Lab Practical One

Week 2: Epithelial Connective Bone Cartilage

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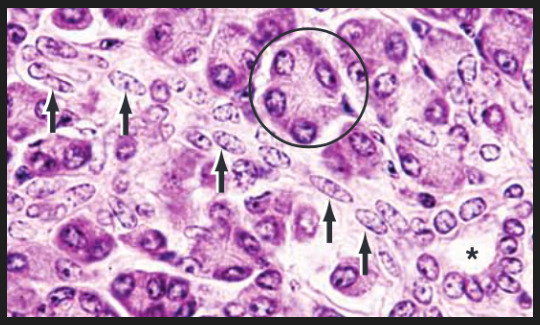
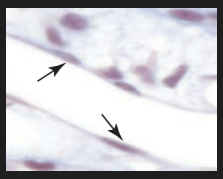
Epithelial Tissue

Examples

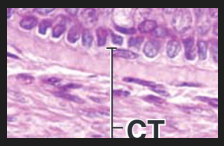
- **Simple squamous epithelium ↑**



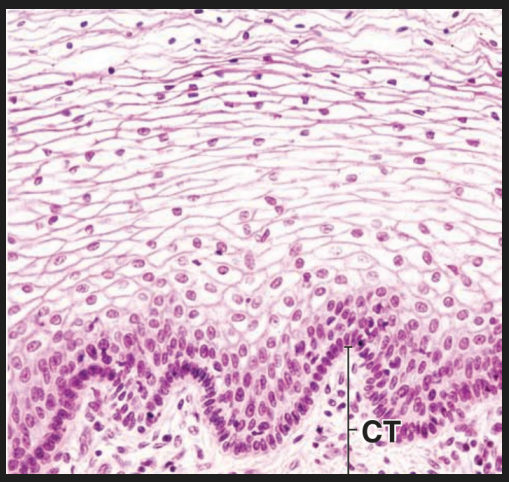
  - Cell nuclei



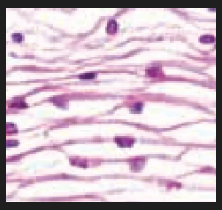
  - Basement membrane (BM)



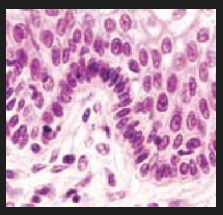
- **Stratified squamous epithelium**



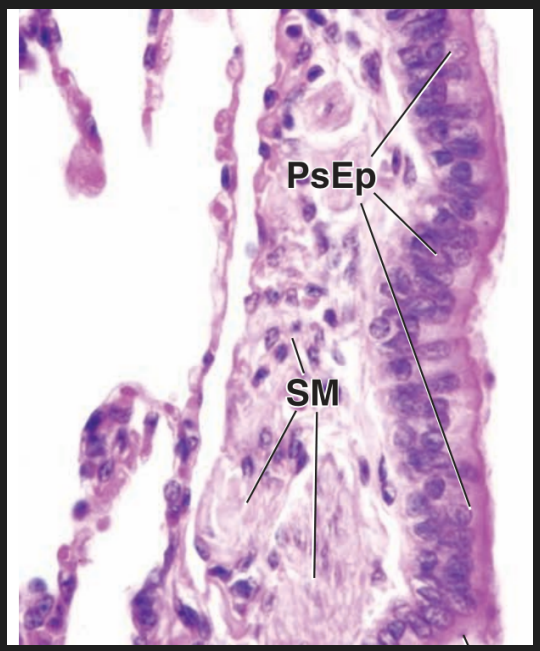
  - Cell nuclei



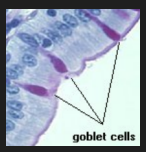
  - BM



- **Ciliated pseudostratified columnar epithelium (PsEp)**

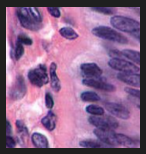


  - Goblet c.

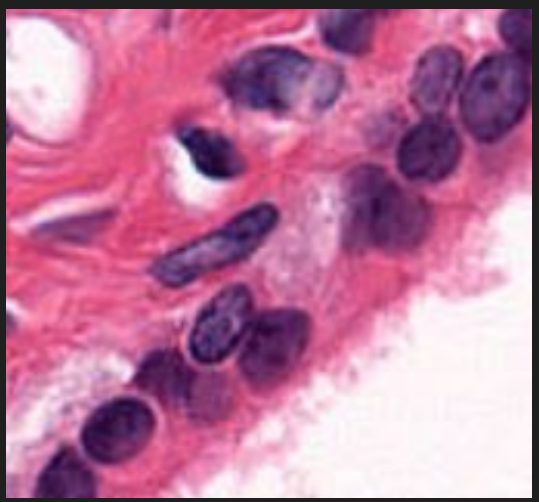


  - Cilia

  - BM

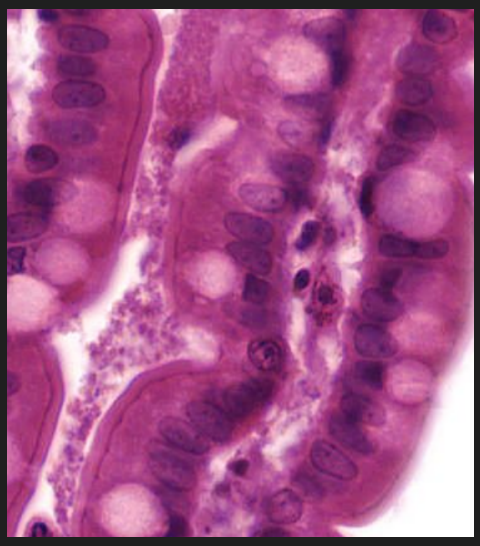


- **Simple cuboidal epithelium**



  - BM (maybe?)

- **Simple columnar epithelium**



  - Microvillous border

  - Goblet cells

Review

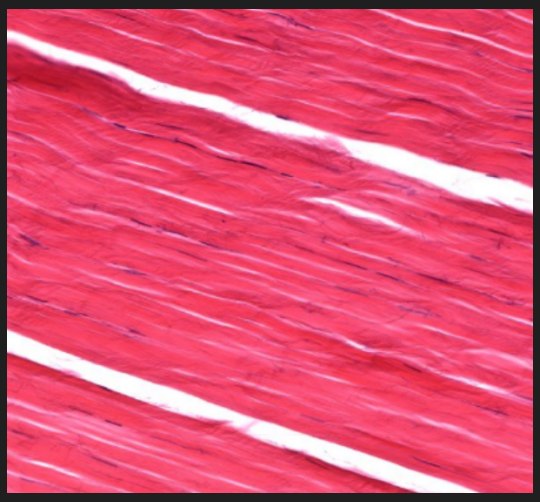
- **Simple squamous**: wider than their height, hence flat and scale like (squamous).
  - Locations: in mouth, esophagus, blood vessels (endothelium), alveoli of lungs, lymphatic vessels, lining of cavities (mesothlium).
  - Function: facilitates movements of viscera via diffusion and filtration, active transport by pinocytosis, secretion of molecules and lubricating substances.
- **Simple cuboidal**: cells with height and width that are approximately the same, hence cuboidal.
  - Location: covering the ovary and thyroid, in kidney tubules, and other secretory portions of small glands.
  - Function: covering, secretion, absorption.
- **Simple columnar**: cells that are taller than they are wide, i.e., column shaped, hence columnar.
  - Location: ciliated tissues are in bronchi, uterine tubes, and uterus; smooth line intestine and gallbladder.
  - Function: protection, lubrication, absorption, and secretion.
- **Pseudostratified columnar**: cells with nuclei that appear at different heights, leading the pseudo impression of stratified columnar cells when viewed in cross-section.
  - Location: ciliated tissues lines the trachea and much of the upper respiratory tract, including the nasal cavity.
  - Function: protection, secretion (mostly mucus), celia-mediated transport of particles trapped in mucus.

- **Stratified squamous**: like simple squamous, but multilayered. Cells generally become more squamous as they become more apical.
  - Location: lines the esophagus, mouth, vagina, anal canal, larynx.
  - Function: multi layers protects against abrasion, prevents water loss.
- **Stratified cuboidal**: again, same as simple cuboidal, but multi layered.
  - Location: sweat, salivary, and mammary glands, also in developing ovarian follicles.
  - Function: Protection, secretion.
- **Stratified columnar**: multilayered columnar…
  - Location: the male urethra and the ducts of some glands, and the conjunctiva (mucus membrane in front eye and inside eyelid).
  - Function: protection, secretion of mucus.
- **Transitional**: cells that can change from squamous to cuboidal, depending on amount of tension in the epithelium.
  - Location: bladder, ureters, urethra, and renal calyces (chambers in kidney through which urine passes).
  - Function: protection, distensibility (ability to swell from inside), stretch.

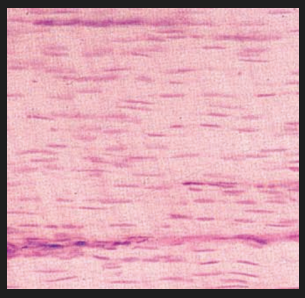
Connective Tissue Proper

Examples

- **Dense regular connective tissue**:

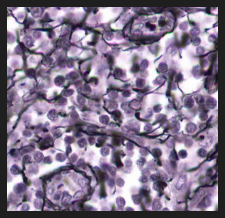


  - Collagenous tissue

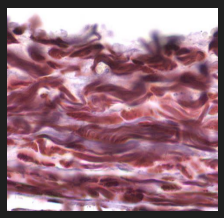


- **Reticular tissue**

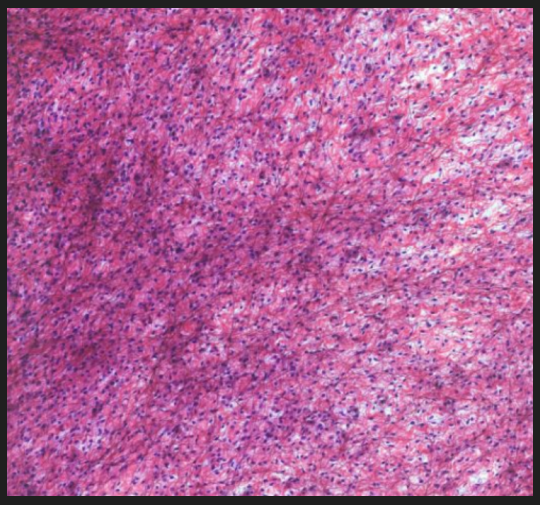
  - Reticular fibers



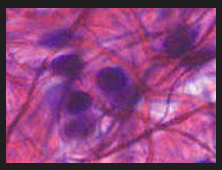
  - Collagen (type I)



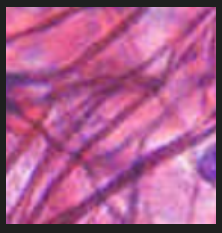
- **Loose connective tissue**



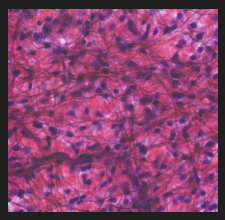
  - Nuclei



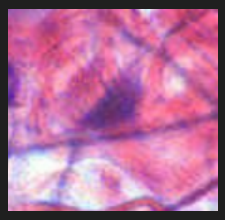
  - Elastin fibers



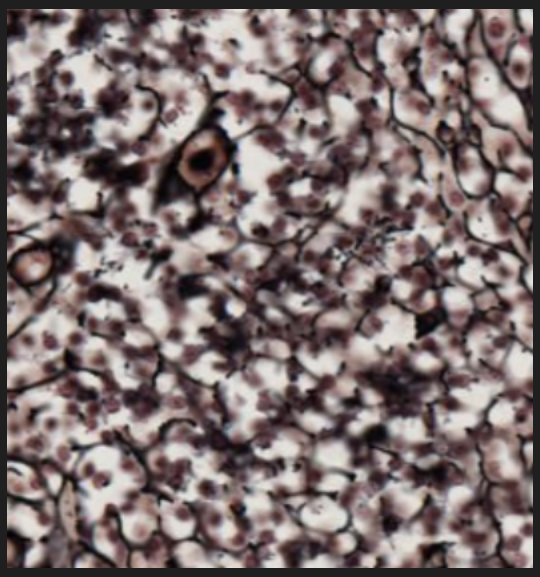
  - Matrix



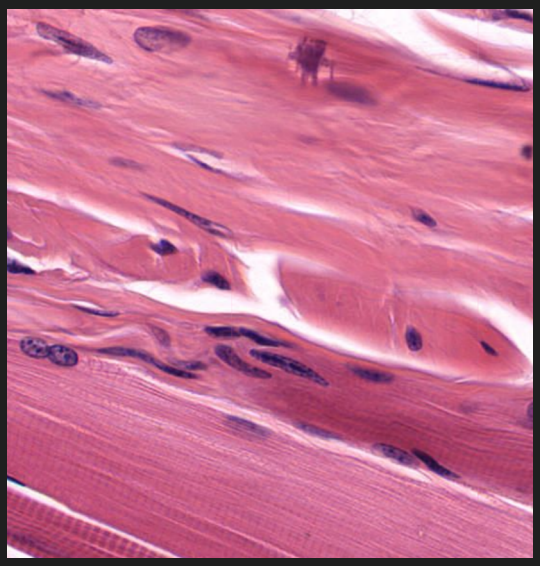
  - Collagen fibers



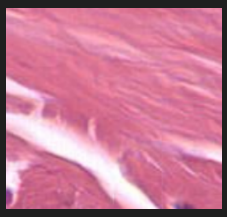
- **Lymph node reticular fibers**



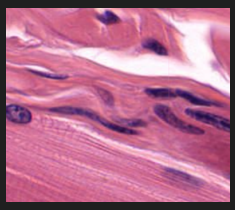
- **Muscle tendon junctions**



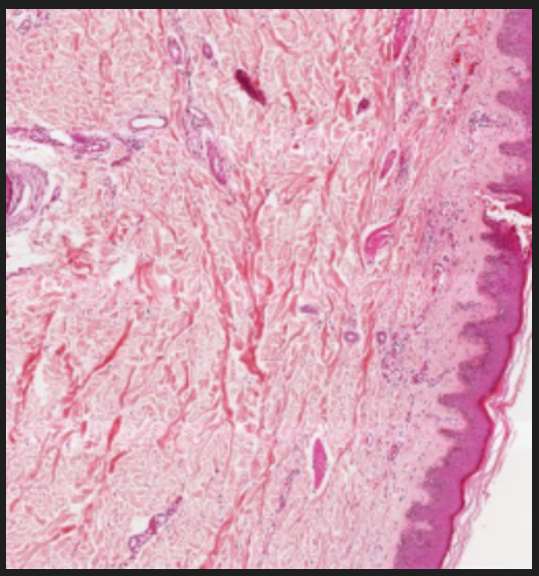
  - Collagen I



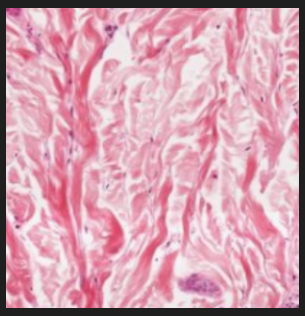
  - Fibroblasts



- **Thin skin**



  - Thick collagenous fibers type I



Review

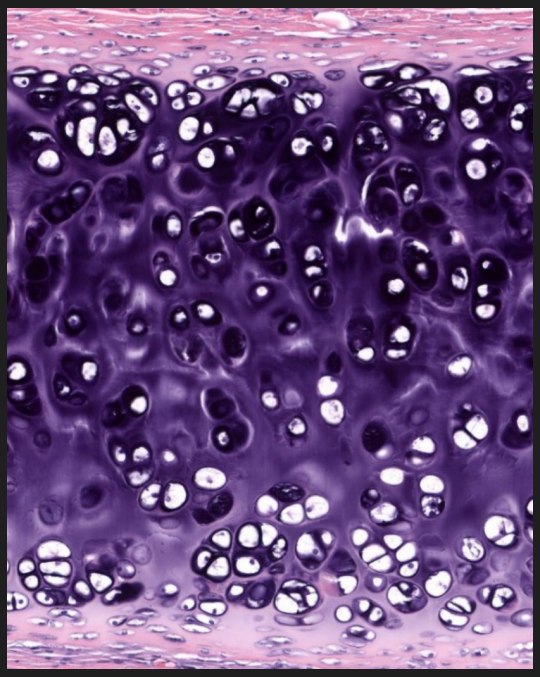
- **Mesenchyme**: connective tissue found mostly during embryonic development and is generally undifferentiated, sparse, and uniformly distributed in the matrix with sparse collagen fibers.
  - Location: mesodermal layer of early embryo, develops into tissues of lymphatic and circulatory system; can migrate easily. Organized into adherent sheets.
  - Function: contains stem/progenitor cells for all adult connective tissue cells.
- **Areolar**: or loose connective tissue, is the most widely distributed connective tissue type, has much ground substance (gel like), many cells, little collagen, and randomly distributed.
  - Location: can be found in the skin and in places that connect the epithelium to other tissues; found beneath the dermis layer and under epithelial tissue of body systems that have external openings. Also surrounds blood vessels and nerves and a component of mucus membranes in the digestive, respiratory, reproductive and urinary systems.
  - Function: supports microvasculature, nerves, immune defense cells, holds organs in place, and serves as reservoir of water and salts.

- **Loose CT reticular**: a network of reticular fibers (synthesized by fibroblasts called reticular cells) made up of type III collagen.
  - Location: bone marrow, spleen, liver, kidney, lymph nodes (not thymus), adrenal glands.
  - Function: supports blood-forming cells, many secretory cells, and lymphocytes in most lymphoid organs.
- **Dense regular**: filled with mostly parallel bundles of collagen, few fibroblasts, is aligned with collagen, and very strong. Slow to heal due to poor blood supply.
  - Location: tendons, ligaments, aponeuroses (layers of flat broad tendons), and corneal stroma.
  - Function: provide strong connections within musculoskeletal system and strong resistance to force, especially in well in one direction.
- **Dense elastic fibers**: an essential component of the extracellular matrix composed of bundles of protein (elastin) produced by fibroblasts, endothelial, smooth muscle, and airway epithelial cells. Can stretch many times their length and return to back to original length.
  - Location: found in the skin, lungs, arteries, veins, connective tissue proper, elastic cartilage, periodontal ligaments, fetal tissues and more; basically anything that must undergo stretching.
  - Function: provides the elastic properties to connective tissues.
- **Dense irregular**: fibers not arranged in parallel bundles as in dense regular connective tissue. Still consists of mostly collagen fibers, but has less ground substance than loose connective tissue. Fibroblasts are scattered sparsely across the tissue.
  - Location: found mostly in the reticular layer of the dermis, but also in the sclera in the deeper skin layers. Found in the submucosal layer of the digestive tract.
  - Function: mainly provides strength, similar to regular tissue. Protects organs and helps resist tearing.

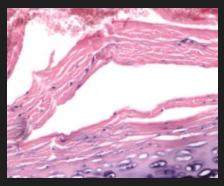
Cartilage and Bone

Examples

- **Hyaline cartilage**

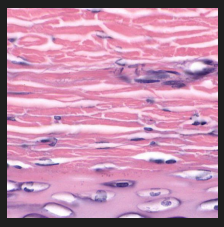


  - Incomplete rings???

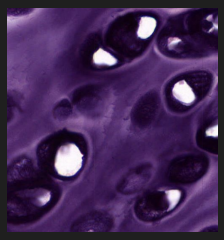


  - Inner Perichondrium

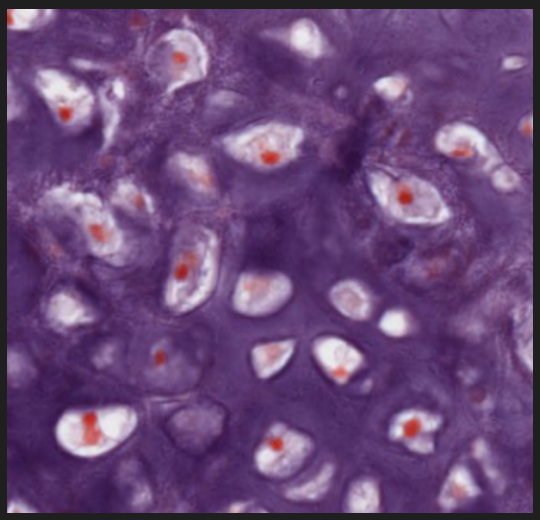
  - Outer Perichondrium



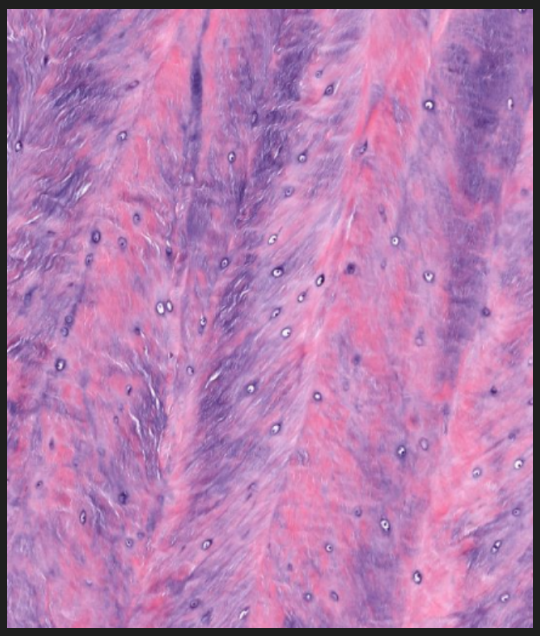
  - Chondrocytes



- **Elastic cartilage**



- **Fibrocartilage**



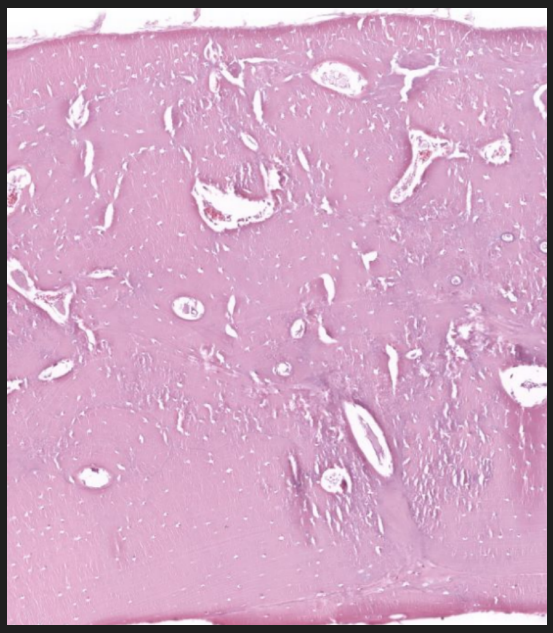
Review

- **Hyaline Cartilage**: homogeneous with type II collagen, most common of the cartilage types. Covered externally by fibrous membrane known as perichondrium.
  - Location: components of the upper respiratory tact; in the larynx, trachea, bronchi, sternal ends of the ribs, and articular ends and epiphyseal plates of long bones.
  - Function: gives structures (particularly respiratory) a definite but pliable form, low friction surface to joints.

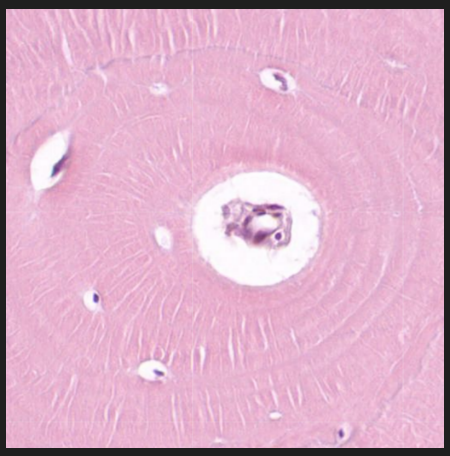
- **Elastic Cartilage**: similar to hyaline cartilage, but contains many yellow elastic fibers in a solid matrix.
  - Location: external ear, external acoustic meatus (ear canal), auditory tube; epiglottis (leaf shape flap in throat), and more.
  - Function: provides flexible shape and support of soft tissues.
- **Fibrocartilage**: a mixture of white fibrous tissue and cartilaginous tissue in various proportions; contains type I collagen in addition to type II.
  - Location: many joints (shoulder, hip, knee), as well secondary joints (pubic symphysis, manubriosternal joint), intervertebral discs, and insertions of tendons.
  - Function: provides cushioning, tensile strength, and resistance to tearing and compression.
- **Bone**: calcified connective tissue also consisting of cells, fibers, and ground substances. Structurally rigid using calcium phosphate salts within its matrix. There are multiple types of bone, i.e., cortical (hard, outer) and cancellous (trabecular, spongy, internal).
  - Location: like, everywhere. Spooky Scary Skeletons.
  - Function: provides solid support for the body, protects organs, encloses internal cavities, server as reservoir of calcium, phosphate, and other ions, form systems of levers that multiply forces generated during skeletal muscle contraction, and transforms energy into bodily movement.

Bone Examples

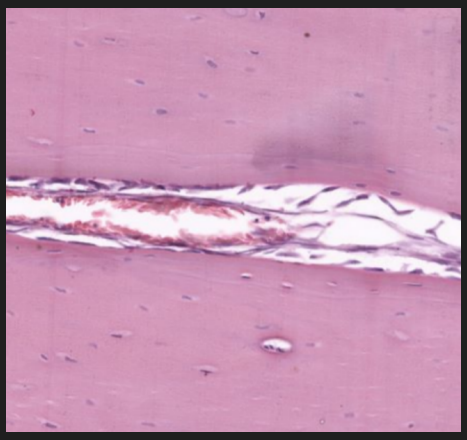
- **Ground bone cross-section and longitudinal-section**



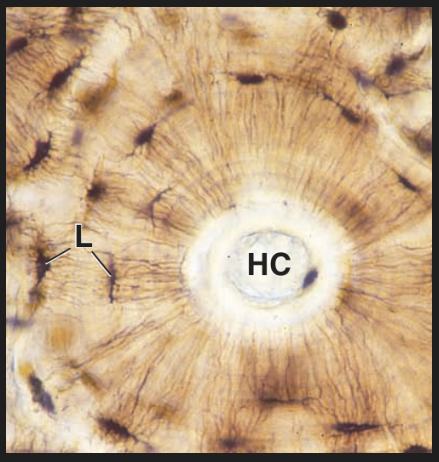
- Osteons canal (HC)



- Axial canals

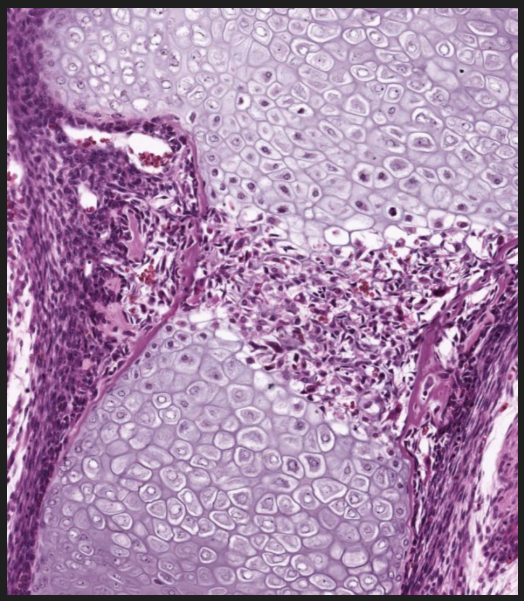


- Lacunae (L)

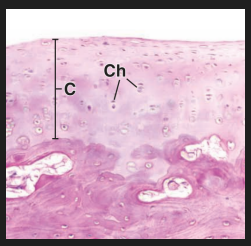


- Canaliculi ↑

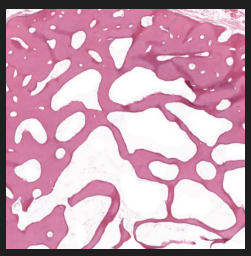
- **Decalcified bone**



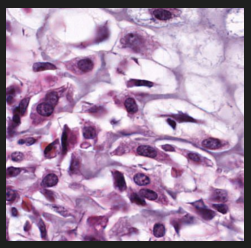
- Compact bone



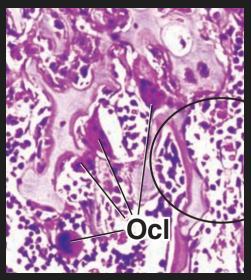
- Spongy bone



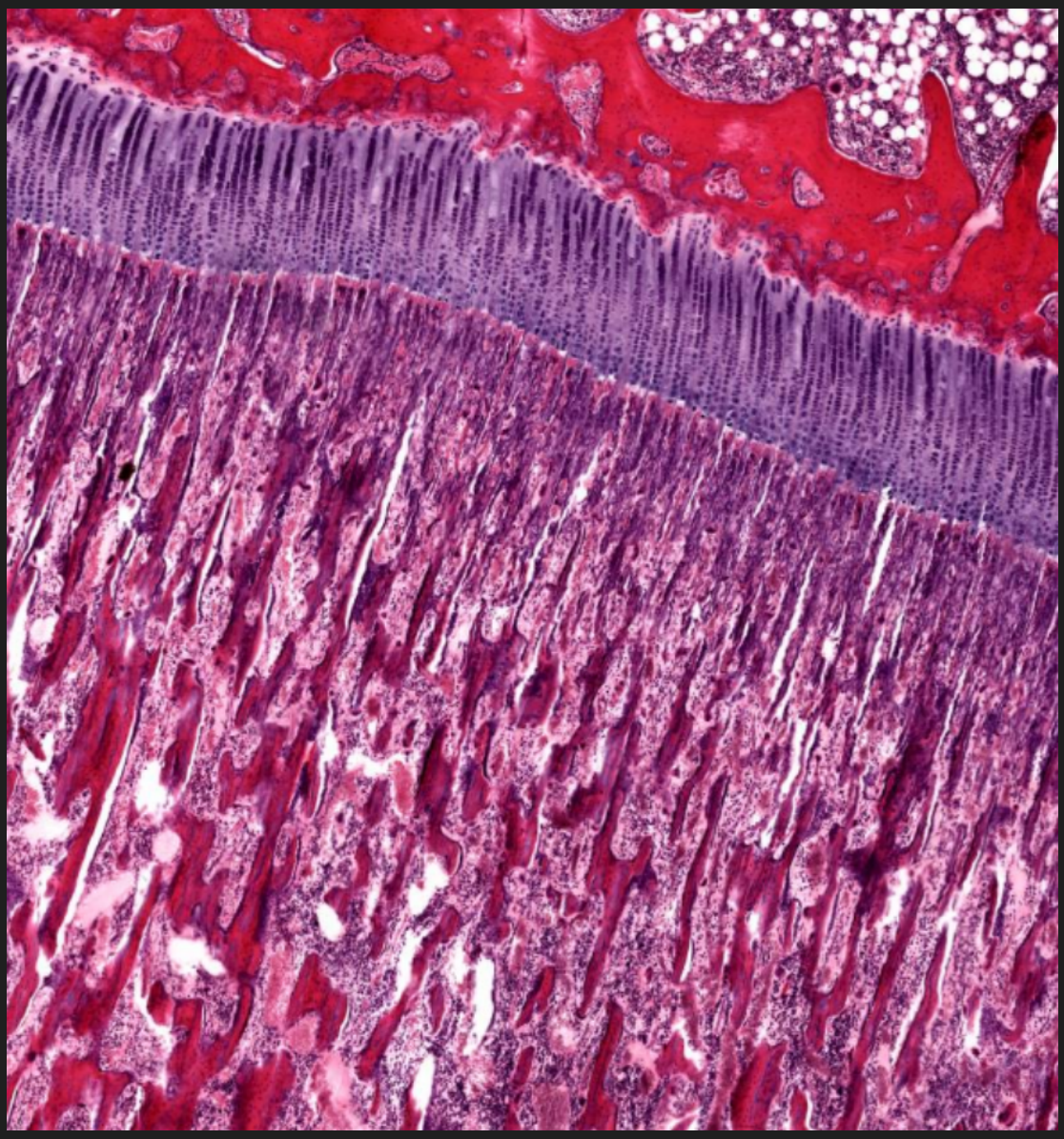
- Osteoblasts



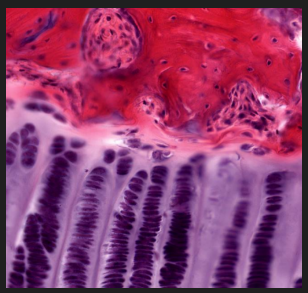
- Osteoclasts (Ocl)



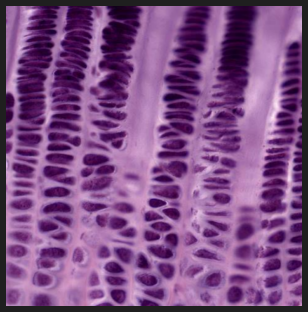
- **Growth at the epiphyseal plate**



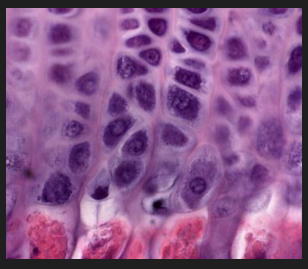
- Resting zone



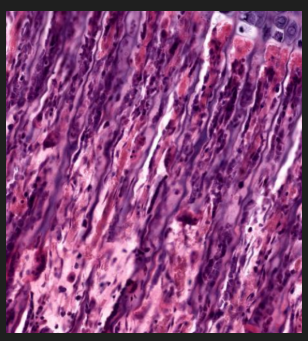
- Zone of proliferation



- Zone of hypertrophy



- Zone of calcification



- Zone of ossification