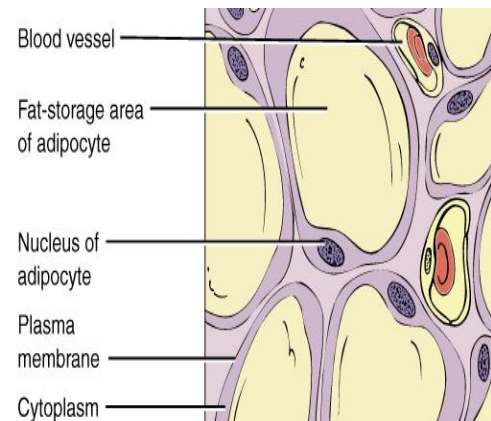


Specialized Connective Tissues

Specialized connective tissues include a number of different tissues with specialized cells and unique ground substances. Some of these tissues are solid and strong, while others are fluid and flexible. Examples include adipose, cartilage, bone, blood, and lymph.

Adipose Tissue

- Adipose tissue is a specialized type of connective tissue in which adipocytes or fat cells predominate.
- These cells can be found isolated or in groups within loose or irregular connective tissue.
- The primary cells of adipose are adipocytes.
- Peripheral nuclei due to large fat storage droplet.
- Deeper layer of skin, organ padding, yellow marrow
- Reduces heat loss , energy storage , protection.



There are two types of adipose tissue with different locations, structures, colors, and pathologic characteristics.

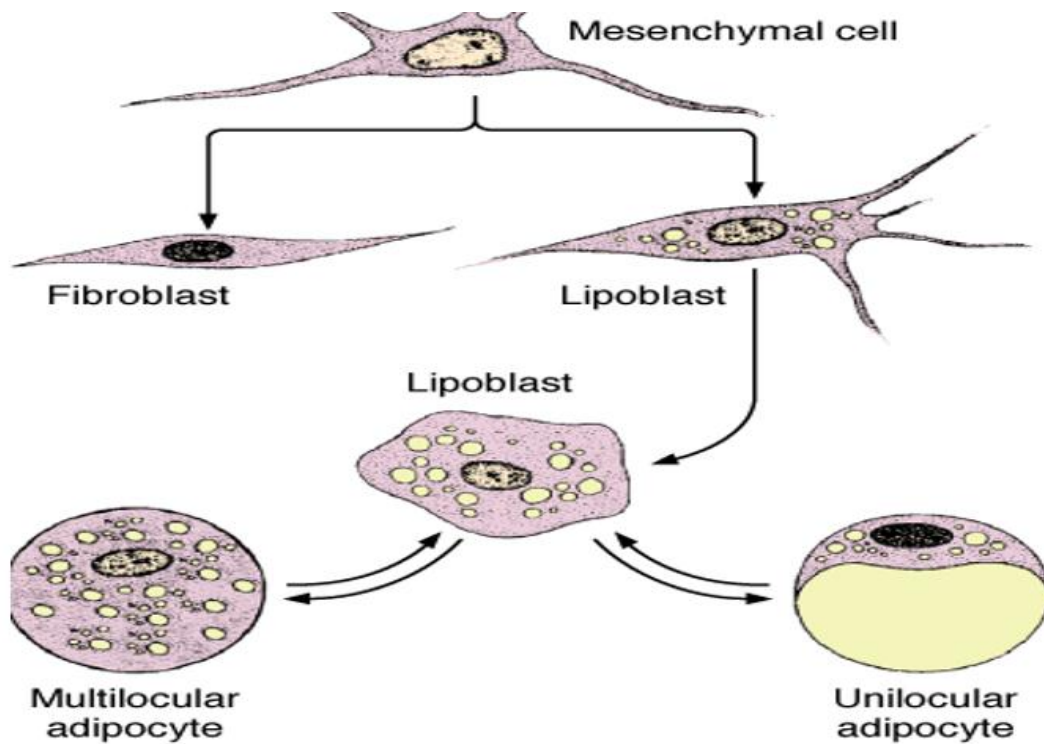
White Adipose Tissue

- The more common type , is composed of cells that contain one large central droplet of whitish-yellow fat in their cytoplasm.
- White adipose cells are spherical when isolated but are polyhedral when closely packed in adipose tissue.

- White adipocytes are called unilocular because triglycerides are stored in a single locus. The large droplet causes these cells to have eccentric and flattened nuclei. Specialized for energy storage.

Brown Adipose Tissue

- The color of brown adipose tissue or brown fat is due to both the numerous mitochondria scattered through the adipocytes and the large number of blood capillaries in this tissue.
- Adipocytes of brown fat contain many small lipid , therefore called multilocular .
- The many small lipid droplets, abundant mitochondria , and rich vasculature all help mediate this tissue's principal function of heat production.
- Adipocytes have spherical and central nuclei and the numerous mitochondria.

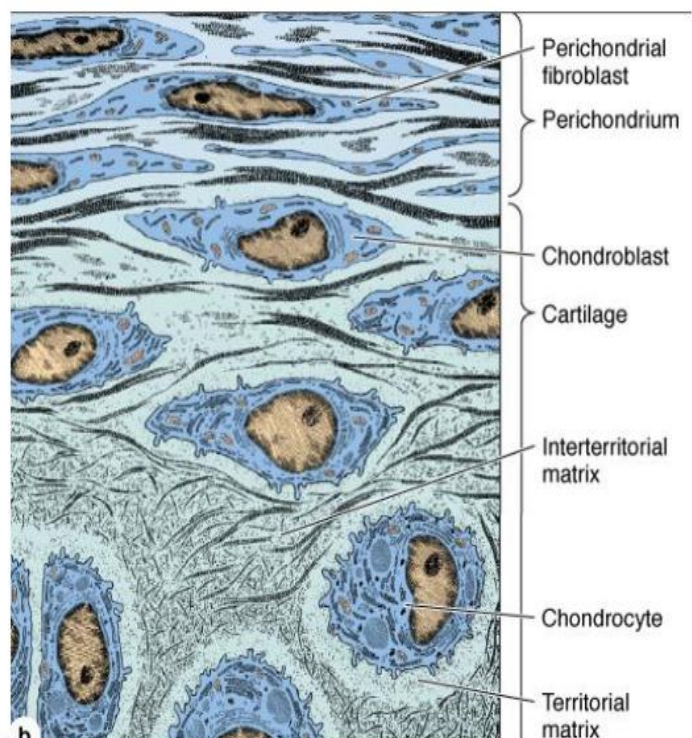
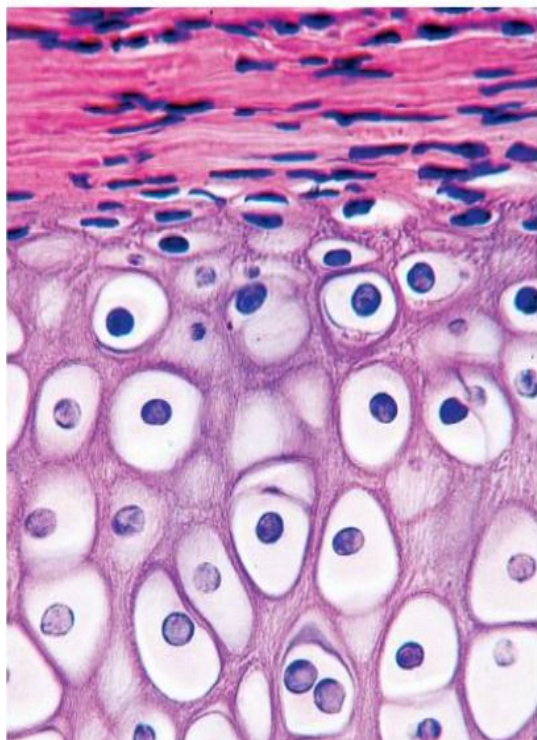


Cartilage

- Cartilage is a specialized form of connective tissue
- Network of fibers in rubbery ground substance
- Resilient(flexible) and can endure more stress than loose or dense connective tissue
- Consists of cells called **chondrocytes** and an extensive extracellular matrix composed of fibers and ground substance.
- Provides flexible support for certain structures in adult humans including the nose, trachea, and ears.

Chondrocytes synthesize and secrete the ECM and the cells themselves are located in matrix cavities called **lacunae**.

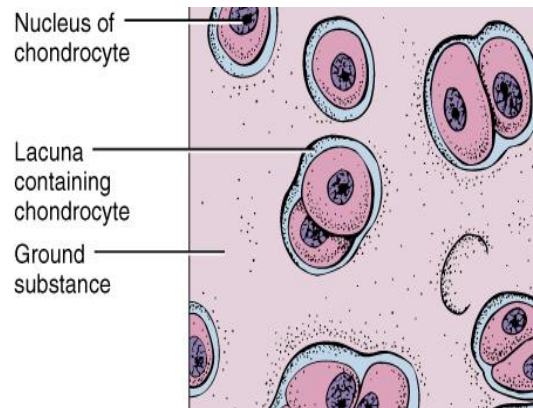
The perichondrium is a sheath of dense connective tissue that surrounds cartilage in most places, forming an interface between the cartilage and the tissue supported by the cartilage.



Variations in the composition of the matrix components produce three types of cartilage adapted to local biomechanical needs.

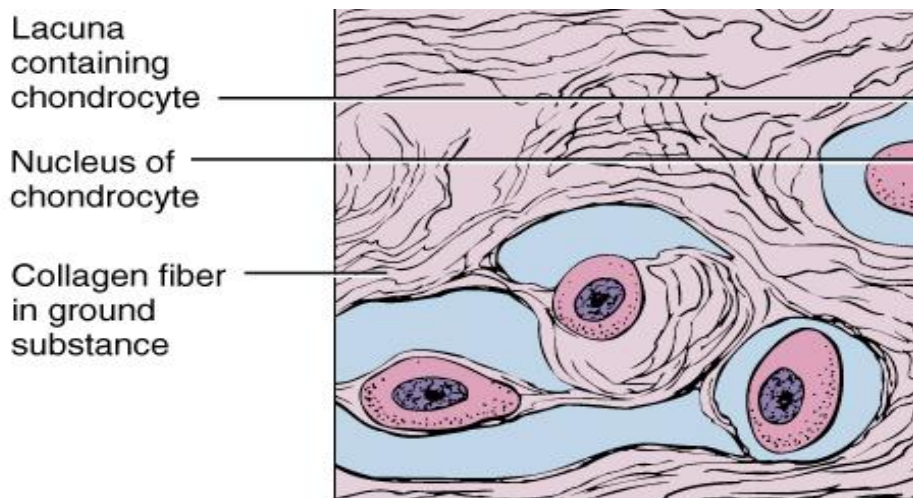
1- Hyaline cartilage

- Is found in trachea , ribs , and nose
- Hyaline cartilage is flexible , elastic , and surrounded by a dense membrane called perichondrium.
- Bluish-shiny white rubbery substance
- Chondrocytes sit in spaces called lacunae
- No blood vessels or nerves so repair is very slow
- Reduces friction at joints as articular cartilage



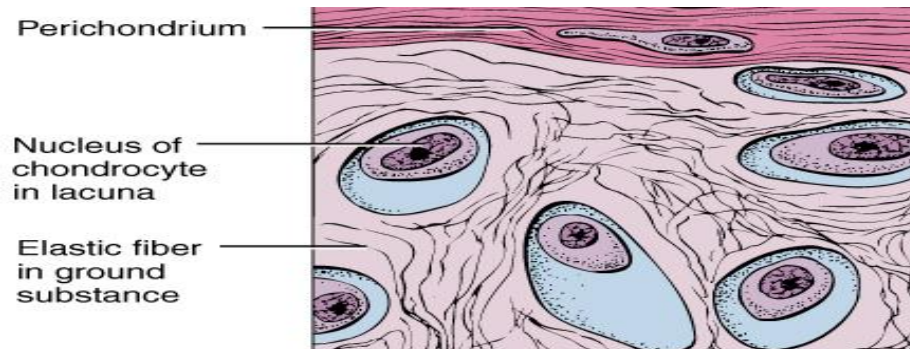
2- Fibrocartilage

- composed of hyaline and dense collagen fibers.
- Many more collagen fibers causes rigidity & stiffness.
- Fibrocartilage does not have perichondrium.
- Strongest type of cartilage (intervertebral discs), some joints , and in heart valves.



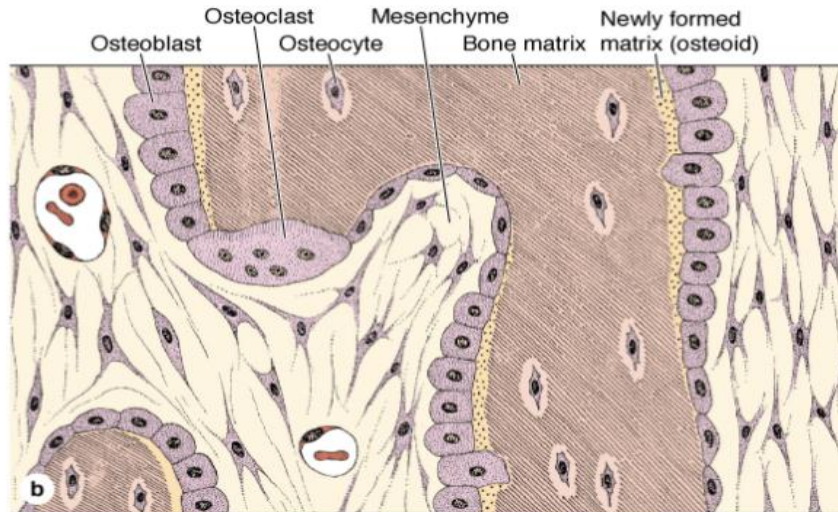
3-Elastic cartilage

- Elastic fibers help maintain shape after deformations , is the most flexible type of cartilage.
- Ear, nose, and larynx (voice box).



Bone Tissue

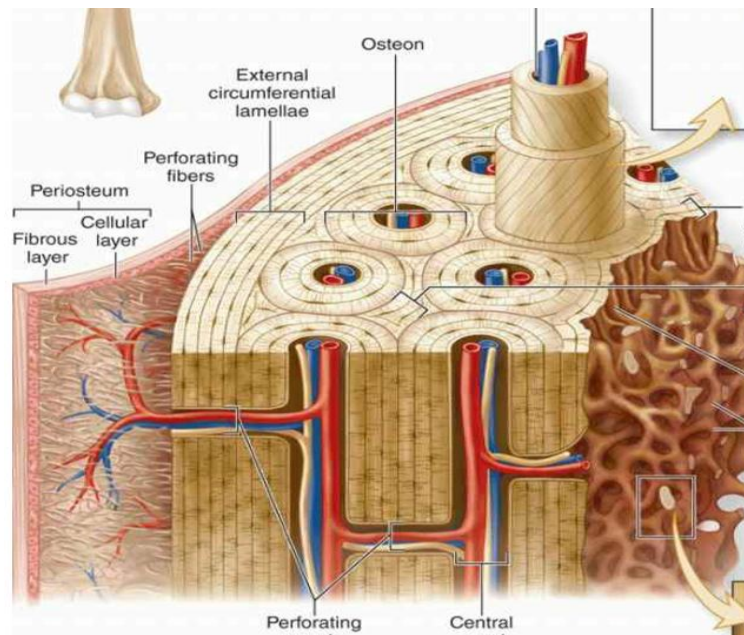
- As the main constituent of the adult skeleton, bone tissue supports fleshy structures, protects vital organs such as those in the cranial and thoracic cavities, and harbors the bone marrow.
- Bone also serves as a reservoir of calcium, phosphate, and other ions.
- Bone is a specialized connective tissue composed of calcified intercellular material, the bone matrix, and three cell types:
 - 1- Osteocytes which are found in cavities (lacunae) between layers (lamellae) of bone matrix, surrounded by calcifying matrix. An osteocyte and its processes occupy each lacuna and the canaliculi radiating from it.
 - 2- Osteoblasts which synthesize the organic components of the matrix, are located exclusively at the surfaces of bone matrix, usually side by side in a layer somewhat resembling a simple epithelium .
 - 3- Osteoclasts which are multi-nucleated giant cells involved in the resorption and remodeling of bone tissue.



Because metabolites are unable to diffuse through the calcified matrix of bone, the exchanges between osteocytes and blood capillaries depend on communication through the canaliculi , which are very thin, cylindrical spaces that perforate the matrix.

All bones are lined on both internal and external surfaces by layers of connective tissue **endosteum** on the internal surface and **periosteum** on the external surface.

- The **Periosteum** is a layer of dense connective tissue on the outer surface of bone, bound to bone matrix by bundles of type I collagen.
- The **endosteum** is a thin layer of active and inactive osteoblasts, which lines all the internal surfaces within bone; osteoblasts here are also required for bone growth.



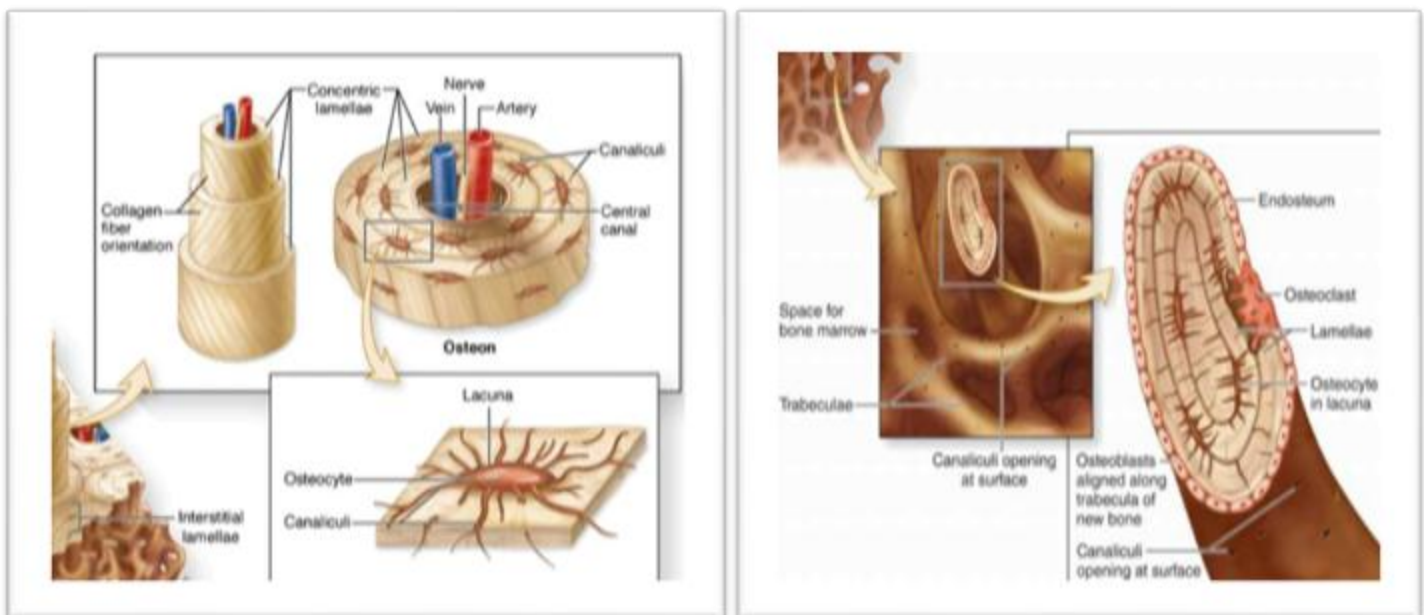
There are two types of bone tissue: spongy and compact.

- Spongy bone
 - Sponge-like with spaces and trabeculae.
 - Trabeculae : struts of bone surrounded by red bone marrow.
 - No osteons (cellular organization).
 - Contain blood vessels and bone marrow.
 - Is surrounded by compact bone.
- Compact bone
 - solid , dense bone and forms the hard outer bone surface
 - Small canals within the tissue allow for the passage of blood vessels and nerves
 - basic unit of structure is osteon (haversian system)

It characteristically shows multiple layers of calcified matrix and is often referred to as lamellar bone. The lamellae are quite organized, either parallel to each other or concentrically around a vascular canal.

Osteon is concentric bony lamellae surrounding a small canal containing blood vessels, nerves, and loose connective tissue .

Lacunae with **osteocytes** are found between the lamellae, interconnected by **canaliculi** which allow all cells to be in contact with the source of nutrients and oxygen in the osteonic canal.

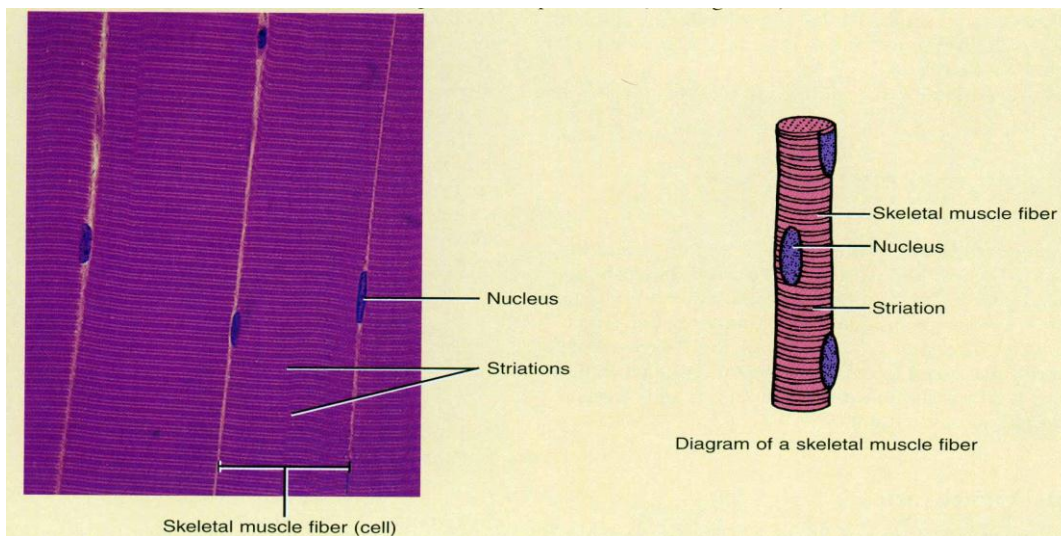


Muscle Tissue

- Cells that shorten
- Provide us with motion, posture and heat
- Types of muscle

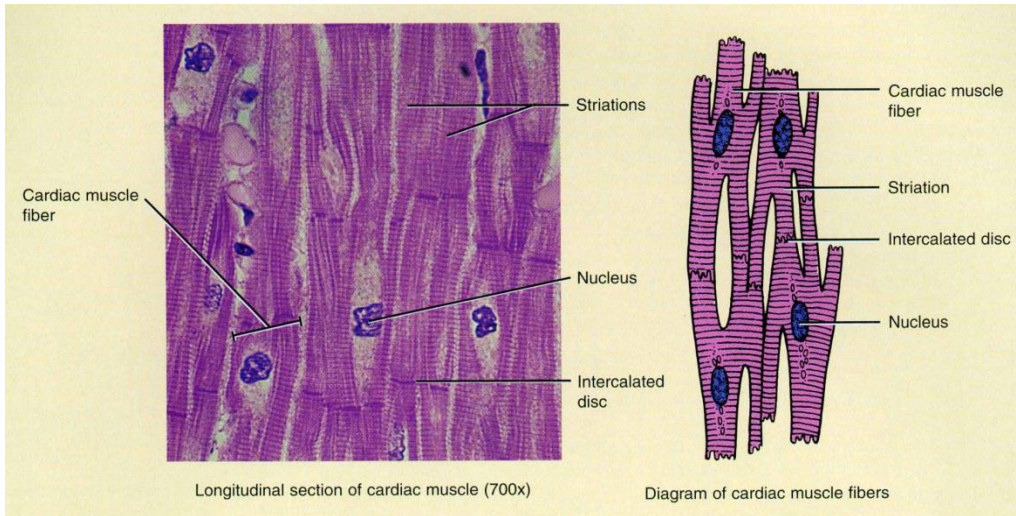
1- Skeletal muscle

- contains bundles of very long, multinucleated cells with cross-striations. peripheral nuclei.
- Their contraction is quick, forceful, and usually under voluntary control.



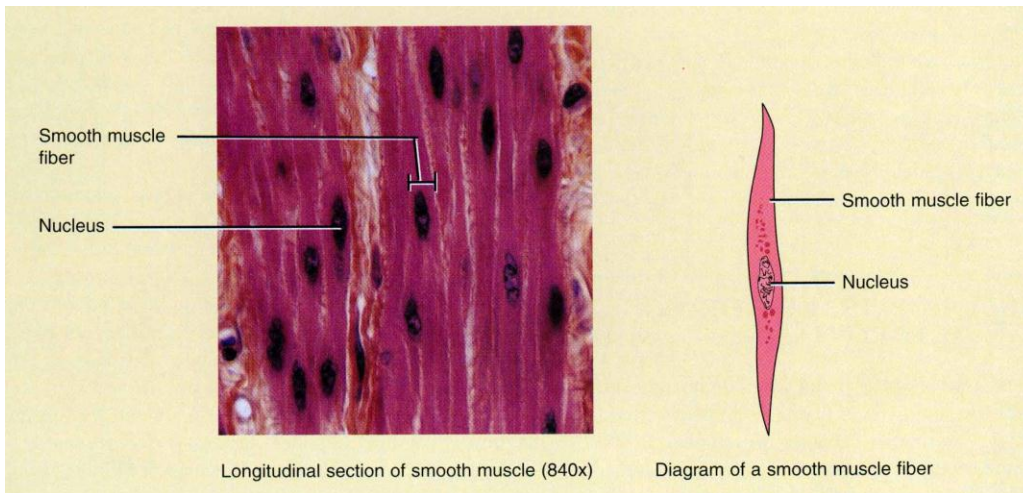
2- Cardiac muscle

- has cross-striations and is composed of elongated, branched cells bound to one another at structures called intercalated discs that are unique to cardiac muscle.
- Contraction is involuntary, vigorous, and rhythmic.



3- Smooth muscle

- consists of collections of fusiform cells with a single central nuclei, that lack striations,
- involuntary contractions.
- Walls of hollow organs (blood vessels , GI tract , bladder)



Nerve Tissue

- Cell types : nerve cells and neuroglial (supporting) cells
- Nerve cell structure:
 - nucleus & long cell processes conduct nerve signals.
 - dendrite : signal travels towards the cell body.
 - axon : signal travels away from cell body.

