

## *Sensory organ of Pigeon*

### *5. Visual Organs or Eyes:*

Birds depend more on their eyes than on the other senses. The eyes are extremely large. The eyes of hawks and owls are larger than in man. The eyes of pigeon are well developed and are very large in correlation with an aerial life for a precise vision over considerable distances.

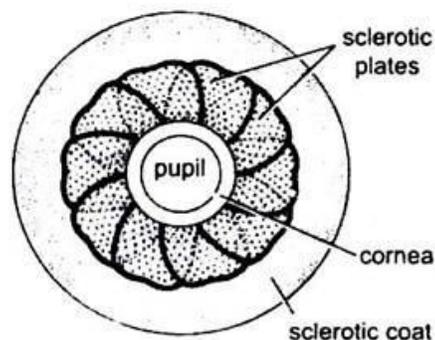
#### **Shape:**

The eyeball is not spherical, the lens and cornea bulge forwards in front of the posterior chamber. This form is maintained by a ring of bony sclerotic plates. In most birds the whole eye is thus broader than it is deep. Eyeball is longer in those birds whose sight is very acute and in some eagles and crows it is tubular.

#### **Eyelids:**

The eyebrows or eyelashes are absent. There occur two inconspicuous eyelids, a slightly movable upper eyelid and a more movable and well developed lower eyelid which rises upwards to close the eye during the sleep. A semi-transparent third eyelid or nictitating membrane occurs as a fold at the anterior angle of the eye.

It can be drawn posteriorly over eye with great rapidity. It cleans the eyeball and also protects the eyes from wind and during flight and from water during swimming in aquatic birds. It also protects the eyes from glare of the sunlight during day in nocturnal birds.



**Fig. 26.45.** Pigeon. Eye in outer view showing sclerotic plates.

**Glands:**

The nictitating membrane is lubricated by the oily secretion of a Harderian gland occurring in the inner angle of the eye. The tear gland or lacrymal glands are also well developed and lie below the outer angle of lower eyelid. Their watery secretion nourishes the non-vascular cornea, and also keeps it clean.

The wall of hollow eyeball consists of three usual layers, namely, an outer sclerotic, a middle choroid and an inner retina.

**Sclerotic:**

The external coat of the eyeball is sclerotic. In the posterior hidden part of the eye, it is opaque, white, dense and cartilaginous. In front in the exposed part of the eye, it bulges out to form a convex, transparent and horny cornea of connective tissue.

The cornea is externally covered by a thin, transparent, sensitive and vascular epithelial membrane, the conjunctiva, which is formed by modified epidermis and is continuous with the mucous lining of the eyelids. Anteriorly, at the junction of cornea and sclerotic coat, the latter is strengthened by a ring of 10-12 small overlapping bony, sclerotic plates or ossicles.

**Choroid:**

The sclerotic coat is followed by the middle layer, the choroid, which is thin, dark pigmented and highly vascular. The choroid closely lines the sclerotic, but it separates in front to form a circular, pigmented diaphragm, the iris, perforated by a rounded aperture, the pupil. The iris regulates the amount of the entering light. It contains intrinsic circular and radial smooth muscles, the circular muscles contract the pupil, while radial muscles dilate it.

Along the peripheral margin of the iris, the choroid forms a ring-like ciliary body which is a thickened fold containing smooth ciliary muscles. From ciliary body arises striated ciliary processes or suspensory ligaments and attached to the lens. The ciliary muscles are divided into anterior Crampton muscles and posterior Brucke muscles.

The Brucke muscles draws the lens forward into the anterior chamber so that since the shape of the eye is fixed by the sclerotic plates, the lens becomes more curved and, hence, accommodated for near vision. Contraction of the iris sphincter assists in this

process. At the same time the Crampton muscles pull the cornea reducing its radius and further assist in accommodation. The circular and radial muscles of the iris and ciliary muscles are under the control of the autonomic nervous system receiving sympathetic and parasympathetic fibres.

### **Retina:**

The innermost coat of the eyeball is a thin, light sensitive nervous layer called retina. It is transparent, devoid of blood vessels, thick and consists of nerve fibres, nerve cells and minute rods and cones. Pigeon, being a diurnal bird, has largely more cones than rods. The high resolving power and high powers of discrimination and of movement detection depend on the great density of the cones, as many as 1 million per square millimetre in the fovea of a hawk. Nocturnal bird's retina is composed mainly or completely of rods.

### **Sensitive Spots:**

The retina has two sensitive spots or fovea. The central fovea, which lies near the centre of retina as a slight depression, is more sensitive and used for lateral or monocular vision. The second fovea, the temporal fovea, lies more towards the outer side of the eye and is used for forward or binocular vision. The foveae have comparatively more cones and give more distinct vision. The cones of birds often contain carotenoid oil droplets, which are also found in frogs, turtles and marsupials.

In diurnal birds, they are red, yellow, orange or colourless, but in nocturnal ones pale yellow or colourless. Colour droplets may produce narrow-band sensitivity channels for the mediation of colour discrimination. The lower part of retina contains yellow droplets and upper part (dorso-posterior) contains red droplets. These droplets serve as filters and increase the colour vision of birds up to great degree. The red may provide finer colour discrimination of objects in feeding.

### **Lens:**

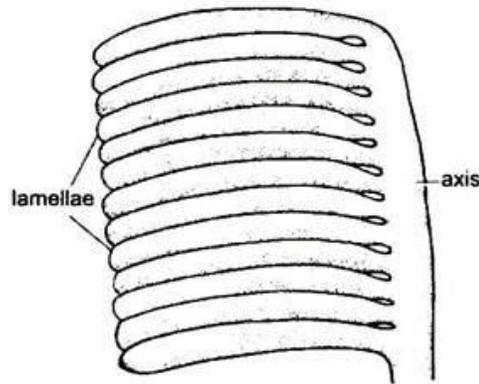
The lens is biconvex, soft, pliable, crystalline, colourless, transparent and is surrounded by a fibrous capsule. It remains suspended just behind the iris by suspensory ligaments. It divides the eye cavity into a small anterior aqueous chamber and a large posterior vitreous chamber.

The aqueous chamber is filled with a colourless watery fluid, the aqueous humour, while vitreous chamber contains a thick colourless, gelatinous vitreous humour. The two

humours keep the eyeball tight or tense and also serve to focus the light rays on the retina.

### **Pecten:**

Pecten (Fig. 26.46) is a pleated, strongly pigmented vascular fold projecting into the cavity of the eye from the entrance of the optic nerve. It is large and much pleated in predatory birds, which detect minute movements at great distances, and is small and smooth in nocturnal birds. It is also well developed in diurnal birds (pigeon). Except kiwi, all birds have pecten.



**Fig. 26.46.** Pigeon. Pecten.

### **Functions of Pecten:**

There are many speculations about the function of pecten but none is known definitely. Probably its main function is to bring oxygen and nourishment to the retina, which in birds has no capillary circulation. It helps in accommodation, it is not likely that it actually assists in focussing, for instance, by pressing forward the lens, and no changes have been seen in it during accommodation. However, it might possibly assist by adjusting the intraocular pressure, which must be increased by the extensive changes in the lens during accommodation.

### **Vision:**

In pigeon, because the cornea projects outwards and the posterior part is expanded, so the eye is broader than deep. Due to expansion of retina over the broad posterior portion, the distant objects are sharply focussed on it. Further, though the eyes are lateral in position, there is an overlapping of the two visual fields to some extent. This is called binocular vision. It is worth noting that there occurs little movement in pigeons' eyes due to ill-development of extrinsic eyeball muscles and that is compensated by flexibility of neck which turns the neck very quickly.

