* which is a late-onset form of PRA inherited as autosomal recessive. The mutation is allelic to that present in Miniature Poodles, English and American Cocker Spaniels, and others. The locus is termed the progressive rod-cone degeneration (*prcd*) gene and at least 30+ breeds are affected. In most affected dogs to date, the disease is recognized clinically in dogs 3-6 years of age or older. This photoreceptor degeneration is characterized by slow death of visual cells following their normal development. The disease begins clinically with signs of night blindness followed by day blindness. A DNA test is available.

References

There are no breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the Russo-European Laika. The condition listed above is currently noted solely due to the availability of a genetic test for the disease.

1. Gould D, Pettitt L, McLaughlin B, et al. ADAMTS17 mutation associated with primary lens luxation is widespread among breeds. *Vet Ophthalmol*. 2011;14:378-384.

SALUKI

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Cataract	Not defined	1, 2	NO

Description and Comments

A. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Saluki breed. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 2002-2003 and/or Data from CERF All-Breeds Report, 2002-2003.

2. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report 2003-2004.

OCULAR DISORDERS REPORT
SALUKI

Diagnostic Name		1991-2013 TOTAL DOGS EXAMINED 251 #	 %	2014-2018 59 #	 %
EYELIDS					
25.110	distichiasis	0		2	3.4%
CORNEA					
70.700	corneal dystrophy	1	0.4%	0	
UVEA					
93.710	persistent pupillary membranes, iris to iris	6	2.4%	1	1.7%
93.730	persistent pupillary membranes, iris to cornea	3	1.2%	0	
93.740	persistent pupillary membranes, iris sheets	2	0.8%	0	
93.760	persistent pupillary membranes, endothelial opacity/no strands	1	0.4%	0	
LENS					
100.210	cataract. suspect not inherited/significance unknown	15	6.0%	5	8.5%
100.301	punctate cataract, anterior cortex	1	0.4%	0	
100.302	punctate cataract, posterior cortex	3	1.2%	1	1.7%
100.305	punctate cataract, posterior sutures	1	0.4%	0	
100.307	punctate cataract, capsular	0		2	3.4%
100.312	incipient cataract, posterior cortex	1	0.4%	0	
100.313	incipient cataract, equatorial cortex	2	0.8%	0	
100.316	incipient cataract, nucleus	1	0.4%	0	
100.330	generalized/complete cataract	2	0.8%	0	
100.999	*significant cataracts (summary)*	*11*	*4.4%*	*3*	*5.1%*
VITREOUS					
110.200	vitritis	1	0.4%	3	5.1%
110.320	vitreal degeneration	6	2.4%	0	
RETINA					
120.310	generalized progressive retinal atrophy (PRA)	2	0.8%	0	
OPTIC NERVE					
130.150	optic disc coloboma	1	0.4%	1	1.7%
OTHER					
900.000	other, unspecified	1	0.4%	0	
900.100	other, not inherited	5	2.0%	0	
NORMAL					
0.000	normal globe	215	85.7%	47	79.7%

SAMOYED

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Glaucoma	Not defined	1-7	NO	
B.	Distichiasis	Not defined	1	Breeder option	
C.	Corneal dystrophy - epithelial/stromal	Not defined	1, 8	Breeder option	
D.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder option	
E.	Cataract	Not defined	1	NO	
F.	Retinal atrophy - generalized	X-linked recessive	1, 9, 10	NO	Mutation in the *RPGR* gene
G.	Retinal dysplasia - folds	Presumed autosomal recessive	1, 11, 12	NO (Breeder option with Normal DNA test for folds)	Mutation in the *COL9A2* gene
H.	Retinal dysplasia - geographic/ detached	Presumed autosomal recessive	1, 11, 12	NO	
I.	Retinal dysplasia - folds/geographic/ detached (with skeletal defects)	Autosomal recessive with incomplete dominance for the eyes	1, 11-13	NO	Mutation in the *COL9A2* gene
J.	Uveodermatologic syndrome	Not defined	1, 14, 15	NO	

Description and Comments

A. Glaucoma

An elevation of intraocular pressure (IOP) which, when sustained, causes intraocular damage resulting in blindness. The elevated IOP occurs because the fluid cannot leave through the iridocorneal angle. Diagnosis and classification of glaucoma requires measurement of IOP (tonometry) and examination of the iridocorneal angle (gonioscopy).

Neither of these tests are part of a routine breed eye screening exam.

B. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established, although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

C. Corneal dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

D. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

In the Samoyed, many of the PPMs identified on routine screening examinations bridge from the iris to the cornea where they may be associated with corneal opacity and vision impairment.

E. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

F. Retinal atrophy - generalized

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. In the Samoyed, one form of PRA, known as XLPRA1, is due to a mutation in the *RPGR* gene and is inherited as a recessive, sex-linked trait. A DNA test is available.

G. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness.

In the Samoyed, the presence of retinal folds may be seen in the heterozygous state described in "I" below. Thus the recommendation against breeding. The breeding advice for Labrador Retrievers and Samoyeds diagnosed with "retinal dysplasia - folds" will be changed from "No" to "Breeder option" if the owner of the dog provides the registering office with results of the DNA test for the affected dog showing that it is not a carrier of the *COL9A2* mutation.

H. Retinal dysplasia - geographic/detached without skeletal defects

Abnormal development of the retina present at birth.

Retinal dysplasia - geographic: Any irregularly shaped area of abnormal retinal development containing both areas of thinning and areas of elevation representing folds and retinal disorganization.

Retinal dysplasia - detached: Severe retinal disorganization associated with separation (detachment) of the retina.

These two forms are associated with vision impairment or blindness. Retinal dysplasia is known to be inherited in many breeds. The genetic relationship among the three forms of retinal dysplasia is not known for all breeds.

I. Retinal dysplasia - folds or detachment with skeletal defects in homozygous affected dogs

This condition is also known as oculo-skeletal dysplasia (OSD) or dwarfism with retinal dysplasia type 2 (DRD2) in the Samoyed. A similar condition, DRD1, occurs in the Labrador Retriever. The condition is autosomal recessive and homozygous affected dogs have shortened forelimbs (“downhill” conformation) with valgus deformity. They have severe ocular defects including cataract, retinal folds/multifocal retinal dysplasia, vitreal degeneration and retinal detachment. The ocular abnormalities result in blindness in most dogs. Heterozygous dogs can have either a normal ocular exam or have multiple retinal folds, vitreal membranes, or vitreal degeneration suggesting a semi-dominant mechanism with respect to the eyes. It is important to note that generally the retinal folds present in heterozygous dogs tend to cluster around the major superior blood vessels of the central tapetal region. The condition is caused by a 1,267 bp deletion of *COL9A2.* A DNA test is available.

J. Uveodermatologic syndrome

Uveodermatologic syndrome in the Samoyed bears many similarities to a condition in people called Vogt-Koyanagi-Harada (or VKH) syndrome. Thus, the condition in dogs is often referred to as VKH or VKH-like syndrome. It is an immune-mediated disease in which pigmented cells (melanocytes) in the eye and in the skin are destroyed by white blood cells (lymphocytes). The first clinical signs are usually inflammation of the intraocular structures (or uveitis) in both eyes. Adhesions between the iris and lens (posterior synechiae) and the peripheral iris and cornea (peripheral anterior synechiae) develop rapidly. Other complications include cataract development, retinal degeneration, retinal separation or detachment, optic disc atrophy and secondary glaucoma. The uveitis is very difficult to control medically and ultimately results in blindness in most affected dogs. Whitening of the hair (poliosis) and skin (vitiligo) may also be noted in advanced cases. Some veterinary ophthalmologists feel there is a prevalence of this entity in the Samoyed. Additional studies

are needed to validate this experience and explore the possibility of a genetic basis.

References

1. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

2. Ekesten B, Narfstrom K. Correlation of morphologic features of the iridocorneal angle to intraocular pressure in Samoyeds. *Am J Vet Res*. 1991;52:1875-1878.

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11. Meyers VN, Jezyk PF, Aguirre GD, et al. Short-limbed dwarfism and ocular defects in the Samoyed dog. *J Am Vet Med Assoc*. 1983;183:975-979.

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OCULAR DISORDERS REPORT
SAMOYED

Diagnostic Name		1991-2013 TOTAL DOGS EXAMINED 21048 #	%	2014-2018 5401 #	%
GLOBE					
0.110	microphthalmia	20	0.1%	3	0.1%
10.000	glaucoma	10	0.0%	0	
EYELIDS					
20.140	ectopic cilia	7	0.0%	0	
20.160	macropalpebral fissure	1	0.0%	0	
21.000	entropion, unspecified	6	0.0%	0	
22.000	ectropion, unspecified	3	0.0%	0	
25.110	distichiasis	1220	5.8%	258	4.8%
NASOLACRIMAL					
32.110	imperforate lower nasolacrimal punctum	4	0.0%	16	0.3%
40.910	keratoconjunctivitis sicca	12	0.1%	3	0.1%
NICTITANS					
51.100	third eyelid cartilage anomaly	4	0.0%	1	0.0%
CORNEA					
70.210	corneal pannus	4	0.0%	0	
70.220	pigmentary keratitis	1	0.0%	1	0.0%
70.700	corneal dystrophy	699	3.3%	253	4.7%
70.730	corneal endothelial degeneration	14	0.1%	3	0.1%
UVEA					
93.140	corneal endothelial pigment without PPM	1	0.0%	0	
93.150	iris coloboma	1	0.0%	0	
93.710	persistent pupillary membranes, iris to iris	377	1.8%	154	2.9%
93.720	persistent pupillary membranes, iris to lens	22	0.1%	7	0.1%
93.730	persistent pupillary membranes, iris to cornea	32	0.2%	8	0.1%
93.740	persistent pupillary membranes, iris sheets	16	0.1%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	6	0.0%	7	0.1%
93.760	persistent pupillary membranes, endothelial opacity/no strands	7	0.0%	7	0.1%
93.810	uveal melanoma	1	0.0%	0	
93.999	uveal cysts	8	0.0%	5	0.1%
97.150	chorioretinal coloboma, congenital	0		3	0.1%
LENS					
100.200	cataract, unspecified	100	0.5%	0	
100.210	cataract. suspect not inherited/significance unknown	688	3.3%	172	3.2%
100.301	punctate cataract, anterior cortex	60	0.3%	22	0.4%
100.302	punctate cataract, posterior cortex	137	0.7%	27	0.5%
100.303	punctate cataract, equatorial cortex	14	0.1%	1	0.0%
100.304	punctate cataract, anterior sutures	7	0.0%	3	0.1%
100.305	punctate cataract, posterior sutures	56	0.3%	11	0.2%
100.306	punctate cataract, nucleus	17	0.1%	1	0.0%
100.307	punctate cataract, capsular	16	0.1%	18	0.3%
100.311	incipient cataract, anterior cortex	73	0.3%	25	0.5%
100.312	incipient cataract, posterior cortex	226	1.1%	52	1.0%
100.313	incipient cataract, equatorial cortex	23	0.1%	3	0.1%

LENS CONTINUED		1991-2013		2014-2018	
100.314	incipient cataract, anterior sutures	7	0.0%	0	
100.315	incipient cataract, posterior sutures	47	0.2%	9	0.2%
100.316	incipient cataract, nucleus	31	0.1%	4	0.1%
100.317	incipient cataract, capsular	24	0.1%	13	0.2%
100.321	incomplete cataract, anterior cortex	0		2	0.0%
100.322	incomplete cataract, posterior cortex	3	0.0%	18	0.3%
100.325	incomplete cataract, posterior sutures	0		3	0.1%
100.326	incomplete cataract, nucleus	0		2	0.0%
100.327	incomplete cataract, capsular	0		6	0.1%
100.328	posterior suture tip opacities	2	0.0%	14	0.3%
100.330	generalized/complete cataract	66	0.3%	0	
100.340	resorbing/hypermature cataract	1	0.0%	1	0.0%
100.375	subluxation/luxation, unspecified	3	0.0%	0	
100.999	*significant cataracts (summary)*	*908*	*4.3%*	*221*	*4.1%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	20	0.1%	6	0.1%
110.135	PHPV/PTVL	11	0.1%	3	0.1%
110.200	vitritis	0		2	0.0%
110.320	vitreal degeneration	89	0.4%	12	0.2%
FUNDUS					
97.110	choroidal hypoplasia	4	0.0%	0	
97.120	coloboma	7	0.0%	0	
RETINA					
120.170	retinal dysplasia, folds	459	2.2%	79	1.5%
120.180	retinal dysplasia, geographic	151	0.7%	54	1.0%
120.190	retinal dysplasia, detached	23	0.1%	7	0.1%
120.310	generalized progressive retinal atrophy (PRA)	56	0.3%	0	
120.400	retinal hemorrhage	2	0.0%	0	
120.910	retinal detachment without dialysis	10	0.0%	0	
120.920	retinal detachment with dialysis	0		2	0.0%
120.960	retinopathy	1	0.0%	8	0.1%
OPTIC NERVE					
130.110	micropapilla	17	0.1%	2	0.0%
130.120	optic nerve hypoplasia	13	0.1%	2	0.0%
130.150	optic disc coloboma	70	0.3%	3	0.1%
OTHER					
900.000	other, unspecified	176	0.8%	0	
900.100	other, not inherited	467	2.2%	200	3.7%
900.110	other. suspect not inherited/significance unknown	130	0.6%	11	0.2%
NORMAL					
0.000	normal globe	17459	82.9%	4143	76.7%

SCHAPENDOES

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Retinal atrophy - generalized	Autosomal recessive	1, 2	NO	Mutation in the *CCDC66* gene

Description and Comments

A. Retinal atrophy - generalized

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

In the Schapendoes the age of onset is between 2-5 years of age. The causal mutation is a single base pair insertion in exon 6 of the gene coiled-coil domain containing 66 (*CCDC66)* that leads to a stop codon. The mutation is inherited as an autosomal recessive trait. A DNA test is available.

References

1. Dekomien G, Vollrath C, Petrasch-Parwez E, et al. Progressive retinal atrophy in Schapendoes dogs: mutation of the newly identified CCDC66 gene. *Neurogenetics.* 2010 May;11:163-174.

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OCULAR DISORDERS REPORT
SCHAPENDOES

Diagnostic Name		1991-2013 TOTAL DOGS EXAMINED 63 #	 %	2014-2018 38 #	 %
EYELIDS					
25.110	distichiasis	1	1.6%	1	2.6%
UVEA					
93.710	persistent pupillary membranes, iris to iris	0		1	2.6%
93.750	persistent pupillary membranes, lens pigment foci/no strands	1	1.6%	0	
LENS					
100.210	cataract. suspect not inherited/significance unknown	3	4.8%	1	2.6%
100.301	punctate cataract, anterior cortex	1	1.6%	1	2.6%
100.312	incipient cataract, posterior cortex	0		1	2.6%
100.315	incipient cataract, posterior sutures	1	1.6%	1	2.6%
100.328	posterior suture tip opacities	0		2	5.3%
100.999	*significant cataracts (summary)*	*2*	*3.2%*	*3*	*7.9%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	2	3.2%	0	
110.320	vitreal degeneration	1	1.6%	0	
RETINA					
120.180	retinal dysplasia, geographic	1	1.6%	0	
OTHER					
900.100	other, not inherited	5	7.9%	0	
900.110	other. suspect not inherited/significance unknown	1	1.6%	0	
NORMAL					
0.000	normal globe	53	84.1%	30	78.9%

SCHIPPERKE

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Distichiasis	Not defined	1, 2	Breeder option	
B.	Persistent pupillary membranes				
	- iris to iris	Not defined	2, 3	Breeder option	
	- iris sheets	Not defined	4	NO	
C.	Cataract	Not defined	3	NO	
D.	Vitreous degeneration	Not defined	4, 5	Breeder option	
E.	Retinal atrophy - generalized (*prcd*)	Presumed autosomal recessive	3	NO	Mutation in the *prcd* gene

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

C. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

D. Vitreous degeneration

Liquefaction of the vitreous gel which may predispose to retinal detachment.

E. Retinal atrophy – generalized (prcd)

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

Studies have shown that the principal form of PRA in the Schipperke is *prcd* which is a late-onset form of PRA inherited as autosomal recessive. The mutation is allelic to that present in Miniature Poodles, English and American Cocker Spaniels, and others. The locus is termed the progressive rod-cone degeneration (*prcd*) gene and at least 30+ breeds are affected. In most affected dogs to date, the disease is recognized clinically in dogs 3-6 years of age or older. This photoreceptor degeneration is characterized by slow death of visual cells following their normal development. The disease begins clinically with signs of night blindness followed by day blindness. A DNA test is available.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Schipperke breed. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 2002-2003 and/or Data from CERF All-Breeds Report, 2002-2003.

2. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

3. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

4. ACVO Genetics Committee, 2008 and/or Data from CERF All-Breeds Report, 2003-2007.

5. ACVO Genetics Committee, 2007 and/or Data from CERF All-Breeds Report 2002-2006.

OCULAR DISORDERS REPORT
SCHIPPERKE

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2013 1278 #	%	2014-2018 340 #	%
GLOBE						
0.110	microphthalmia		1	0.1%	0	
EYELIDS						
25.110	distichiasis		33	2.6%	17	5.0%
CORNEA						
70.210	corneal pannus		1	0.1%	0	
70.220	pigmentary keratitis		0		1	0.3%
70.700	corneal dystrophy		2	0.2%	1	0.3%
70.730	corneal endothelial degeneration		2	0.2%	0	
UVEA						
93.710	persistent pupillary membranes, iris to iris		91	7.1%	52	15.3%
93.720	persistent pupillary membranes, iris to lens		6	0.5%	0	
93.730	persistent pupillary membranes, iris to cornea		2	0.2%	0	
93.740	persistent pupillary membranes, iris sheets		10	0.8%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands		4	0.3%	3	0.9%
LENS						
100.200	cataract, unspecified		4	0.3%	0	
100.210	cataract. suspect not inherited/significance unknown		55	4.3%	20	5.9%
100.301	punctate cataract, anterior cortex		9	0.7%	6	1.8%
100.302	punctate cataract, posterior cortex		1	0.1%	0	
100.303	punctate cataract, equatorial cortex		4	0.3%	1	0.3%
100.304	punctate cataract, anterior sutures		1	0.1%	0	
100.305	punctate cataract, posterior sutures		1	0.1%	0	
100.306	punctate cataract, nucleus		5	0.4%	3	0.9%
100.311	incipient cataract, anterior cortex		18	1.4%	3	0.9%
100.312	incipient cataract, posterior cortex		10	0.8%	0	
100.313	incipient cataract, equatorial cortex		7	0.5%	1	0.3%
100.315	incipient cataract, posterior sutures		1	0.1%	0	
100.316	incipient cataract, nucleus		3	0.2%	3	0.9%
100.317	incipient cataract, capsular		1	0.1%	1	0.3%
100.321	incomplete cataract, anterior cortex		1	0.1%	0	
100.322	incomplete cataract, posterior cortex		0		1	0.3%
100.328	posterior suture tip opacities		0		4	1.2%
100.330	generalized/complete cataract		8	0.6%	0	
100.999	*significant cataracts (summary)*		*74*	*5.8%*	*19*	*5.6%*
VITREOUS						
110.120	persistent hyaloid artery/remnant		0		1	0.3%
110.135	PHPV/PTVL		1	0.1%	0	
110.200	vitritis		1	0.1%	0	
110.320	vitreal degeneration		18	1.4%	4	1.2%
RETINA						
120.170	retinal dysplasia, folds		8	0.6%	3	0.9%
120.180	retinal dysplasia, geographic		4	0.3%	0	
120.310	generalized progressive retinal atrophy (PRA)		16	1.3%	1	0.3%
120.920	retinal detachment with dialysis		0		1	0.3%

RETINA CONTINUED	1991-2013		2014-2018	
120.960 retinopathy	1	0.1%	1	0.3%
OTHER				
900.000 other, unspecified	16	1.3%	0	
900.100 other, not inherited	55	4.3%	23	6.8%
900.110 other. suspect not inherited/significance unknown	4	0.3%	0	
NORMAL				
0.000 normal globe	1055	82.6%	227	66.8%

OCULAR DISORDERS REPORT
SCOTTISH DEERHOUND

There are insufficient breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the SCOTTISH DEERHOUND breed. Therefore, there are no conditions listed with breeding advice.

OCULAR DISORDERS REPORT
SCOTTISH DEERHOUND

Diagnostic Name	TOTAL DOGS EXAMINED	1991-2013 11 #	%	2014-2018 13 #	%
EYELIDS					
25.110	distichiasis	3	27.3%	2	15.4%
UVEA					
93.710	persistent pupillary membranes, iris to iris	2	18.2%	1	7.7%
LENS					
100.312	incipient cataract, posterior cortex	1	9.1%	0	
100.999	*significant cataracts (summary)*	*1*	*9.1%*	*0*	
OTHER					
900.100	other, not inherited	0		1	7.7%
NORMAL					
0.000	normal globe	9	81.8%	10	76.9%

SCOTTISH TERRIER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Persistent pupillary membranes			
	- iris to iris	Not defined	1, 2	Breeder option
	- iris to lens	Not defined	4	NO
	- lens pigment foci/no strands	Not defined	5	Passes with no notation
	- endothelial opacity/no strands	Not defined	4	NO
B.	Cataract	Not defined	1	NO
C.	Vitreous degeneration	Not defined	6	Breeder option
D.	Ligneous conjunctivitis	Not defined	7, 8	NO

Description and Comments

A. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

B. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

C. Vitreous degeneration

Liquefaction of the vitreous gel which may predispose to retinal detachment.

D. Ligneous conjunctivitis

A rare type of conjunctivitis characterized by the formation of thick membranes covering conjunctiva of the nictitans and eyelids of affected dogs. This condition has been diagnosed in four unrelated Doberman Pinschers, three of which had life-threatening systemic disease. Ligneous conjunctivitis has also been reported in one Yorkshire Terrier.

References

1. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

2. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

3. ACVO Genetics Committee, 2002-2003 and/or Data from CERF All-Breeds Report, 2002-2003.

4. ACVO Genetics Committee, 2017 and/or Data from OFA All-Breeds Report 2013-2017.

5. ACVO Genetics Committee, 2016 and/or Data from CERF/OFA All-Breeds Report, 2010-2015.

6. ACVO Genetics Committee, 2006 and/or Data from CERF All-Breeds Report, 2001-2005.

7. Ramsey DT, Ketring K, Glaze MB, et al. Ligneous conjunctivitis in four Doberman Pinschers. *J Am Anim Hosp Assoc*. 1996; 32: 439-447.

8. Mason SL, McElroy P, Nuttall T. Ligneous membranitis in Scottish Terriers. Vet Rec. 2012; 171: 160.

OCULAR DISORDERS REPORT
SCOTTISH TERRIER

		1991-2013		2014-2018	
	TOTAL DOGS EXAMINED	**701**		**192**	
Diagnostic Name		**#**	**%**	**#**	**%**
EYELIDS					
25.110	distichiasis	3	0.4%	0	
NASOLACRIMAL					
40.910	keratoconjunctivitis sicca	1	0.1%	0	
NICTITANS					
52.110	prolapsed gland of the third eyelid	2	0.3%	0	
CORNEA					
70.210	corneal pannus	1	0.1%	0	
70.220	pigmentary keratitis	2	0.3%	0	
70.700	corneal dystrophy	5	0.7%	1	0.5%
70.730	corneal endothelial degeneration	2	0.3%	0	
UVEA					
93.140	corneal endothelial pigment without PPM	3	0.4%	0	
93.710	persistent pupillary membranes, iris to iris	208	29.7%	52	27.1%
93.720	persistent pupillary membranes, iris to lens	36	5.1%	7	3.6%
93.730	persistent pupillary membranes, iris to cornea	9	1.3%	1	0.5%
93.740	persistent pupillary membranes, iris sheets	3	0.4%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	34	4.9%	75	39.1%
93.760	persistent pupillary membranes, endothelial opacity/no strands	3	0.4%	6	3.1%
LENS					
100.210	cataract. suspect not inherited/significance unknown	71	10.1%	11	5.7%
100.301	punctate cataract, anterior cortex	7	1.0%	0	
100.302	punctate cataract, posterior cortex	2	0.3%	0	
100.303	punctate cataract, equatorial cortex	2	0.3%	0	
100.304	punctate cataract, anterior sutures	2	0.3%	0	
100.305	punctate cataract, posterior sutures	1	0.1%	0	
100.306	punctate cataract, nucleus	3	0.4%	0	
100.307	punctate cataract, capsular	2	0.3%	0	
100.311	incipient cataract, anterior cortex	6	0.9%	1	0.5%
100.312	incipient cataract, posterior cortex	5	0.7%	1	0.5%
100.313	incipient cataract, equatorial cortex	3	0.4%	0	
100.314	incipient cataract, anterior sutures	1	0.1%	0	
100.315	incipient cataract, posterior sutures	1	0.1%	1	0.5%
100.316	incipient cataract, nucleus	9	1.3%	0	
100.317	incipient cataract, capsular	2	0.3%	1	0.5%
100.321	incomplete cataract, anterior cortex	0		1	0.5%
100.322	incomplete cataract, posterior cortex	0		1	0.5%
100.326	incomplete cataract, nucleus	0		1	0.5%
100.327	incomplete cataract, capsular	0		1	0.5%
100.328	posterior suture tip opacities	0		2	1.0%
100.330	generalized/complete cataract	4	0.6%	1	0.5%
100.375	subluxation/luxation, unspecified	1	0.1%	0	
100.999	*significant cataracts (summary)*	*50*	*7.1%*	*9*	*4.7%*

	1991-2013		2014-2018	
VITREOUS				
110.120 persistent hyaloid artery/remnant	1	0.1%	0	
110.320 vitreal degeneration	5	0.7%	0	
RETINA				
120.170 retinal dysplasia, folds	5	0.7%	0	
120.310 generalized progressive retinal atrophy (PRA)	8	1.1%	0	
OPTIC NERVE				
130.150 optic disc coloboma	1	0.1%	1	0.5%
OTHER				
900.000 other, unspecified	13	1.9%	0	
900.100 other, not inherited	62	8.8%	6	3.1%
900.110 other. suspect not inherited/significance unknown	16	2.3%	0	
NORMAL				
0.000 normal globe	378	53.9%	77	40.1%

SEALYHAM TERRIER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Distichiasis	Not defined	1	Breeder option	
B.	Persistent pupillary membranes - iris to iris	Not defined	1-3	Breeder option	
C.	Cataract	Not defined	3	NO	
D.	Lens luxation	Autosomal recessive	4-8	NO	Mutation in the *ADAMTS17* gene
E.	Retinal dysplasia - folds	Presumed autosomal recessive	4, 9	Breeder option	
F.	Retinal dysplasia - geographic/detached	Presumed autosomal recessive	4, 9	NO	

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

C. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

D. Lens luxation

Partial (subluxation) or complete displacement of the lens from the normal anatomic site behind the pupil. Lens luxation not associated with trauma or inflammation is presumed to be inherited. Lens luxation may result in elevated intraocular pressure (glaucoma) causing vision impairment or blindness. A mutation in *ADAMTS17* has been associated with primary lens luxation. A DNA test is available.

E. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

F. Retinal dysplasia - geographic/detached

Abnormal development of the retina present at birth.

Retinal dysplasia - geographic: Any irregularly shaped area of abnormal retinal development containing both areas of thinning and areas of elevation representing folds and retinal disorganization.

Retinal dysplasia - detached: Severe retinal disorganization associated with separation (detachment) of the retina.

These two forms are associated with vision impairment or blindness. Retinal dysplasia is known to be inherited in many breeds. The genetic relationship among the three forms of retinal dysplasia is not known for all breeds.

References

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OCULAR DISORDERS REPORT
SEALYHAM TERRIER

		1991-2013		2014-2018	
	TOTAL DOGS EXAMINED	470		44	
Diagnostic Name		#	%	#	%
EYELIDS					
25.110	distichiasis	25	5.3%	3	6.8%
NICTITANS					
52.110	prolapsed gland of the third eyelid	1	0.2%	0	
UVEA					
93.710	persistent pupillary membranes, iris to iris	31	6.6%	5	11.4%
93.720	persistent pupillary membranes, iris to lens	2	0.4%	0	
93.730	persistent pupillary membranes, iris to cornea	1	0.2%	0	
93.740	persistent pupillary membranes, iris sheets	2	0.4%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	1	0.2%	2	4.5%
93.760	persistent pupillary membranes, endothelial opacity/no strands	1	0.2%	0	
LENS					
100.200	cataract, unspecified	2	0.4%	0	
100.210	cataract. suspect not inherited/significance unknown	20	4.3%	1	2.3%
100.301	punctate cataract, anterior cortex	4	0.9%	0	
100.302	punctate cataract, posterior cortex	2	0.4%	1	2.3%
100.303	punctate cataract, equatorial cortex	1	0.2%	0	
100.305	punctate cataract, posterior sutures	2	0.4%	0	
100.307	punctate cataract, capsular	1	0.2%	4	9.1%
100.311	incipient cataract, anterior cortex	3	0.6%	0	
100.312	incipient cataract, posterior cortex	8	1.7%	0	
100.313	incipient cataract, equatorial cortex	1	0.2%	0	
100.315	incipient cataract, posterior sutures	1	0.2%	0	
100.316	incipient cataract, nucleus	2	0.4%	0	
100.317	incipient cataract, capsular	2	0.4%	0	
100.330	generalized/complete cataract	6	1.3%	1	2.3%
100.375	subluxation/luxation, unspecified	5	1.1%	0	
100.999	*significant cataracts (summary)*	*35*	*7.4%*	*6*	*13.6%*
VITREOUS					
110.135	PHPV/PTVL	2	0.4%	0	
110.320	vitreal degeneration	6	1.3%	0	
FUNDUS					
97.120	coloboma	1	0.2%	0	
RETINA					
120.170	retinal dysplasia, folds	9	1.9%	0	
120.180	retinal dysplasia, geographic	1	0.2%	0	
120.190	retinal dysplasia, detached	1	0.2%	0	
120.310	generalized progressive retinal atrophy (PRA)	11	2.3%	0	
120.910	retinal detachment without dialysis	1	0.2%	0	
OPTIC NERVE					
130.110	micropapilla	0		1	2.3%
130.120	optic nerve hypoplasia	1	0.2%	0	

	1991-2013		2014-2018	
OTHER				
900.000 other, unspecified	4	0.9%	0	
900.100 other, not inherited	10	2.1%	2	4.5%
900.110 other. suspect not inherited/significance unknown	1	0.2%	0	
NORMAL				
0.000 normal globe	396	84.3%	30	68.2%

OCULAR DISORDERS REPORT
SEPPALA SIBERIAN SLED DOG

There are insufficient breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the SEPPALA SIBERIAN SLED DOG breed. Therefore, there are no conditions listed with breeding advice.

OCULAR DISORDERS REPORT
SEPPALA SIBERIAN SLED DOG

Diagnostic Name	TOTAL DOGS EXAMINED	1991-2013 0 #	%	2014-2018 1 #	%
NORMAL					
0.000 normal globe		0		1	100.0%

SERBIAN HOUND

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Retinal atrophy - generalized (*prcd*)	Autosomal recessive	1	NO	Mutation in the *prcd* gene

Description and Comments

A. Retinal atrophy – generalized (prcd)

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

Studies have shown that the principal form of PRA in the Serbian Hound is *prcd* which is a late-onset form of PRA inherited as autosomal recessive. The mutation is allelic to that present in Miniature Poodles, English and American Cocker Spaniels, and others. The locus is termed the progressive rod-cone degeneration (*prcd*) gene and at least 30+ breeds are affected. In most affected dogs to date, the disease is recognized clinically in dogs 3-6 years of age or older. This photoreceptor degeneration is characterized by slow death of visual cells following their normal development. The disease begins clinically with signs of night blindness followed by day blindness. A DNA test is available.

References

There are no breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the Serbian Hound. The condition listed above is currently noted solely due to the availability of a genetic test for the disease.

1. Gould D, Pettitt L, McLaughlin B, et al. ADAMTS17 mutation associated with primary lens luxation is widespread among breeds. *Vet Ophthalmol*. 2011;14:378-384.

SHETLAND SHEEPDOG
(Sheltie)

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Distichiasis	Not defined	1	Breeder option	
B.	1. Corneal dystrophy	Not defined	1, 2	Breeder option	
	2. Sheltie corneal dystrophy	Not defined	1, 2	NO	
C.	Uveodermatologic syndrome	Not defined	1	NO	
D.	Persistent pupillary membranes				
	- iris to iris	Not defined	1, 3	Breeder option	
	- iris to lens	Not defined	4	NO	
	- iris to cornea	Not defined	4	NO	
E.	Cataract	Not defined	1	NO	
F.	Retinal atrophy - generalized (*CNGA1*)	Autosomal recessive	1, 5	NO	Mutation in the *CNGA1* gene
G.	Slowly progressing retinopathy	Not defined	6	NO	
H.	Choroidal hypoplasia (Collie eye anomaly) - optic nerve coloboma - retinal detachment - retinal hemorrhage - staphyloma/coloboma	Autosomal recessive	1, 7, 8	NO	Mutation in the *NHEJ1* gene
I.	Optic nerve coloboma	Not defined	1	NO	

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded.

Breeding discretion is advised.

Distichiasis in the Shetland Sheepdog usually involves stiff lashes which require permanent epilation.

B. 1. Corneal dystrophy

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

2. Sheltie corneal dystrophy

The corneal changes in the Shetland Sheepdog are characterized grossly by multifocal, central, subepithelial and superficial stromal, grey-white, circular or irregular rings. Some affected animals develop corneal erosions. The preocular tear film in the majority of dogs is unstable and requires symptomatic therapy to keep the patients comfortable. Further studies are necessary to define this disorder.

C. Uveodermatologic syndrome

Uveodermatologic syndrome in the Shetland Sheepdog bears many similarities to a condition in people called Vogt-Koyanagi-Harada (or VKH) syndrome. Thus, the condition in dogs is often referred to as VKH or VKH-like syndrome. It is an immune-mediated disease in which pigmented cells (melanocytes) in the eye and in the skin are destroyed by white blood cells (lymphocytes). The first clinical signs are usually inflammation of the intraocular structures (or uveitis) in both eyes. Adhesions between the iris and lens (posterior synechia) and the peripheral iris and cornea (peripheral anterior synechia) develop rapidly. Other complications include cataract development, retinal degeneration, retinal separation or detachment, optic disc atrophy and secondary glaucoma. The uveitis is very difficult to control medically and ultimately results in blindness in most affected dogs. Whitening of the hair (poliosis) and skin (vitiligo) may also be noted in advanced cases. The genetics of this condition are unclear, but some genetic predisposition is indicated by the higher prevalence of this disorder in Shetland Sheepdogs compared with other dog breeds. Affected dogs are generally young, ranging in age between 1-1/2 to 4 years.

D. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms are seen in the Shetland sheepdog and pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

E. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

F. Retinal atrophy - generalized

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. PRA is inherited as an autosomal recessive trait in most breeds.

One form of PRA in the Shetland Sheepdog is caused by a 4bp exonic deletion in *CNGA1.* However multiple forms of PRA exist in the breed and slowly progressive retinopathy is also not genetically linked to this mutation. A DNA test is available; however it will only detect this mutation.

G. Slowly progressing retinopathy

A syndrome as yet not well defined. May be a variant of PRA.

H. Choroidal hypoplasia (Collie eye anomaly)
- staphyloma/coloboma
- retinal detachment
- retinal hemorrhage
- optic nerve coloboma

A spectrum of malformations present at birth and ranging from inadequate development of the choroid (choroidal hypoplasia) to defects of the choroid, sclera, and/or optic nerve (coloboma/staphyloma) to complete retinal detachment (with or without hemorrhage). Mildly affected animals will have no detectable vision deficit.

This disorder is collectively referred to as "Collie eye anomaly." The choroidal hypoplasia component is caused by a 7799 base pair deletion with the gene *NHEJ1.* The mutation is a recessive trait. A DNA test is available and is diagnostic only for the choroidal hypoplasia component of CEA. For colobomas to develop, an additional mutation in a second gene has to be present; that gene is still unknown.

A DNA test is available and may not be predictive of all populations. As the genotype-phenotype correlation is complex, and not always straightforward, one should refer to http://www.optigen.com/opt9_coloboma_res.html for a summary and more details of the molecular studies of CEA.

I. Optic nerve coloboma (without choroidal hypoplasia)

A congenital cavity in the optic nerve which, if large, may cause blindness or vision impairment.

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OCULAR DISORDERS REPORT
SHETLAND SHEEPDOG

Diagnostic Name		1991-2013 TOTAL DOGS EXAMINED 36054 #	%	2014-2018 5628 #	%
GLOBE					
0.110	microphthalmia	61	0.2%	10	0.2%
10.000	glaucoma	2	0.0%	0	
EYELIDS					
20.140	ectopic cilia	9	0.0%	0	
21.000	entropion, unspecified	6	0.0%	3	0.1%
22.000	ectropion, unspecified	10	0.0%	0	
25.110	distichiasis	2379	6.6%	270	4.8%
NASOLACRIMAL					
32.110	imperforate lower nasolacrimal punctum	3	0.0%	3	0.1%
40.910	keratoconjunctivitis sicca	5	0.0%	2	0.0%
NICTITANS					
51.100	third eyelid cartilage anomaly	5	0.0%	2	0.0%
52.110	prolapsed gland of the third eyelid	4	0.0%	0	
CORNEA					
70.210	corneal pannus	9	0.0%	0	
70.220	pigmentary keratitis	3	0.0%	1	0.0%
70.700	corneal dystrophy	977	2.7%	159	2.8%
70.730	corneal endothelial degeneration	33	0.1%	2	0.0%
UVEA					
90.200	uveitis	0		1	0.0%
93.110	iris hypoplasia	4	0.0%	3	0.1%
93.140	corneal endothelial pigment without PPM	5	0.0%	0	
93.150	iris coloboma	24	0.1%	4	0.1%
93.710	persistent pupillary membranes, iris to iris	1458	4.0%	329	5.8%
93.720	persistent pupillary membranes, iris to lens	112	0.3%	13	0.2%
93.730	persistent pupillary membranes, iris to cornea	181	0.5%	23	0.4%
93.740	persistent pupillary membranes, iris sheets	29	0.1%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	8	0.0%	12	0.2%
93.760	persistent pupillary membranes, endothelial opacity/no strands	16	0.0%	6	0.1%
93.810	uveal melanoma	0		1	0.0%
93.999	uveal cysts	24	0.1%	3	0.1%
97.150	chorioretinal coloboma, congenital	1	0.0%	10	0.2%
LENS					
100.200	cataract, unspecified	73	0.2%	0	
100.210	cataract. suspect not inherited/significance unknown	550	1.5%	117	2.1%
100.301	punctate cataract, anterior cortex	70	0.2%	12	0.2%
100.302	punctate cataract, posterior cortex	59	0.2%	9	0.2%
100.303	punctate cataract, equatorial cortex	28	0.1%	3	0.1%
100.304	punctate cataract, anterior sutures	4	0.0%	2	0.0%
100.305	punctate cataract, posterior sutures	7	0.0%	4	0.1%
100.306	punctate cataract, nucleus	21	0.1%	1	0.0%
100.307	punctate cataract, capsular	17	0.0%	9	0.2%
100.311	incipient cataract, anterior cortex	129	0.4%	19	0.3%

LENS CONTINUED		1991-2013		2014-2018	
100.312	incipient cataract, posterior cortex	90	0.2%	11	0.2%
100.313	incipient cataract, equatorial cortex	54	0.1%	4	0.1%
100.314	incipient cataract, anterior sutures	4	0.0%	1	0.0%
100.315	incipient cataract, posterior sutures	13	0.0%	0	
100.316	incipient cataract, nucleus	33	0.1%	3	0.1%
100.317	incipient cataract, capsular	28	0.1%	4	0.1%
100.321	incomplete cataract, anterior cortex	0		4	0.1%
100.322	incomplete cataract, posterior cortex	0		5	0.1%
100.323	incomplete cataract, equatorial cortex	0		3	0.1%
100.327	incomplete cataract, capsular	0		2	0.0%
100.328	posterior suture tip opacities	1	0.0%	7	0.1%
100.330	generalized/complete cataract	43	0.1%	3	0.1%
100.340	resorbing/hypermature cataract	0		1	0.0%
100.375	subluxation/luxation, unspecified	6	0.0%	1	0.0%
100.999	*significant cataracts (summary)*	*673*	*1.9%*	*100*	*1.8%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	85	0.2%	13	0.2%
110.135	PHPV/PTVL	17	0.0%	5	0.1%
110.200	vitritis	1	0.0%	1	0.0%
110.320	vitreal degeneration	128	0.4%	21	0.4%
FUNDUS					
97.110	choroidal hypoplasia	115	0.3%	24	0.4%
97.120	coloboma	82	0.2%	0	
RETINA					
120.170	retinal dysplasia, folds	85	0.2%	10	0.2%
120.180	retinal dysplasia, geographic	16	0.0%	1	0.0%
120.190	retinal dysplasia, detached	5	0.0%	0	
120.310	generalized progressive retinal atrophy (PRA)	214	0.6%	6	0.1%
120.910	retinal detachment without dialysis	18	0.0%	0	
120.920	retinal detachment with dialysis	0		1	0.0%
120.960	retinopathy	9	0.0%	15	0.3%
OPTIC NERVE					
130.110	micropapilla	12	0.0%	6	0.1%
130.120	optic nerve hypoplasia	25	0.1%	0	
130.150	optic disc coloboma	185	0.5%	9	0.2%
OTHER					
900.000	other, unspecified	243	0.7%	0	
900.100	other, not inherited	598	1.7%	188	3.3%
900.110	other. suspect not inherited/significance unknown	160	0.4%	19	0.3%
NORMAL					
0.000	normal globe	30652	85.0%	4444	79.0%

SHIBA INU

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Glaucoma	Not defined	1-3	NO
B.	Distichiasis	Not defined	4	Breeder option
C.	Corneal dystrophy - epithelial/stromal	Not defined	5	Breeder option
D.	Persistent pupillary membranes			
	- iris to iris	Not defined	4, 5	Breeder option
	- lens pigment foci/no strands	Not defined	6	Passes with no notation
E.	Cataract	Not defined	4	NO

Description and Comments

A. Glaucoma

An elevation of intraocular pressure (IOP) which, when sustained, causes intraocular damage resulting in blindness. The elevated IOP occurs because the fluid cannot leave through the iridocorneal angle. Diagnosis and classification of glaucoma requires measurement of IOP (tonometry) and examination of the iridocorneal angle (gonioscopy). Neither of these tests are part of a routine breed eye screening exam.

A recent study found that a *SRBD1* polymorphism in exon 4 plays an important role in the development of glaucoma in the Shiba Inu. A genetic test is not yet available.

B. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established, although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

C. Corneal Dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

D. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

E. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

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4. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

5. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

6. ACVO Genetics Committee, 2017 and/or Data from OFA All-Breeds Report, 2013-2017.

OCULAR DISORDERS REPORT
SHIBA INU

Diagnostic Name		1991-2013 TOTAL DOGS EXAMINED 4006 #	%	2014-2018 1030 #	%
GLOBE					
10.000	glaucoma	2	0.0%	0	
EYELIDS					
20.140	ectopic cilia	4	0.1%	0	
20.160	macropalpebral fissure	6	0.1%	0	
21.000	entropion, unspecified	12	0.3%	0	
25.110	distichiasis	86	2.1%	34	3.3%
NASOLACRIMAL					
32.110	imperforate lower nasolacrimal punctum	2	0.0%	0	
40.910	keratoconjunctivitis sicca	1	0.0%	0	
NICTITANS					
52.110	prolapsed gland of the third eyelid	2	0.0%	0	
CORNEA					
70.210	corneal pannus	4	0.1%	0	
70.220	pigmentary keratitis	8	0.2%	3	0.3%
70.700	corneal dystrophy	31	0.8%	4	0.4%
70.730	corneal endothelial degeneration	10	0.2%	0	
UVEA					
93.710	persistent pupillary membranes, iris to iris	152	3.8%	53	5.1%
93.720	persistent pupillary membranes, iris to lens	14	0.3%	1	0.1%
93.730	persistent pupillary membranes, iris to cornea	1	0.0%	0	
93.740	persistent pupillary membranes, iris sheets	1	0.0%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	10	0.2%	40	3.9%
93.760	persistent pupillary membranes, endothelial opacity/no strands	2	0.0%	1	0.1%
93.999	uveal cysts	0		2	0.2%
LENS					
100.200	cataract, unspecified	10	0.2%	0	
100.210	cataract. suspect not inherited/significance unknown	163	4.1%	57	5.5%
100.301	punctate cataract, anterior cortex	6	0.1%	3	0.3%
100.302	punctate cataract, posterior cortex	15	0.4%	2	0.2%
100.303	punctate cataract, equatorial cortex	3	0.1%	0	
100.304	punctate cataract, anterior sutures	3	0.1%	0	
100.305	punctate cataract, posterior sutures	21	0.5%	12	1.2%
100.306	punctate cataract, nucleus	1	0.0%	0	
100.307	punctate cataract, capsular	1	0.0%	1	0.1%
100.311	incipient cataract, anterior cortex	30	0.7%	5	0.5%
100.312	incipient cataract, posterior cortex	22	0.5%	3	0.3%
100.313	incipient cataract, equatorial cortex	10	0.2%	2	0.2%
100.314	incipient cataract, anterior sutures	2	0.0%	0	
100.315	incipient cataract, posterior sutures	10	0.2%	3	0.3%
100.316	incipient cataract, nucleus	3	0.1%	3	0.3%
100.317	incipient cataract, capsular	2	0.0%	0	
100.322	incomplete cataract, posterior cortex	0		1	0.1%
100.328	posterior suture tip opacities	6	0.1%	28	2.7%

LENS CONTINUED		1991-2013		2014-2018	
100.330	generalized/complete cataract	19	0.5%	0	
100.375	subluxation/luxation, unspecified	3	0.1%	1	0.1%
100.999	*significant cataracts (summary)*	*158*	*3.9%*	*35*	*3.4%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	15	0.4%	7	0.7%
110.135	PHPV/PTVL	4	0.1%	0	
110.320	vitreal degeneration	30	0.7%	2	0.2%
RETINA					
120.170	retinal dysplasia, folds	7	0.2%	3	0.3%
120.180	retinal dysplasia, geographic	2	0.0%	0	
120.190	retinal dysplasia, detached	2	0.0%	0	
120.310	generalized progressive retinal atrophy (PRA)	28	0.7%	1	0.1%
120.400	retinal hemorrhage	1	0.0%	0	
120.910	retinal detachment without dialysis	1	0.0%	0	
120.960	retinopathy	1	0.0%	1	0.1%
OPTIC NERVE					
130.120	optic nerve hypoplasia	7	0.2%	0	
OTHER					
900.000	other, unspecified	31	0.8%	0	
900.100	other, not inherited	100	2.5%	28	2.7%
900.110	other. suspect not inherited/significance unknown	23	0.6%	2	0.2%
NORMAL					
0.000	normal globe	3407	85.0%	796	77.3%

SHIH TZU

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Keratoconjunctivitis sicca	Not defined	1, 2	NO
B.	Glaucoma	Not defined	3	NO
C.	Entropion	Not defined	1	Breeder option
D.	Distichiasis	Not defined	1	Breeder option
E.	Ectopic cilia	Not defined	1	Breeder option
F.	Corneal dystrophy - epithelial/stromal	Not defined	4	Breeder option
G.	Exposure/pigmentary keratitis	Not defined	1, 5	Breeder option
H.	Persistent pupillary membranes - iris to iris	Not defined	6	Breeder option
I.	Cataract	Not defined	1	NO
J.	Persistent hyaloid artery	Not defined	4	Breeder option
K.	Vitreous degeneration	Not defined	6, 7	Breeder option
L.	Retinal detachment	Not defined	7, 8	NO
M.	Retinal atrophy - generalized	Not defined	1	NO
N.	Optic nerve hypoplasia	Not defined	9, 10	NO
O.	Micropapilla	Not defined	9	Breeder option
P.	Ciliated caruncle	Not defined	1	Breeder option
Q.	Retinal degeneration	Not defined	8	NO

Description and Comments

A. Keratoconjunctivitis sicca (KCS)

An abnormality of the tear film, most commonly a deficiency of the aqueous portion, although the mucin and/or lipid layers may be affected; results in ocular irritation and/or vision impairment.

B. Glaucoma

An elevation of intraocular pressure (IOP) which, when sustained, causes intraocular damage resulting in blindness. The elevated IOP occurs because the fluid cannot leave through the iridocorneal angle. Diagnosis and classification of glaucoma requires measurement of IOP (tonometry) and examination of the iridocorneal angle (gonioscopy). Neither of these tests are part of a routine breed eye screening exam.

A recent study found that a *SRBD1* polymorphism in intron 1 plays an important role in the development of glaucoma in the Shih Tzu. A genetic test is not yet available.

C. Entropion

A conformational defect resulting in an "in-rolling" of one or both of the eyelids which may cause ocular irritation. It is likely that entropion is influenced by several genes (polygenic), defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

D. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded. Breeding discretion is advised.

E. Ectopic cilia

Hair emerging through the eyelid conjunctiva. Ectopic cilia occur more frequently in younger dogs and cause discomfort and corneal disease.

F. Corneal dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

G. Exposure/pigmentary keratitis

A condition characterized by variable degrees of superficial vascularization, fibrosis and/or pigmentation of the cornea. May be associated with excessive exposure/irritation of the globe due to shallow orbits, lower eyelid medial entropion, lagophthalmos and macropalpebral fissure.

H. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

I. Persistent hyaloid artery (PHA)

Congenital defect resulting from abnormalities in the development and regression of the hyaloid artery. The blood vessel remnant can be present in the vitreous as a small patent vascular strand (PHA) or as a non-vascular strand that appears gray-white (persistent hyaloid remnant).

J. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

K. Vitreous degeneration

A liquefaction of the vitreous gel which may predispose to retinal detachment.

L. Retinal detachment

A separation of the sensory retina from the underlying tissue. It results in blindness when complete.

M. Retinal atrophy - generalized

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

N. Optic nerve hypoplasia

A congenital defect of the optic nerve which causes blindness and abnormal pupil response in the affected eye. May be unable to differentiate from micropapilla on a routine (dilated) screening ophthalmoscopic exam.

O. Micropapilla

Micropapilla refers to a small optic disc which is not associated with vision impairment. Optic nerve hypoplasia refers to a congenital defect of the optic nerve which causes blindness and abnormal pupil response in the affected eye. It may be difficult to differentiate between micropapilla and optic nerve hypoplasia on a routine (dilated) screening ophthalmoscopic

exam.

P. Ciliated caruncle

The caruncle is a normal structure (a mass of fleshy conjunctival tissue at the nasal canthus). In abnormal conditions, it may contain hair which, if contacting the cornea, may cause irritation and/or tearing.

Q. Retinal degeneration

A unilateral or bilateral retinal disease which can be progressive. When bilateral, the ophthalmoscopic lesions are sometimes asymmetrical, particularly in the early stages of the disease. Fundus examination shows initially single or multiple focal retinal lesions that appear active (local infiltrative inflammation or granulation) or inactive. The lesions can progress resulting in widespread retinal atrophy. The end-stage ophthalmoscopic lesions vary and may appear indistinguishable from PRA, or may be more characteristic of an inflammatory retinopathy. The asymmetry of the fundus abnormalities and the presence of inflammatory lesions in the retina and choroid help to differentiate this disorder from PRA. The mode of inheritance of this disease is not known; however, studies of different families suggest that it is possibly inherited. An intriguing aspect of the disease has been the preponderance of affected males compared to females. This has been confirmed in a recent unpublished survey.

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OCULAR DISORDERS REPORT
SHIH TZU

		1991-2013 2254		2014-2018 721	
	TOTAL DOGS EXAMINED				
Diagnostic Name		**#**	**%**	**#**	**%**
GLOBE					
0.110	microphthalmia	6	0.3%	0	
EYELIDS					
20.140	ectopic cilia	37	1.6%	4	0.6%
20.160	macropalpebral fissure	57	2.5%	0	
21.000	entropion, unspecified	155	6.9%	43	6.0%
22.000	ectropion, unspecified	4	0.2%	0	
25.110	distichiasis	447	19.8%	70	9.7%
NASOLACRIMAL					
32.110	imperforate lower nasolacrimal punctum	4	0.2%	2	0.3%
40.910	keratoconjunctivitis sicca	12	0.5%	14	1.9%
NICTITANS					
51.100	third eyelid cartilage anomaly	1	0.0%	0	
CORNEA					
70.210	corneal pannus	25	1.1%	0	
70.220	pigmentary keratitis	116	5.1%	63	8.7%
70.700	corneal dystrophy	30	1.3%	5	0.7%
70.730	corneal endothelial degeneration	3	0.1%	1	0.1%
UVEA					
93.140	corneal endothelial pigment without PPM	1	0.0%	0	
93.150	iris coloboma	4	0.2%	1	0.1%
93.710	persistent pupillary membranes, iris to iris	30	1.3%	22	3.1%
93.720	persistent pupillary membranes, iris to lens	3	0.1%	2	0.3%
93.730	persistent pupillary membranes, iris to cornea	1	0.0%	4	0.6%
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		3	0.4%
93.999	uveal cysts	5	0.2%	0	
LENS					
100.200	cataract, unspecified	16	0.7%	0	
100.210	cataract. suspect not inherited/significance unknown	44	2.0%	26	3.6%
100.301	punctate cataract, anterior cortex	14	0.6%	0	
100.302	punctate cataract, posterior cortex	6	0.3%	2	0.3%
100.303	punctate cataract, equatorial cortex	1	0.0%	0	
100.304	punctate cataract, anterior sutures	1	0.0%	0	
100.305	punctate cataract, posterior sutures	9	0.4%	1	0.1%
100.306	punctate cataract, nucleus	1	0.0%	1	0.1%
100.307	punctate cataract, capsular	2	0.1%	2	0.3%
100.311	incipient cataract, anterior cortex	21	0.9%	1	0.1%
100.312	incipient cataract, posterior cortex	19	0.8%	2	0.3%
100.313	incipient cataract, equatorial cortex	12	0.5%	2	0.3%
100.314	incipient cataract, anterior sutures	1	0.0%	0	
100.315	incipient cataract, posterior sutures	6	0.3%	2	0.3%
100.316	incipient cataract, nucleus	7	0.3%	1	0.1%
100.317	incipient cataract, capsular	2	0.1%	0	
100.321	incomplete cataract, anterior cortex	0		2	0.3%
100.322	incomplete cataract, posterior cortex	0		1	0.1%

LENS CONTINUED		1991-2013		2014-2018	
100.326	incomplete cataract, nucleus	0		2	0.3%
100.328	posterior suture tip opacities	0		2	0.3%
100.330	generalized/complete cataract	23	1.0%	2	0.3%
100.375	subluxation/luxation, unspecified	4	0.2%	0	
100.999	*significant cataracts (summary)*	*141*	*6.3%*	*21*	*2.9%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	9	0.4%	11	1.5%
110.200	vitritis	3	0.1%	14	1.9%
110.320	vitreal degeneration	135	6.0%	31	4.3%
FUNDUS					
97.110	choroidal hypoplasia	1	0.0%	0	
97.120	coloboma	2	0.1%	0	
RETINA					
120.170	retinal dysplasia, folds	10	0.4%	2	0.3%
120.180	retinal dysplasia, geographic	4	0.2%	0	
120.310	generalized progressive retinal atrophy (PRA)	41	1.8%	0	
120.910	retinal detachment without dialysis	9	0.4%	0	
120.920	retinal detachment with dialysis	0		2	0.3%
120.960	retinopathy	1	0.0%	3	0.4%
OPTIC NERVE					
130.120	optic nerve hypoplasia	10	0.4%	1	0.1%
130.150	optic disc coloboma	4	0.2%	0	
OTHER					
900.000	other, unspecified	43	1.9%	0	
900.100	other, not inherited	101	4.5%	69	9.6%
900.110	other. suspect not inherited/significance unknown	51	2.3%	5	0.7%
NORMAL					
0.000	normal globe	1346	59.7%	428	59.4%

SHIKOKU

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder option

Description and Comments

A. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Shikoku breed. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 2017 and/or Data from OFA All-Breeds Report, 2013-2017.

OCULAR DISORDERS REPORT
SHIKOKU

Diagnostic Name		1991-2013 TOTAL DOGS EXAMINED 6 #	 %	2014-2018 38 #	 %
UVEA					
93.710	persistent pupillary membranes, iris to iris	1	16.7%	24	63.2%
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		3	7.9%
LENS					
100.210	cataract. suspect not inherited/significance unknown	0		4	10.5%
100.307	punctate cataract, capsular	0		1	2.6%
100.999	*significant cataracts (summary)*	*0*		*1*	*2.6%*
OTHER					
900.100	other, not inherited	0		1	2.6%
NORMAL					
0.000	normal globe	2	33.3%	10	26.3%

SHILOH SHEPHERD

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Corneal dystrophy - epithelial/stromal	Not defined	1	Breeder option

Description and Comments

A. Corneal Dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Shiloh Shepherd breed. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 2000-2002 and/or Data from CERF All-Breeds Report, 2000-2002.

OCULAR DISORDERS REPORT
SHILOH SHEPHERD

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2013 206 #	 %	2014-2018 97 #	 %
EYELIDS						
25.110	distichiasis		2	1.0%	0	
NICTITANS						
50.210	pannus of third eyelid		0		1	1.0%
CORNEA						
70.210	corneal pannus		0		3	3.1%
70.700	corneal dystrophy		25	12.1%	10	10.3%
70.730	corneal endothelial degeneration		1	0.5%	0	
UVEA						
93.710	persistent pupillary membranes, iris to iris		2	1.0%	1	1.0%
93.750	persistent pupillary membranes, lens pigment foci/no strands		0		1	1.0%
93.999	uveal cysts		1	0.5%	1	1.0%
LENS						
100.210	cataract. suspect not inherited/significance unknown		9	4.4%	4	4.1%
100.302	punctate cataract, posterior cortex		1	0.5%	0	
100.307	punctate cataract, capsular		1	0.5%	0	
100.312	incipient cataract, posterior cortex		1	0.5%	0	
100.314	incipient cataract, anterior sutures		0		1	1.0%
100.330	generalized/complete cataract		1	0.5%	0	
100.999	*significant cataracts (summary)*		*4*	*1.9%*	*1*	*1.0%*
RETINA						
120.180	retinal dysplasia, geographic		2	1.0%	0	
OTHER						
900.000	other, unspecified		1	0.5%	0	
900.100	other, not inherited		4	1.9%	3	3.1%
NORMAL						
0.000	normal globe		179	86.9%	75	77.3%

OCULAR DISORDERS REPORT
SHORTY BULL

There are insufficient breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the SHORTY BULL breed. Therefore, there are no conditions listed with breeding advice.

OCULAR DISORDERS REPORT
SHORTY BULL

Diagnostic Name	TOTAL DOGS EXAMINED	1991-2013 0 #	%	2014-2018 2 #	%
NORMAL					
0.000 normal globe		0		2	100.0%

SIBERIAN HUSKY

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Glaucoma	Not defined	1-4	NO	
B.	Distichiasis	Not defined	1	Breeder option	
C.	Entropion	Not defined	1	Breeder option	
D.	Corneal dystrophy - epithelial/stromal	Presumed autosomal recessive	1, 5-8	NO	
E.	Persistent pupillary membranes - iris to iris	Not defined	9, 10	Breeder option	
F.	Cataract	Not defined	1, 4	NO	
G.	Persistent hyperplastic primary vitreous	Not defined	1	NO	
H.	Retinal atrophy - generalized	X-linked	1, 12, 13	NO	Mutation in the *RPGR* gene
I.	Cone degeneration - (achromatopsia)	Autosomal recessive	14	NO	Mutation in the *CNGB3* gene
J.	Retinal dysplasia - geographic/ detached	Presumed autosomal recessive	1	NO	
K.	Uveodermatologic syndrome	Not defined	1, 15-17	NO	

Description and Comments

A. Glaucoma

An elevation of intraocular pressure (IOP) which, when sustained, causes intraocular damage resulting in blindness. The elevated IOP occurs because the fluid cannot leave

through the iridocorneal angle. Diagnosis and classification of glaucoma requires measurement of IOP (tonometry) and examination of the iridocorneal angle (gonioscopy). Neither of these tests is part of a routine breed eye screening exam.

B. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded. Breeding discretion is advised.

C. Entropion

A conformational defect resulting in an "in-rolling" of one or both of the eyelids which may cause ocular irritation. It is likely that entropion is influenced by several genes (polygenic), defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

D. Corneal dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

In the Siberian Husky, the opacities are bilaterally symmetrical, round to oval and ring shaped. They occur early in life (0.5-2 years) and may progress to cause significant vision loss.

E. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

F. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

In the Siberian Husky, cataracts begin in the axial posterior cortex at approximately one year of age. Progression is variable and vision impairment may occur. In cases with rapid progression, secondary lens-induced uveitis and glaucoma may be associated with partial cataract resorption.

G. Persistent hyperplastic primary vitreous (PHPV)

Persistent hyperplastic primary vitreous is a congenital defect resulting from abnormalities in the development and regression of the hyaloid artery (the primary vitreous) and the interaction of this blood vessel with the posterior lens capsule/cortex during embryogenesis. This condition is often associated with persistent hyperplastic tunica vasculosa lentis which results from failure of regression of the embryologic vascular network which surrounds the developing lens.

H. Retinal atrophy - generalized

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. In the Siberian Husky, one form of PRA, known as XLPRA1, is due to a mutation in the *RPGR* gene and is inherited as a recessive, sex-linked trait. A DNA test is available.

I. Cone degeneration - hemeralopia/achromatopsia

Autosomal recessively inherited early degeneration of the cone photoreceptors. Afflicted puppies develop day-blindness, colorblindness, and photophobia between 8 and 12 weeks of age. Afflicted dogs remain ophthalmoscopically normal their entire life. Electroretinography is required to definitively diagnose the disorder. A missense mutation in the same gene (*CNGB3*) that has been identified in CD-affected Alaskan Malamute-derived dogs has been detected in German Shorthaired Pointers affected with a clinically identical allelic disorder. A DNA test is available.

J. Retinal dysplasia - geographic/detached

Abnormal development of the retina present at birth.

Retinal dysplasia - geographic: Any irregularly shaped area of abnormal retinal development containing both areas of thinning and areas of elevation representing folds and retinal disorganization.

Retinal dysplasia - detached: Severe retinal disorganization associated with separation (detachment) of the retina.

These two forms are associated with vision impairment or blindness. Retinal dysplasia is known to be inherited in many breeds. The genetic relationship among the three forms of retinal dysplasia is not known for all breeds.

K. Uveodermatologic syndrome

Uveodermatologic syndrome in the Siberian Husky bears many similarities to a condition in people called Vogt-Koyanagi-Harada (or VKH) syndrome. Thus, the condition in dogs is often referred to as VKH or VKH-like syndrome. It is an immune-mediated disease in which pigmented cells (melanocytes) in the eye and in the skin are destroyed by white blood cells (lymphocytes). The first clinical signs are usually inflammation of the intraocular structures (or uveitis) in both eyes. Adhesions between the iris and lens (posterior synechia) and the peripheral iris and cornea (peripheral anterior synechia) develop rapidly. Other complications

include cataract development, retinal degeneration, retinal separation or detachment, optic disc atrophy and secondary glaucoma. The uveitis is very difficult to control medically and ultimately results in blindness in most affected dogs. Whitening of the hair (poliosis) and skin (vitiligo) may also be noted in advanced cases. The genetics of this condition are unclear, but some genetic predisposition is indicated by the higher prevalence of this disorder in Siberian Huskies compared with other dog breeds. Affected dogs are generally young, ranging in age between 1-1/2 to 4 years.

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OCULAR DISORDERS REPORT
SIBERIAN HUSKY

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2013 35229 #	%	2014-2018 6328 #	%
GLOBE						
0.110	microphthalmia		7	0.0%	0	
10.000	glaucoma		12	0.0%	2	0.0%
EYELIDS						
20.110	eyelid dermoid		4	0.0%	0	
20.140	ectopic cilia		3	0.0%	0	
20.160	macropalpebral fissure		1	0.0%	0	
21.000	entropion, unspecified		19	0.1%	1	0.0%
22.000	ectropion, unspecified		4	0.0%	0	
25.110	distichiasis		351	1.0%	85	1.3%
NASOLACRIMAL						
32.110	imperforate lower nasolacrimal punctum		1	0.0%	2	0.0%
40.910	keratoconjunctivitis sicca		3	0.0%	0	
NICTITANS						
51.100	third eyelid cartilage anomaly		2	0.0%	0	
52.110	prolapsed gland of the third eyelid		2	0.0%	0	
CORNEA						
70.210	corneal pannus		20	0.1%	2	0.0%
70.220	pigmentary keratitis		1	0.0%	2	0.0%
70.700	corneal dystrophy		953	2.7%	111	1.8%
70.730	corneal endothelial degeneration		36	0.1%	1	0.0%
UVEA						
93.110	iris hypoplasia		2	0.0%	2	0.0%
93.140	corneal endothelial pigment without PPM		1	0.0%	0	
93.150	iris coloboma		5	0.0%	4	0.1%
93.710	persistent pupillary membranes, iris to iris		826	2.3%	179	2.8%
93.720	persistent pupillary membranes, iris to lens		25	0.1%	3	0.0%
93.730	persistent pupillary membranes, iris to cornea		44	0.1%	11	0.2%
93.740	persistent pupillary membranes, iris sheets		5	0.0%	1	0.0%
93.750	persistent pupillary membranes, lens pigment foci/no strands		8	0.0%	14	0.2%
93.760	persistent pupillary membranes, endothelial opacity/no strands		12	0.0%	6	0.1%
93.810	uveal melanoma		1	0.0%	0	
93.999	uveal cysts		17	0.0%	5	0.1%
97.150	chorioretinal coloboma, congenital		1	0.0%	2	0.0%
LENS						
100.200	cataract, unspecified		576	1.6%	0	
100.210	cataract. suspect not inherited/significance unknown		616	1.7%	157	2.5%
100.301	punctate cataract, anterior cortex		60	0.2%	18	0.3%
100.302	punctate cataract, posterior cortex		192	0.5%	19	0.3%
100.303	punctate cataract, equatorial cortex		32	0.1%	8	0.1%
100.304	punctate cataract, anterior sutures		10	0.0%	2	0.0%
100.305	punctate cataract, posterior sutures		99	0.3%	7	0.1%
100.306	punctate cataract, nucleus		22	0.1%	6	0.1%
100.307	punctate cataract, capsular		25	0.1%	15	0.2%

LENS CONTINUED		1991-2013		2014-2018	
100.311	incipient cataract, anterior cortex	119	0.3%	27	0.4%
100.312	incipient cataract, posterior cortex	1234	3.5%	109	1.7%
100.313	incipient cataract, equatorial cortex	59	0.2%	12	0.2%
100.314	incipient cataract, anterior sutures	17	0.0%	1	0.0%
100.315	incipient cataract, posterior sutures	253	0.7%	12	0.2%
100.316	incipient cataract, nucleus	85	0.2%	11	0.2%
100.317	incipient cataract, capsular	81	0.2%	18	0.3%
100.321	incomplete cataract, anterior cortex	0		10	0.2%
100.322	incomplete cataract, posterior cortex	20	0.1%	94	1.5%
100.323	incomplete cataract, equatorial cortex	0		8	0.1%
100.324	incomplete cataract, anterior sutures	0		2	0.0%
100.325	incomplete cataract, posterior sutures	0		7	0.1%
100.326	incomplete cataract, nucleus	3	0.0%	16	0.3%
100.327	incomplete cataract, capsular	1	0.0%	11	0.2%
100.328	posterior suture tip opacities	1	0.0%	12	0.2%
100.330	generalized/complete cataract	457	1.3%	17	0.3%
100.340	resorbing/hypermature cataract	0		2	0.0%
100.375	subluxation/luxation, unspecified	13	0.0%	2	0.0%
100.999	*significant cataracts (summary)*	*3345*	*9.5%*	*432*	*6.8%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	41	0.1%	16	0.3%
110.135	PHPV/PTVL	5	0.0%	2	0.0%
110.200	vitritis	0		1	0.0%
110.320	vitreal degeneration	32	0.1%	7	0.1%
FUNDUS					
97.110	choroidal hypoplasia	45	0.1%	12	0.2%
97.120	coloboma	16	0.0%	0	
RETINA					
120.170	retinal dysplasia, folds	88	0.2%	5	0.1%
120.180	retinal dysplasia, geographic	47	0.1%	9	0.1%
120.190	retinal dysplasia, detached	11	0.0%	3	0.0%
120.310	generalized progressive retinal atrophy (PRA)	159	0.5%	10	0.2%
120.400	retinal hemorrhage	7	0.0%	0	
120.910	retinal detachment without dialysis	27	0.1%	0	
120.920	retinal detachment with dialysis	1	0.0%	1	0.0%
120.960	retinopathy	7	0.0%	31	0.5%
OPTIC NERVE					
130.110	micropapilla	3	0.0%	0	
130.120	optic nerve hypoplasia	7	0.0%	0	
130.150	optic disc coloboma	3	0.0%	0	
OTHER					
900.000	other, unspecified	354	1.0%	0	
900.100	other, not inherited	817	2.3%	409	6.5%
900.110	other. suspect not inherited/significance unknown	231	0.7%	11	0.2%
NORMAL					
0.000	normal globe	29940	85.0%	5038	79.6%

SILKEN WINDHOUND

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Cataract	Not defined	1	NO	
B.	Vitreous degeneration	Not defined	2	Breeder option	
C.	Choroidal hypoplasia (Collie Eye Anomaly) - staphyloma/coloboma - retinal detachment - retinal hemorrhage - optic nerve coloboma	Autosomal recessive	3, 4	NO	Mutation in the *NHEJ1* gene

Description and Comments

A. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

B. Vitreous degeneration

A liquefaction of the vitreous gel which may predispose to retinal detachment.

C. Choroidal hypoplasia (Collie Eye Anomaly)
- Staphyloma/coloboma
- Retinal detachment
- Retinal hemorrhage
- Optic nerve coloboma

A spectrum of malformations present at birth and ranging from inadequate development of the choroid (choroidal hypoplasia) to defects of the choroid, sclera, and/or optic nerve (coloboma/staphyloma) to complete retinal detachment (with or without hemorrhage). Mildly affected animals will have no detectable vision deficit.

This disorder is collectively referred to as "Collie Eye Anomaly." The choroidal hypoplasia component is caused by a 7799 base pair deletion with the gene *NHEJ1.* The mutation is a recessive trait. A DNA test is available and is diagnostic only for the choroidal hypoplasia component of CEA. For colobomas to develop, an additional mutation in a second gene has to be present; that gene is still unknown.

References

1. ACVO Genetics Committee, 2016 and/or Data from CERF/OFA All-Breeds Report, 2010-2015.

2. ACVO Genetics Committee, 2017 and/or Data from OFA All-Breeds Report, 2013-2017.

3. ACVO Genetics Committee, 2015 and Data from OFA All-Breeds Report, 2014-2015.

4. Parker HG, Kukekova AV, Akey DT, et al. Breed relationships facilitate fine-mapping studies: a 7.8-kb deletion cosegregates with Collie eye anomaly across multiple dog breeds. *Gen Res*. 2007;17:1562-1571.

OCULAR DISORDERS REPORT
SILKEN WINDHOUND

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2013 163 #	%	2014-2018 382 #	%
EYELIDS						
25.110	distichiasis		1	0.6%	5	1.3%
UVEA						
93.710	persistent pupillary membranes, iris to iris		1	0.6%	1	0.3%
LENS						
100.210	cataract. suspect not inherited/significance unknown		9	5.5%	13	3.4%
100.302	punctate cataract, posterior cortex		1	0.6%	0	
100.305	punctate cataract, posterior sutures		0		1	0.3%
100.307	punctate cataract, capsular		2	1.2%	0	
100.311	incipient cataract, anterior cortex		1	0.6%	1	0.3%
100.315	incipient cataract, posterior sutures		1	0.6%	1	0.3%
100.317	incipient cataract, capsular		1	0.6%	0	
100.328	posterior suture tip opacities		0		5	1.3%
100.999	*significant cataracts (summary)*		*6*	*3.7%*	*3*	*0.8%*
VITREOUS						
110.200	vitritis		0		3	0.8%
110.320	vitreal degeneration		3	1.8%	5	1.3%
FUNDUS						
97.110	choroidal hypoplasia		1	0.6%	0	
RETINA						
120.180	retinal dysplasia, geographic		3	1.8%	0	
120.310	generalized progressive retinal atrophy (PRA)		1	0.6%	0	
120.960	retinopathy		0		4	1.0%
OTHER						
900.000	other, unspecified		2	1.2%	0	
900.100	other, not inherited		0		18	4.7%
900.110	other. suspect not inherited/significance unknown		0		1	0.3%
NORMAL						
0.000	normal globe		157	96.3%	334	87.4%

SILKY TERRIER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Corneal dystrophy - epithelial/stromal	Not defined	1, 2	Breeder option	
B.	Persistent pupillary membranes - iris to iris	Not defined	1, 2	Breeder option	
C.	Cataract	Not defined	1-4	NO	
D.	Vitreous degeneration	Not defined	2, 3, 5	Breeder option	
E.	Retinal atrophy - generalized (*prcd)*	Autosomal recessive	6	NO	Mutation in the *prcd* gene

Description and Comments

A. Corneal Dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

B. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally in the neonatal period. These strands may bridge from iris to iris, iris to cornea, iris to lens, or from sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

C. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membranes, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

D. Vitreous degeneration

Liquefaction of the vitreous gel which may predispose to retinal detachment.

E. Retinal atrophy - generalized (*prcd*)

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

Studies have shown that the principal form of PRA in the Silky Terrier is *prcd* which is a late-onset form of PRA inherited as autosomal recessive. The mutation is allelic to that present in Miniature Poodles, Labrador Retrievers, English and American Cocker Spaniels, and others. The locus is termed the progressive rod-cone degeneration (*prcd*) gene and at least 30+ breeds are affected. In most affected dogs to date, the disease is recognized clinically in dogs 3-6 years of age or older. This photoreceptor degeneration is characterized by slow death of visual cells following their normal development. The disease begins clinically with signs of night blindness followed by day blindness. A DNA test is available.

References

1. ACVO Genetics Committee, 2002-2003 and/or Data from CERF All-Breeds Report, 2002-2003.

2. ACVO Genetics Committee, 2006 and/or Data from CERF All-Breeds Report, 2001-2005.

3. Gelatt KN, Samuelson DA, Barrie KP, et al. Biometry and clinical characteristics of congenital cataracts and microphthalmia in the Miniature Schnauzer. *J Am Vet Med Assoc*. 1983;183:99-102.

4. Gelatt KN, Mackay EO. Prevalence of primary breed-related cataracts in the dog in North America. *Vet Ophthalmol*. 2005;8:101-111.

5. Koch SA. Cataracts in interrelated old English Sheepdogs. *J Am Vet Med Assoc*. 1972;160:299-301.

6. Zangerl B, Goldstein O, Philp AR, et al. Identical mutation in a novel retinal gene causes progressive rod-cone degeneration in dogs and retinitis pigmentosa in humans. *Genomics*. 2006;88:551-563.

OCULAR DISORDERS REPORT
SILKY TERRIER

Diagnostic Name		1991-2013 610 #	1991-2013 610 %	2014-2018 213 #	2014-2018 213 %
EYELIDS					
21.000	entropion, unspecified	1	0.2%	0	
25.110	distichiasis	2	0.3%	1	0.5%
NICTITANS					
52.110	prolapsed gland of the third eyelid	1	0.2%	0	
CORNEA					
70.700	corneal dystrophy	7	1.1%	1	0.5%
UVEA					
93.140	corneal endothelial pigment without PPM	1	0.2%	0	
93.710	persistent pupillary membranes, iris to iris	40	6.6%	17	8.0%
93.720	persistent pupillary membranes, iris to lens	1	0.2%	0	
93.730	persistent pupillary membranes, iris to cornea	3	0.5%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		1	0.5%
93.760	persistent pupillary membranes, endothelial opacity/no strands	1	0.2%	1	0.5%
LENS					
100.200	cataract, unspecified	4	0.7%	0	
100.210	cataract. suspect not inherited/significance unknown	29	4.8%	14	6.6%
100.301	punctate cataract, anterior cortex	8	1.3%	1	0.5%
100.302	punctate cataract, posterior cortex	3	0.5%	1	0.5%
100.303	punctate cataract, equatorial cortex	6	1.0%	0	
100.304	punctate cataract, anterior sutures	1	0.2%	0	
100.305	punctate cataract, posterior sutures	0		2	0.9%
100.306	punctate cataract, nucleus	1	0.2%	1	0.5%
100.307	punctate cataract, capsular	0		1	0.5%
100.311	incipient cataract, anterior cortex	12	2.0%	1	0.5%
100.312	incipient cataract, posterior cortex	16	2.6%	3	1.4%
100.313	incipient cataract, equatorial cortex	7	1.1%	3	1.4%
100.314	incipient cataract, anterior sutures	1	0.2%	0	
100.315	incipient cataract, posterior sutures	2	0.3%	1	0.5%
100.316	incipient cataract, nucleus	0		1	0.5%
100.317	incipient cataract, capsular	1	0.2%	0	
100.321	incomplete cataract, anterior cortex	0		1	0.5%
100.322	incomplete cataract, posterior cortex	0		1	0.5%
100.328	posterior suture tip opacities	0		1	0.5%
100.330	generalized/complete cataract	22	3.6%	0	
100.999	*significant cataracts (summary)*	*84*	*13.8%*	*17*	*8.0%*
VITREOUS					
110.200	vitritis	0		1	0.5%
110.320	vitreal degeneration	27	4.4%	11	5.2%
FUNDUS					
97.110	choroidal hypoplasia	2	0.3%	1	0.5%

		1991-2013		2014-2018	
RETINA					
120.170	retinal dysplasia, folds	3	0.5%	2	0.9%
120.180	retinal dysplasia, geographic	1	0.2%	0	
120.310	generalized progressive retinal atrophy (PRA)	7	1.1%	2	0.9%
120.910	retinal detachment without dialysis	1	0.2%	0	
OPTIC NERVE					
130.110	micropapilla	1	0.2%	1	0.5%
OTHER					
900.000	other, unspecified	12	2.0%	0	
900.100	other, not inherited	28	4.6%	6	2.8%
900.110	other. suspect not inherited/significance unknown	2	0.3%	0	
NORMAL					
0.000	normal globe	461	75.6%	156	73.2%

OCULAR DISORDERS REPORT
SKYE TERRIER

There are insufficient breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the SKYE TERRIER breed. Therefore, there are no conditions listed with breeding advice.

OCULAR DISORDERS REPORT
SKYE TERRIER

Diagnostic Name	TOTAL DOGS EXAMINED	1991-2013 4 #	%	2014-2018 6 #	%
EYELIDS					
25.110	distichiasis	1	25.0%	0	
OTHER					
900.000	other, unspecified	1	25.0%	0	
NORMAL					
0.000	normal globe	3	75.0%	6	100.0%

SLOUGHI

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Retinal atrophy-generalized (*rcd1a*)	Autosomal recessive	1	NO	Mutation in the *PDE6B* gene

Description and Comments

A. Retinal atrophy - generalized (rcd1a)

A later onset degenerative disease of the retinal visual cells with visual deficits detectable at 2 to 3 years of age and which progresses to blindness. This abnormality may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. It is inherited as an autosomal recessive trait.

In the Sloughi, the disease is due to an 8-bp insertion in exon 21 of the *PDE6B* gene causing the *rcd1a* form of PRA. The disease is genetically distinct from that in the Irish Setter and has a later age of onset. A DNA test is available.
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References

1. Dekomien G, Runte M, Godde R, et al. Generalized progressive retinal atrophy of Sloughi dogs is due to an 8-bp insertion in exon 21 of the PDE6B gene. *Cytogenet Cell Gene*t. 2000;90:261-267.

OCULAR DISORDERS REPORT
SLOUGHI

Diagnostic Name	TOTAL DOGS EXAMINED	1991-2013 32 #	 %	2014-2018 2 #	 %
NICTITANS					
51.100	third eyelid cartilage anomaly	1	3.1%	0	
UVEA					
93.750	persistent pupillary membranes, lens pigment foci/no strands	2	6.2%	0	
LENS					
100.210	cataract. suspect not inherited/significance unknown	1	3.1%	0	
VITREOUS					
110.320	vitreal degeneration	1	3.1%	0	
OTHER					
900.000	other, unspecified	1	3.1%	0	
NORMAL					
0.000	normal globe	31	96.9%	2	100.0%

OCULAR DISORDERS REPORT
SLOVAKIAN WIREHAIRED POINTER

There are insufficient breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the SLOVAKIAN WIREHAIRED POINTER breed. Therefore, there are no conditions listed with breeding advice.

OCULAR DISORDERS REPORT
SLOVAKIAN WIREHAIRED POINTER

Diagnostic Name	TOTAL DOGS EXAMINED	1991-2013 0 #	%	2014-2018 1 #	%
NORMAL					
0.000 normal globe		0		1	100.0%

OCULAR DISORDERS REPORT
SMALL MUNSTERLANDER

There are insufficient breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the SMALL MUNSTERLANDER breed. Therefore, there are no conditions listed with breeding advice.

OCULAR DISORDERS REPORT
SMALL MUNSTERLANDER

Diagnostic Name	TOTAL DOGS EXAMINED	1991-2013 11 #	1991-2013 11 %	2014-2018 12 #	2014-2018 12 %
EYELIDS					
22.000	ectropion, unspecified	0		1	8.3%
CORNEA					
70.700	corneal dystrophy	2	18.2%	0	
UVEA					
93.710	persistent pupillary membranes, iris to iris	1	9.1%	0	
LENS					
100.210	cataract. suspect not inherited/significance unknown	2	18.2%	1	8.3%
100.302	punctate cataract, posterior cortex	0		2	16.7%
100.312	incipient cataract, posterior cortex	0		1	8.3%
100.999	*significant cataracts (summary)*	*0*		*3*	*25.0%*
VITREOUS					
110.320	vitreal degeneration	1	9.1%	0	
NORMAL					
0.000	normal globe	9	81.8%	7	58.3%

SMOOTH FOX TERRIER*

*The Smooth Fox Terrier and the Wire Fox Terrier were originally considered two varieties of the same breed. They became separate breeds in 1985. It is likely that the same genetic diseases exist in both breeds.

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Glaucoma	Not defined	1, 2	NO	
B.	Persistent pupillary membranes				
	- iris to iris	Not defined	3	Breeder option	
	- all other forms	Not defined	3	NO	
C.	Cataract	Not defined	1	NO	
D.	Lens luxation	Autosomal recessive	1, 4-8	NO	Mutation in the *ADAMTS17* gene

Description and Comments

A. Glaucoma

Glaucoma is characterized by an elevation of intraocular pressure (IOP) which, when sustained, causes intraocular damage resulting in blindness. The elevated IOP occurs because the fluid cannot leave through the iridocorneal angle. Diagnosis and classification of glaucoma requires measurement of the intraocular pressure (tonometry) and examination of the iridocorneal angle (gonioscopy). Neither of these tests is part of a routine breed eye screening exam.

B. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

C. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely

(diffuse) or in a localized region.

The cataracts observed in the Smooth Fox Terrier begin in the posterior sub-capsular region and are progressive.

D. Lens luxation

Partial (subluxation) or complete displacement of the lens from the normal anatomic site behind the pupil. Lens luxation not associated with trauma or inflammation is presumed to be inherited. Lens luxation may result in elevated intraocular pressure (glaucoma), causing vision impairment or blindness. A mutation in *ADAMTS17* has been associated with primary lens luxation. A DNA test is available.

References

1. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

2. Martin CL and Wyman M. Primary glaucoma in the dog. *Vet Clin North Am*. 1978 May;8:257-286.

3. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

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7. Formston C. Observations on subluxation and luxation of the crystalline lens in the dog. *Journal of Comparative Pathology*. 1945;55:168.

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OCULAR DISORDERS REPORT
SMOOTH FOX TERRIER

Diagnostic Name		1991-2013 TOTAL DOGS EXAMINED 254 #	%	2014-2018 63 #	%
UVEA					
93.710	persistent pupillary membranes, iris to iris	12	4.7%	2	3.2%
93.720	persistent pupillary membranes, iris to lens	0		1	1.6%
93.730	persistent pupillary membranes, iris to cornea	0		1	1.6%
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		1	1.6%
93.760	persistent pupillary membranes, endothelial opacity/no strands	0		1	1.6%
LENS					
100.210	cataract. suspect not inherited/significance unknown	3	1.2%	0	
100.311	incipient cataract, anterior cortex	1	0.4%	0	
100.312	incipient cataract, posterior cortex	2	0.8%	0	
100.330	generalized/complete cataract	2	0.8%	0	
100.999	*significant cataracts (summary)*	*5*	*2.0%*	*0*	
VITREOUS					
110.320	vitreal degeneration	3	1.2%	0	
RETINA					
120.170	retinal dysplasia, folds	1	0.4%	2	3.2%
120.310	generalized progressive retinal atrophy (PRA)	2	0.8%	1	1.6%
OTHER					
900.000	other, unspecified	1	0.4%	0	
900.100	other, not inherited	7	2.8%	5	7.9%
NORMAL					
0.000	normal globe	228	89.8%	51	81.0%

SOFT-COATED WHEATEN TERRIER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Microphthalmia with multiple ocular defects	Not defined	1	NO
B.	Distichiasis	Not defined	2	Breeder option
C.	Corneal dystrophy - epithelial/stromal	Not defined	3	Breeder option
D.	Persistent pupillary membranes			
	- iris to iris	Not defined	1-3	Breeder option
	- lens pigment foci/no strands	Not defined	4	Passes with no notation
E.	Cataract	Not defined	1, 2	NO
F.	Persistent hyaloid artery	Not defined	1, 2	Breeder option
G.	Retinal dysplasia - folds	Not defined	2	Breeder option
H.	Choroidal hypoplasia	Not defined	5	NO

Description and Comments

A. Microphthalmia with multiple ocular defects

Microphthalmia is a congenital defect characterized by a small eye often associated with defects of the cornea, iris (coloboma), anterior chamber, lens (cataract) and/or retina (retinal dysplasia).

B. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

C. Corneal dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

D. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore is not noted on the certificate.

E. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

F. Persistent hyaloid artery (PHA)

A congenital defect resulting from abnormalities in the development and regression of the hyaloid artery. The blood vessel remnant can be present in the vitreous as a small vascular strand (PHA) or as a non-vascular strand that appears gray-white (persistent hyaloid remnant).

G. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

H. Choroidal hypoplasia

Inadequate development of the choroid present at birth and non-progressive. This condition is most commonly identified in the Collie breed where it is a manifestation of "Collie Eye Anomaly."

References

1. Van der Woerdt A. Multiple ocular anomalies in two related litters of Soft-Coated Wheaten Terriers. *Prog Vet Comp Ophthal*. 1995;5:78.

2. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

3. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

4. ACVO Genetics Committee, 2017 and/or Data from CERF/OFA All-Breeds Report, 2010-2016.

5. ACVO Genetics Committee, 2009 and/or Data from CERF All-Breeds Report, 2008.

OCULAR DISORDERS REPORT
SOFT COATED WHEATEN TERRIER

		1991-2013 6879		2014-2018 1198	
	TOTAL DOGS EXAMINED				
Diagnostic Name		**#**	**%**	**#**	**%**
GLOBE					
10.000	glaucoma	2	0.0%	0	
EYELIDS					
20.160	macropalpebral fissure	1	0.0%	0	
21.000	entropion, unspecified	1	0.0%	0	
25.110	distichiasis	108	1.6%	47	3.9%
NASOLACRIMAL					
32.110	imperforate lower nasolacrimal punctum	6	0.1%	4	0.3%
NICTITANS					
52.110	prolapsed gland of the third eyelid	3	0.0%	0	
CORNEA					
70.700	corneal dystrophy	52	0.8%	4	0.3%
UVEA					
93.140	corneal endothelial pigment without PPM	3	0.0%	0	
93.150	iris coloboma	1	0.0%	0	
93.710	persistent pupillary membranes, iris to iris	223	3.2%	54	4.5%
93.720	persistent pupillary membranes, iris to lens	17	0.2%	1	0.1%
93.740	persistent pupillary membranes, iris sheets	3	0.0%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	24	0.3%	53	4.4%
93.760	persistent pupillary membranes, endothelial opacity/no strands	4	0.1%	4	0.3%
93.999	uveal cysts	14	0.2%	5	0.4%
LENS					
100.200	cataract, unspecified	24	0.3%	0	
100.210	cataract. suspect not inherited/significance unknown	312	4.5%	67	5.6%
100.301	punctate cataract, anterior cortex	26	0.4%	9	0.8%
100.302	punctate cataract, posterior cortex	9	0.1%	1	0.1%
100.303	punctate cataract, equatorial cortex	12	0.2%	2	0.2%
100.304	punctate cataract, anterior sutures	4	0.1%	3	0.3%
100.305	punctate cataract, posterior sutures	4	0.1%	0	
100.306	punctate cataract, nucleus	4	0.1%	0	
100.307	punctate cataract, capsular	12	0.2%	5	0.4%
100.311	incipient cataract, anterior cortex	28	0.4%	5	0.4%
100.312	incipient cataract, posterior cortex	28	0.4%	3	0.3%
100.313	incipient cataract, equatorial cortex	17	0.2%	2	0.2%
100.314	incipient cataract, anterior sutures	2	0.0%	1	0.1%
100.315	incipient cataract, posterior sutures	10	0.1%	3	0.3%
100.316	incipient cataract, nucleus	16	0.2%	2	0.2%
100.317	incipient cataract, capsular	11	0.2%	1	0.1%
100.321	incomplete cataract, anterior cortex	0		1	0.1%
100.322	incomplete cataract, posterior cortex	0		2	0.2%
100.328	posterior suture tip opacities	1	0.0%	2	0.2%
100.330	generalized/complete cataract	35	0.5%	0	
100.375	subluxation/luxation, unspecified	3	0.0%	1	0.1%
100.999	*significant cataracts (summary)*	*242*	*3.5%*	*40*	*3.3%*

		1991-2013		2014-2018	
VITREOUS					
110.120	persistent hyaloid artery/remnant	65	0.9%	7	0.6%
110.135	PHPV/PTVL	6	0.1%	0	
110.320	vitreal degeneration	12	0.2%	3	0.3%
FUNDUS					
97.110	choroidal hypoplasia	17	0.2%	0	
97.120	coloboma	1	0.0%	0	
RETINA					
120.170	retinal dysplasia, folds	67	1.0%	4	0.3%
120.180	retinal dysplasia, geographic	3	0.0%	1	0.1%
120.190	retinal dysplasia, detached	2	0.0%	0	
120.310	generalized progressive retinal atrophy (PRA)	14	0.2%	0	
120.910	retinal detachment without dialysis	1	0.0%	0	
120.960	retinopathy	1	0.0%	1	0.1%
OPTIC NERVE					
130.110	micropapilla	13	0.2%	1	0.1%
130.120	optic nerve hypoplasia	5	0.1%	0	
130.150	optic disc coloboma	9	0.1%	0	
OTHER					
900.000	other, unspecified	49	0.7%	0	
900.100	other, not inherited	193	2.8%	57	4.8%
900.110	other. suspect not inherited/significance unknown	29	0.4%	1	0.1%
NORMAL					
0.000	normal globe	6017	87.5%	915	76.4%

OCULAR DISORDERS REPORT
SPANISH GREYHOUND

There are insufficient breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the SPANISH GREYHOUND breed. Therefore, there are no conditions listed with breeding advice.

OCULAR DISORDERS REPORT
SPANISH GREYHOUND

Diagnostic Name	TOTAL DOGS EXAMINED	1991-2013 0 #	%	2014-2018 2 #	%
NORMAL					
0.000 normal globe		0		2	100.0%

OCULAR DISORDERS REPORT
SPANISH MASTIFF

There are insufficient breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the SPANISH MASTIFF breed. Therefore, there are no conditions listed with breeding advice.

OCULAR DISORDERS REPORT
SPANISH MASTIFF

Diagnostic Name	TOTAL DOGS EXAMINED	1991-2013 0 #	%	2014-2018 1 #	%
NORMAL					
0.000 normal globe		0		1	100.0%

SPANISH WATER DOG

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Persistent pupillary membranes				
	- iris to iris	Not defined	1	Breeder option	
	- all other forms	Not defined	1	NO	
B.	Retinal atrophy - generalized (*prcd*)	Autosomal recessive	2, 3	NO	Mutation in the *prcd* gene
C.	Retinal dysplasia - folds	Not defined	4	Breeder option	

Description and Comments

A. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

B. Retinal atrophy - generalized

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

Studies have shown that one form of PRA in the Spanish Water Dog is PRCD which is a late-onset form of PRA inherited as autosomal recessive. The mutation is allelic to that present in Miniature Poodles, Labrador Retrievers, English and American Cocker Spaniels, and others. The locus is termed the progressive rod-cone degeneration (*prcd*) gene and at least 30+ breeds are affected. In most affected dogs to date, the disease is recognized clinically in dogs 3-6 years of age or older. This photoreceptor degeneration is characterized by slow death of visual cells following their normal development. The disease begins clinically with signs of night blindness followed by day blindness. A DNA test is available.

C. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with

maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

References

1. ACVO Genetics Committee, 2015 and Data from OFA All-Breeds Report, 2014-2015.

2. ACVO Genetics Committee, 2013-2014 and Data from OFA All-Breeds Report, 2013-2014.

3. Zangerl B, Goldstein O, Philp AR, et al. Identical mutation in a novel retinal gene causes progressive rod-cone degeneration in dogs and retinitis pigmentosa in humans. *Genomics*. 2006;88:551-563.

4. ACVO Genetics Committee, 2017 and/or Data from OFA All-Breeds Report, 2013-2017.

OCULAR DISORDERS REPORT
SPANISH WATER DOG

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2013 167 #	%	2014-2018 202 #	%
EYELIDS						
25.110	distichiasis		2	1.2%	1	0.5%
NICTITANS						
52.110	prolapsed gland of the third eyelid		1	0.6%	0	
CORNEA						
70.700	corneal dystrophy		2	1.2%	1	0.5%
UVEA						
93.710	persistent pupillary membranes, iris to iris		5	3.0%	9	4.5%
93.750	persistent pupillary membranes, lens pigment foci/no strands		0		1	0.5%
LENS						
100.210	cataract. suspect not inherited/significance unknown		11	6.6%	8	4.0%
100.302	punctate cataract, posterior cortex		1	0.6%	0	
100.306	punctate cataract, nucleus		1	0.6%	1	0.5%
100.313	incipient cataract, equatorial cortex		1	0.6%	0	
100.316	incipient cataract, nucleus		0		1	0.5%
100.317	incipient cataract, capsular		1	0.6%	0	
100.999	*significant cataracts (summary)*		*4*	*2.4%*	*2*	*1.0%*
VITREOUS						
110.120	persistent hyaloid artery/remnant		1	0.6%	0	
110.320	vitreal degeneration		0		2	1.0%
RETINA						
120.170	retinal dysplasia, folds		3	1.8%	6	3.0%
120.180	retinal dysplasia, geographic		1	0.6%	3	1.5%
120.190	retinal dysplasia, detached		0		1	0.5%
120.310	generalized progressive retinal atrophy (PRA)		4	2.4%	4	2.0%
OTHER						
900.000	other, unspecified		4	2.4%	0	
900.100	other, not inherited		7	4.2%	13	6.4%
900.110	other. suspect not inherited/significance unknown		1	0.6%	0	
NORMAL						
0.000	normal globe		145	86.8%	161	79.7%

SPINONE ITALIANO

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Ectropion	Not defined	1	Breeder option
B.	Distichiasis	Not defined	2, 3	Breeder option
C.	Persistent pupillary membranes			
	- iris to iris	Not defined	4	Breeder options
	- lens pigment foci/no strands	Not defined	5	Passes with no notation
D.	Cataract	Not defined	6	NO

Description and Comments

A. Ectropion

A conformational defect resulting in eversion of the eyelids, which may cause ocular irritation due to exposure. It is likely that ectropion is influenced by several genes (polygenic), defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

B. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded. Breeding discretion is advised.

C. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

D. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Spinone Italiano breed. The conditions listed above are generally recognized to exist in the breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 2017 and/or Data from OFA All-Breeds Report, 2013-2017.

2. ACVO Genetics Committee, 2007 and/or Data from CERF All-Breeds Report, 2002-2006.

3. ACVO Genetics Committee, 2008 and/or Data from CERF All-Breeds Report, 2003-2007.

4. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

5. ACVO Genetics Committee, 2015 and/or Data from CERF/OFA All-Breeds Report, 2010-2014.

6. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

OCULAR DISORDERS REPORT
SPINONE ITALIANO

		1991-2013		2014-2018	
	TOTAL DOGS EXAMINED	1845		512	
Diagnostic Name		#	%	#	%
GLOBE					
0.110	microphthalmia	1	0.1%	0	
EYELIDS					
20.160	macropalpebral fissure	3	0.2%	0	
21.000	entropion, unspecified	28	1.5%	3	0.6%
22.000	ectropion, unspecified	9	0.5%	9	1.8%
25.110	distichiasis	17	0.9%	13	2.5%
NASOLACRIMAL					
40.910	keratoconjunctivitis sicca	1	0.1%	0	
NICTITANS					
51.100	third eyelid cartilage anomaly	2	0.1%	1	0.2%
52.110	prolapsed gland of the third eyelid	3	0.2%	0	
UVEA					
90.200	uveitis	1	0.1%	0	
93.150	iris coloboma	1	0.1%	0	
93.710	persistent pupillary membranes, iris to iris	71	3.8%	37	7.2%
93.720	persistent pupillary membranes, iris to lens	1	0.1%	3	0.6%
93.730	persistent pupillary membranes, iris to cornea	1	0.1%	0	
93.740	persistent pupillary membranes, iris sheets	2	0.1%	1	0.2%
93.750	persistent pupillary membranes, lens pigment foci/no strands	1	0.1%	7	1.4%
93.999	uveal cysts	3	0.2%	0	
LENS					
100.200	cataract, unspecified	2	0.1%	0	
100.210	cataract. suspect not inherited/significance unknown	93	5.0%	28	5.5%
100.301	punctate cataract, anterior cortex	6	0.3%	0	
100.302	punctate cataract, posterior cortex	3	0.2%	0	
100.303	punctate cataract, equatorial cortex	1	0.1%	1	0.2%
100.304	punctate cataract, anterior sutures	2	0.1%	1	0.2%
100.305	punctate cataract, posterior sutures	2	0.1%	3	0.6%
100.306	punctate cataract, nucleus	14	0.8%	0	
100.307	punctate cataract, capsular	3	0.2%	0	
100.311	incipient cataract, anterior cortex	12	0.7%	3	0.6%
100.312	incipient cataract, posterior cortex	6	0.3%	0	
100.313	incipient cataract, equatorial cortex	5	0.3%	0	
100.314	incipient cataract, anterior sutures	1	0.1%	0	
100.315	incipient cataract, posterior sutures	4	0.2%	2	0.4%
100.316	incipient cataract, nucleus	5	0.3%	7	1.4%
100.317	incipient cataract, capsular	0		2	0.4%
100.322	incomplete cataract, posterior cortex	0		1	0.2%
100.328	posterior suture tip opacities	0		6	1.2%
100.330	generalized/complete cataract	5	0.3%	0	
100.375	subluxation/luxation, unspecified	3	0.2%	0	
100.999	*significant cataracts (summary)*	*71*	*3.8%*	*20*	*3.9%*

		1991-2013		2014-2018	
VITREOUS					
110.120	persistent hyaloid artery/remnant	2	0.1%	0	
110.200	vitritis	1	0.1%	1	0.2%
110.320	vitreal degeneration	17	0.9%	2	0.4%
RETINA					
120.170	retinal dysplasia, folds	8	0.4%	2	0.4%
120.180	retinal dysplasia, geographic	0		1	0.2%
120.310	generalized progressive retinal atrophy (PRA)	1	0.1%	0	
OPTIC NERVE					
130.110	micropapilla	0		1	0.2%
OTHER					
900.000	other, unspecified	22	1.2%	0	
900.100	other, not inherited	65	3.5%	24	4.7%
900.110	other. suspect not inherited/significance unknown	3	0.2%	0	
NORMAL					
0.000	normal globe	1648	89.3%	380	74.2%

ST. BERNARD

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Microphthalmia with multiple ocular defects	Not defined	1, 2	NO
B.	Eury/macroblepharon	Not defined	3	Breeder option
C.	Ectropion	Not defined	1	Breeder option
D.	Entropion	Not defined	1, 4, 5	Breeder option
E.	Distichiasis	Not defined	6	Breeder option
F.	Dermoid	Not defined	1, 4, 7-9	Breeder option
G.	Persistent pupillary membrane - iris to iris	Not defined	10	Breeder option
H.	Cataract	Not defined	1	NO

Description and Comments

A. Microphthalmia with multiple ocular defects

Multiple ocular defects have been described in Saint Bernard puppies. The syndrome was composed of microphthalmia, microphakia, aphakia, acoria, peripheral anterior synechia, and retinal dysplasia. Glaucoma was also reported. Although the cause was not proven to be hereditary, the fact that several of these dogs were related suggests a hereditary basis. Affected dogs should not be bred.

B. Eury/Macroblepharon

Defined as an exceptionally large palpebral fissure, macroblepharon in conjunction with laxity of the lateral canthal structures may lead to lower lid ectropion and upper lid entropion. Either of these conditions may lead to severe ocular irritation.

C. Ectropion

A conformational defect resulting in eversion of the eyelids which may cause ocular irritation. It is likely that ectropion is influenced by several genes (polygenic) defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

D. Entropion

A conformational defect resulting in an "in-rolling" of one or both of the eyelids which may cause ocular irritation. It is likely that entropion is influenced by several genes (polygenic), defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull. In this breed, entropion is associated with an exceptionally large palpebral fissure.

E. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established, although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

F. Dermoid

A patch of skin, usually located on the cornea; its presence usually causes ocular irritation.

G. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

H. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

References

1. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

2. Martin CL and Leipold HW. Aphakia and multiple ocular defects in Saint Bernard puppies. *Vet Med Small Anim Clin*. 1974 Apr;69:448-453.

3. ACVO Genetics Committee, 2000-2002 and/or Data from CERF All-Breeds Report, 2000-2002.

4. Priester WA. Congenital ocular defects in cattle, horses, cats, and dogs. *J Am Vet Med Assoc*. 1972 Jun 1;160:1504-1511.

5. ACVO Genetics Committee, 2001 and/or Data from CERF All-Breeds Report, 2001.

6. ACVO Genetics Committee, 2017 and/or Data from OFA All-Breeds Report, 2013-2017.

7. Gelatt KN. Bilateral corneal dermoids and distichiasis in a dog. *Vet Med Small Anim Clin.* 1971 Jul;66:658-659.

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9. Szczudlowska M. Dermoid cyst of the eye in relation to heredity and overfeeding. *Med Vet.* 1967;23:567.

10. ACVO Genetics Committee, 2007 and/or Data from CERF All-Breeds Report, 2002-2006.

OCULAR DISORDERS REPORT
ST. BERNARD

Diagnostic Name		1991-2013 TOTAL DOGS EXAMINED 173 #	 %	2014-2018 127 #	 %
EYELIDS					
20.160	macropalpebral fissure	21	12.1%	0	
21.000	entropion, unspecified	37	21.4%	37	29.1%
22.000	ectropion, unspecified	61	35.3%	38	29.9%
25.110	distichiasis	8	4.6%	10	7.9%
NICTITANS					
51.100	third eyelid cartilage anomaly	1	0.6%	0	
52.110	prolapsed gland of the third eyelid	1	0.6%	0	
CORNEA					
70.220	pigmentary keratitis	0		1	0.8%
70.700	corneal dystrophy	2	1.2%	0	
UVEA					
93.710	persistent pupillary membranes, iris to iris	15	8.7%	16	12.6%
93.720	persistent pupillary membranes, iris to lens	0		1	0.8%
93.730	persistent pupillary membranes, iris to cornea	0		2	1.6%
93.760	persistent pupillary membranes, endothelial opacity/no strands	0		1	0.8%
93.999	uveal cysts	0		2	1.6%
LENS					
100.210	cataract. suspect not inherited/significance unknown	9	5.2%	7	5.5%
100.302	punctate cataract, posterior cortex	1	0.6%	2	1.6%
100.303	punctate cataract, equatorial cortex	1	0.6%	0	
100.305	punctate cataract, posterior sutures	0		1	0.8%
100.306	punctate cataract, nucleus	0		1	0.8%
100.307	punctate cataract, capsular	1	0.6%	0	
100.311	incipient cataract, anterior cortex	1	0.6%	3	2.4%
100.312	incipient cataract, posterior cortex	3	1.7%	1	0.8%
100.313	incipient cataract, equatorial cortex	5	2.9%	1	0.8%
100.316	incipient cataract, nucleus	3	1.7%	1	0.8%
100.317	incipient cataract, capsular	0		1	0.8%
100.321	incomplete cataract, anterior cortex	0		1	0.8%
100.326	incomplete cataract, nucleus	0		1	0.8%
100.328	posterior suture tip opacities	0		1	0.8%
100.330	generalized/complete cataract	8	4.6%	0	
100.999	*significant cataracts (summary)*	*23*	*13.3%*	*13*	*10.2%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	2	1.2%	1	0.8%
110.135	PHPV/PTVL	1	0.6%	0	
RETINA					
120.170	retinal dysplasia, folds	5	2.9%	0	
OPTIC NERVE					
130.110	micropapilla	1	0.6%	0	
130.120	optic nerve hypoplasia	1	0.6%	0	

	1991-2013		2014-2018	
OTHER				
900.000 other, unspecified	3	1.7%	0	
900.100 other, not inherited	5	2.9%	9	7.1%
900.110 other. suspect not inherited/significance unknown	8	4.6%	5	3.9%
NORMAL				
0.000 normal globe	71	41.0%	45	35.4%

OCULAR DISORDERS REPORT
STABYHOUN

There are insufficient breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the STABYHOUN breed. Therefore, there are no conditions listed with breeding advice.

OCULAR DISORDERS REPORT
STABYHOUN

Diagnostic Name	TOTAL DOGS EXAMINED	1991-2013 2 #	 %	2014-2018 4 #	 %
LENS					
100.312	incipient cataract, posterior cortex	1	50.0%	0	
100.999	*significant cataracts (summary)*	*1*	*50.0%*	*0*	
RETINA					
120.310	generalized progressive retinal atrophy (PRA)	1	50.0%	0	
NORMAL					
0.000	normal globe	1	50.0%	4	100.0%

STAFFORDSHIRE BULL TERRIER*

* Please note that since 1972 the AKC considers the Staffordshire Bull Terrier a different breed from the American Staffordshire Terrier.

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Distichiasis	Not defined	1	Breeder option	
B.	Persistent pupillary membranes				
	- iris to iris	Not defined	2, 3	Breeder option	
	- lens pigment foci/no strands	Not defined	4	Passes with no notation	
C.	Cataract	Autosomal recessive	2, 5-8	NO	Mutation in the *HSF4* gene
D.	Persistent hyperplastic primary vitreous (PHPV)	Not defined	4, 9, 10	NO	
E.	Persistent hyaloid artery	Not defined	1	Breeder option	
F.	Vitreous degeneration	Not defined	11	Breeder option	

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest

threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore is not noted on the certificate.

C. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

In the Staffordshire Bull Terrier, cataracts usually develop by one year of age. There is initial opacification of the suture lines progressing to nuclear and cortical cataract formation; complete cataracts and blindness develop by three years of age. The condition is inherited as an autosomal recessive mutation in the *HSF4* gene (*HSF4-1*). A DNA test is available.

D. Persistent hyperplastic primary vitreous (PHPV)

A congenital defect resulting from abnormalities in the development and regression of the hyaloid artery (the primary vitreous) and the interaction of this blood vessel with the posterior lens capsule/cortex during embryogenesis. This condition is often associated with persistent tunica vasculosa lentis (PTVL) which results from failure of regression of the embryologic vascular network which surrounds the developing lens.

The majority of affected dogs have a retrolental fibrovascular plaque and variable lenticular defects which include posterior lenticonus/globus, colobomata, intralenticular hemorrhage and/or secondary cataracts. Vision impairment may result. The disease is an inherited disorder in the breed, but the mode of inheritance has not been defined. The results of current studies cannot rule out autosomal recessive or a dominant trait with incomplete penetrance.

E. Persistent hyaloid artery (PHA)

A congenital defect resulting from abnormalities in the development and regression of the hyaloid artery. The blood vessel remnant can be present in the vitreous as a small patent vascular strand (PHA) or as a non-vascular strand that appears gray-white (persistent hyaloid remnant).

F. Vitreous degeneration

Liquefaction of the vitreous gel which may predispose to retinal detachment.

References

1. ACVO Genetics Committee, 2000-2002 and/or Data from CERF All-Breeds Report, 2000-2002.

2. ACVO Genetics Committee, 2002-2003 and/or Data from CERF All-Breeds Report, 2002-2003.

3. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

4. ACVO Genetics Committee, 2017 and/or Data from CERF/OFA All-Breeds Report, 2010-2016.

5. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

6. Barnett KC. Hereditary cataract in the dog. *J Small Anim Pract*. 1978;19:109-120.

7. Barnett KC. The diagnosis and differential diagnosis of cataract in the dog. *J Small Anim Pract*. 1985;26:305-316.

8. Mellersh CS, McLaughlin B, Ahonen S, et al. Mutation in HSF4 is associated with hereditary cataract in the Australian Shepherd. *Vet Ophthalmol*. 2009;12:372-378.

9. Curtis R, Barnett KC, Leon A. Persistent hyperplastic primary vitreous in the Staffordshire Bull Terrier. *Vet Rec*. 1984;115:385.

10. Leon A, Curtis R, Barnett K. Hereditary persistent hyperplastic primary vitreous in the Staffordshire Bull Terrier. *J Am Anim Hosp Assoc*. 1986;22:765-774.

11. ACVO Genetics Committee, 2015 and Data from OFA All-Breeds Report, 2014-2015.

OCULAR DISORDERS REPORT
STAFFORDSHIRE BULL TERRIER

		1991-2013		2014-2018	
	TOTAL DOGS EXAMINED	**745**		**383**	
Diagnostic Name		**#**	**%**	**#**	**%**
EYELIDS					
25.110	distichiasis	68	9.1%	21	5.5%
CORNEA					
70.700	corneal dystrophy	1	0.1%	2	0.5%
UVEA					
93.710	persistent pupillary membranes, iris to iris	18	2.4%	12	3.1%
93.720	persistent pupillary membranes, iris to lens	2	0.3%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	3	0.4%	9	2.3%
93.760	persistent pupillary membranes, endothelial opacity/no strands	0		1	0.3%
93.999	uveal cysts	4	0.5%	2	0.5%
LENS					
100.210	cataract. suspect not inherited/significance unknown	29	3.9%	14	3.7%
100.301	punctate cataract, anterior cortex	4	0.5%	4	1.0%
100.302	punctate cataract, posterior cortex	1	0.1%	0	
100.303	punctate cataract, equatorial cortex	1	0.1%	1	0.3%
100.304	punctate cataract, anterior sutures	1	0.1%	0	
100.305	punctate cataract, posterior sutures	0		4	1.0%
100.307	punctate cataract, capsular	1	0.1%	1	0.3%
100.311	incipient cataract, anterior cortex	0		5	1.3%
100.312	incipient cataract, posterior cortex	4	0.5%	5	1.3%
100.313	incipient cataract, equatorial cortex	4	0.5%	1	0.3%
100.314	incipient cataract, anterior sutures	0		1	0.3%
100.315	incipient cataract, posterior sutures	1	0.1%	1	0.3%
100.317	incipient cataract, capsular	2	0.3%	0	
100.328	posterior suture tip opacities	0		3	0.8%
100.330	generalized/complete cataract	0		1	0.3%
100.999	*significant cataracts (summary)*	*19*	*2.6%*	*24*	*6.3%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	4	0.5%	0	
110.320	vitreal degeneration	12	1.6%	8	2.1%
RETINA					
120.170	retinal dysplasia, folds	4	0.5%	2	0.5%
120.180	retinal dysplasia, geographic	4	0.5%	2	0.5%
120.310	generalized progressive retinal atrophy (PRA)	1	0.1%	1	0.3%
OTHER					
900.000	other, unspecified	9	1.2%	0	
900.100	other, not inherited	33	4.4%	12	3.1%
NORMAL					
0.000	normal globe	617	82.8%	290	75.7%

STANDARD SCHNAUZER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Distichiasis	Not defined	1	Breeder option
B.	Corneal dystrophy - epithelial/stromal	Not defined	1	Breeder option
C.	Persistent pupillary membranes - iris to iris	Not defined	2	Breeder option
D.	Cataract	Not defined	1	NO
E.	Vitreous degeneration	Not defined	3	Breeder option
F.	Retinal atrophy - generalized	Presumed autosomal recessive	1	NO
G.	Retinal dysplasia - folds	Not defined	1	Breeder option

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Corneal dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

C. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest potential threat to vision.

D. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membranes, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

There are apparently several forms of cataracts in the Standard Schnauzer: 1) posterior cortex and posterior/total nucleus involvement, with slow progression; 2) dense posterior polar opacity near the sub-capsular region which progresses rapidly to very dense posterior polar plaques in young animals; 3) dense posterior polar opacity like that reported in young animals but found in older animals with variable progression.

E. Vitreous degeneration

Liquefaction of the vitreous gel which may predispose to retinal detachment.

F. Retinal atrophy - generalized

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. Except for X-linked PRA in the Siberian Husky, in all breeds studied to date, PRA is inherited as an autosomal recessive trait.

G. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Standard Schnauzer breed. The conditions listed are generally recognized to exist in the breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

2. ACVO Genetics Committee, 2009 and/or Data from CERF All-Breeds Report, 2008.

3. ACVO Genetics Committee, 2014 and/or Data from OFA All-Breeds Reports, 2013-2014.

OCULAR DISORDERS REPORT
STANDARD SCHNAUZER

		1991-2013 2793		2014-2018 657	
	TOTAL DOGS EXAMINED				
Diagnostic Name		#	%	#	%
GLOBE					
0.110	microphthalmia	1	0.0%	0	
10.000	glaucoma	2	0.1%	0	
EYELIDS					
20.140	ectopic cilia	0		1	0.2%
25.110	distichiasis	61	2.2%	7	1.1%
NASOLACRIMAL					
40.910	keratoconjunctivitis sicca	0		1	0.2%
NICTITANS					
51.100	third eyelid cartilage anomaly	2	0.1%	1	0.2%
52.110	prolapsed gland of the third eyelid	2	0.1%	0	
CORNEA					
70.700	corneal dystrophy	22	0.8%	6	0.9%
70.730	corneal endothelial degeneration	0		1	0.2%
UVEA					
93.710	persistent pupillary membranes, iris to iris	14	0.5%	1	0.2%
93.720	persistent pupillary membranes, iris to lens	3	0.1%	1	0.2%
93.730	persistent pupillary membranes, iris to cornea	3	0.1%	0	
93.740	persistent pupillary membranes, iris sheets	2	0.1%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	5	0.2%	5	0.8%
93.760	persistent pupillary membranes, endothelial opacity/no strands	1	0.0%	0	
93.999	uveal cysts	2	0.1%	0	
LENS					
100.200	cataract, unspecified	2	0.1%	0	
100.210	cataract. suspect not inherited/significance unknown	107	3.8%	26	4.0%
100.301	punctate cataract, anterior cortex	9	0.3%	7	1.1%
100.302	punctate cataract, posterior cortex	5	0.2%	3	0.5%
100.303	punctate cataract, equatorial cortex	4	0.1%	1	0.2%
100.304	punctate cataract, anterior sutures	1	0.0%	1	0.2%
100.305	punctate cataract, posterior sutures	7	0.3%	6	0.9%
100.306	punctate cataract, nucleus	4	0.1%	3	0.5%
100.307	punctate cataract, capsular	10	0.4%	4	0.6%
100.311	incipient cataract, anterior cortex	11	0.4%	3	0.5%
100.312	incipient cataract, posterior cortex	11	0.4%	3	0.5%
100.313	incipient cataract, equatorial cortex	14	0.5%	2	0.3%
100.314	incipient cataract, anterior sutures	2	0.1%	0	
100.315	incipient cataract, posterior sutures	1	0.0%	1	0.2%
100.316	incipient cataract, nucleus	9	0.3%	0	
100.317	incipient cataract, capsular	4	0.1%	0	
100.321	incomplete cataract, anterior cortex	0		1	0.2%
100.322	incomplete cataract, posterior cortex	0		1	0.2%
100.323	incomplete cataract, equatorial cortex	0		1	0.2%
100.328	posterior suture tip opacities	0		10	1.5%
100.330	generalized/complete cataract	13	0.5%	0	

LENS CONTINUED		1991-2013		2014-2018	
100.375	subluxation/luxation, unspecified	1	0.0%	0	
100.999	*significant cataracts (summary)*	*107*	*3.8%*	*37*	*5.6%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	3	0.1%	1	0.2%
110.320	vitreal degeneration	16	0.6%	2	0.3%
RETINA					
120.170	retinal dysplasia, folds	29	1.0%	2	0.3%
120.180	retinal dysplasia, geographic	4	0.1%	0	
120.310	generalized progressive retinal atrophy (PRA)	23	0.8%	1	0.2%
120.910	retinal detachment without dialysis	1	0.0%	0	
OPTIC NERVE					
130.110	micropapilla	4	0.1%	1	0.2%
130.120	optic nerve hypoplasia	3	0.1%	0	
130.150	optic disc coloboma	0		1	0.2%
OTHER					
900.000	other, unspecified	31	1.1%	0	
900.100	other, not inherited	74	2.6%	31	4.7%
900.110	other. suspect not inherited/significance unknown	8	0.3%	2	0.3%
NORMAL					
0.000	normal globe	2494	89.3%	552	84.0%

SUSSEX SPANIEL

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Ectropion	Not defined	1	Breeder option
B.	Distichiasis	Not defined	2	Breeder option
C.	Exposure/Pigmentary Keratitis/Pigmentary Keratopathy	Not defined		Breeder option
D.	Iris coloboma	Not defined	2	NO
E.	Cataract	Not defined	3	NO
F.	Persistent hyaloid artery	Not defined	1	Breeder option
G.	Retinal dysplasia - folds	Not defined	1	Breeder option

Description and Comments

A. Ectropion

A conformational defect resulting in eversion of the eyelid(s), which may cause ocular irritation due to exposure. It is likely that ectropion is influenced by several genes (polygenic) defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

B. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

C. Exposure/Pigmentary keratitis/Pigmentary keratopathy

A condition characterized by variable degrees of superficial vascularization, fibrosis and/or pigmentation of the cornea. May be associated with excessive exposure/irritation of the globe due to shallow orbits, lower eyelid medial entropion, lagophthalmos and macropalpebral fissure.

D. Iris coloboma

A coloboma is a congenital defect which may affect the iris, choroid or optic disc. Iris colobomas are seen as notches in the pupillary margin. Scleral ectasia is defined as a congenital thinning and secondary distention of the sclera; when lined by uveal tissue it is called a staphyloma. These may be anteriorly located, apparent as a bulge beneath the upper eyelid or posteriorly located, requiring visualization with an ophthalmoscope. These conditions may or may not be genetically related to the same anomalies seen associated with microphthalmia.

E. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membranes, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

F. Persistent hyaloid artery (PHA)

Congenital defect resulting from abnormalities in the development and regression of the hyaloid artery. The blood vessel remnant can be present in the vitreous as a small patent vascular strand (PHA) or as a non-vascular strand that appears gray-white (persistent hyaloid remnant).

G. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Sussex Spaniel breed. The conditions listed are generally recognized to exist in the breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 2000-2002 and/or Data from CERF All-Breeds Report, 2000-2002.

2. ACVO Genetics Committee, 2002-2003 and/or Data from CERF All-Breeds Report, 2002-2003.

3. ACVO Genetics Committee, 2017 and/or Data from CERF/OFA All-Breeds Report, 2010-2016.

OCULAR DISORDERS REPORT
SUSSEX SPANIEL

Diagnostic Name		1991-2013 TOTAL DOGS EXAMINED 400 #	 %	2014-2018 68 #	 %
EYELIDS					
20.160	macropalpebral fissure	23	5.8%	0	
21.000	entropion, unspecified	1	0.2%	0	
22.000	ectropion, unspecified	26	6.5%	7	10.3%
25.110	distichiasis	24	6.0%	0	
NICTITANS					
52.110	prolapsed gland of the third eyelid	0		2	2.9%
CORNEA					
70.700	corneal dystrophy	2	0.5%	0	
UVEA					
93.110	iris hypoplasia	1	0.2%	2	2.9%
93.150	iris coloboma	7	1.8%	1	1.5%
93.710	persistent pupillary membranes, iris to iris	2	0.5%	1	1.5%
93.720	persistent pupillary membranes, iris to lens	6	1.5%	1	1.5%
93.740	persistent pupillary membranes, iris sheets	1	0.2%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		2	2.9%
LENS					
100.210	cataract. suspect not inherited/significance unknown	13	3.2%	4	5.9%
100.302	punctate cataract, posterior cortex	1	0.2%	0	
100.305	punctate cataract, posterior sutures	0		1	1.5%
100.307	punctate cataract, capsular	1	0.2%	0	
100.312	incipient cataract, posterior cortex	2	0.5%	0	
100.315	incipient cataract, posterior sutures	1	0.2%	1	1.5%
100.316	incipient cataract, nucleus	0		2	2.9%
100.317	incipient cataract, capsular	4	1.0%	1	1.5%
100.322	incomplete cataract, posterior cortex	0		1	1.5%
100.328	posterior suture tip opacities	0		1	1.5%
100.330	generalized/complete cataract	2	0.5%	0	
100.999	*significant cataracts (summary)*	*11*	*2.8%*	*6*	*8.8%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	33	8.2%	6	8.8%
110.135	PHPV/PTVL	4	1.0%	0	
110.320	vitreal degeneration	1	0.2%	0	
RETINA					
120.170	retinal dysplasia, folds	40	10.0%	3	4.4%
120.180	retinal dysplasia, geographic	2	0.5%	0	
OPTIC NERVE					
130.110	micropapilla	1	0.2%	0	
130.120	optic nerve hypoplasia	1	0.2%	0	
130.150	optic disc coloboma	3	0.8%	0	
OTHER					
900.000	other, unspecified	10	2.5%	0	
900.100	other, not inherited	19	4.8%	5	7.4%

OTHER CONTINUED	1991-2013	2014-2018
900.110 other. suspect not inherited/significance unknown	2 0.5%	2 2.9%
NORMAL		
0.000 normal globe	253 63.2%	45 66.2%

SWEDISH LAPPHUND

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Retinal atrophy - generalized (*prcd*)	Autosomal recessive	1	NO	Mutation in the *prcd* gene

Description and Comments

A. Retinal atrophy - generalized (*prcd*)

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

Studies have shown that the principal form of PRA in the Swedish Lapphund is *prcd* which is a late-onset form of PRA inherited as autosomal recessive. The mutation is allelic to that present in Miniature Poodles, Labrador Retrievers, English and American Cocker Spaniels, and others. The locus is termed the progressive rod-cone degeneration (*prcd*) gene and at least 30+ breeds are affected. In most affected dogs to date, the disease is recognized clinically in dogs 3-6 years of age or older. This photoreceptor degeneration is characterized by slow death of visual cells following their normal development. The disease begins clinically with signs of night blindness followed by day blindness. A DNA test is available.

References

There are no breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the Swedish Lapphund. The condition listed above is currently noted solely due to the availability of a genetic test for the disease.

1. Zangerl B, Goldstein O, Philp AR, et al. Identical mutation in a novel retinal gene causes progressive rod-cone degeneration in dogs and retinitis pigmentosa in humans. *Genomics*. 2006 Nov;88:551-563.

OCULAR DISORDERS REPORT
SWEDISH LAPPHUND

Diagnostic Name	TOTAL DOGS EXAMINED	1991-2013 1 #	%	2014-2018 8 #	%
UVEA					
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		1	12.5%
LENS					
100.210	cataract. suspect not inherited/significance unknown	1	100.0%	0	
100.305	punctate cataract, posterior sutures	0		1	12.5%
100.315	incipient cataract, posterior sutures	0		1	12.5%
100.328	posterior suture tip opacities	0		1	12.5%
100.999	*significant cataracts (summary)*	*0*		*2*	*25.0%*
RETINA					
120.310	generalized progressive retinal atrophy (PRA)	0		1	12.5%
NORMAL					
0.000	normal globe	0		5	62.5%

SWEDISH VALLHUND

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Distichiasis	Not defined	1, 2	Breeder option	
B.	Corneal dystrophy - epithelial/stromal	Not defined	1	Breeder option	
C.	Persistent pupillary membranes				
	- iris to iris	Not defined	3, 4	Breeder option	
	- iris to lens	Not defined	5	NO	
	- lens pigment foci/no strands	Not defined	6	Passes with no notation	
D.	Cataract	Not defined	7	NO	
E.	Vitreous degeneration	Not defined	7, 8	Breeder option	
F.	Retinopathy	Presumed autosomal recessive	9-13	NO	Mutation in the *MERTK* gene
G.	Retinal dysplasia - folds	Not defined	1	Breeder option	

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Corneal dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral. In the Swedish Vallhund, lesions are circular or semicircular central crystalline deposits in the anterior corneal stroma that appear between 2 and 5 years of age. It may be associated with exophthalmos and

lagophthalmos common in these dogs.

C. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

D. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

E. Vitreous degeneration

Liquefaction of the vitreous gel which may predispose to retinal detachment.

F. Retinopathy

Swedish Vallhunds have a unique form of retinal degeneration compared to most forms of PRA. The condition is multifocal rather than diffuse and the age of onset and rate of progression vary dramatically, even between littermates. The clinical signs progress in three stages. (A. Komaromy, personal communication 2016)

- Stage one usually occurs between 2-3 years of age and is characterized by mottling or multifocal brown discoloration of the tapetal fundus – this should be marked as retinopathy even though visual deficits are not yet noted.

- In stage two, geographic thinning of the retina can be seen and subtle night vision deficits are observed.

- In stage three, the retinal thinning becomes more generalized with small islands of retinal sparing and deficits are noted in both photopic and scotopic vision. The disease has been associated with a mutation in the *MERTK* gene on canine chromosome 17. Dogs homozogous for the mutation have an 18 fold increased risk of developing the retinopathy. However, the actual causative mutation has not yet been identified.

G. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with

maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

References

1. ACVO Genetics Committee, 2008 and/or Data from CERF All-Breeds Report, 2003-2007.

2. ACVO Genetics Committee, 2007 and/or Data from CERF All-Breeds Report, 2002-2006.

3. ACVO Genetics Committee, 2000-2002 and/or Data from CERF All-Breeds Report, 2000-2002.

4. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

5. ACVO Genetics Committee, 2016 and/or Data from CERF/OFA All-Breeds Report, 2010-2015.

6. ACVO Genetics Committee, 2017 and/or Data from OFA All-Breeds Report, 2013-2017.

7. ACVO Genetics Committee, 2006 and/or Data from CERF All-Breeds Report, 2001-2005.

8. ACVO Genetics Committee, 2009 and/or Data from CERF All-Breeds Report, 2008.

9. ACVO Genetics Committee, 2011 and/or Data from CERF All-Breeds Report, 2010.

10. ACVO Genetics Committee, 2015 and Data from OFA All-Breeds Report, 2014-2015.

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13. Everson R, Pettitt L, Forman OP, et al. An intronic LINE-1 insertion in MRTK is strongly associated with retinopathy in Swedish Vallhund Dogs. PLoS one. 2017; 12(8):e0183021

OCULAR DISORDERS REPORT
SWEDISH VALLHUND

Diagnostic Name		1991-2013 TOTAL DOGS EXAMINED 1142 #	%	2014-2018 505 #	%
EYELIDS					
20.140	ectopic cilia	1	0.1%	0	
25.110	distichiasis	32	2.8%	6	1.2%
NASOLACRIMAL					
40.910	keratoconjunctivitis sicca	1	0.1%	0	
CORNEA					
70.700	corneal dystrophy	14	1.2%	9	1.8%
UVEA					
93.140	corneal endothelial pigment without PPM	1	0.1%	0	
93.710	persistent pupillary membranes, iris to iris	200	17.5%	98	19.4%
93.720	persistent pupillary membranes, iris to lens	2	0.2%	8	1.6%
93.730	persistent pupillary membranes, iris to cornea	1	0.1%	2	0.4%
93.740	persistent pupillary membranes, iris sheets	1	0.1%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	2	0.2%	9	1.8%
93.760	persistent pupillary membranes, endothelial opacity/no strands	1	0.1%	0	
93.810	uveal melanoma	2	0.2%	0	
93.999	uveal cysts	5	0.4%	1	0.2%
LENS					
100.210	cataract. suspect not inherited/significance unknown	175	15.3%	64	12.7%
100.301	punctate cataract, anterior cortex	8	0.7%	1	0.2%
100.302	punctate cataract, posterior cortex	3	0.3%	0	
100.303	punctate cataract, equatorial cortex	2	0.2%	1	0.2%
100.305	punctate cataract, posterior sutures	9	0.8%	4	0.8%
100.306	punctate cataract, nucleus	8	0.7%	7	1.4%
100.307	punctate cataract, capsular	0		3	0.6%
100.311	incipient cataract, anterior cortex	14	1.2%	4	0.8%
100.312	incipient cataract, posterior cortex	2	0.2%	2	0.4%
100.313	incipient cataract, equatorial cortex	5	0.4%	2	0.4%
100.314	incipient cataract, anterior sutures	1	0.1%	3	0.6%
100.315	incipient cataract, posterior sutures	5	0.4%	1	0.2%
100.316	incipient cataract, nucleus	12	1.1%	3	0.6%
100.321	incomplete cataract, anterior cortex	0		2	0.4%
100.323	incomplete cataract, equatorial cortex	0		1	0.2%
100.328	posterior suture tip opacities	0		13	2.6%
100.330	generalized/complete cataract	7	0.6%	0	
100.999	*significant cataracts (summary)*	*76*	*6.7%*	*34*	*6.7%*
VITREOUS					
110.135	PHPV/PTVL	1	0.1%	0	
110.200	vitritis	0		2	0.4%
110.320	vitreal degeneration	39	3.4%	12	2.4%
FUNDUS					
97.110	choroidal hypoplasia	0		1	0.2%

		1991-2013		2014-2018	
RETINA					
120.170	retinal dysplasia, folds	18	1.6%	6	1.2%
120.180	retinal dysplasia, geographic	4	0.4%	1	0.2%
120.190	retinal dysplasia, detached	1	0.1%	0	
120.310	generalized progressive retinal atrophy (PRA)	43	3.8%	3	0.6%
120.960	retinopathy	25	2.2%	26	5.1%
OPTIC NERVE					
130.110	micropapilla	1	0.1%	4	0.8%
130.150	optic disc coloboma	1	0.1%	0	
OTHER					
900.000	other, unspecified	47	4.1%	0	
900.100	other, not inherited	79	6.9%	50	9.9%
900.110	other. suspect not inherited/significance unknown	17	1.5%	3	0.6%
NORMAL					
0.000	normal globe	749	65.6%	256	50.7%

TEDDY ROOSEVELT TERRIER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Lens luxation	Autosomal recessive	1	NO	Mutation in the *ADAMTS17* gene

Description and Comments

A. Lens luxation

Partial (subluxation) or complete displacement of the lens from the normal anatomic site behind the pupil. Lens luxation not associated with trauma or inflammation is presumed to be inherited. Lens luxation may result in elevated intraocular pressure (glaucoma), causing vision impairment or blindness. A mutation in *ADAMTS17* has been associated with primary lens luxation. A DNA test is available.

References

There are no breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the Teddy Roosevelt Terrier. The condition listed above is currently noted solely due to the availability of a genetic test for the disease.

1. Gould D, Pettitt L, McLaughlin B, et al. ADAMTS17 mutation associated with primary lens luxation is widespread among breeds. *Vet Ophthalmol*. 2011; 14: 378-384.

OCULAR DISORDERS REPORT
TEDDY ROOSEVELT TERRIER

Diagnostic Name	TOTAL DOGS EXAMINED	1991-2013 1 #	 %	2014-2018 4 #	 %
LENS					
100.311	incipient cataract, anterior cortex	0		1	25.0%
100.312	incipient cataract, posterior cortex	0		1	25.0%
100.313	incipient cataract, equatorial cortex	0		1	25.0%
100.999	*significant cataracts (summary)*	*0*		*3*	*75.0%*
VITREOUS					
110.200	vitritis	0		1	25.0%
OTHER					
900.100	other, not inherited	0		2	50.0%
NORMAL					
0.000	normal globe	1	100.0%	0	

TENTERFIELD TERRIER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Lens luxation	Autosomal recessive	1	NO	Mutation in the *ADAMTS17* gene

Description and Comments

A. Lens luxation

Partial (subluxation) or complete displacement of the lens from the normal anatomic site behind the pupil. Lens luxation not associated with trauma or inflammation is presumed to be inherited. Lens luxation may result in elevated intraocular pressure (glaucoma), causing vision impairment or blindness. A mutation in *ADAMTS17* has been associated with primary lens luxation. A DNA test is available.

References

There are no breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the Tenterfield Terrier. The condition listed above is currently noted solely due to the availability of a genetic test for the disease.

1. Gould D, Pettitt L, McLaughlin B, et al. ADAMTS17 mutation associated with primary lens luxation is widespread among breeds. *Vet Ophthalmol*. 2011; 14: 378-384.

TIBETAN MASTIFF

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Persistent pupillary membranes			
	- iris to iris	Not defined	1	Breeder option
	- lens pigment foci/no strands	Not defined	1	Passes with no notation

Description and Comments

A. Persistent pupillary membranes (PPM)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Tibetan Mastiff breed. The conditions listed above are generally recognized to exist in the breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 2017 and/or Data from CERF/OFA All-Breeds Report, 2010-2016.

OCULAR DISORDERS REPORT
TIBETAN MASTIFF

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2013 29 #	 %	2014-2018 48 #	 %
EYELIDS						
21.000	entropion, unspecified		3	10.3%	0	
25.110	distichiasis		1	3.4%	2	4.2%
CORNEA						
70.700	corneal dystrophy		1	3.4%	0	
UVEA						
93.710	persistent pupillary membranes, iris to iris		1	3.4%	9	18.8%
93.750	persistent pupillary membranes, lens pigment foci/no strands		2	6.9%	3	6.2%
LENS						
100.210	cataract. suspect not inherited/significance unknown		1	3.4%	1	2.1%
100.301	punctate cataract, anterior cortex		1	3.4%	0	
100.302	punctate cataract, posterior cortex		0		1	2.1%
100.307	punctate cataract, capsular		0		1	2.1%
100.315	incipient cataract, posterior sutures		0		1	2.1%
100.317	incipient cataract, capsular		0		2	4.2%
100.328	posterior suture tip opacities		0		1	2.1%
100.999	*significant cataracts (summary)*		*1*	*3.4%*	*5*	*10.4%*
OTHER						
900.000	other, unspecified		2	6.9%	0	
900.100	other, not inherited		0		2	4.2%
NORMAL						
0.000	normal globe		22	75.9%	32	66.7%

TIBETAN SPANIEL

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Entropion	Not defined	1	Breeder option	
B.	Distichiasis	Not defined	1	Breeder option	
C.	Exposure / pigmentary keratitis	Not defined	2	Breeder option	
D.	Persistent pupillary membranes - iris to iris	Not defined	3, 4	Breeder option	
E.	Cataract	Not defined	1	NO	
F.	Retinal atrophy - generalized	Autosomal recessive	1, 5, 6	NO	Mutation in the *FAM161A* gene
G.	Ceroid lipofuscinosis	Not defined	7	NO	

Descriptions and Comments

A. Entropion

A conformational defect resulting in an "in rolling" of one or more of the eyelids which may cause ocular irritation. It is likely that entropion is influenced by several genes (polygenic), defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

B. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time. It is difficult to make a strong recommendation with regards to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded and breeding discretion is advised.

C. Exposure/pigmentary keratitis

A condition characterized by variable degrees of superficial vascularization, fibrosis and/or pigmentation of the cornea. May be associated with excessive exposure/irritation of the globe due to shallow orbits, lower eyelid medial entropion, lagophthalmos and macropalpebral fissure.

D. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

E. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

F. Retinal atrophy - generalized

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. In most breeds PRA is inherited as an autosomal recessive trait.

In the Tibetan Spaniel, a mutation in *FAM161A* causes a later onset (4-5 years) of PRA. This form is being called progressive retinal atrophy 3 (PRA3) and appears to be the causative mutation in about 60% of Tibetan Spaniels with PRA. This form is inherited as an autosomal recessive trait. A DNA test for PRA3 is available. This test will not detect PRA caused by other genetic mutations. At least one other form of PRA appears to be present in the Tibetan Spaniel.

G. Ceroid Lipofuscinosis

An inherited disease of man and animal characterized by the accumulation of lipopigment in various tissues of the body including the eye. It results in progressive neurologic disease including blindness. (Also called Batten's disease.)

References

1. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

2. ACVO Genetics Committee, 2013-2014 and Data from OFA All-Breeds Report, 2013-2014.

3. ACVO Genetics Committee, 2000-2002 and/or Data from CERF All-Breeds Report, 2000-2002.

4. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

5. Bjerkas E. Progressive retinal atrophy in dogs in Norway. *Norsk Veterinaertidsskrift*. 1991;103:601-610.

6. Downs LM, Mellersh CS. An Intronic SINE insertion in FAM161A that causes exon-skipping is associated with progressive retinal atrophy in Tibetan Spaniels and Tibetan Terriers. *PLoS One*. 2014;9:e93990.

7. Katz ML, Narfstrom K, Johnson GS, et al. Assessment of retinal function and characterization of lysosomal storage body accumulation in the retinas and brains of Tibetan Terriers with ceroid-lipofuscinosis. *Am J Vet Res*. 2005;66:67-76.

OCULAR DISORDERS REPORT
TIBETAN SPANIEL

Diagnostic Name		1991-2013 3024 #	%	2014-2018 420 #	%
GLOBE					
0.110	microphthalmia	2	0.1%	0	
EYELIDS					
20.140	ectopic cilia	3	0.1%	1	0.2%
20.160	macropalpebral fissure	5	0.2%	0	
21.000	entropion, unspecified	86	2.8%	4	1.0%
22.000	ectropion, unspecified	2	0.1%	0	
25.110	distichiasis	262	8.7%	31	7.4%
NASOLACRIMAL					
32.110	imperforate lower nasolacrimal punctum	1	0.0%	0	
40.910	keratoconjunctivitis sicca	2	0.1%	0	
NICTITANS					
51.100	third eyelid cartilage anomaly	2	0.1%	0	
52.110	prolapsed gland of the third eyelid	6	0.2%	0	
CORNEA					
70.210	corneal pannus	8	0.3%	0	
70.220	pigmentary keratitis	17	0.6%	2	0.5%
70.700	corneal dystrophy	10	0.3%	0	
70.730	corneal endothelial degeneration	1	0.0%	0	
UVEA					
93.110	iris hypoplasia	1	0.0%	0	
93.150	iris coloboma	4	0.1%	0	
93.710	persistent pupillary membranes, iris to iris	53	1.8%	13	3.1%
93.720	persistent pupillary membranes, iris to lens	4	0.1%	1	0.2%
93.730	persistent pupillary membranes, iris to cornea	4	0.1%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	1	0.0%	6	1.4%
93.760	persistent pupillary membranes, endothelial opacity/no strands	1	0.0%	0	
93.810	uveal melanoma	0		2	0.5%
93.999	uveal cysts	2	0.1%	1	0.2%
LENS					
100.200	cataract, unspecified	9	0.3%	0	
100.210	cataract. suspect not inherited/significance unknown	74	2.4%	9	2.1%
100.301	punctate cataract, anterior cortex	4	0.1%	2	0.5%
100.302	punctate cataract, posterior cortex	2	0.1%	0	
100.303	punctate cataract, equatorial cortex	2	0.1%	0	
100.304	punctate cataract, anterior sutures	1	0.0%	0	
100.305	punctate cataract, posterior sutures	8	0.3%	3	0.7%
100.306	punctate cataract, nucleus	1	0.0%	0	
100.307	punctate cataract, capsular	1	0.0%	0	
100.311	incipient cataract, anterior cortex	20	0.7%	1	0.2%
100.312	incipient cataract, posterior cortex	12	0.4%	0	
100.313	incipient cataract, equatorial cortex	6	0.2%	0	
100.314	incipient cataract, anterior sutures	2	0.1%	0	
100.315	incipient cataract, posterior sutures	4	0.1%	0	

LENS CONTINUED		1991-2013		2014-2018	
100.316	incipient cataract, nucleus	6	0.2%	1	0.2%
100.317	incipient cataract, capsular	2	0.1%	0	
100.325	incomplete cataract, posterior sutures	1	0.0%	0	
100.328	posterior suture tip opacities	3	0.1%	8	1.9%
100.330	generalized/complete cataract	1	0.0%	0	
100.375	subluxation/luxation, unspecified	1	0.0%	0	
100.999	*significant cataracts (summary)*	*82*	*2.7%*	*7*	*1.7%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	8	0.3%	0	
110.135	PHPV/PTVL	1	0.0%	0	
110.200	vitritis	1	0.0%	1	0.2%
110.320	vitreal degeneration	13	0.4%	1	0.2%
RETINA					
120.170	retinal dysplasia, folds	9	0.3%	0	
120.180	retinal dysplasia, geographic	0		1	0.2%
120.190	retinal dysplasia, detached	2	0.1%	0	
120.310	generalized progressive retinal atrophy (PRA)	26	0.9%	3	0.7%
120.960	retinopathy	0		4	1.0%
OPTIC NERVE					
130.120	optic nerve hypoplasia	2	0.1%	0	
130.150	optic disc coloboma	6	0.2%	1	0.2%
OTHER					
900.000	other, unspecified	32	1.1%	0	
900.100	other, not inherited	85	2.8%	20	4.8%
900.110	other. suspect not inherited/significance unknown	13	0.4%	1	0.2%
NORMAL					
0.000	normal globe	2471	81.7%	331	78.8%

TIBETAN TERRIER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Distichiasis	Not defined	1	Breeder option	
B.	Corneal dystrophy - epithelial/stromal	Not defined	2	Breeder option	
C.	Persistent pupillary membranes				
	- iris to iris	Not defined	1	Breeder option	
	- lens pigment foci/no strands	Not defined	3	Passes with no notation	
D.	Cataract	Not defined	1	NO	
E.	Lens luxation	Autosomal recessive	1, 4-9	NO	Mutation in the *ADAMTS17* gene
F.	Vitreous degeneration	Not defined	10	Breeder option	
G.	Retinal atrophy - generalized	Autosomal recessive	1, 5, 11-14	NO	Mutation in the *FAM161A* gene
H.	Retinal atrophy - Rod-cone dysplasia (*rcd4*)	Autosomal recessive	15	NO	Mutation in the *C2orf71* gene
I.	Ceroid lipofuscinosis	Not defined	16, 17	NO	

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time. It is difficult to make a strong recommendation with regards to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded and breeding discretion is advised.

B. Corneal dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

C. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

D. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

E. Lens luxation

Partial (subluxation) or complete displacement of the lens from the normal anatomic site behind the pupil. Lens luxation not associated with trauma or inflammation is presumed to be inherited. Lens luxation may result in elevated intraocular pressure (glaucoma), causing vision impairment or blindness. A mutation in *ADAMTS17* has been associated with primary lens luxation. A DNA test is available.

F. Vitreous degeneration

A liquefaction of the vitreous gel which may predispose to retinal detachment.

G. Retinal atrophy - generalized

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. Except for X-linked PRA in the Siberian Husky and Samoyed, in most breeds studied to date, PRA is inherited as an autosomal recessive trait.

There are ERG studies to indicate that there is depression of the B wave at 10-12 weeks of age in the second variety and slower depression in the first variety. Some may have no obvious signs at 5-6 years of age, only to develop clinical signs at 6-7 years of age. It is logical that any animal found with signs of bilateral atrophy should not be bred. Members of the family of the affected animal should be carefully screened. Perhaps, ERG in animals less than 4 years of age is logical, especially if the animal is intended for breed foundation.

In the Tibetan Terrier a mutation in *FAM161A* causes a later onset (4-5 years) of PRA. This form is being called progressive retinal atrophy 3 (PRA3). This form is inherited as an autosomal recessive trait. A DNA test for PRA3 is available. This test will not detect PRA caused by other genetic mutations. At least one other form of PRA appears to be present in the Tibetan Terrier.

H. Rod-cone dysplasia, type 4 (*rcd4*)

A form of PRA initially identified in the Gordon and Irish Setter breeds. Clinical night blindness is observed on average as late as 10 years of age and progresses to total blindness. This form of PRA has been referred to as late-onset PRA (LOPRA). The disorder is caused by a mutation present in the *C2orf71* gene. A mutation-based gene test is now available that will unequivocally identify genetically normal, affected and carrier dogs. The test is accurate only for this mutation and is of no value in identifying other forms of PRA.

I. Ceroid Lipofuscinosis

An inherited disease of man and animal characterized by the accumulation of lipopigment in various tissues of the body including the eye. It results in progressive neurologic disease. In the Tibetan Terrier, moderate visual impairment can occur in low-light conditions.

References

1. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

2. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

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OCULAR DISORDERS REPORT
TIBETAN TERRIER

		1991-2013 7675		2014-2018 1392	
	TOTAL DOGS EXAMINED				
Diagnostic Name		#	%	#	%
GLOBE					
0.110	microphthalmia	4	0.1%	0	
10.000	glaucoma	3	0.0%	0	
EYELIDS					
21.000	entropion, unspecified	1	0.0%	0	
25.110	distichiasis	112	1.5%	10	0.7%
NASOLACRIMAL					
32.110	imperforate lower nasolacrimal punctum	0		5	0.4%
NICTITANS					
52.110	prolapsed gland of the third eyelid	4	0.1%	0	
CORNEA					
70.220	pigmentary keratitis	3	0.0%	0	
70.700	corneal dystrophy	82	1.1%	11	0.8%
70.730	corneal endothelial degeneration	1	0.0%	0	
UVEA					
93.710	persistent pupillary membranes, iris to iris	440	5.7%	89	6.4%
93.720	persistent pupillary membranes, iris to lens	21	0.3%	1	0.1%
93.730	persistent pupillary membranes, iris to cornea	40	0.5%	0	
93.740	persistent pupillary membranes, iris sheets	10	0.1%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	14	0.2%	43	3.1%
93.760	persistent pupillary membranes, endothelial opacity/no strands	9	0.1%	5	0.4%
93.810	uveal melanoma	0		1	0.1%
LENS					
100.200	cataract, unspecified	34	0.4%	0	
100.210	cataract. suspect not inherited/significance unknown	347	4.5%	82	5.9%
100.301	punctate cataract, anterior cortex	60	0.8%	17	1.2%
100.302	punctate cataract, posterior cortex	33	0.4%	6	0.4%
100.303	punctate cataract, equatorial cortex	11	0.1%	3	0.2%
100.304	punctate cataract, anterior sutures	12	0.2%	0	
100.305	punctate cataract, posterior sutures	6	0.1%	1	0.1%
100.306	punctate cataract, nucleus	6	0.1%	4	0.3%
100.307	punctate cataract, capsular	11	0.1%	5	0.4%
100.311	incipient cataract, anterior cortex	53	0.7%	16	1.1%
100.312	incipient cataract, posterior cortex	58	0.8%	14	1.0%
100.313	incipient cataract, equatorial cortex	33	0.4%	5	0.4%
100.314	incipient cataract, anterior sutures	12	0.2%	1	0.1%
100.315	incipient cataract, posterior sutures	13	0.2%	1	0.1%
100.316	incipient cataract, nucleus	7	0.1%	4	0.3%
100.317	incipient cataract, capsular	5	0.1%	0	
100.321	incomplete cataract, anterior cortex	1	0.0%	10	0.7%
100.322	incomplete cataract, posterior cortex	0		6	0.4%
100.323	incomplete cataract, equatorial cortex	0		5	0.4%
100.326	incomplete cataract, nucleus	0		1	0.1%
100.328	posterior suture tip opacities	0		2	0.1%

LENS CONTINUED		1991-2013		2014-2018	
100.330	generalized/complete cataract	38	0.5%	2	0.1%
100.340	resorbing/hypermature cataract	1	0.0%	0	
100.375	subluxation/luxation, unspecified	16	0.2%	1	0.1%
100.999	*significant cataracts (summary)*	*394*	*5.1%*	*101*	*7.3%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	4	0.1%	2	0.1%
110.135	PHPV/PTVL	2	0.0%	0	
110.320	vitreal degeneration	38	0.5%	3	0.2%
FUNDUS					
97.110	choroidal hypoplasia	1	0.0%	0	
97.120	coloboma	1	0.0%	0	
RETINA					
120.170	retinal dysplasia, folds	9	0.1%	3	0.2%
120.180	retinal dysplasia, geographic	3	0.0%	2	0.1%
120.190	retinal dysplasia, detached	3	0.0%	1	0.1%
120.310	generalized progressive retinal atrophy (PRA)	119	1.6%	5	0.4%
120.400	retinal hemorrhage	3	0.0%	0	
120.910	retinal detachment without dialysis	3	0.0%	0	
120.960	retinopathy	2	0.0%	8	0.6%
OPTIC NERVE					
130.110	micropapilla	2	0.0%	0	
130.120	optic nerve hypoplasia	4	0.1%	1	0.1%
OTHER					
900.000	other, unspecified	82	1.1%	0	
900.100	other, not inherited	159	2.1%	46	3.3%
900.110	other. suspect not inherited/significance unknown	26	0.3%	2	0.1%
NORMAL					
0.000	normal globe	6601	86.0%	1081	77.7%

TOY AUSTRALIAN SHEPHERD

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Microphthalmia with multiple ocular defects	Presumed autosomal recessive with incomplete penetrance	1-6	NO	
B.	Distichiasis	Not defined	1, 7	Breeder option	
C.	Corneal dystrophy - epithelial/stromal	Not defined	8	Breeder option	
D.	Iris coloboma	Not defined	1	NO	
E.	Iris hypoplasia	Not defined	9	Breeder option	
F.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder option	
G.	Cataract	Autosomal co-dominant	1, 10, 11	NO	Mutation in the *HSF4-2* gene
H.	Persistent hyaloid artery	Not defined	8	Breeder option	
I.	Retinal atrophy - generalized (*prcd*)	Autosomal recessive	1, 9, 12, 13	NO	Mutation in the *prcd* gene
J.	Cone degeneration - day blindness	Autosomal recessive	14	NO	Mutation in the *CNGB3* gene
K.	Multifocal retinopathy - *cmr1*	Autosomal recessive	15	Breeder option	Mutation in the *BEST1* gene
L.	Retinal dysplasia - folds	Not defined	8	Breeder option	

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
M.	Choroidal hypoplasia (Collie Eye Anomaly) - Optic nerve coloboma - Retinal detachment - Retinal hemorrhage - Staphyloma/coloboma	Autosomal recessive	1, 7, 16	NO	Mutation in the *NHEJ1* gene
N.	Coloboma/staphyloma without microphthalmia	Not defined	1	NO	
O.	Micropapilla	Not defined	20	Breeder option	

It is recommended that this breed be examined prior to pharmacological dilation to best facilitate identification of iris coloboma.

Description and Comments

A. Microphthalmia with multiple ocular defects

Microphthalmia is a congenital defect characterized by a small eye with associated defects of the cornea, iris (coloboma), anterior chamber, lens (cataract) and/or retina (dysplasia). In the Australian Shepherd, microphthalmia has long been suspected to be associated with merled coat coloration but a definitive genetic relationship has not been established. The eyes of affected homozygous merle (usually white) dogs have extreme forms of this entity and are usually blind at birth. Affected heterozygous merle-coated dogs demonstrate less severe manifestations.

B. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

C. Corneal Dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

D. Iris coloboma

A congenital abnormality in iris development usually characterized by a full-thickness defect in iris tissue, commonly (though not exclusively) located at the 6 o'clock position associated with failure of closure of the optic fissure. A partial-thickness defect in iris tissue should be recorded as iris hypoplasia on the OFA form.

E. Iris hypoplasia

A congenital abnormality in iris development usually characterized by a reduced quantity of tissue identified as a partial-thickness defect in iris tissue. Full-thickness iris hypoplasia is rare and should be recorded as an iris coloboma on the OFA form.

F. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

G. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

In the Australian Shepherd, a mutation in *HSF4* (heat shock transcription factor 4), the *HSF4-2* mutation, has been shown to increase the likelihood of cataract formation. The mutation is inherited in a co-dominant manner. Dogs with one copy of the mutation develop bilateral posterior cataracts and homozygotes develop a nuclear cataract that typically progresses to a mature cataract. A DNA test is available for this mutation. Other genetic factors can contribute to cataract formation in this breed and will not be detected by this test.

H. Persistent hyaloid artery (PHA)

Congenital defect resulting from abnormalities in the development and regression of the hyaloid artery. The blood vessel remnant can be present in the vitreous as a small patent vascular strand (PHA) or as a non-vascular strand that appears gray-white (persistent hyaloid remnant).

I. Retinal atrophy - generalized (*prcd*)

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent

clinically. With limited exceptions, most PRAs are recessively inherited.

Studies have shown that the principal form of PRA in the Toy Australian Shepherd is *prcd* which is a late-onset form of PRA inherited as autosomal recessive. The mutation is allelic to that present in Miniature Poodles, Labrador Retrievers, English and American Cocker Spaniels, and others. The locus is termed the progressive rod-cone degeneration (*prcd*) gene and at least 30+ breeds are affected. In most affected dogs to date, the disease is recognized clinically in dogs 3-6 years of age or older. This photoreceptor degeneration is characterized by slow death of visual cells following their normal development. The disease begins clinically with signs of night blindness followed by day blindness. A DNA test is available.

J. Cone degeneration - day blindness or hemeralopia

Autosomal recessively inherited early degeneration of the cone photoreceptors. Affected puppies develop day-blindness, colorblindness, and photophobia between 8 and 12 weeks of age. Affected dogs remain ophthalmoscopically normal their entire life. Electroretinography is required to definitively diagnose the disorder. Genetically, the condition results from a mutation in the *CNGB3* gene. A DNA test is available.

K. Multifocal retinopathy

Canine Multifocal Retinopathy type 1 (cmr1) is characterized by numerous distinct (i.e. multifocal), roughly circular patches of elevated retina (multifocal bullous retinal detachments). There may be a serous subretinal fluid, or accumulation of subretinal material that produces gray-tan-pink colored lesions. These lesions, looking somewhat like blisters, vary in location and size, although typically they are present in both eyes of the affected dog.

The disease generally develops in young dogs between 11-20 weeks of age and there is minimal progression after 1 year of age. The lesions may flatten, leaving areas of retinal thinning and RPE hypertrophy, hyperplasia, and pigmentation. Discrete areas of tapetal hyper-reflectivity may be seen in areas of previous retinal and RPE detachments. Most dogs exhibit no noticeable problem with vision or electroretinographic abnormalities despite their abnormal appearing retinas.

Canine Multifocal Retinopathy type 1 is caused by a mutation in the Bestrophin 1 gene (*BEST1*) and is described to be recessively inherited in the Great Pyrenees, Dogue de Bordeaux, Bullmastiff, and Mastiff.

L. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

M. Choroidal hypoplasia (Collie Eye Anomaly)
- staphyloma/coloboma
- retinal detachment
- retinal hemorrhage
- optic nerve coloboma

A spectrum of malformations present at birth and ranging from inadequate development of the choroid (choroidal hypoplasia) to defects of the choroid, sclera, and/or optic nerve (coloboma/staphyloma) to complete retinal detachment (with or without hemorrhage). Mildly affected animals will have no detectable vision deficit.

This disorder is collectively referred to as "Collie Eye Anomaly." The choroidal hypoplasia component is caused by a 7799 base pair deletion with the gene *NHEJ1.* The mutation is a recessive trait. A DNA test is available and is diagnostic only for the choroidal hypoplasia component of CEA. For colobomas to develop, an additional mutation in a second gene has to be present; that gene is still unknown.

N. Coloboma/staphyloma (unassociated with microphthalmia)

A coloboma is a congenital defect which may affect the iris, choroid or optic disc. Iris colobomas are seen as notches in the pupillary margin. Scleral ectasia is defined as a congenital thinning and secondary distention of the sclera; when lined by uveal tissue it is called a staphyloma. These may be anteriorly located, apparent as a bulge beneath the upper eyelid or posteriorly located, requiring visualization with an ophthalmoscope. These conditions may or may not be genetically related to the same anomalies seen associated with microphthalmia (entity "A" above).

O. Micropapilla

Micropapilla refers to a small optic disc which is not associated with vision impairment. Optic nerve hypoplasia refers to a congenital defect of the optic nerve which causes blindness and abnormal pupil response in the affected eye. It may be difficult to differentiate between micropapilla and optic nerve hypoplasia on a routine (dilated) screening ophthalmoscopic exam.

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OCULAR DISORDERS REPORT
TOY AUSTRALIAN SHEPHERD

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2013 800 #	1991-2013 800 %	2014-2018 220 #	2014-2018 220 %
GLOBE						
0.110	microphthalmia		2	0.2%	2	0.9%
EYELIDS						
25.110	distichiasis		27	3.4%	21	9.5%
CORNEA						
70.700	corneal dystrophy		1	0.1%	2	0.9%
UVEA						
93.110	iris hypoplasia		5	0.6%	14	6.4%
93.150	iris coloboma		11	1.4%	7	3.2%
93.710	persistent pupillary membranes, iris to iris		91	11.4%	19	8.6%
93.720	persistent pupillary membranes, iris to lens		5	0.6%	2	0.9%
93.730	persistent pupillary membranes, iris to cornea		2	0.2%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands		1	0.1%	0	
93.760	persistent pupillary membranes, endothelial opacity/no strands		0		1	0.5%
LENS						
100.210	cataract. suspect not inherited/significance unknown		9	1.1%	4	1.8%
100.302	punctate cataract, posterior cortex		1	0.1%	0	
100.303	punctate cataract, equatorial cortex		1	0.1%	0	
100.305	punctate cataract, posterior sutures		1	0.1%	0	
100.306	punctate cataract, nucleus		0		1	0.5%
100.311	incipient cataract, anterior cortex		3	0.4%	1	0.5%
100.312	incipient cataract, posterior cortex		1	0.1%	0	
100.313	incipient cataract, equatorial cortex		2	0.2%	0	
100.317	incipient cataract, capsular		2	0.2%	0	
100.330	generalized/complete cataract		1	0.1%	0	
100.999	*significant cataracts (summary)*		*12*	*1.5%*	*2*	*0.9%*
VITREOUS						
110.120	persistent hyaloid artery/remnant		3	0.4%	2	0.9%
110.135	PHPV/PTVL		2	0.2%	0	
110.320	vitreal degeneration		1	0.1%	2	0.9%
RETINA						
120.170	retinal dysplasia, folds		3	0.4%	0	
120.180	retinal dysplasia, geographic		1	0.1%	0	
120.310	generalized progressive retinal atrophy (PRA)		1	0.1%	0	
OPTIC NERVE						
130.110	micropapilla		9	1.1%	3	1.4%
130.120	optic nerve hypoplasia		2	0.2%	0	
OTHER						
900.000	other, unspecified		6	0.8%	0	
900.100	other, not inherited		7	0.9%	6	2.7%
900.110	other. suspect not inherited/significance unknown		1	0.1%	2	0.9%

	1991-2013	2014-2018
NORMAL		
0.000 normal globe	714 89.2%	147 66.8%

TOY FOX TERRIER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder option	
B.	Lens luxation	Autosomal recessive	2	NO	Mutation in the *ADAMTS17* gene

Description and Comments

A. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

B. Lens luxation

Partial (subluxation) or complete displacement of the lens from the normal anatomic site behind the pupil. Lens luxation not associated with trauma or inflammation is presumed to be inherited. Lens luxation may result in elevated intraocular pressure (glaucoma), causing vision impairment or blindness. A mutation in *ADAMTS17* has been associated with primary lens luxation. A DNA test is available.

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OCULAR DISORDERS REPORT
TOY FOX TERRIER

Diagnostic Name		1991-2013 TOTAL DOGS EXAMINED 167 #	 %	2014-2018 50 #	 %
EYELIDS					
25.110	distichiasis	2	1.2%	0	
NASOLACRIMAL					
32.110	imperforate lower nasolacrimal punctum	0		1	2.0%
CORNEA					
70.700	corneal dystrophy	0		1	2.0%
70.730	corneal endothelial degeneration	1	0.6%	0	
UVEA					
93.710	persistent pupillary membranes, iris to iris	15	9.0%	4	8.0%
93.720	persistent pupillary membranes, iris to lens	2	1.2%	0	
93.730	persistent pupillary membranes, iris to cornea	1	0.6%	0	
LENS					
100.210	cataract. suspect not inherited/significance unknown	3	1.8%	0	
100.311	incipient cataract, anterior cortex	4	2.4%	2	4.0%
100.312	incipient cataract, posterior cortex	1	0.6%	1	2.0%
100.321	incomplete cataract, anterior cortex	0		1	2.0%
100.375	subluxation/luxation, unspecified	1	0.6%	0	
100.999	*significant cataracts (summary)*	*5*	*3.0%*	*4*	*8.0%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	1	0.6%	0	
110.320	vitreal degeneration	2	1.2%	2	4.0%
RETINA					
120.170	retinal dysplasia, folds	7	4.2%	0	
120.310	generalized progressive retinal atrophy (PRA)	2	1.2%	0	
OPTIC NERVE					
130.120	optic nerve hypoplasia	2	1.2%	0	
OTHER					
900.000	other, unspecified	2	1.2%	0	
900.100	other, not inherited	4	2.4%	6	12.0%
NORMAL					
0.000	normal globe	138	82.6%	36	72.0%

OCULAR DISORDERS REPORT
TREEING WALKER

There are insufficient breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the TREEING WALKER breed. Therefore, there are no conditions listed with breeding advice.

OCULAR DISORDERS REPORT
TREEING WALKER COONHOUND

Diagnostic Name	TOTAL DOGS EXAMINED	1991-2013 3 # %	2014-2018 6 # %
LENS			
100.210	cataract. suspect not inherited/significance unknown	0	1 16.7%
OTHER			
900.100	other, not inherited	0	2 33.3%
NORMAL			
0.000	normal globe	3 100.0%	4 66.7%

VIZSLA

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Distichiasis	Not defined	1	Breeder option
B.	Entropion	Not defined	2	NO
C.	Prolapse of gland of third eyelid	Not defined	3	Breeder option
D.	Corneal dystrophy - epithelial/stromal	Not defined	2	Breeder option
E.	Persistent pupillary membranes			
	- iris to iris	Not defined	4	Breeder option
	- lens pigment foci/no strands	Not defined	5	Passes with no notation
F.	Cataract	Not defined	6	NO
G.	Vitreous degeneration	Not defined	3	Breeder option

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established, although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Entropion

A conformational defect resulting in an "in-rolling" of one or both of the eyelids which may cause ocular irritation. It is likely that entropion is influenced by several genes (polygenic), defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull. The Vizsla Club of America, recognizing entropion as an unacceptable problem in their breed, has requested that entropion be given a "NO" rating.

C. Prolapse of the gland of the third eyelid

Protrusion of the tear gland associated with the third eyelid. The mode of inheritance of this disorder is unknown. The exposed gland may become irritated. Commonly referred to as "cherry eye."

D. Corneal Dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

E. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore is not noted on the certificate.

F. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

G. Vitreous degeneration

Liquefaction of the vitreous gel which may predispose to retinal detachment.

References

1. ACVO Genetics Committee, 2006 and/or Data from CERF All-Breeds Report, 2001-2005.

2. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

3. ACVO Genetics Committee, 2014 and/or Data from OFA All-Breeds Report, 2013-2014

4. ACVO Genetics Committee, 2002-2003 and/or Data from CERF All-Breeds Report, 2002-2003.

5. ACVO Genetics Committee, 2017 and/or Data from CERF/OFA All-Breeds Report, 2010-2016.

6. Strom AR, Hassig M, Iburg TM, et al. Epidemiology of canine glaucoma presented to University of Zurich from 1995 to 2009. Part 1: Congenital and primary glaucoma (4 and 123 cases). *Vet Ophthalmol*. 2011 Mar;14:121-126.

OCULAR DISORDERS REPORT
VIZSLA

		1991-2013 2397		2014-2018 1283	
TOTAL DOGS EXAMINED					
Diagnostic Name		#	%	#	%
EYELIDS					
20.140	ectopic cilia	1	0.0%	0	
21.000	entropion, unspecified	3	0.1%	0	
22.000	ectropion, unspecified	3	0.1%	0	
25.110	distichiasis	22	0.9%	10	0.8%
NASOLACRIMAL					
32.110	imperforate lower nasolacrimal punctum	0		1	0.1%
40.910	keratoconjunctivitis sicca	1	0.0%	0	
NICTITANS					
51.100	third eyelid cartilage anomaly	4	0.2%	1	0.1%
52.110	prolapsed gland of the third eyelid	7	0.3%	0	
CORNEA					
70.700	corneal dystrophy	36	1.5%	15	1.2%
70.730	corneal endothelial degeneration	2	0.1%	0	
UVEA					
93.710	persistent pupillary membranes, iris to iris	48	2.0%	25	1.9%
93.720	persistent pupillary membranes, iris to lens	12	0.5%	1	0.1%
93.740	persistent pupillary membranes, iris sheets	1	0.0%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	41	1.7%	99	7.7%
93.760	persistent pupillary membranes, endothelial opacity/no strands	1	0.0%	0	
93.999	uveal cysts	1	0.0%	1	0.1%
LENS					
100.200	cataract, unspecified	4	0.2%	0	
100.210	cataract. suspect not inherited/significance unknown	85	3.5%	40	3.1%
100.301	punctate cataract, anterior cortex	10	0.4%	2	0.2%
100.302	punctate cataract, posterior cortex	14	0.6%	6	0.5%
100.303	punctate cataract, equatorial cortex	2	0.1%	1	0.1%
100.305	punctate cataract, posterior sutures	4	0.2%	1	0.1%
100.307	punctate cataract, capsular	8	0.3%	4	0.3%
100.311	incipient cataract, anterior cortex	14	0.6%	4	0.3%
100.312	incipient cataract, posterior cortex	12	0.5%	20	1.6%
100.313	incipient cataract, equatorial cortex	17	0.7%	3	0.2%
100.314	incipient cataract, anterior sutures	0		2	0.2%
100.315	incipient cataract, posterior sutures	3	0.1%	1	0.1%
100.316	incipient cataract, nucleus	2	0.1%	1	0.1%
100.317	incipient cataract, capsular	3	0.1%	5	0.4%
100.326	incomplete cataract, nucleus	0		1	0.1%
100.328	posterior suture tip opacities	1	0.0%	3	0.2%
100.330	generalized/complete cataract	2	0.1%	0	
100.375	subluxation/luxation, unspecified	2	0.1%	0	
100.999	*significant cataracts (summary)*	*95*	*4.0%*	*51*	*4.0%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	2	0.1%	2	0.2%
110.135	PHPV/PTVL	1	0.0%	0	

VITREOUS CONTINUED		1991-2013		2014-2018	
110.200	vitritis	1	0.0%	5	0.4%
110.320	vitreal degeneration	12	0.5%	4	0.3%
RETINA					
120.170	retinal dysplasia, folds	3	0.1%	0	
120.310	generalized progressive retinal atrophy (PRA)	5	0.2%	0	
120.960	retinopathy	1	0.0%	3	0.2%
OPTIC NERVE					
130.120	optic nerve hypoplasia	1	0.0%	0	
OTHER					
900.000	other, unspecified	51	2.1%	0	
900.100	other, not inherited	87	3.6%	62	4.8%
900.110	other. suspect not inherited/significance unknown	8	0.3%	2	0.2%
NORMAL					
0.000	normal globe	2140	89.3%	1016	79.2%

VOLPINO ITALIANO

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Lens luxation	Autosomal recessive	1	NO	Mutation in the *ADAMTS17* gene

Description and Comments

A. Lens luxation

Partial (subluxation) or complete displacement of the lens from the normal anatomic site behind the pupil. Lens luxation not associated with trauma or inflammation is presumed to be inherited. Lens luxation may result in elevated intraocular pressure (glaucoma), causing vision impairment or blindness. A mutation in *ADAMTS17* has been associated with primary lens luxation. A DNA test is available.

References

There are no breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the Volpino Italiano. The condition listed above is currently noted solely due to the availability of a genetic test for the disease.

1. Gould D, Pettitt L, McLaughlin B, et al. ADAMTS17 mutation associated with primary lens luxation is widespread among breeds. *Vet Ophthalmol*. 2011; 14: 378-384.

OCULAR DISORDERS REPORT
VOLPINO ITALIANO

Diagnostic Name	TOTAL DOGS EXAMINED	1991-2013 1 # %	2014-2018 0 # %
NORMAL			
0.000 normal globe		1 100.0%	0

OCULAR DISORDERS REPORT
WACHTELHUND

There are insufficient breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the WACHTELHUND breed. Therefore, there are no conditions listed with breeding advice.

OCULAR DISORDERS REPORT
WACHTELHUND

Diagnostic Name	TOTAL DOGS EXAMINED	1991-2013 0 #	%	2014-2018 2 #	%
NORMAL					
0.000 normal globe		0		2	100.0%

WEIMARANER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Distichiasis	Not defined	1	Breeder option
B.	Entropion	Not defined	1	Breeder option
C.	Everted cartilage of the third eyelid	Not defined	1	Breeder option
D.	Corneal dystrophy - epithelial/stromal	Not defined	2, 3	Breeder option
E.	Persistent pupillary membranes - iris to iris	Not defined	3	Breeder option
F.	Cataract	Not defined	1	NO
G.	Retinal atrophy - generalized	Not defined	1, 4	NO

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regards to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded. Breeding discretion is advised.

In the Weimaraner, because there is significant clinical disease associated with the abnormal hairs, breeding should be discouraged.

B. Entropion

A conformational defect resulting in an "in-rolling" of one or both of the eyelids which may cause ocular irritation. It is likely that entropion is influenced by several genes (polygenic), defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

C. Everted cartilage of the third eyelid

A scroll-like curling of the cartilage of the third eyelid, usually everting the margin. This condition may occur in one or both eyes and may cause mild ocular irritation.

D. Corneal Dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

E. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

F. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

G. Retinal atrophy - generalized

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. PRA is inherited as an autosomal recessive trait in most breeds.

References

1. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

2. ACVO Genetics Committee, 2000-2002 and/or Data from CERF All-Breeds Report, 2000-2002.

3. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

4. Kropatsch R, Akkad D, Frank M, et al. A large deletion in RPGR causes XLPRA in Weimarener dogs. Canine Genetics and Epidemiol. 2016; 3:7.

OCULAR DISORDERS REPORT
WEIMARANER

		1991-2013		2014-2018	
	TOTAL DOGS EXAMINED	1423		546	
Diagnostic Name		#	%	#	%
EYELIDS					
21.000	entropion, unspecified	3	0.2%	0	
25.110	distichiasis	411	28.9%	164	30.0%
NASOLACRIMAL					
32.110	imperforate lower nasolacrimal punctum	0		2	0.4%
NICTITANS					
51.100	third eyelid cartilage anomaly	11	0.8%	4	0.7%
CORNEA					
70.700	corneal dystrophy	27	1.9%	6	1.1%
70.730	corneal endothelial degeneration	5	0.4%	0	
UVEA					
93.150	iris coloboma	1	0.1%	1	0.2%
93.710	persistent pupillary membranes, iris to iris	12	0.8%	5	0.9%
93.720	persistent pupillary membranes, iris to lens	3	0.2%	0	
93.730	persistent pupillary membranes, iris to cornea	1	0.1%	4	0.7%
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		5	0.9%
93.760	persistent pupillary membranes, endothelial opacity/no strands	0		2	0.4%
93.810	uveal melanoma	1	0.1%	0	
93.999	uveal cysts	4	0.3%	3	0.5%
LENS					
100.200	cataract, unspecified	2	0.1%	0	
100.210	cataract. suspect not inherited/significance unknown	82	5.8%	35	6.4%
100.301	punctate cataract, anterior cortex	10	0.7%	4	0.7%
100.302	punctate cataract, posterior cortex	5	0.4%	0	
100.303	punctate cataract, equatorial cortex	8	0.6%	1	0.2%
100.304	punctate cataract, anterior sutures	1	0.1%	0	
100.305	punctate cataract, posterior sutures	1	0.1%	1	0.2%
100.306	punctate cataract, nucleus	7	0.5%	4	0.7%
100.307	punctate cataract, capsular	1	0.1%	2	0.4%
100.311	incipient cataract, anterior cortex	37	2.6%	8	1.5%
100.312	incipient cataract, posterior cortex	9	0.6%	5	0.9%
100.313	incipient cataract, equatorial cortex	7	0.5%	10	1.8%
100.314	incipient cataract, anterior sutures	1	0.1%	2	0.4%
100.315	incipient cataract, posterior sutures	2	0.1%	0	
100.316	incipient cataract, nucleus	4	0.3%	0	
100.317	incipient cataract, capsular	1	0.1%	2	0.4%
100.321	incomplete cataract, anterior cortex	0		2	0.4%
100.323	incomplete cataract, equatorial cortex	0		1	0.2%
100.328	posterior suture tip opacities	0		2	0.4%
100.330	generalized/complete cataract	5	0.4%	0	
100.375	subluxation/luxation, unspecified	0		2	0.4%
100.999	*significant cataracts (summary)*	*101*	*7.1%*	*42*	*7.7%*

		1991-2013		2014-2018	
VITREOUS					
110.120	persistent hyaloid artery/remnant	4	0.3%	0	
110.135	PHPV/PTVL	0		1	0.2%
110.200	vitritis	0		2	0.4%
110.320	vitreal degeneration	1	0.1%	2	0.4%
RETINA					
120.170	retinal dysplasia, folds	2	0.1%	0	
120.180	retinal dysplasia, geographic	4	0.3%	0	
120.310	generalized progressive retinal atrophy (PRA)	5	0.4%	1	0.2%
120.400	retinal hemorrhage	1	0.1%	0	
120.960	retinopathy	0		1	0.2%
OTHER					
900.000	other, unspecified	12	0.8%	0	
900.100	other, not inherited	56	3.9%	27	4.9%
900.110	other. suspect not inherited/significance unknown	2	0.1%	3	0.5%
NORMAL					
0.000	normal globe	942	66.2%	297	54.4%

OCULAR DISORDERS REPORT
WELSH SHEEPDOG

There are insufficient breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the WELSH SHEEPDOG breed. Therefore, there are no conditions listed with breeding advice.

OCULAR DISORDERS REPORT
WELSH SHEEPDOG

Diagnostic Name	TOTAL DOGS EXAMINED	1991-2013 1 #	% 	2014-2018 0 #	%
NORMAL					
0.000 normal globe		1	100.0%	0	

WELSH SPRINGER SPANIEL

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Glaucoma	Presumed autosomal dominant	1-4	NO
B.	Entropion	Not defined	5, 6	Breeder option
C.	Distichiasis	Not defined	1	Breeder option
D.	Corneal dystrophy - epithelial/stromal	Not defined	5, 6	Breeder option
E.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder option
F.	Cataract	Presumed autosomal recessive	1, 7, 8	NO
G.	Vitreous degeneration	Not defined	9	Breeder option
H.	Retinal atrophy - generalized	Not defined	1, 10	NO
I.	Retinal dysplasia - folds	Not defined	6	Breeder option

Description and Comments

A. Glaucoma

An elevation of intraocular pressure (IOP) which, when sustained, causes intraocular damage resulting in blindness. The elevated IOP occurs because the fluid cannot leave through the iridocorneal angle. Diagnosis and classification of glaucoma requires measurement of IOP (tonometry) and examination of the iridocorneal angle (gonioscopy). Neither of these tests is part of a routine breed eye screening exam. Due to the increased incidence of PLD in the breed and the increased progression observed with age, it may be prudent to perform repeated gonioscopy examinations over time.

Primary angle closure glaucoma has been reported in the Welsh Springer Spaniel. Females are affected more than males. Onset ranges from 10 weeks to 10 years. At the iridocorneal angle, the pectinate ligaments appear sparse and wispy in contrast to the sturdy fibers seen in other breeds. A dominant mode of inheritance is reported.

B. Entropion

A conformational defect resulting in an "in-rolling" of one or both of the eyelids which may cause ocular irritation. It is likely that entropion is influenced by several genes (polygenic), defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

C. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established, although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

D. Corneal Dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

E. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

F. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

In the Welsh Springer Spaniel, lesions may be seen as early as 8-12 weeks of age and progress rapidly to complete cataract, impairing vision. A recessive mode of inheritance is reported.

G. Vitreous degeneration

Liquefaction of the vitreous gel which may predispose to retinal detachment.

H. Retinal atrophy - generalized

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. Except for X-linked PRA in the Siberian Husky, in all breeds studied to date, PRA

is inherited as an autosomal recessive trait.

I. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

References

1. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

2. Cottrell B, Barnett K. Primary glaucoma in the Welsh Springer Spaniel. *J Small Anim Pract*. 1988;29:185-199.

3. Gelatt KN, MacKay EO. Prevalence of the breed-related glaucomas in pure-bred dogs in North America. *Vet Ophthalmol*. 2004;7:97-111. Epub 2004/02/26.

4. Oliver JA, Ekiri A, Mellersh. Prevalence and Progression of Pectinate Ligament Dysplasia in the Welsh Springer Spaniel. J Sm Anim Pract. 2016;57: 416-421.

5. ACVO Genetics Committee, 2002-2003 and/or Data from CERF All-Breeds Report, 2002-2003.

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7. Barnett KC. Hereditary cataract in the Welsh Springer Spaniel. *J Small Anim Pract*. 1980;21:621-625. Epub 1980/11/01.

8. Barnett KC. The diagnosis and differential diagnosis of cataract in the dog. *J Small Anim Pract*. 1985;26:305.

9. ACVO Genetics Committee, 2006 and/or Data from CERF All-Breeds Report, 2001-2005.

10. Priester W. Canine progressive retinal atrophy: Occurrence by age, breed, and sex. *Am J Vet Res*. 1974;35:571-574.

OCULAR DISORDERS REPORT
WELSH SPRINGER SPANIEL

		1991-2013		2014-2018	
	TOTAL DOGS EXAMINED	2337		683	
Diagnostic Name		#	%	#	%
GLOBE					
10.000	glaucoma	1	0.0%	0	
EYELIDS					
21.000	entropion, unspecified	35	1.5%	17	2.5%
22.000	ectropion, unspecified	3	0.1%	0	
25.110	distichiasis	257	11.0%	111	16.3%
NASOLACRIMAL					
32.110	imperforate lower nasolacrimal punctum	1	0.0%	2	0.3%
CORNEA					
70.700	corneal dystrophy	37	1.6%	23	3.4%
70.730	corneal endothelial degeneration	2	0.1%	0	
UVEA					
93.150	iris coloboma	1	0.0%	0	
93.710	persistent pupillary membranes, iris to iris	512	21.9%	193	28.3%
93.720	persistent pupillary membranes, iris to lens	2	0.1%	1	0.1%
93.730	persistent pupillary membranes, iris to cornea	1	0.0%	0	
93.740	persistent pupillary membranes, iris sheets	1	0.0%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	2	0.1%	6	0.9%
93.999	uveal cysts	1	0.0%	2	0.3%
97.150	chorioretinal coloboma, congenital	0		1	0.1%
LENS					
100.200	cataract, unspecified	6	0.3%	0	
100.210	cataract. suspect not inherited/significance unknown	122	5.2%	27	4.0%
100.301	punctate cataract, anterior cortex	9	0.4%	6	0.9%
100.302	punctate cataract, posterior cortex	3	0.1%	4	0.6%
100.303	punctate cataract, equatorial cortex	1	0.0%	1	0.1%
100.304	punctate cataract, anterior sutures	1	0.0%	2	0.3%
100.306	punctate cataract, nucleus	1	0.0%	2	0.3%
100.307	punctate cataract, capsular	1	0.0%	3	0.4%
100.311	incipient cataract, anterior cortex	4	0.2%	0	
100.312	incipient cataract, posterior cortex	2	0.1%	2	0.3%
100.313	incipient cataract, equatorial cortex	2	0.1%	2	0.3%
100.316	incipient cataract, nucleus	2	0.1%	0	
100.317	incipient cataract, capsular	2	0.1%	0	
100.321	incomplete cataract, anterior cortex	0		1	0.1%
100.328	posterior suture tip opacities	0		1	0.1%
100.330	generalized/complete cataract	1	0.0%	0	
100.375	subluxation/luxation, unspecified	1	0.0%	0	
100.999	*significant cataracts (summary)*	*35*	*1.5%*	*23*	*3.4%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	8	0.3%	2	0.3%
110.135	PHPV/PTVL	1	0.0%	0	
110.320	vitreal degeneration	5	0.2%	0	

		1991-2013		2014-2018	
FUNDUS					
97.120	coloboma	2	0.1%	0	
RETINA					
120.170	retinal dysplasia, folds	29	1.2%	3	0.4%
120.180	retinal dysplasia, geographic	4	0.2%	0	
120.310	generalized progressive retinal atrophy (PRA)	8	0.3%	1	0.1%
OPTIC NERVE					
130.110	micropapilla	3	0.1%	0	
130.120	optic nerve hypoplasia	6	0.3%	2	0.3%
130.150	optic disc coloboma	4	0.2%	0	
OTHER					
900.000	other, unspecified	19	0.8%	0	
900.100	other, not inherited	51	2.2%	27	4.0%
900.110	other. suspect not inherited/significance unknown	10	0.4%	5	0.7%
NORMAL					
0.000	normal globe	1598	68.4%	340	49.8%

WELSH TERRIER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Distichiasis	Not defined	1	Breeder option	
B.	Persistent pupillary membranes - iris to iris	Not defined	1-3	Breeder option	
C.	Glaucoma	Not defined	1	NO	
D.	Cataract	Not defined	1	NO	
E.	Lens luxation	Autosomal recessive	1, 4	NO	Mutation in the *ADAMTS17* gene

Description and Comment

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regards to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded. Breeding discretion is advised.

B. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

C. Glaucoma

Glaucoma is characterized by an elevation of intraocular pressure (IOP) which, when sustained, causes intraocular damage resulting in blindness. The elevated IOP occurs because the fluid cannot leave through the iridocorneal angle. Diagnosis and classification of glaucoma requires measurement of the intraocular pressure (tonometry) and examination of the iridocorneal angle (gonioscopy). Neither of these tests is part of a routine breed eye screening exam.

D. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

E. Lens luxation

Partial (subluxation) or complete displacement of the lens from the normal anatomic site behind the pupil. Lens luxation not associated with trauma or inflammation is presumed to be inherited. Lens luxation may result in elevated intraocular pressure (glaucoma) causing vision impairment or blindness. A mutation in *ADAMTS17* has been associated with primary lens luxation. A DNA test is available.

References

1. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

2. ACVO Genetics Committee, 2000-2002 and/or Data from CERF All-Breeds Report, 2000-2002.

3. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

4. Gould D, Pettitt L, McLaughlin B, et al. ADAMTS17 mutation associated with primary lens luxation is widespread among breeds. *Vet Ophthalmol*. 2011 Nov;14:378-384.

OCULAR DISORDERS REPORT
WELSH TERRIER

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2013 344 #	%	2014-2018 29 #	%
GLOBE						
10.000	glaucoma		1	0.3%	0	
EYELIDS						
20.140	ectopic cilia		1	0.3%	0	
25.110	distichiasis		12	3.5%	1	3.4%
NASOLACRIMAL						
40.910	keratoconjunctivitis sicca		1	0.3%	0	
CORNEA						
70.700	corneal dystrophy		4	1.2%	0	
70.730	corneal endothelial degeneration		3	0.9%	0	
UVEA						
93.710	persistent pupillary membranes, iris to iris		28	8.1%	2	6.9%
93.720	persistent pupillary membranes, iris to lens		2	0.6%	0	
93.730	persistent pupillary membranes, iris to cornea		3	0.9%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands		3	0.9%	1	3.4%
LENS						
100.200	cataract, unspecified		1	0.3%	0	
100.210	cataract. suspect not inherited/significance unknown		22	6.4%	0	
100.301	punctate cataract, anterior cortex		2	0.6%	0	
100.302	punctate cataract, posterior cortex		2	0.6%	0	
100.307	punctate cataract, capsular		1	0.3%	0	
100.311	incipient cataract, anterior cortex		3	0.9%	0	
100.312	incipient cataract, posterior cortex		2	0.6%	0	
100.313	incipient cataract, equatorial cortex		1	0.3%	0	
100.317	incipient cataract, capsular		2	0.6%	0	
100.375	subluxation/luxation, unspecified		3	0.9%	0	
100.999	*significant cataracts (summary)*		*14*	*4.1%*	*0*	
RETINA						
120.170	retinal dysplasia, folds		1	0.3%	0	
OTHER						
900.000	other, unspecified		6	1.7%	0	
900.100	other, not inherited		13	3.8%	0	
900.110	other. suspect not inherited/significance unknown		1	0.3%	0	
NORMAL						
0.000	normal globe		279	81.1%	25	86.2%

WEST HIGHLAND WHITE TERRIER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Microphthalmia	Not defined	1	NO
B.	Keratoconjunctivitis sicca	Not defined	1-5	NO
C.	Persistent pupillary membranes			
	- iris to iris	Not defined	1, 6	Breeder option
	- iris to lens	Not defined	7	NO
	- lens pigment foci/no strands	Not defined	8	Passes with no notation
D.	Cataract	Presumed autosomal recessive	1, 6	NO
E.	Vitreous degeneration	Not defined	9	Breeder option
F.	Retinal atrophy - generalized	Not defined	1	NO
G.	Retinal dysplasia - folds	Not defined	1	Breeder option

Description and Comments

A. Microphthalmia

Microphthalmia is a congenital defect characterized by a small eye. The condition may be seen alone without vision impairment but it is most often associated with defects of the cornea, iris (coloboma), anterior chamber, lens (cataract) and/or retina (retinal dysplasia).

B. Keratoconjunctivitis sicca

An abnormality of the tear film, most commonly a deficiency of the aqueous portion, although the mucin and/or lipid layers may be affected; results in ocular irritation and/or vision impairment.

In the West Highland White Terrier, this disease has been reported more commonly in females than males.

C. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

In the West Highland White Terrier, these membranes, when present, often bridge from the iris to the lens and may result in cataract with vision impairment.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

D. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

The cataract described in the West Highland White Terrier initially involves the posterior Y sutures and may infrequently progress, resulting in vision impairment. The age of onset is less than 6 months of age. A recessive mode of inheritance is suggested by the pedigrees which have been studied.

E. Vitreous degeneration

Liquefaction of the vitreous gel which may predispose to retinal detachment.

F. Retinal atrophy - generalized

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. Except for X-linked PRA in the Siberian Husky, in all breeds studied to date, PRA is inherited as an autosomal recessive trait.

G. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

References

1. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

2. Sansom J, Barnett KC, Neumann W, et al. Treatment of keratoconjunctivitis sicca in dogs with cyclosporine ophthalmic ointment: a European clinical field trial. *Vet Rec*. 1995; 137: 504-507.

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OCULAR DISORDERS REPORT
WEST HIGHLAND WHITE TERRIER

		1991-2013		2014-2018	
	TOTAL DOGS EXAMINED	1180		440	
Diagnostic Name		#	%	#	%
GLOBE					
0.110	microphthalmia	5	0.4%	0	
EYELIDS					
25.110	distichiasis	2	0.2%	1	0.2%
NASOLACRIMAL					
32.110	imperforate lower nasolacrimal punctum	0		2	0.5%
40.910	keratoconjunctivitis sicca	2	0.2%	1	0.2%
CORNEA					
70.210	corneal pannus	1	0.1%	0	
70.700	corneal dystrophy	1	0.1%	0	
70.730	corneal endothelial degeneration	3	0.3%	0	
UVEA					
93.710	persistent pupillary membranes, iris to iris	93	7.9%	43	9.8%
93.720	persistent pupillary membranes, iris to lens	20	1.7%	4	0.9%
93.730	persistent pupillary membranes, iris to cornea	5	0.4%	1	0.2%
93.750	persistent pupillary membranes, lens pigment foci/no strands	14	1.2%	7	1.6%
93.760	persistent pupillary membranes, endothelial opacity/no strands	4	0.3%	0	
LENS					
100.200	cataract, unspecified	21	1.8%	0	
100.210	cataract. suspect not inherited/significance unknown	97	8.2%	32	7.3%
100.301	punctate cataract, anterior cortex	16	1.4%	4	0.9%
100.302	punctate cataract, posterior cortex	8	0.7%	3	0.7%
100.303	punctate cataract, equatorial cortex	3	0.3%	1	0.2%
100.304	punctate cataract, anterior sutures	1	0.1%	0	
100.305	punctate cataract, posterior sutures	14	1.2%	5	1.1%
100.306	punctate cataract, nucleus	9	0.8%	1	0.2%
100.307	punctate cataract, capsular	7	0.6%	4	0.9%
100.311	incipient cataract, anterior cortex	31	2.6%	6	1.4%
100.312	incipient cataract, posterior cortex	21	1.8%	5	1.1%
100.313	incipient cataract, equatorial cortex	5	0.4%	0	
100.314	incipient cataract, anterior sutures	2	0.2%	0	
100.315	incipient cataract, posterior sutures	4	0.3%	1	0.2%
100.316	incipient cataract, nucleus	14	1.2%	1	0.2%
100.317	incipient cataract, capsular	8	0.7%	2	0.5%
100.321	incomplete cataract, anterior cortex	0		3	0.7%
100.322	incomplete cataract, posterior cortex	2	0.2%	1	0.2%
100.325	incomplete cataract, posterior sutures	2	0.2%	2	0.5%
100.326	incomplete cataract, nucleus	0		1	0.2%
100.328	posterior suture tip opacities	10	0.8%	14	3.2%
100.330	generalized/complete cataract	29	2.5%	1	0.2%
100.999	*significant cataracts (summary)*	*197*	*16.7%*	*41*	*9.3%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	0		2	0.5%
110.200	vitritis	0		1	0.2%

VITREOUS CONTINUED		1991-2013		2014-2018	
110.320	vitreal degeneration	11	0.9%	1	0.2%
RETINA					
120.170	retinal dysplasia, folds	38	3.2%	15	3.4%
120.180	retinal dysplasia, geographic	3	0.3%	0	
120.190	retinal dysplasia, detached	1	0.1%	0	
120.310	generalized progressive retinal atrophy (PRA)	14	1.2%	2	0.5%
120.910	retinal detachment without dialysis	1	0.1%	0	
120.920	retinal detachment with dialysis	2	0.2%	0	
120.960	retinopathy	0		1	0.2%
OPTIC NERVE					
130.150	optic disc coloboma	1	0.1%	1	0.2%
OTHER					
900.000	other, unspecified	33	2.8%	0	
900.100	other, not inherited	22	1.9%	27	6.1%
900.110	other. suspect not inherited/significance unknown	8	0.7%	1	0.2%
NORMAL					
0.000	normal globe	870	73.7%	299	68.0%

WHIPPET

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Persistent pupillary membranes - iris to iris	Not defined	1, 2	Breeder option	
B.	Cataract	Not defined	3	NO	
C.	Vitreous degeneration	Not defined	2-4	Breeder option	
D.	Choroidal hypoplasia (Collie Eye Anomaly) - staphyloma/coloboma - retinal detachment - retinal hemorrhage - optic nerve coloboma	Autosomal recessive	5, 6	NO	Mutation in the *NHEJ1* gene
E.	Retinal atrophy – generalized	Not defined	7	NO	

Description and Comments

A. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

B. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

C. Vitreous degeneration

A liquefaction of the vitreous gel which may predispose to retinal detachment. This is a significant problem in the Whippet.

D. Choroidal hypoplasia (Collie Eye Anomaly)
- staphyloma/coloboma
- retinal detachment
- retinal hemorrhage
- optic nerve coloboma

A spectrum of malformations present at birth and ranging from inadequate development of the choroid (choroidal hypoplasia) to defects of the choroid, sclera, and/or optic nerve (coloboma/staphyloma) to complete retinal detachment (with or without hemorrhage). Mildly affected animals will have no detectable vision deficit.

This disorder is collectively referred to as "Collie Eye Anomaly" and has been identified in the longhaired Whippet. The choroidal hypoplasia component is caused by a 7799 base pairs deletion with the gene *NHEJ1.* The mutation is a recessive trait. A DNA test is available and is diagnostic only for the choroidal hypoplasia component of CEA. For colobomas to develop, an additional mutation in a second gene has to be present; that gene is still unknown.

E. Retinal atrophy - generalized

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. Except for X-linked PRA in the Siberian Husky, in all breeds studied to date, PRA is inherited as an autosomal recessive trait.

References

1. ACVO Genetics Committee, 2000-2002 and/or Data from CERF All-Breeds Report, 2000-2002.

2. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds-Report, 2003-2004.

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OCULAR DISORDERS REPORT
WHIPPET

		1991-2013		2014-2018	
	TOTAL DOGS EXAMINED	9831		2871	
Diagnostic Name		#	%	#	%
GLOBE					
0.110	microphthalmia	1	0.0%	0	
EYELIDS					
20.140	ectopic cilia	2	0.0%	0	
22.000	ectropion, unspecified	1	0.0%	0	
25.110	distichiasis	7	0.1%	2	0.1%
NICTITANS					
50.210	pannus of third eyelid	0		1	0.0%
52.110	prolapsed gland of the third eyelid	1	0.0%	0	
CORNEA					
70.210	corneal pannus	4	0.0%	1	0.0%
70.700	corneal dystrophy	33	0.3%	10	0.3%
70.730	corneal endothelial degeneration	5	0.1%	1	0.0%
UVEA					
93.110	iris hypoplasia	0		4	0.1%
93.140	corneal endothelial pigment without PPM	1	0.0%	0	
93.710	persistent pupillary membranes, iris to iris	85	0.9%	43	1.5%
93.720	persistent pupillary membranes, iris to lens	10	0.1%	0	
93.730	persistent pupillary membranes, iris to cornea	7	0.1%	4	0.1%
93.740	persistent pupillary membranes, iris sheets	16	0.2%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	4	0.0%	5	0.2%
93.760	persistent pupillary membranes, endothelial opacity/no strands	3	0.0%	3	0.1%
93.810	uveal melanoma	0		1	0.0%
93.999	uveal cysts	14	0.1%	5	0.2%
LENS					
100.200	cataract, unspecified	11	0.1%	0	
100.210	cataract. suspect not inherited/significance unknown	348	3.5%	129	4.5%
100.301	punctate cataract, anterior cortex	41	0.4%	15	0.5%
100.302	punctate cataract, posterior cortex	19	0.2%	5	0.2%
100.303	punctate cataract, equatorial cortex	18	0.2%	9	0.3%
100.304	punctate cataract, anterior sutures	4	0.0%	2	0.1%
100.305	punctate cataract, posterior sutures	5	0.1%	8	0.3%
100.306	punctate cataract, nucleus	15	0.2%	3	0.1%
100.307	punctate cataract, capsular	0		3	0.1%
100.311	incipient cataract, anterior cortex	44	0.4%	15	0.5%
100.312	incipient cataract, posterior cortex	36	0.4%	1	0.0%
100.313	incipient cataract, equatorial cortex	50	0.5%	11	0.4%
100.314	incipient cataract, anterior sutures	1	0.0%	1	0.0%
100.315	incipient cataract, posterior sutures	8	0.1%	1	0.0%
100.316	incipient cataract, nucleus	12	0.1%	2	0.1%
100.317	incipient cataract, capsular	17	0.2%	2	0.1%
100.321	incomplete cataract, anterior cortex	0		4	0.1%
100.322	incomplete cataract, posterior cortex	0		4	0.1%
100.323	incomplete cataract, equatorial cortex	0		3	0.1%
100.328	posterior suture tip opacities	1	0.0%	21	0.7%

LENS CONTINUED		1991-2013		2014-2018	
100.330	generalized/complete cataract	15	0.2%	1	0.0%
100.375	subluxation/luxation, unspecified	33	0.3%	1	0.0%
100.999	*significant cataracts (summary)*	*296*	*3.0%*	*90*	*3.1%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	13	0.1%	10	0.3%
110.135	PHPV/PTVL	11	0.1%	1	0.0%
110.200	vitritis	13	0.1%	43	1.5%
110.320	vitreal degeneration	555	5.6%	75	2.6%
FUNDUS					
97.110	choroidal hypoplasia	19	0.2%	0	
97.120	coloboma	4	0.0%	0	
RETINA					
120.170	retinal dysplasia, folds	30	0.3%	3	0.1%
120.180	retinal dysplasia, geographic	3	0.0%	2	0.1%
120.190	retinal dysplasia, detached	4	0.0%	0	
120.310	generalized progressive retinal atrophy (PRA)	38	0.4%	5	0.2%
120.400	retinal hemorrhage	1	0.0%	0	
120.910	retinal detachment without dialysis	4	0.0%	0	
120.920	retinal detachment with dialysis	0		1	0.0%
120.960	retinopathy	5	0.1%	5	0.2%
OPTIC NERVE					
130.110	micropapilla	3	0.0%	0	
130.120	optic nerve hypoplasia	3	0.0%	0	
130.150	optic disc coloboma	14	0.1%	0	
OTHER					
900.000	other, unspecified	114	1.2%	0	
900.100	other, not inherited	259	2.6%	130	4.5%
900.110	other. suspect not inherited/significance unknown	32	0.3%	3	0.1%
NORMAL					
0.000	normal globe	8756	89.1%	2399	83.6%

WHITE SHEPHERD

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Corneal dystrophy - epithelial/stromal	Not defined	1	Breeder option

Description and Comments

A. Corneal dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral. In the Swedish Vallhund, lesions are circular or semicircular central crystalline deposits in the anterior corneal stroma that appear between 2 and 5 years of age. It may be associated with exophthalmos and lagophthalmos common in these dogs.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the White Shepherd breed. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 2017 and/or Data from OFA All-Breeds Report, 2013-2017.

OCULAR DISORDERS REPORT
WHITE SHEPHERD

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2013 6 #	%	2014-2018 51 #	%
CORNEA						
70.210	corneal pannus		0		2	3.9%
70.700	corneal dystrophy		1	16.7%	3	5.9%
UVEA						
93.720	persistent pupillary membranes, iris to lens		1	16.7%	0	
LENS						
100.210	cataract. suspect not inherited/significance unknown		0		4	7.8%
100.305	punctate cataract, posterior sutures		0		1	2.0%
100.317	incipient cataract, capsular		0		1	2.0%
100.328	posterior suture tip opacities		0		1	2.0%
100.999	*significant cataracts (summary)*		*0*		*2*	*3.9%*
RETINA						
120.170	retinal dysplasia, folds		1	16.7%	0	
OPTIC NERVE						
130.110	micropapilla		0		2	3.9%
130.120	optic nerve hypoplasia		1	16.7%	0	
OTHER						
900.100	other, not inherited		0		5	9.8%
NORMAL						
0.000	normal globe		3	50.0%	34	66.7%

OCULAR DISORDERS REPORT
WHITE SWISS SHEPHERD

There are insufficient breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the WHITE SWISS SHEPHERD breed. Therefore, there are no conditions listed with breeding advice.

OCULAR DISORDERS REPORT
WHITE SWISS SHEPHERD

Diagnostic Name	TOTAL DOGS EXAMINED	1991-2013 2 #	 %	2014-2018 3 #	 %
UVEA					
93.999	uveal cysts	0		1	33.3%
LENS					
100.210	cataract. suspect not inherited/significance unknown	1	50.0%	0	
100.316	incipient cataract, nucleus	0		1	33.3%
100.999	*significant cataracts (summary)*	*0*		*1*	*33.3%*
NORMAL					
0.000	normal globe	1	50.0%	1	33.3%

OCULAR DISORDERS REPORT
WINDSPRITE

There are insufficient breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the WINDSPRITE breed. Therefore, there are no conditions listed with breeding advice.

OCULAR DISORDERS REPORT
WINDSPRITE

Diagnostic Name	TOTAL DOGS EXAMINED	1991-2013 0 #	%	2014-2018 5 #	%
NORMAL					
0.000 normal globe		0		5	100.0%

WIRE FOX TERRIER*

*The Wire Fox Terrier and the Smooth Fox Terrier were originally considered two varieties of the same breed. They became separate breeds in 1985. It is likely that the same genetic diseases exist in both breeds.

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Glaucoma	Not defined	1, 2	NO	
B.	Persistent pupillary membranes - iris to iris	Not defined	3, 4	Breeder option	
C.	Cataract	Not defined	1	NO	
D.	Lens luxation	Autosomal recessive	5	NO	Mutation in the *ADAMTS17* gene

Description and Comments

A. Glaucoma

Glaucoma is characterized by an elevation of intraocular pressure (IOP) which, when sustained, causes intraocular damage resulting in blindness. The elevated IOP occurs because the fluid cannot leave through the iridocorneal angle. Diagnosis and classification of glaucoma requires measurement of the intraocular pressure (tonometry) and examination of the iridocorneal angle (gonioscopy). Neither of these tests are part of a routine breed eye screening exam.

B. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

C. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region. The cataracts observed in Wire Fox Terrier begin in the posterior subcapsular region and are progressive.

D. Lens luxation

Partial (subluxation) or complete displacement of the lens from the normal anatomic site behind the pupil. Lens luxation not associated with trauma or inflammation is presumed to be inherited. Lens luxation may result in elevated intraocular pressure (glaucoma) causing vision impairment or blindness. A mutation in *ADAMTS17* has been associated with primary lens luxation. A DNA test is available.

References

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3. ACVO Genetics Committee, 2000-2002 and/or Data from CERF All-Breeds Report, 2000-2002.

4. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

5. Gould D, Pettitt L, McLaughlin B, et al. ADAMTS17 mutation associated with primary lens luxation is widespread among breeds. *Vet Ophthalmol*. 2011;14:378-384.

OCULAR DISORDERS REPORT
WIRE FOX TERRIER

Diagnostic Name		1991-2013 TOTAL DOGS EXAMINED 271 #	 %	2014-2018 56 #	 %
GLOBE					
0.110	microphthalmia	1	0.4%	0	
EYELIDS					
25.110	distichiasis	7	2.6%	2	3.6%
CORNEA					
70.700	corneal dystrophy	3	1.1%	0	
70.730	corneal endothelial degeneration	1	0.4%	0	
UVEA					
93.710	persistent pupillary membranes, iris to iris	78	28.8%	34	60.7%
93.720	persistent pupillary membranes, iris to lens	3	1.1%	2	3.6%
93.730	persistent pupillary membranes, iris to cornea	5	1.8%	0	
93.740	persistent pupillary membranes, iris sheets	1	0.4%	0	
LENS					
100.200	cataract, unspecified	4	1.5%	0	
100.210	cataract. suspect not inherited/significance unknown	2	0.7%	0	
100.301	punctate cataract, anterior cortex	2	0.7%	1	1.8%
100.311	incipient cataract, anterior cortex	5	1.8%	0	
100.312	incipient cataract, posterior cortex	4	1.5%	1	1.8%
100.313	incipient cataract, equatorial cortex	1	0.4%	1	1.8%
100.314	incipient cataract, anterior sutures	1	0.4%	0	
100.321	incomplete cataract, anterior cortex	1	0.4%	0	
100.322	incomplete cataract, posterior cortex	1	0.4%	0	
100.326	incomplete cataract, nucleus	1	0.4%	0	
100.330	generalized/complete cataract	7	2.6%	1	1.8%
100.999	*significant cataracts (summary)*	*27*	*10.0%*	*4*	*7.1%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	1	0.4%	0	
110.320	vitreal degeneration	1	0.4%	0	
RETINA					
120.170	retinal dysplasia, folds	1	0.4%	0	
120.310	generalized progressive retinal atrophy (PRA)	4	1.5%	0	
OTHER					
900.000	other, unspecified	3	1.1%	0	
900.100	other, not inherited	12	4.4%	0	
900.110	other. suspect not inherited/significance unknown	1	0.4%	0	
NORMAL					
0.000	normal globe	169	62.4%	19	33.9%

WIREHAIRED POINTING GRIFFON

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Distichiasis	Not defined	1	Breeder option
B.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder option
C.	Cataract	Not defined	1	NO

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

C. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Wirehaired Pointing Griffon breed. The conditions listed above are generally recognized to exist in the breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 2017 and/or Data from CERF/OFA All-Breeds Report, 2010-2016.

OCULAR DISORDERS REPORT
WIREHAIRED POINTING GRIFFON

		1991-2013 353		2014-2018 333	
	TOTAL DOGS EXAMINED				
Diagnostic Name		**#**	**%**	**#**	**%**
GLOBE					
0.110	microphthalmia	0		1	0.3%
EYELIDS					
21.000	entropion, unspecified	3	0.8%	1	0.3%
25.110	distichiasis	1	0.3%	7	2.1%
NICTITANS					
51.100	third eyelid cartilage anomaly	0		1	0.3%
52.110	prolapsed gland of the third eyelid	0		1	0.3%
CORNEA					
70.210	corneal pannus	0		1	0.3%
70.700	corneal dystrophy	1	0.3%	0	
70.730	corneal endothelial degeneration	3	0.8%	0	
UVEA					
93.110	iris hypoplasia	0		1	0.3%
93.710	persistent pupillary membranes, iris to iris	3	0.8%	7	2.1%
93.750	persistent pupillary membranes, lens pigment foci/no strands	1	0.3%	0	
LENS					
100.210	cataract. suspect not inherited/significance unknown	24	6.8%	29	8.7%
100.302	punctate cataract, posterior cortex	1	0.3%	0	
100.305	punctate cataract, posterior sutures	0		1	0.3%
100.306	punctate cataract, nucleus	1	0.3%	2	0.6%
100.307	punctate cataract, capsular	0		1	0.3%
100.311	incipient cataract, anterior cortex	2	0.6%	1	0.3%
100.313	incipient cataract, equatorial cortex	1	0.3%	0	
100.316	incipient cataract, nucleus	2	0.6%	0	
100.328	posterior suture tip opacities	0		7	2.1%
100.999	*significant cataracts (summary)*	*7*	*2.0%*	*5*	*1.5%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	0		1	0.3%
110.200	vitritis	0		1	0.3%
110.320	vitreal degeneration	7	2.0%	1	0.3%
RETINA					
120.170	retinal dysplasia, folds	4	1.1%	1	0.3%
120.180	retinal dysplasia, geographic	1	0.3%	0	
120.400	retinal hemorrhage	1	0.3%	0	
120.960	retinopathy	0		1	0.3%
OTHER					
900.000	other, unspecified	6	1.7%	0	
900.100	other, not inherited	5	1.4%	15	4.5%
900.110	other. suspect not inherited/significance unknown	0		1	0.3%

	1991-2013	2014-2018
NORMAL		
0.000 normal globe	314 89.0%	267 80.2%

WIREHAIRED VIZSLA

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Persistent pupillary membranes			
	- iris to iris	Not defined	1, 2	Breeder option
	- lens pigment foci/no strands	Not defined	3	Passes with no notation
B.	Cataract	Not defined	1	NO

Description and Comments

A. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

B. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

References

There are no references providing detailed descriptions of hereditary conditions of the Wirehaired Vizsla breed. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

2. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

3. ACVO Genetics Committee, 2016 and/or Data from CERF/OFA All-Breeds Report 2010-2015.

OCULAR DISORDERS REPORT
WIREHAIRED VIZSLA

Diagnostic Name		1991-2013 TOTAL DOGS EXAMINED 72 #	%	2014-2018 106 #	%
NICTITANS					
52.110	prolapsed gland of the third eyelid	3	4.2%	0	
UVEA					
93.710	persistent pupillary membranes, iris to iris	6	8.3%	5	4.7%
93.750	persistent pupillary membranes, lens pigment foci/no strands	7	9.7%	7	6.6%
LENS					
100.210	cataract. suspect not inherited/significance unknown	10	13.9%	13	12.3%
100.328	posterior suture tip opacities	1	1.4%	0	
VITREOUS					
110.320	vitreal degeneration	1	1.4%	1	0.9%
RETINA					
120.910	retinal detachment without dialysis	1	1.4%	0	
OTHER					
900.000	other, unspecified	4	5.6%	0	
900.100	other, not inherited	2	2.8%	6	5.7%
900.110	other. suspect not inherited/significance unknown	0		1	0.9%
NORMAL					
0.000	normal globe	58	80.6%	78	73.6%

OCULAR DISORDERS REPORT
WORKING KELPIE

There are insufficient breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the WORKING KELPIE breed. Therefore, there are no conditions listed with breeding advice.

OCULAR DISORDERS REPORT
WORKING KELPIE

Diagnostic Name	TOTAL DOGS EXAMINED	1991-2013 0 #	%	2014-2018 1 #	%
NORMAL					
0.000 normal globe		0		1	100.0%

XOLOITZCUINTLI

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Cataract	Not defined	1	NO

Description and Comments

A. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Xoloitzcuintli breed. The conditions listed above are generally recognized to exist in the breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 2017 and/or Data from CERF/OFA All-Breeds Report, 2010-2016.

OCULAR DISORDERS REPORT
XOLOITZCUINTLI

Diagnostic Name		TOTAL DOGS EXAMINED	1991-2013 31 #	%	2014-2018 67 #	%
EYELIDS						
25.110	distichiasis		0		1	1.5%
UVEA						
93.710	persistent pupillary membranes, iris to iris		0		3	4.5%
93.750	persistent pupillary membranes, lens pigment foci/no strands		0		1	1.5%
LENS						
100.210	cataract. suspect not inherited/significance unknown		0		1	1.5%
100.311	incipient cataract, anterior cortex		1	3.2%	2	3.0%
100.312	incipient cataract, posterior cortex		1	3.2%	6	9.0%
100.313	incipient cataract, equatorial cortex		1	3.2%	2	3.0%
100.317	incipient cataract, capsular		0		3	4.5%
100.328	posterior suture tip opacities		0		1	1.5%
100.999	*significant cataracts (summary)*		*3*	*9.7%*	*13*	*19.4%*
RETINA						
120.180	retinal dysplasia, geographic		1	3.2%	0	
OTHER						
900.100	other, not inherited		0		1	1.5%
900.110	other. suspect not inherited/significance unknown		0		1	1.5%
NORMAL						
0.000	normal globe		30	96.8%	53	79.1%

OCULAR DISORDERS REPORT
YAKUTIAN LAIKA

There are insufficient breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the YAKUTIAN LAIKA breed. Therefore, there are no conditions listed with breeding advice.

OCULAR DISORDERS REPORT
YAKUTIAN LAIKA

Diagnostic Name	TOTAL DOGS EXAMINED	1991-2013 0 #	%	2014-2018 9 #	%
UVEA					
93.710	persistent pupillary membranes, iris to iris	0		1	11.1%
93.999	uveal cysts	0		1	11.1%
RETINA					
120.170	retinal dysplasia, folds	0		1	11.1%
NORMAL					
0.000	normal globe	0		8	88.9%

YORKSHIRE TERRIER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE	GENETIC TESTS AVAILABLE
A.	Keratoconjunctivitis sicca	Not defined	1, 2	NO	
B.	Distichiasis	Not defined	3	Breeder option	
C.	Corneal dystrophy - epithelial/stromal	Not defined	4	Breeder option	
D.	Persistent pupillary membranes - iris to iris - lens pigment foci/no strands	Not defined Not defined	1, 3 4	Breeder option Passes with no notation	
E.	Cataract	Not defined	1	NO	
F.	Lens luxation	Autosomal recessive	5, 6, 7	NO	Mutation in the *ADAMTS17* gene
G.	Retinal atrophy - generalized	Not defined	1	NO	
H.	Retinal dysplasia - folds	Not defined	8	Breeder option	
I.	Retinal dysplasia - geographic/detached	Not defined	7, 9	NO	
J.	Ligneous conjunctivitis	Not defined	10	NO	

Description and Comment

A. Keratoconjunctivitis sicca

An abnormality of the tear film, most commonly a deficiency of the aqueous portion, although the mucin and/or lipid layers may be affected; results in ocular irritation and/or vision impairment. There is evidence that Yorkshire Terriers sometimes present with severe, congenital, unilateral keratoconjunctivitis sicca (KCS) and it is suspected this is due to hypoplasia or aplasia of the gland.

B. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regards to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded. Breeding discretion is advised.

C. Corneal dystrophy-epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

D. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

E. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

F. Lens luxation

Partial (subluxation) or complete displacement of the lens from the normal anatomic site behind the pupil. Lens luxation not associated with trauma or inflammation is presumed to be inherited. Lens luxation may result in elevated intraocular pressure (glaucoma) causing vision impairment or blindness. A mutation in *ADAMTS17* has been associated with primary lens luxation. A DNA test is available.

G. Retinal atrophy - generalized

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. PRA is inherited as an autosomal recessive trait in most breeds.

H. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple.

When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

I. Retinal dysplasia - geographic/detached

Abnormal development of the retina present at birth.

Retinal dysplasia - geographic: Any irregularly shaped area of abnormal retinal development containing both areas of thinning and areas of elevation representing folds and retinal disorganization.

Retinal dysplasia - detached: Severe retinal disorganization associated with separation (detachment) of the retina.

These two forms are associated with vision impairment or blindness. Retinal dysplasia is known to be inherited in many breeds. The genetic relationship among the three forms of retinal dysplasia is not known for all breeds.

J. Ligneous conjunctivitis

A rare type of conjunctivitis characterized by the formation of thick membranes covering conjunctiva of the nictitans and eyelids of affected dogs. This condition has been diagnosed in four unrelated Doberman Pinschers, three of which had life-threatening systemic disease. Ligneous conjunctivitis has also been reported in one Yorkshire terrier.

References

1. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

2. Herrera HD, Weichsler N, Gomez JR, et al. Severe, unilateral, unresponsive keratoconjunctivitis sicca in 16 juvenile Yorkshire Terriers. *Vet Ophthalmol.* 2007;10:285-288.

3. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

4. ACVO Genetics Committee, 2017 and/or Data from CERF/OFA All-Breeds Report, 2010-2016.

5. Gould D, Pettitt L, McLaughlin B, et al. ADAMTS17 mutation associated with primary lens luxation is widespread among breeds. *Vet Ophthalmol.* 2011;14:378-384.

6. Farias FH, Johnson GS, Taylor JF, et al. An ADAMTS17 splice donor site mutation in dogs with primary lens luxation. *Invest Ophthalmol Vis Sci*. 2010;51:4716-4721.

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9. Stades FC. Hereditary retinal dysplasia (RD) in a family of Yorkshire Terriers. *Tijdschr Diergeneeskd*. 1978;103:1087-1090.

10. Torres MD, Leiva M, Tabar MD, et al. Ligneous conjunctivitis in a plasminogen-deficient dog: clinical management and 2-year follow-up. *Vet Ophthalmol.* 2009;12:248-253.

OCULAR DISORDERS REPORT
YORKSHIRE TERRIER

Diagnostic Name	TOTAL DOGS EXAMINED	1991-2013 1284 #	%	2014-2018 617 #	%
GLOBE					
0.110	microphthalmia	3	0.2%	2	0.3%
10.000	glaucoma	1	0.1%	0	
EYELIDS					
25.110	distichiasis	26	2.0%	11	1.8%
NASOLACRIMAL					
40.910	keratoconjunctivitis sicca	5	0.4%	1	0.2%
NICTITANS					
52.110	prolapsed gland of the third eyelid	1	0.1%	0	
CORNEA					
70.210	corneal pannus	4	0.3%	0	
70.220	pigmentary keratitis	0		4	0.6%
70.700	corneal dystrophy	11	0.9%	4	0.6%
70.730	corneal endothelial degeneration	1	0.1%	0	
UVEA					
93.110	iris hypoplasia	1	0.1%	0	
93.710	persistent pupillary membranes, iris to iris	127	9.9%	59	9.6%
93.720	persistent pupillary membranes, iris to lens	4	0.3%	0	
93.730	persistent pupillary membranes, iris to cornea	3	0.2%	3	0.5%
93.750	persistent pupillary membranes, lens pigment foci/no strands	6	0.5%	16	2.6%
93.760	persistent pupillary membranes, endothelial opacity/no strands	1	0.1%	1	0.2%
LENS					
100.200	cataract, unspecified	23	1.8%	0	
100.210	cataract. suspect not inherited/significance unknown	45	3.5%	12	1.9%
100.301	punctate cataract, anterior cortex	25	1.9%	3	0.5%
100.302	punctate cataract, posterior cortex	10	0.8%	2	0.3%
100.303	punctate cataract, equatorial cortex	5	0.4%	1	0.2%
100.304	punctate cataract, anterior sutures	3	0.2%	0	
100.305	punctate cataract, posterior sutures	2	0.2%	4	0.6%
100.306	punctate cataract, nucleus	1	0.1%	1	0.2%
100.307	punctate cataract, capsular	0		1	0.2%
100.311	incipient cataract, anterior cortex	21	1.6%	9	1.5%
100.312	incipient cataract, posterior cortex	15	1.2%	4	0.6%
100.313	incipient cataract, equatorial cortex	15	1.2%	4	0.6%
100.314	incipient cataract, anterior sutures	2	0.2%	1	0.2%
100.315	incipient cataract, posterior sutures	3	0.2%	0	
100.316	incipient cataract, nucleus	3	0.2%	0	
100.317	incipient cataract, capsular	1	0.1%	0	
100.321	incomplete cataract, anterior cortex	2	0.2%	4	0.6%
100.322	incomplete cataract, posterior cortex	0		3	0.5%
100.323	incomplete cataract, equatorial cortex	0		1	0.2%
100.326	incomplete cataract, nucleus	1	0.1%	1	0.2%
100.328	posterior suture tip opacities	0		2	0.3%
100.330	generalized/complete cataract	27	2.1%	2	0.3%

LENS CONTINUED		1991-2013		2014-2018	
100.375	subluxation/luxation, unspecified	1	0.1%	0	
100.999	*significant cataracts (summary)*	*159*	*12.4%*	*41*	*6.6%*
VITREOUS					
110.120	persistent hyaloid artery/remnant	1	0.1%	1	0.2%
110.135	PHPV/PTVL	4	0.3%	0	
110.200	vitritis	0		3	0.5%
110.320	vitreal degeneration	16	1.2%	8	1.3%
RETINA					
120.170	retinal dysplasia, folds	5	0.4%	4	0.6%
120.310	generalized progressive retinal atrophy (PRA)	51	4.0%	5	0.8%
120.920	retinal detachment with dialysis	0		1	0.2%
120.960	retinopathy	0		5	0.8%
OPTIC NERVE					
130.110	micropapilla	0		1	0.2%
130.120	optic nerve hypoplasia	3	0.2%	0	
130.150	optic disc coloboma	1	0.1%	0	
OTHER					
900.000	other, unspecified	19	1.5%	0	
900.100	other, not inherited	23	1.8%	24	3.9%
900.110	other. suspect not inherited/significance unknown	14	1.1%	1	0.2%
NORMAL					
0.000	normal globe	976	76.0%	451	73.1%