

Chapter 6: Introduction to Bones

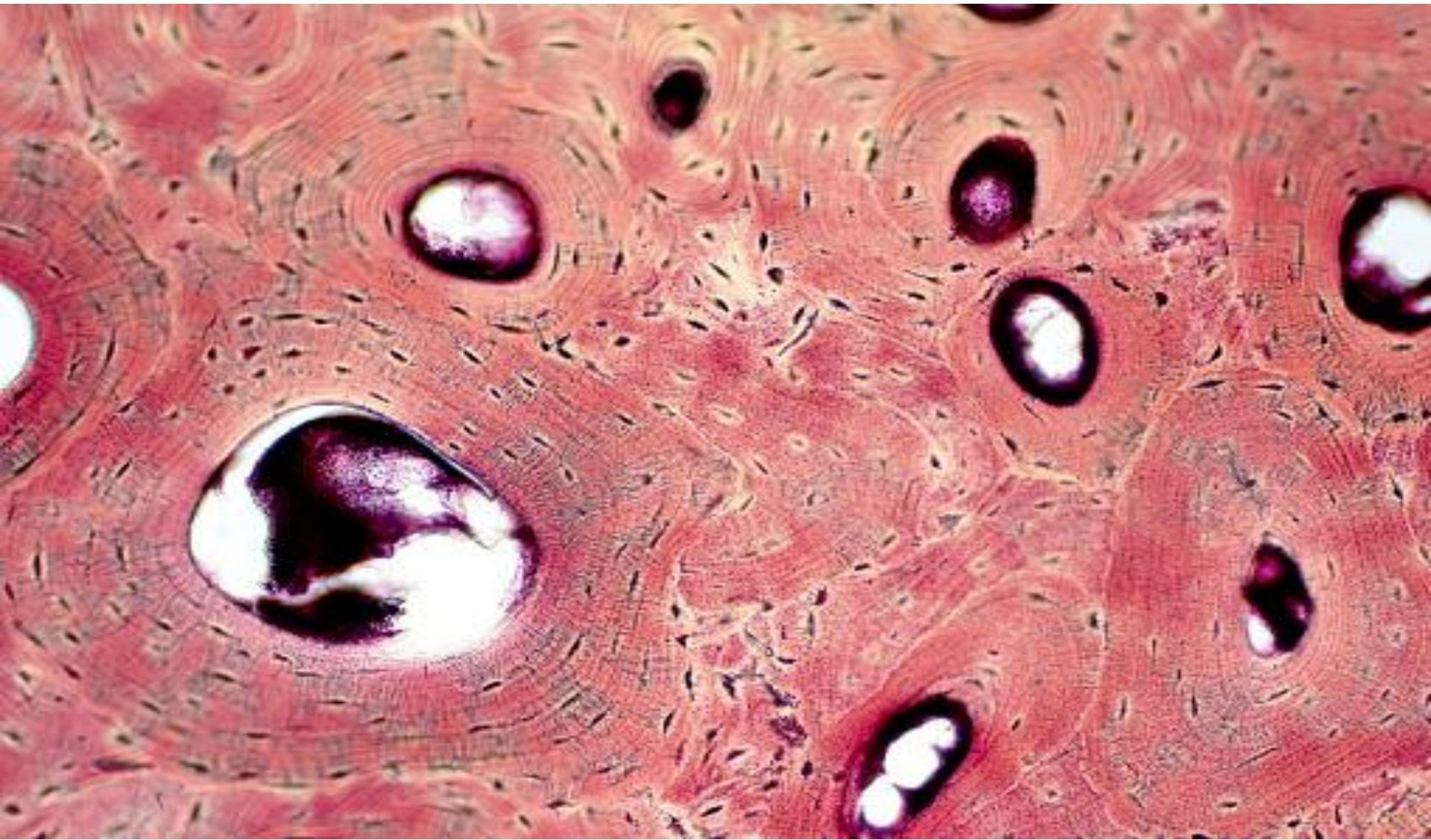


image: compact bone

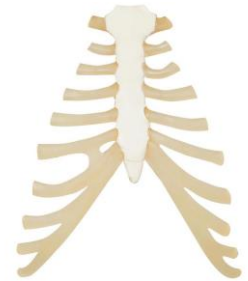
Dr. Paige Morgan
Laramie County Community College

Function of Bones

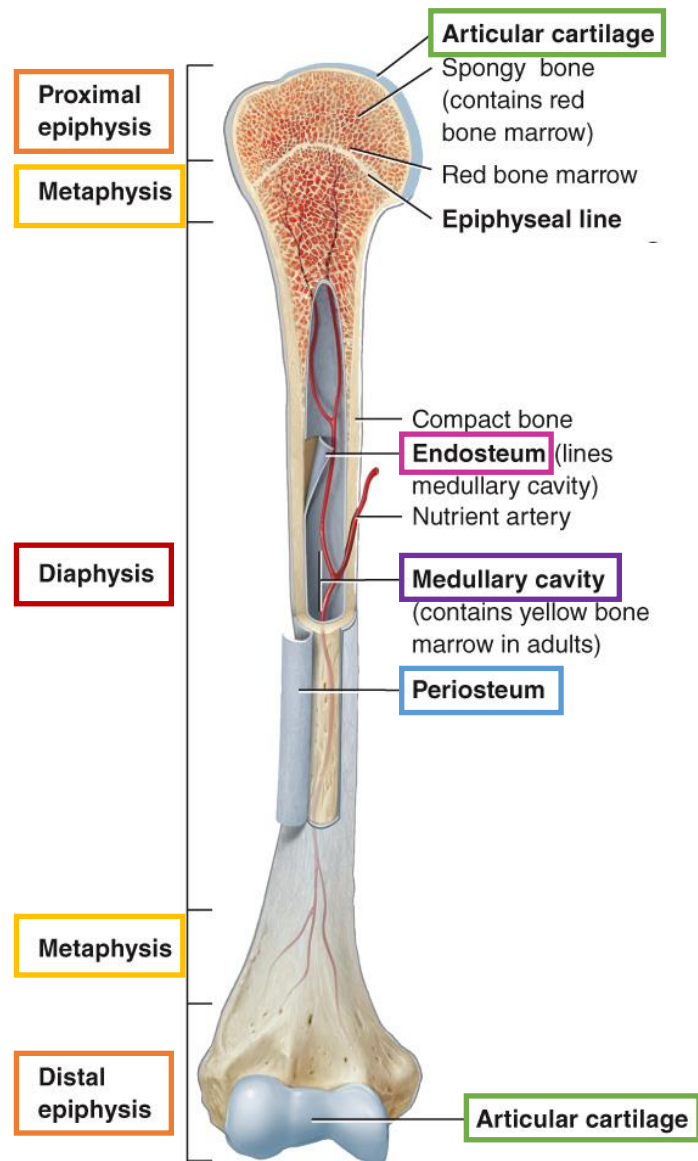
- **support:** serves as structural framework for the body by supporting soft tissues and providing attachment points for tendons of skeletal muscles
- **protection:** protects the most internal organs from injury
ex: rib cage protects the heart and lungs; cranial bones protect the brain
- **assistance in movement:** most skeletal muscles attach to bone; when they contract, they pull on bones to produce movement
- **mineral homeostasis:** stores several minerals (esp. calcium and phosphorous) which contribute to bone strength and can be released into the blood to be distributed to other tissues in the body in order to maintain mineral balance
- **blood cell production:** in certain bones, a connective tissue called red bone marrow produces red blood cells, white blood cells, and platelets in a process known as **hemopoiesis**
red bone marrow = consists of developing blood cells, adipocytes, fibroblasts, and macrophages in network of reticular fibers; found in developing bones of fetus and in some adult bones (ex. pelvic bones, ribs, sternum, vertebrae, skull, and ends of humerus and femur)
- **triglyceride storage:**
yellow bone marrow = consists mainly of adipose cells

Types of Bones

- **long bones:** have greater length than width
→ consist of a shaft and a variable number of extremities or epiphyses (ends)
→ made mostly of compact bone in their diaphyses but have spongy bone in their epiphyses
ex. femur, tibia, fibula, humerus
- **short bones:** somewhat cubed shaped; nearly equal in length and width
→ consist of spongy bone except at the surface, which has a thin layer of compact bone
ex. carpal and tarsal bones
- **flat bones:** generally thin and composed of two nearly parallel plates of compact bone tissue enclosing a layer of spongy bone tissue
→ provide extensive area for muscle attachment and protection
ex. cranial bones, sternum, ribs, scapulae
- **irregular bones:** have complex shapes and cannot be grouped into any other category
ex. vertebrae, hip bones, certain facial bones, calcaneus
- **sesamoid bones:** develop in certain tendons where there is considerable friction, tension, and physical stretch
ex. patella
- **sutural bones:** small bones located in sutures (joints) between certain cranial bones



Bone Structure



(a) Partially sectioned humerus (arm bone)

- **diaphysis:** bone shaft/body; makes up the long, cylindrical portion of the bone
- **epiphyses:** proximal and distal ends of the bone
- **metaphyses:** regions between the diaphysis and epiphyses
→ in a growing bone, each metaphysis contains an **epiphyseal growth plate** = layer of hyaline cartilage that allows the diaphysis of the bone to grow in length
→ when a bone stops growing, the hyaline cartilage is replaced with actual bone
- **articular cartilage:** thin layer of hyaline cartilage covering the part of the bone that forms a joint (articulation)
- **periosteum:** tough connective tissue sheath that surrounds the bone surface wherever it is not covered by articular cartilage
- **medullary cavity** (aka marrow cavity): hollow cylindrical space containing fatty yellow bone marrow
- **endosteum:** thin membrane that lines the medullary cavity

Bone Cytology

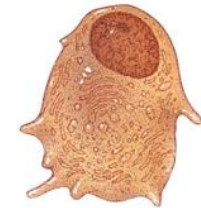
- **osteoprogenitor cells:** unspecialized bone stem cells
 - these are the only bone cells to undergo cell division
 - the resulting cells develop into osteoblasts



- **osteoblasts:** bone-building cells
 - synthesize and secrete collagen fibers and components needed to build the ECM of bone (bone deposition)
 - initiate calcification (hardening of bone tissue)



- **osteocytes:** mature bone cells (main cells in bone)
 - help maintain daily metabolism



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- **osteoclasts:** bone-degrading cells
 - huge cells concentrated in the endosteum (lining the medullary cavity)
 - release powerful lysosomal enzymes and acids that digest bone (bone resorption)



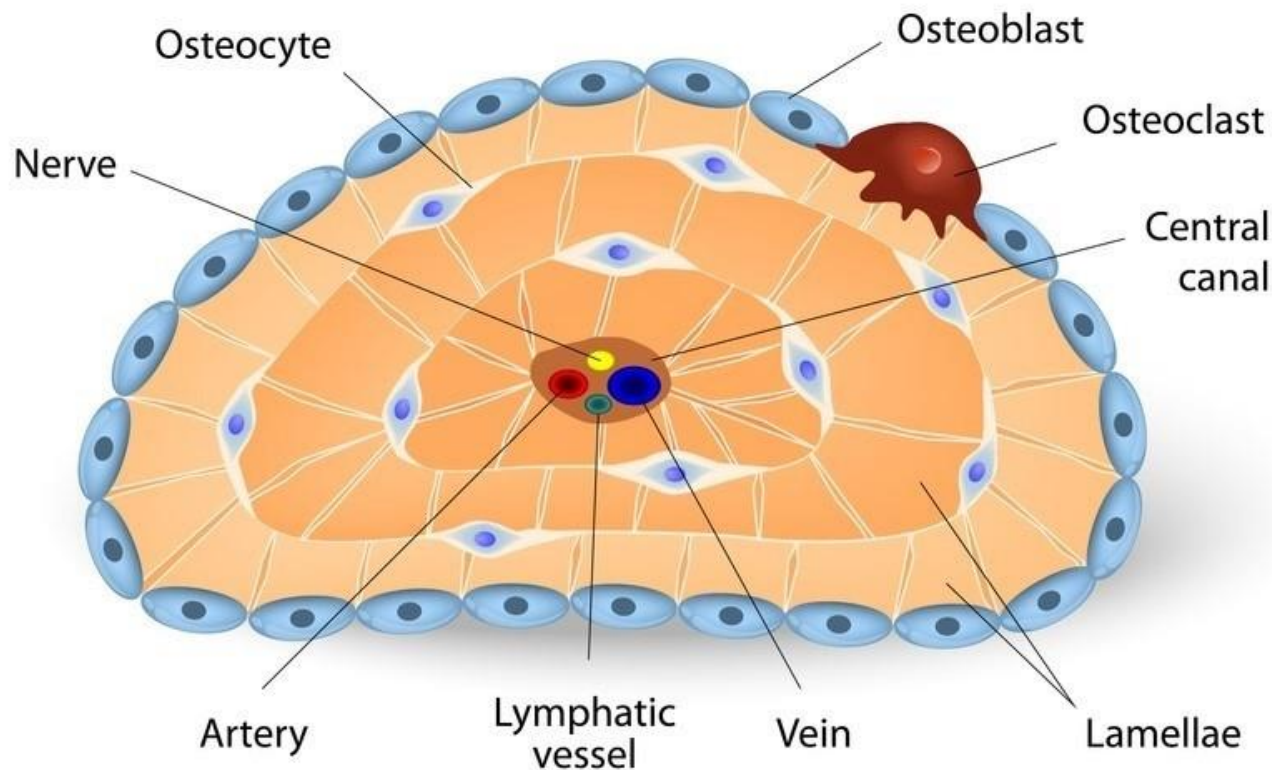
Compact Bone Tissue

- **compact bone tissue:** provides protection and support

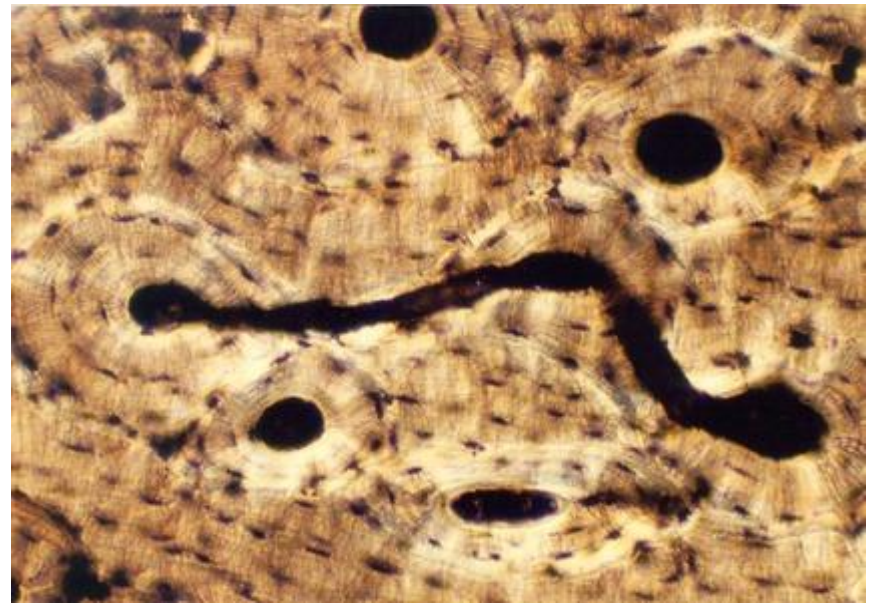
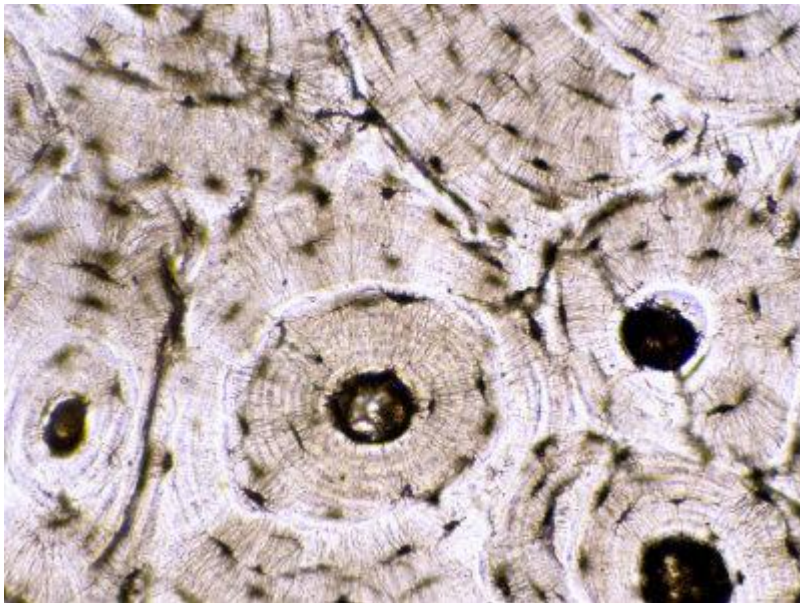
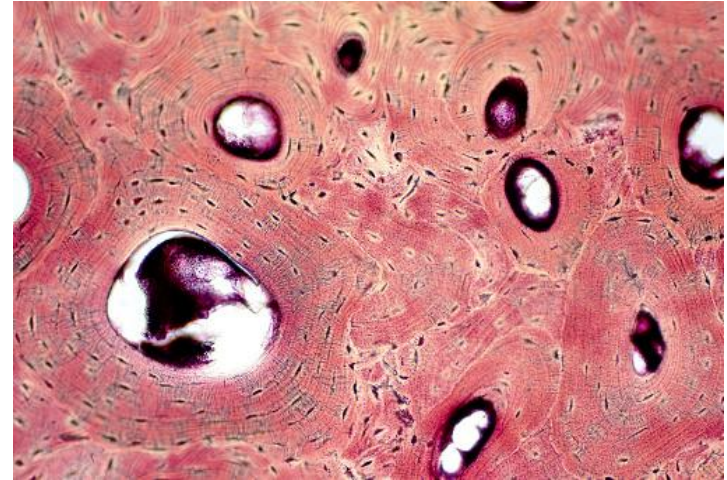
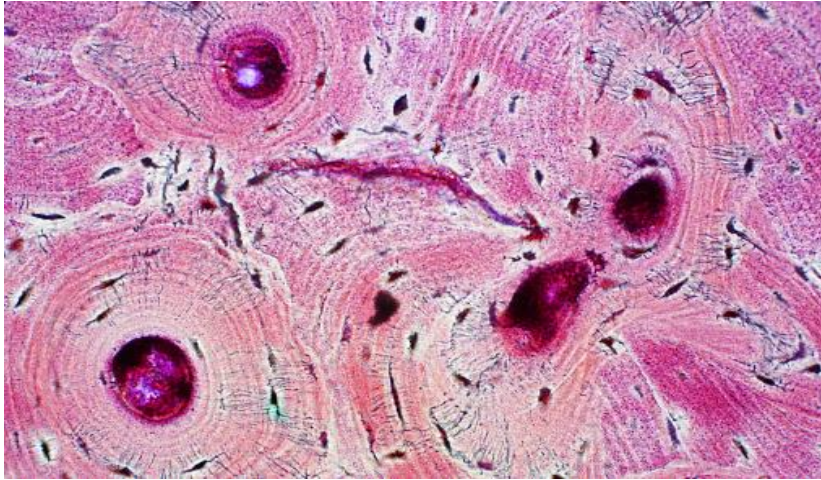
location: found beneath the periosteum of all bones; comprises the diaphysis of long bones

function: helps the bone resist the stress produced by weight and movement

structure: composed of repeating structural units called **osteons** (aka haversian systems)



Compact Bone Tissue – Histology



Spongy Bone Tissue

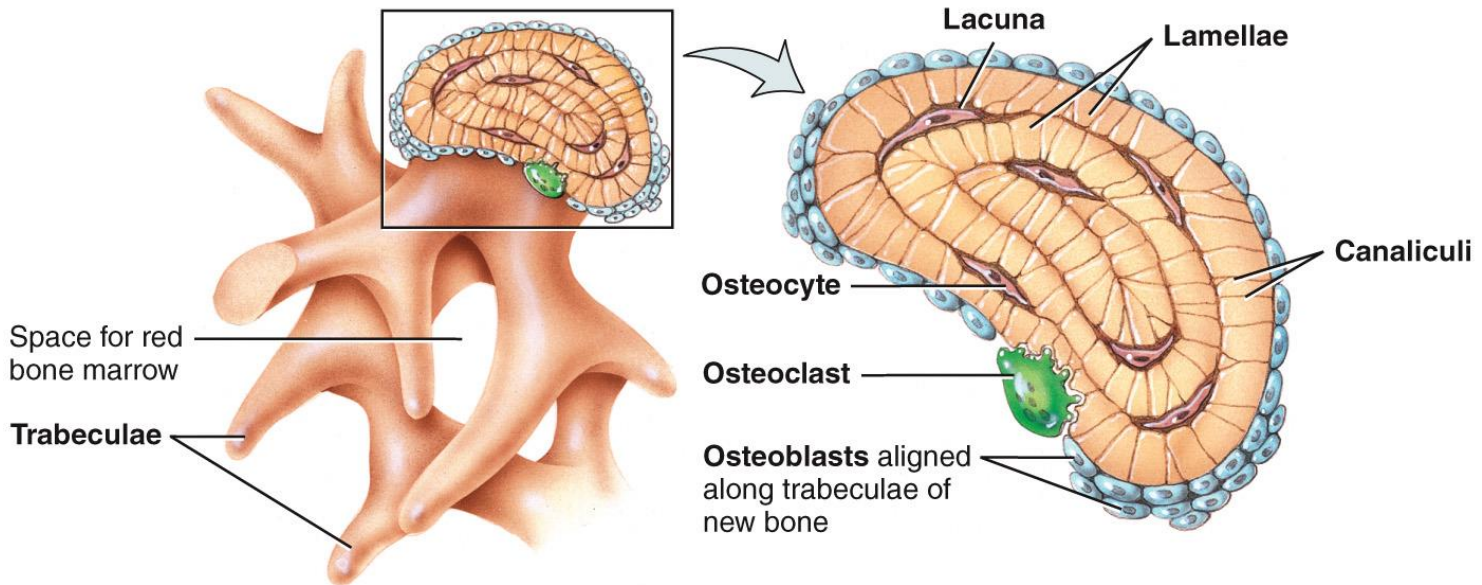
- **spongy bone tissue:** lightweight; provides tissue support

location: in the interior of the bone, protected by a covering of compact bone

function: storage of bone marrow

structure:

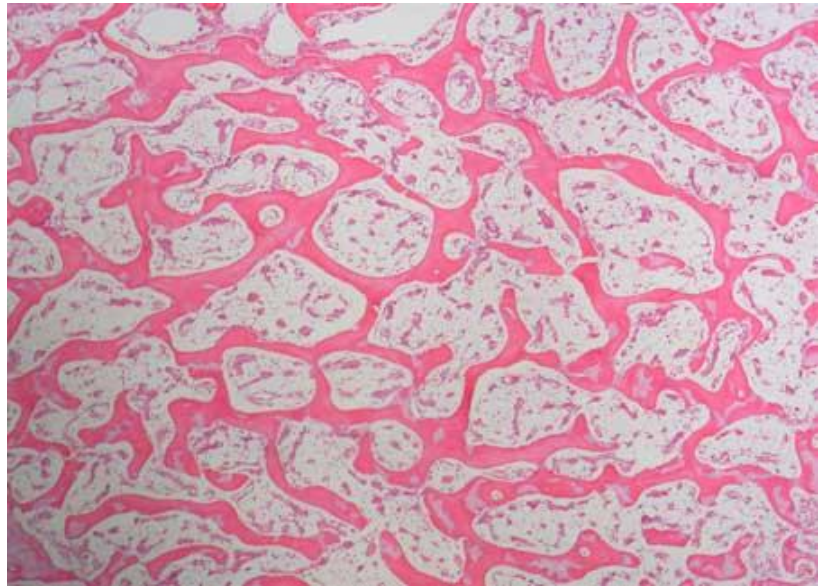
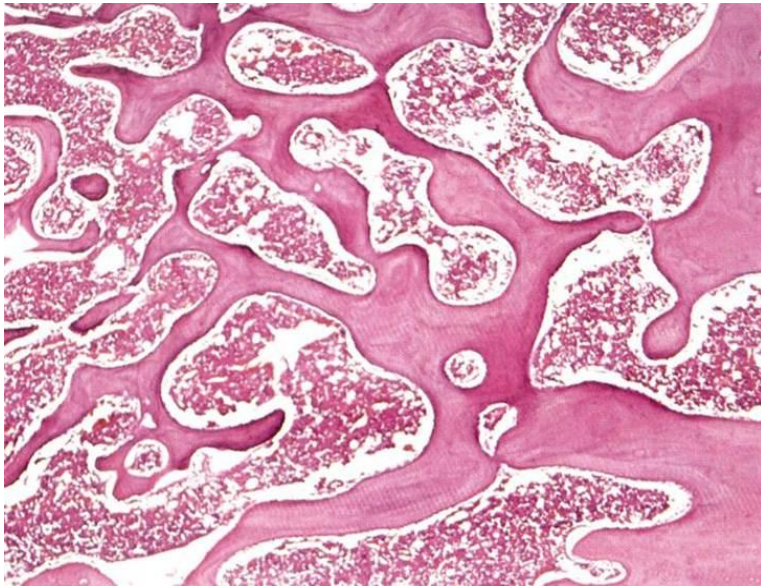
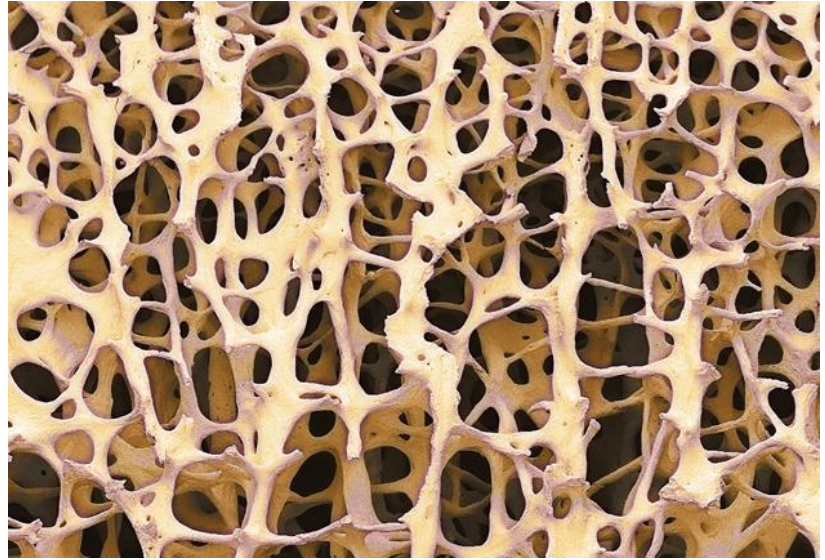
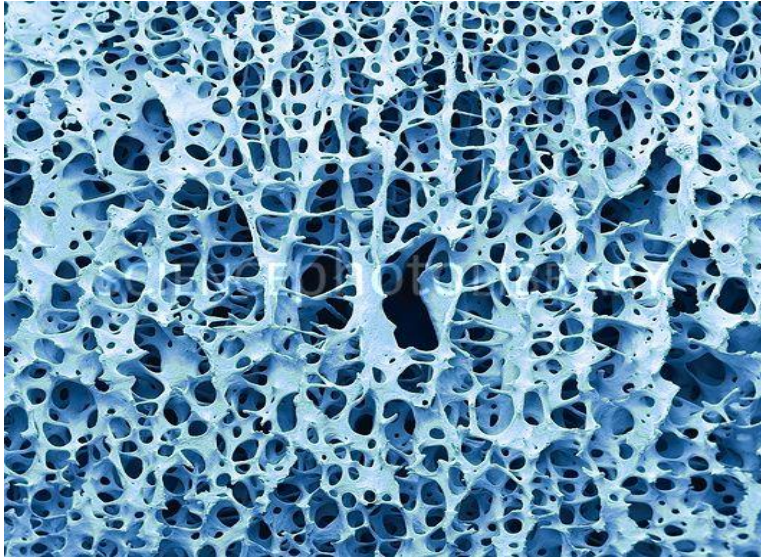
- consists of lamellae that arranged in irregular pattern of thin columns called **trabeculae**
- between the trabeculae are spaces filled with **red bone marrow** (in bones that produce RBCs) and with **yellow bone marrow** (in other bones)



(b) Enlarged aspect of spongy bone trabeculae

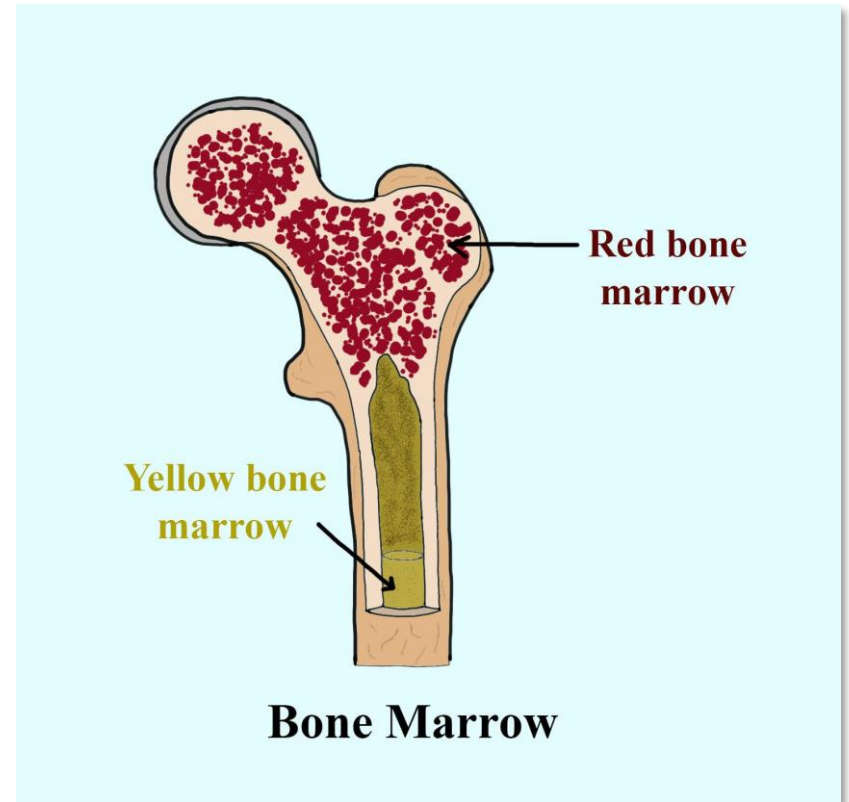
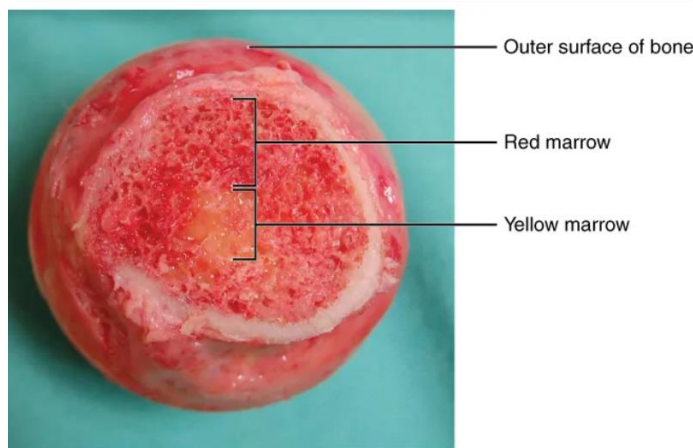
(c) Details of a section of a trabecula

Spongy Bone Tissue - Histology

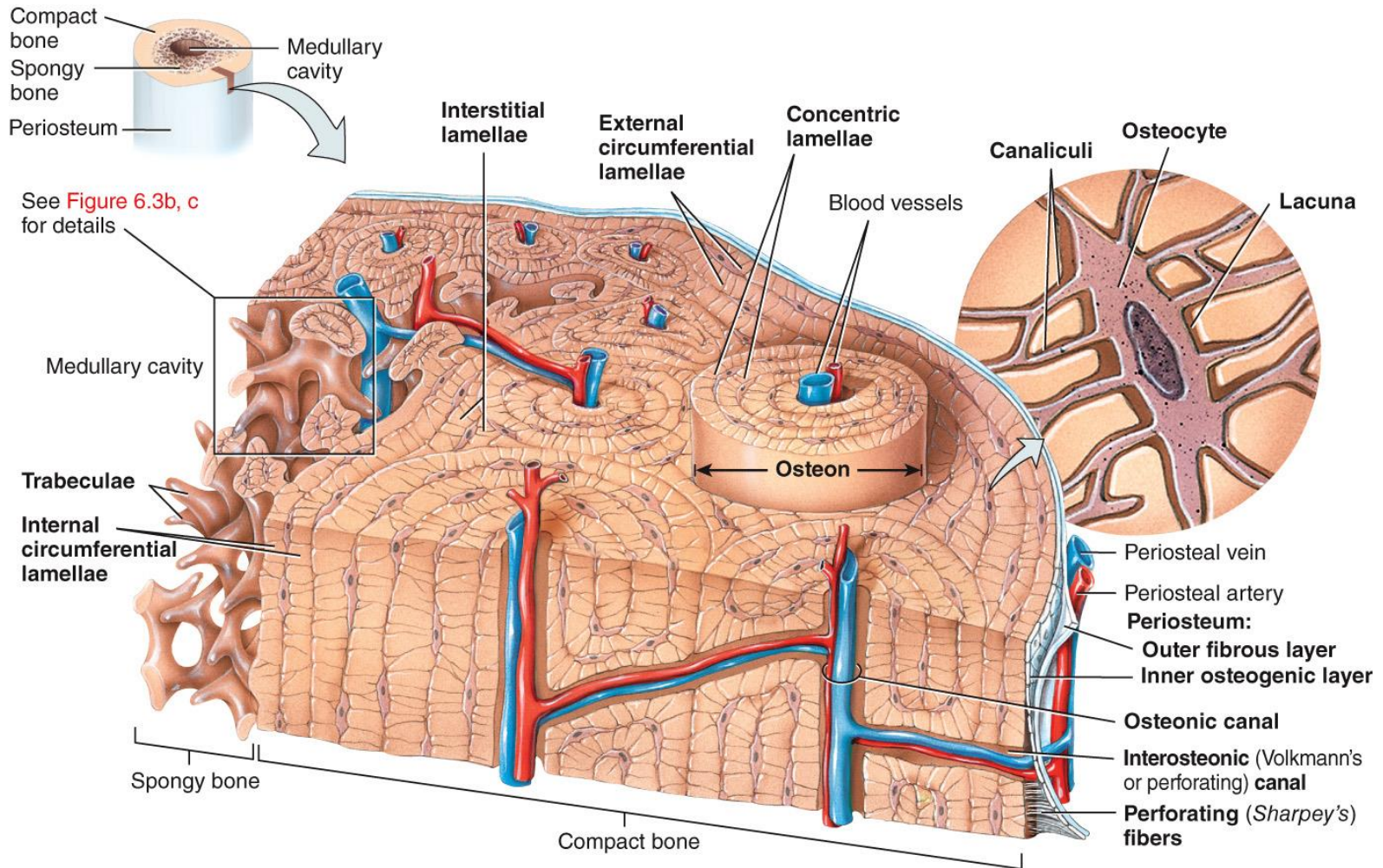


Bone Marrow

- **red bone marrow:**
 - located between the trabeculae of certain bones (ex. ribs, sternum, vertebrae, long bones)
 - primary source of new blood cells
- **yellow bone marrow:**
 - located in diaphysis of long bones like the femur, tibia, and humerus
 - comprised of adipocytes

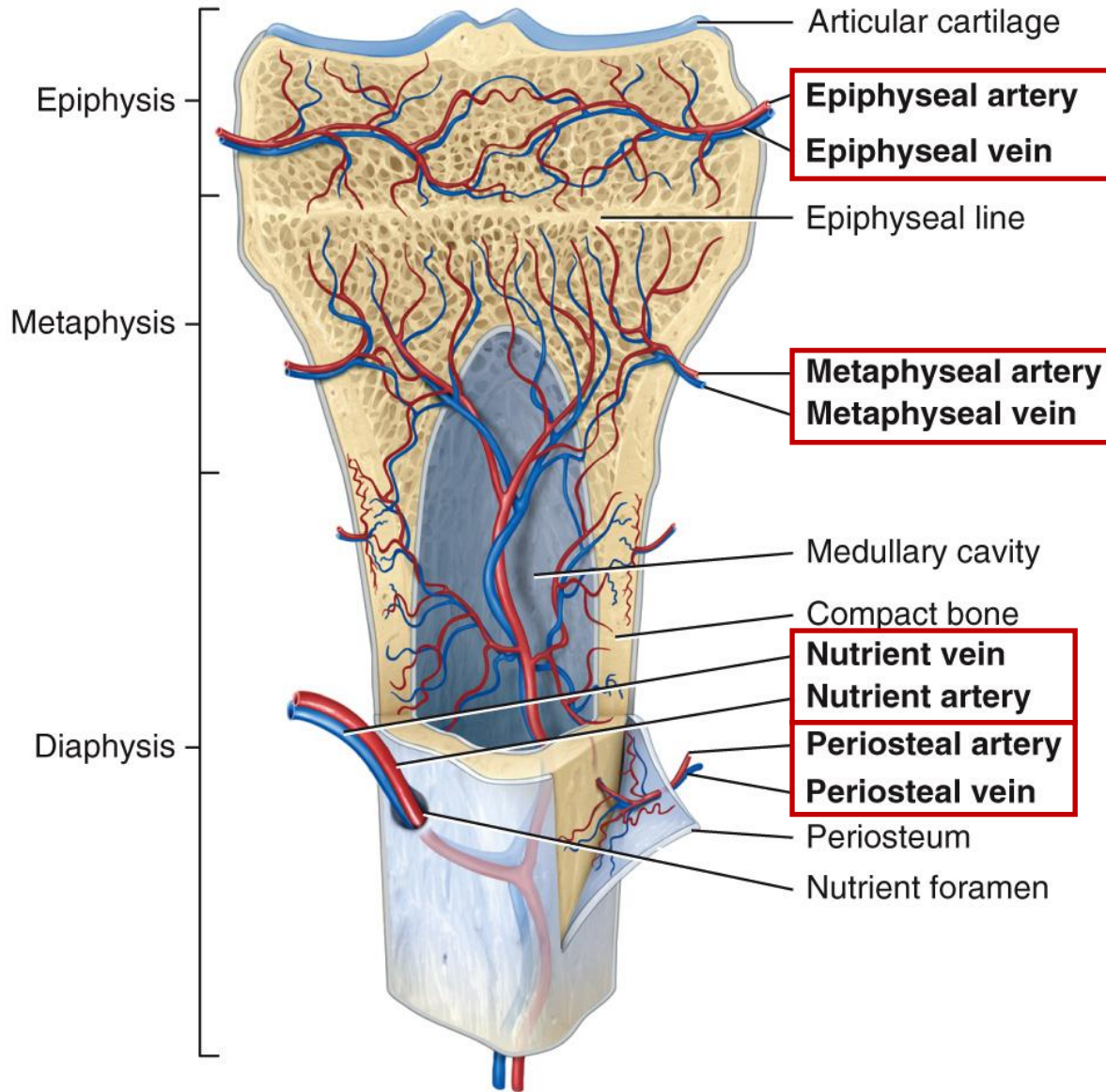


Compact vs. Spongy Bone



(a) Osteons (haversian systems) in compact bone and trabeculae in spongy bone

Blood Supply

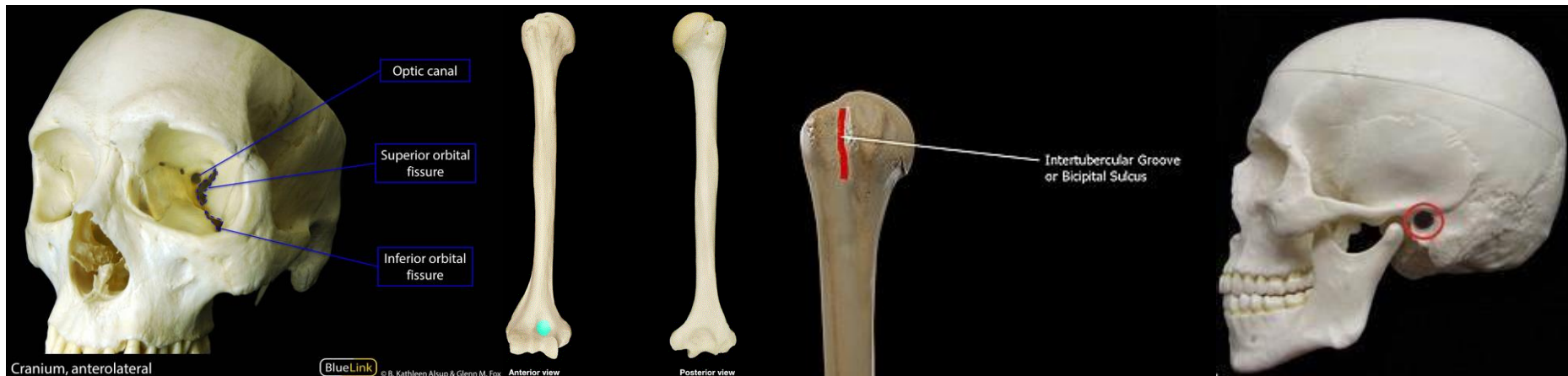


Partially sectioned tibia (shin bone)

Some Vocabulary

[1] depressions and openings

- **fissure** → narrow slit between adjacent parts of bone thru which nerves/vessels pass
- **foramen** → opening through which blood vessels/nerves/ligaments pass
- **fossa** → shallow depression
- **sulcus** → furrow along bone surface that accommodates blood vessels/nerves/tendons
- **meatus** → tube-like opening



superior/inferior orbital **fissure**
optic **foramen**
(sphenoid bone)

coronoid **fossa**
(humerus bone)

intertubercular **sulcus**
(humerus bone)

auditory **meatus**
(temporal bone)

Some Vocabulary

[2] processes

that form joints:

- **condyle** → large, round protuberance with a smooth articular surface at end of bone
- **facet** → smooth, flat, slightly concave or convex articular surface
- **head** → rounded articular projection supported on neck on bone

that form attachment points for connective tissue:

- **crest** → prominent ridge or elongated projection
- **epicondyle** → roughened projection above condyle
- **line** → long narrow ridge or border (less prominent than a crest)
- **spinous process** → sharp, slender projection
- **trochanter** → very large projection
- **tubercle** → variably sized round projection
- **tuberosity** → variable sized projection that has rough bumpy surface

Watch These Videos:

Videos from the textbook:

[Bone Structure and Tissues](#)

[Compact Bone](#)

[Spongy \(Cancellous\) Bone](#)

Videos from the internet:

[The Skeletal System: Crash Course Anatomy & Physiology #19 - YouTube](#)