

Lab 4

Bone Histology @ The Appendicular Skeleton

Slide 1-8-1 Compact Bone:

*This slide includes a “longitudinal-section” and a “*cross-section*” of **compact bone**. Just study the cross-section of the compact bone for this lab. The longitudinal-section will be shown in the demo, but not directly tested on in the lab.

NOTE: These slides tend to have much thicker coverslips and histologic slices underneath them. For that reason, please do NOT use 1000X (the 100X oil immersion objective lens) as it almost always hits the coverslip and can crack it.

□ **Osseous Tissue (Bone Tissue)**

— The Greek word for bone is “*osteon*”.

— 2 forms:

- **Compact Bone** (or Cortical Bone)

- **Osteon** (or **Haversian System**) is the structure providing the ability of the bone to support your body weight, and other mechanical forces exerted on them.

- **Central Canal (Haversian Canal)**

- **Perforating Canal (Volkmann’s Canal)**

- **Spongy Bone** (or Cancellous Bone, Trabecular Bone)

— Functions:

- support
- protection
- provides levers for the muscles to act on
- stores about 99% of all the Calcium ions in your body.
- stores fat in the marrow cavity of adults.
- is the main site for forming RBCs, WBCs, and PLTs.

— Common Locations:

- any of the 206+ **bones** in the body.

□ **Osteocytes in Lacunae**

— “lacuna” (plural: lacunae) is Latin for “gap”. It is a space, “cavity” or “depression” with an osteocyte in it.

— lacunae are “*arranged between the lamellae*” of compact bone and very small with many **canaliculi** extending outward. The lacunae look like “*flat black stars*” arranged in a *ring-like pattern*.

— matrix has **Type I cartilage fibers**. The collagen fibers have two arrangements:

- woven bone (fibrous bone) – haphazard arrangement. It is mechanically weak.
- lamellar bone – regular, parallel arrangement into sheets (called lamellae). It is mechanically strong.

Slide 1-8-2 Endochondral Ossification:

*this is a slide of a finger tip, so you are looking at the epiphyseal (growth) plates in one of the phalanges, a long bone. The list of zones starts nearest the joint and proceeds towards the diaphysis (shaft) of the bone.

- **Endochondral Ossification**
 - growth that increases a bones length.
 - seen in the epiphyseal (growth) plate in long bones.
- **Resting (Quiescent) Zone**
 - looks just like Hyaline Cartilage
 - randomly, scattered small chondrocytes in lacunae.
 - zone closest to the synovial joint surface.
- **Proliferation (Growth) Zone**
 - looks just like Fibrous Cartilage.
 - small chondrocytes in lacuna, arranged in stacks.
 - chondrocytes are rapidly undergoing mitosis (hyperplasia).
- **Hypertrophic (Maturation) Zone**
 - looks just like Fibrous Cartilage with much larger cells.
 - large chondrocytes in lacuna, arranged in stacks.
 - some of the large (mature) chondrocytes have died due to a lack of enough nutrition. This leave the lacunae empty.
- **Calcification Zone**
 - osteoblast & osteoclasts move into the vacant lacunae.
 - chondrocytes are dying or already dead.
 - **matrix has calcified** and looks like stalactites & stalagmites.
 - is the zone at the junction of the epiphysis and diaphysis.
- **Ossification (Osteogenic) Zone**
 - osteoclasts have eaten the spicules of bone so that it looks less like stalactites & stalagmites. This opens up the marrow cavity in the diaphysis more.
 - osteoblasts replace the previous matrix with a bony matrix.

Gross Anatomy of a Bone:

*These bone parts are from many different sources (human & animal), but the features are the same. Mostly we will focus on the gross anatomy of long and flat bones.

- **Compact Bone**
- **Spongy Bone**
 - called **diploë** in flat bones of the calvarium.
- **Epiphysis**
 - has hyaline cartilage on the articular surface of synovial joints.
 - becomes an **Epiphyseal Line** as your age into adulthood.
 - about age 18 years for females.
 - about age 21 years for males.
- **Epiphyseal (Growth Plate)**
- **Diaphysis**
 - **Medullary (Marrow) Cavity**
 - **Red Marrow**
 - red marrow is primarily found in young children.
 - **Yellow Marrow**
 - yellow marrow is primarily found in adults.
 - **Periosteum**
 - dense irregular connective tissue around the bone
 - Type I collagen fibers that anchor the periosteum to the bone.
 - **Sharpey's Fibers**

The Appendicular Skeleton

- **CLAVICLE** (left & right):
 - Sternal (Medial) End*
 - **last epiphyseal plate to close (age 23–28 years old)!*
 - Acromial (Lateral) End

- **SCAPULA** (left & right):
 - Subscapular Fossa
 - Supraspinous Fossa
 - Infraspinous Fossa
 - Spine
 - Suprascapular Notch
 - Glenoid Cavity
 - Acromion
 - Coracoid Process

- **HUMERUS** (left & right):
 - Head
 - Greater Tubercle
 - Lesser Tubercle
 - Intertubercular Sulcus
 - Medial Epicondyle
 - Capitulum
 - Trochlea

- **RADIUS** (left & right):
 - Head

- **ULNA** (left & right):
 - Olecranon
 - Coronoid Process
 - Trochlear Notch
 - Styloid Process

- **BONES OF THE WRIST** (left & right):
 - Scaphoid
 - Lunate
 - Triquetrum
 - Pisiform
 - Trapezium
 - Trapezoid
 - Capitate
 - Hamate

- **FINGERS** (left & right):
 - Metacarpal (1st, 2nd, 3rd, 4th, 5th)
 - Phalanges (Proximal, Middle, Distal), (1st, 2nd, 3rd, 4th, 5th)

- **HIP (COXAL) BONE** (left & right):
 - ILIUM
 - Anterior Superior Iliac Spine
 - Iliac Crest
 - Auricular Surface
 - Greater Sciatic Notch
 - Acetabulum* (*all three coxal bones contribute)
 - ISCHIUM
 - Ischial Spine
 - Ischial Tuberosity
 - Obturator Foramen* (*Ischium & Pubis contribute)
 - PUBIS
 - Pubic Symphysis
 - Pubic Tubercle

- **FEMUR** (left & right):
 - Head
 - Fovea Capitis
 - Greater Trochanter
 - Lesser Trochanter
 - Lateral Condyle
 - Medial Condyle
 - Patellar Surface

- **PATELLA** (left & right)

- **TIBIA** (left & right):
 - Tibial Tuberosity
 - Medial Malleolus

- **FIBULA** (left & right):
 - Lateral Malleolus

- **BONES OF THE ANKLE** (left & right):
 - Talus
 - Calcaneus
 - Navicular
 - Medial Cuneiform
 - Intermediate Cuneiform
 - Lateral Cuneiform
 - Cuboid

- **TOES** (left & right):
 - Metatarsal (1st, 2nd, 3rd, 4th, 5th)
 - Phalanges (Proximal, Middle, Distal), (1st, 2nd, 3rd, 4th, 5th)