

# Lab Practical One

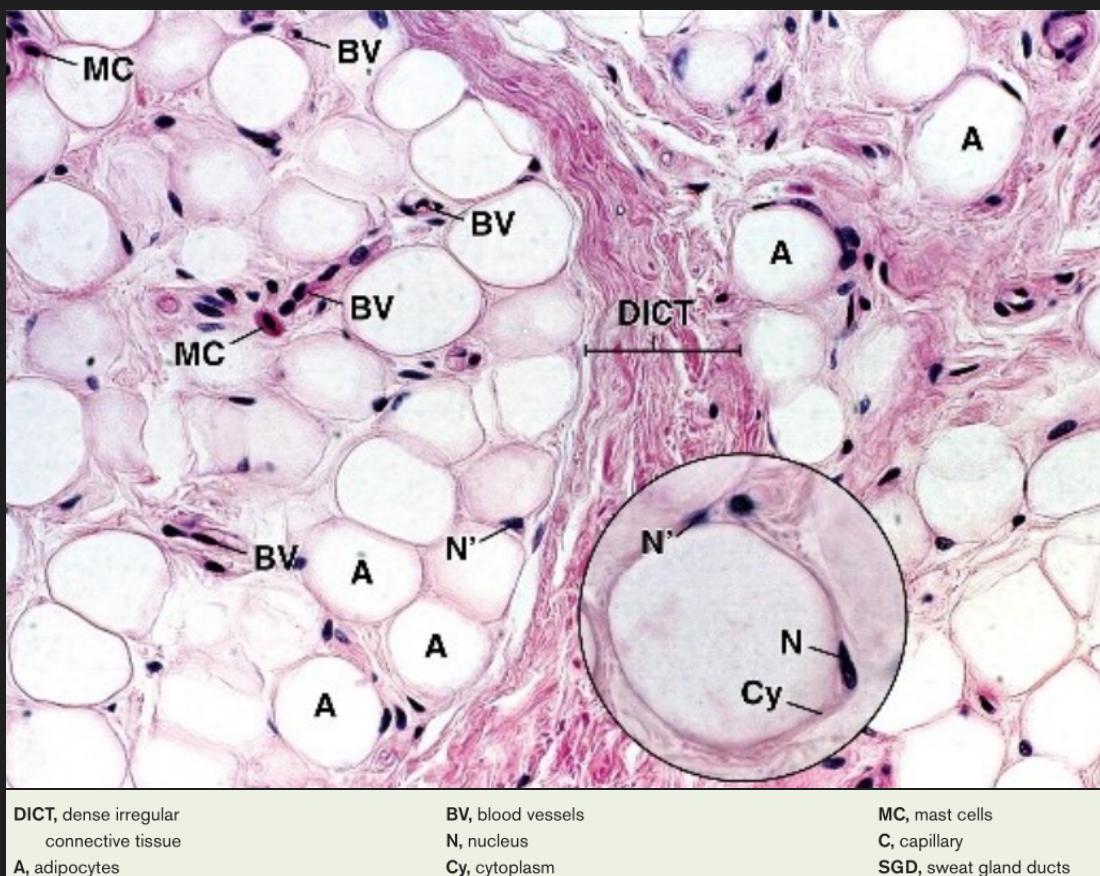
## Week 3: Adipose Blood Muscle Nerve

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# Week 3: Adipose Blood Muscle Nerve

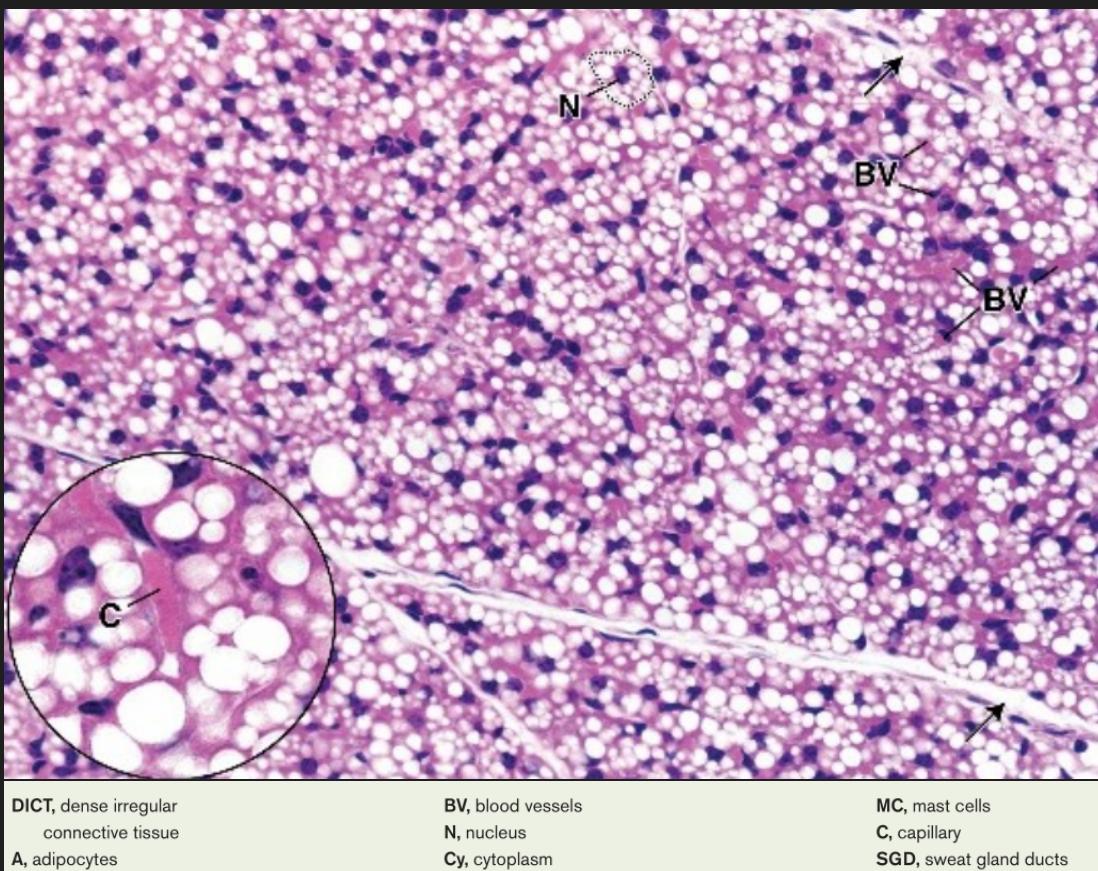
## Adipose

### White Adipose



- Location: subcutaneous layer, mammary gland, greater omentum, mesenteries, retroperitoneal space, visceral pericardium, orbits, bone marrow cavity.
- Function: energy storage, insulation, cushioning, hormone production, source of metabolic water.
- Adipocyte Morphology: unilocular, spherical, flattened nuclear, rim of cytoplasm, large diameter (15–150 µm)
- Factors inducing differentiation: PPAR- $\gamma$ /RXR
- UCP-1 gene expression: None
- Mitochondria: Few, poorly developed
- Response to environmental stress (cold): Decreased lipogenesis, increased lipoprotein lipase activity.
- Growth and differentiation: entire life, starting from stromal-vascular cells

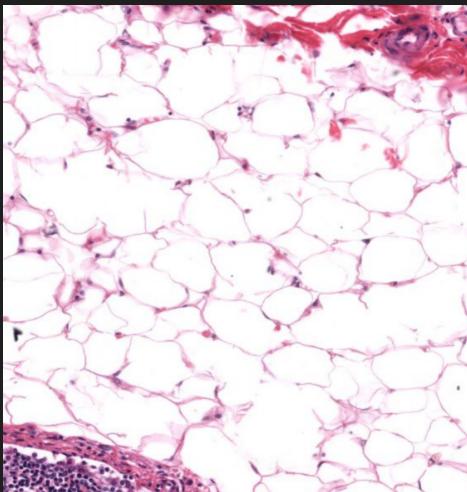
## Brown Adipose



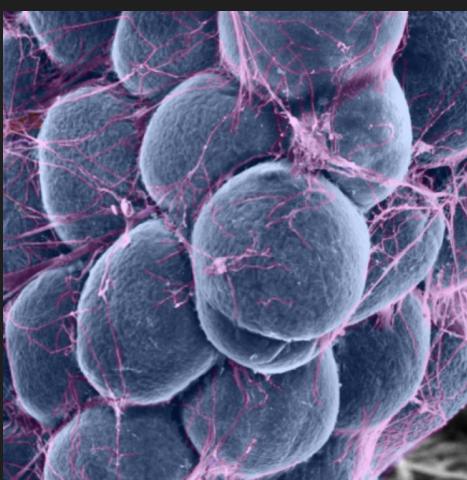
- Location: large amounts in newborn; in adults: retroperitoneal space, deep cervical and supraclavicular regions of neck, interscapular, paravertebral regions of the back, mediastinum.
- Function: thermogenesis.
- Adipocyte Morphology: multiocular, spherical, round eccentric nucleus, smaller diameter (10–25 µm).
- Factors inducing differentiation: PRDM16/PGC-1
- UCP-1 gene expression: Yes (unique to brown fat)
- Mitochondria: many, well-developed.
- Response to environmental stress (cold): increased lipogenesis, decreased lipoprotein lipase activity.
- Growth and differentiation: only during fetal period, decreases in adult life, except those with pheochromocytoma and hibernoma.

## White Adipose Examples

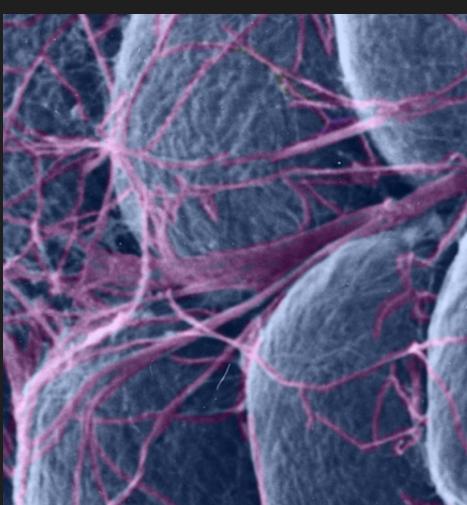
- **Adipocyte:** the largest component of loose connective tissue.



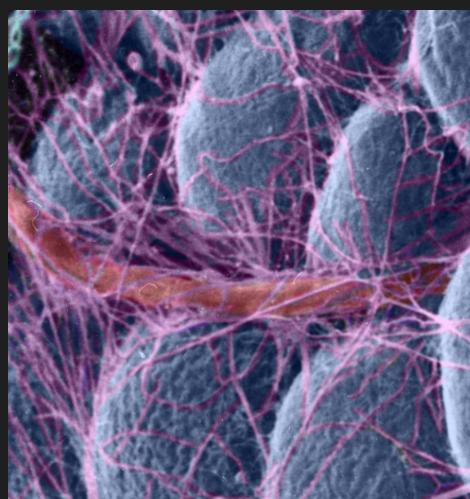
- **EM of adipose (blue)**



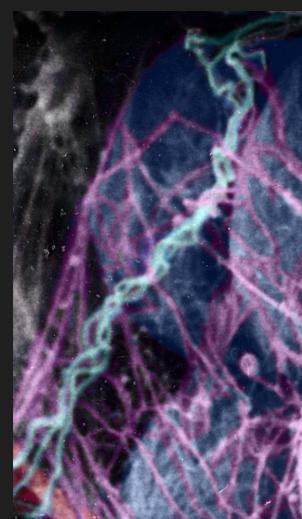
- **Reticular Fibers (purple)**



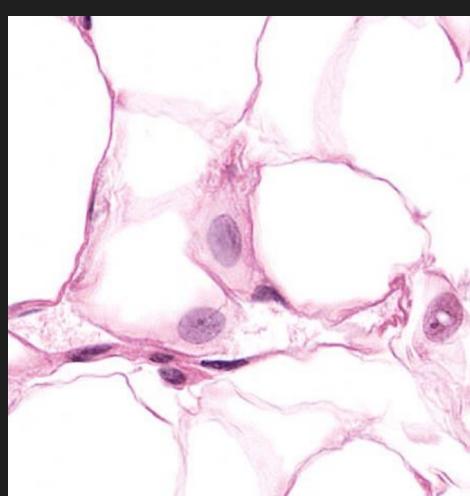
- **Small blood vessel (red)**



- **Nerve Fiber (cyan)**

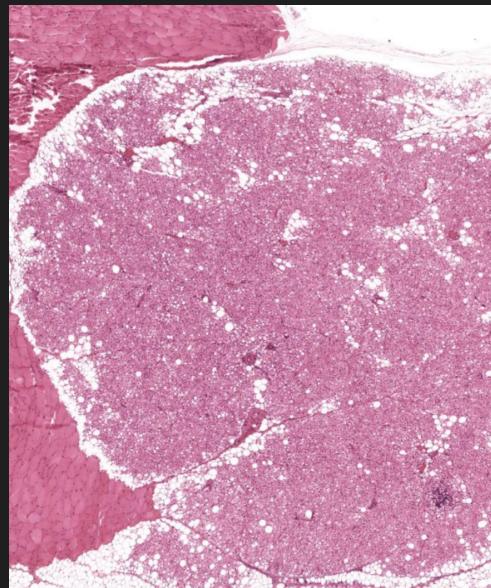


- **Nuclei**

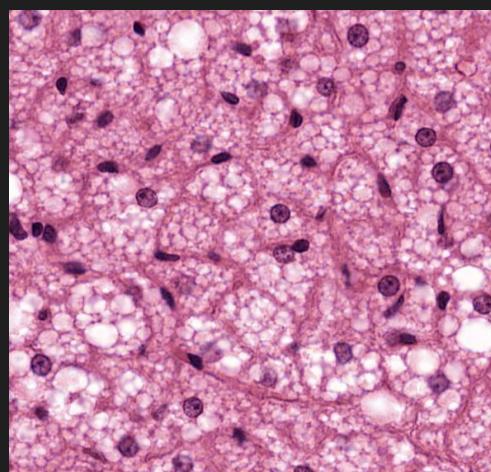


## Brown Adipose Examples

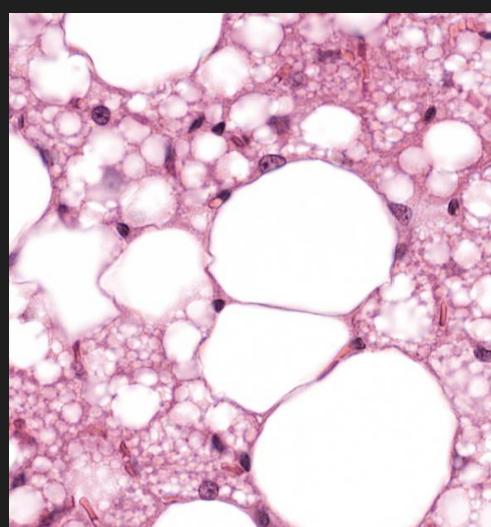
- Brown adipose tissue



- Brown adipocyte



- Contrast between white unilocular and brown multilocular adipocyte

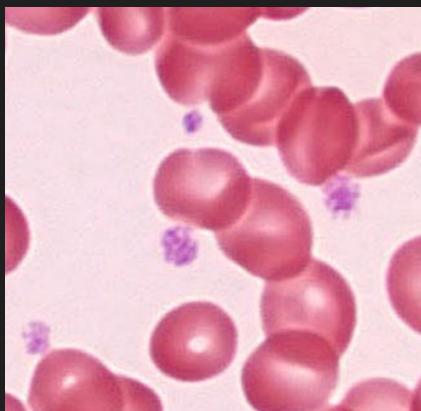


## Blood

- **RBC (erythrocytes):** light red, biconcave discs without nuclei that carry oxygen and return CO<sub>2</sub>. Size:  $\approx 7.5 \mu\text{m}$



- **Platelet:** small, basophilic discs that help prevent bleeding via blood clotting. Size: 2–4  $\mu\text{m}$



- **Eosinophil:** contain distinctive large, eosinophilic granules and usually nuclei with two lobes. Aids in anti-parasitic and bacterial activity, allergic reactions, and modulating inflammation.



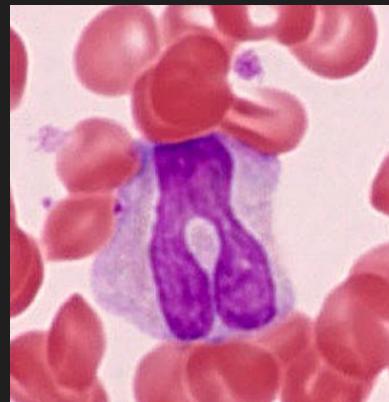
- **Neutrophil:** have distinctive nuclei with 2 to 5 lobes and azurophilic granules that form essential part of innate immune system with various functions.



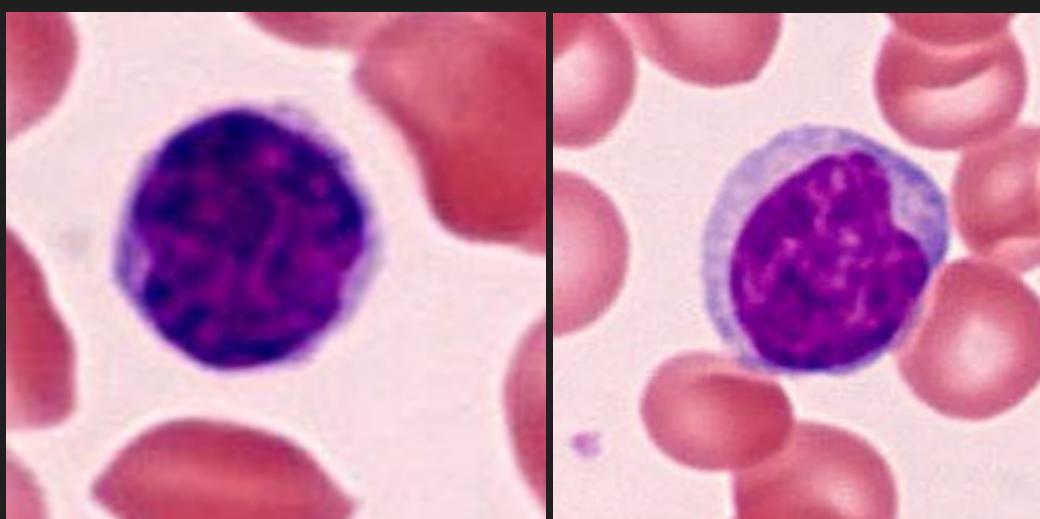
- **Basophil:** rare cells with distinctive large, basophilic granules. Aids immune responses by releasing cytokines, leukotrienes, and histamine.



- **Monocyte:** large cells with "kidney-shaped" or notched nuclei. Precursors of macrophages and other cells of the mononuclear phagocyte system.



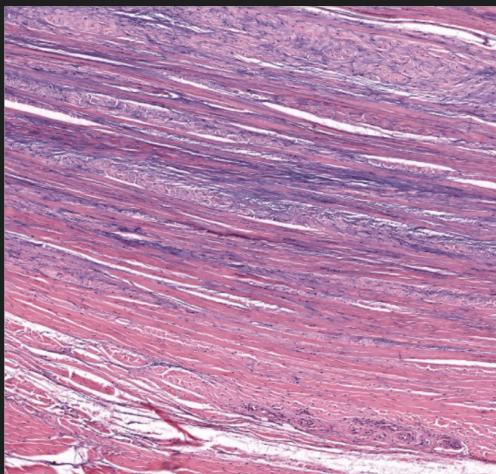
- **Lymphocyte:** occur in a range of sizes (small:left, large:right). Have many functions relating to immune system, as well as subtypes (T and B), helps produce antibodies.



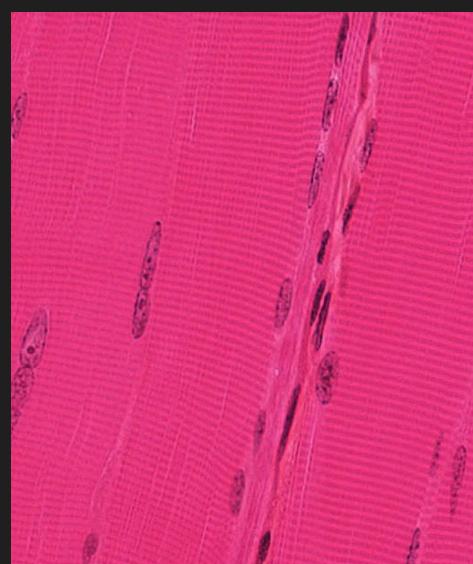
# Muscle

## Skeletal Muscle

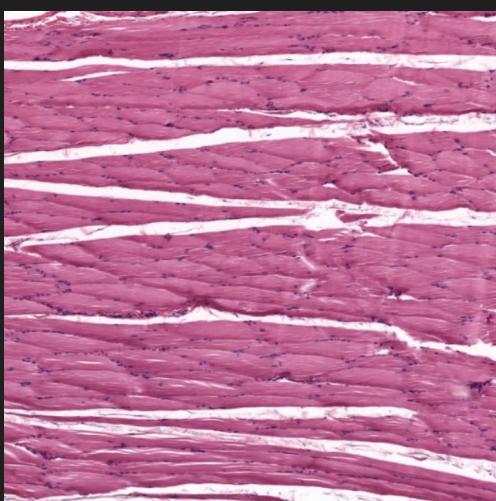
- Tendon



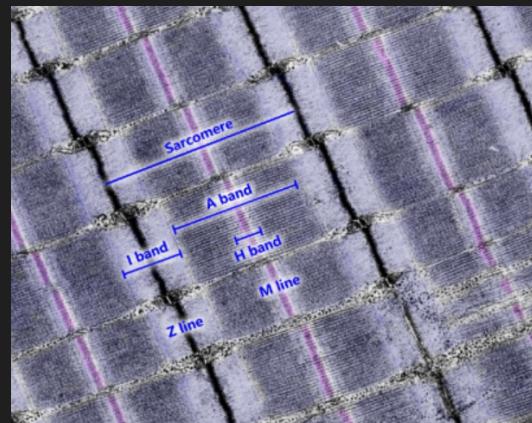
- Fibroblasts Nuclei and Sacromere



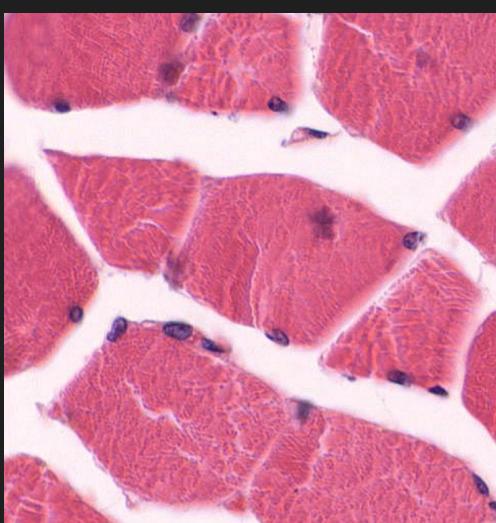
- Skeletal Muscle:



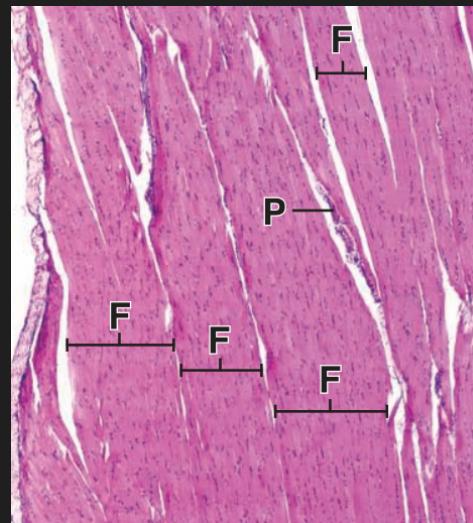
- Sarcomere (Em)



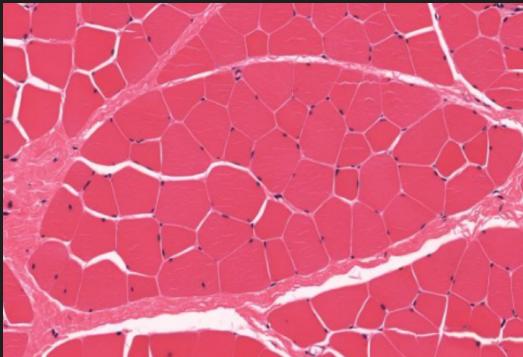
- Skeletal Muscle Cross-Section



- Fascicles (F)



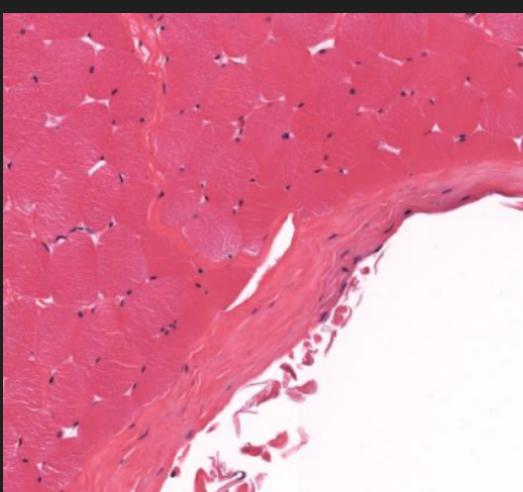
- **Perimysium:** thick layer of connective tissue that surrounds a group of muscle cells to form fascicles. Blood and nerves are found in this layer.



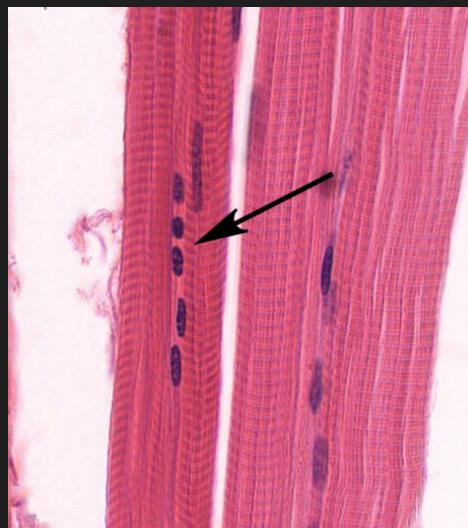
- **Endomysium:** thin layer of connective tissue that surrounds each muscle cell.



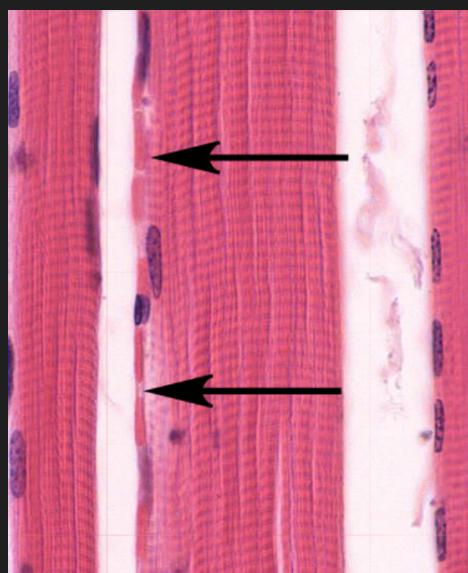
- **Epimysium:** dense connective tissue that surrounds the entire muscle and is usually continuous with a tendon.



- **Satellite Cells:** occur on the surface of muscle cells

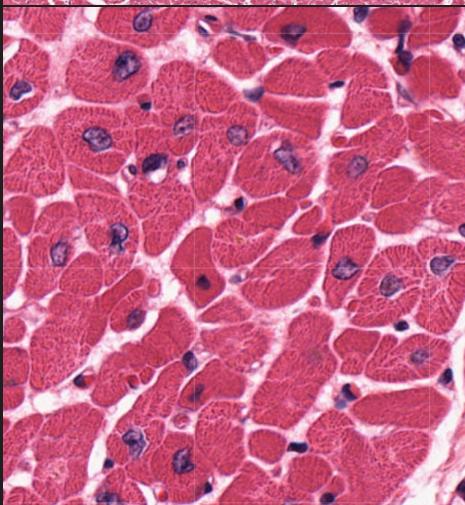
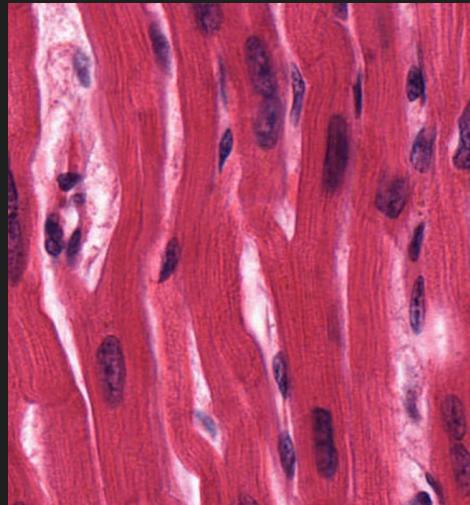
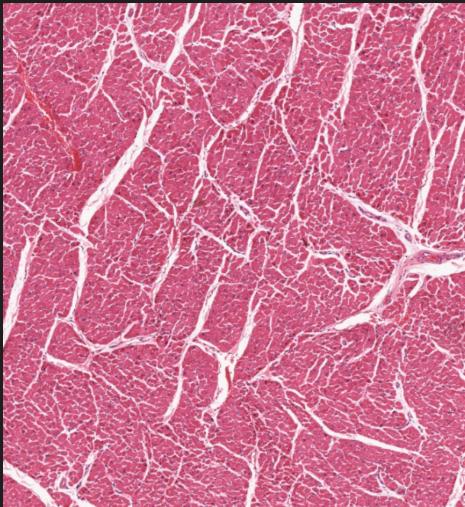


- **Capillaries:** a collapsed capillary containing flattened red blood cells is present on the left edge of the center muscle cell.



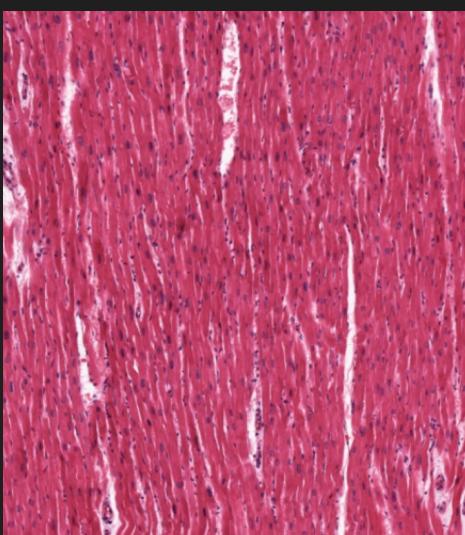
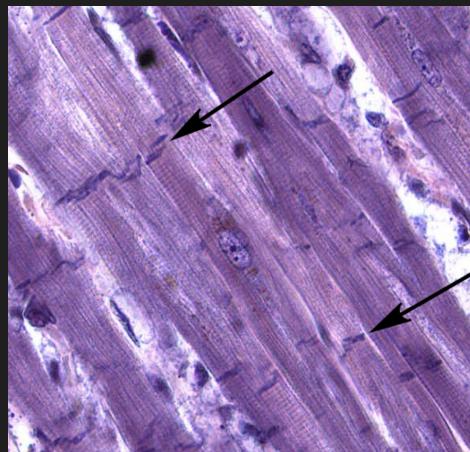
## Cardiac Muscle

- **Cross-striations:** cardiac muscles cells have rounded cross-sections ( $< 25 \mu\text{m}$ ) with a centrally located nucleus.
- **Branched cells:** cells are joined end-to-end and are often branched

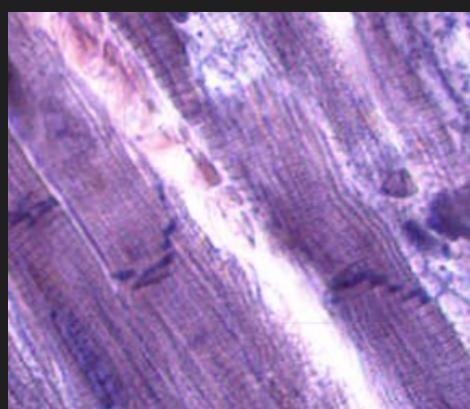


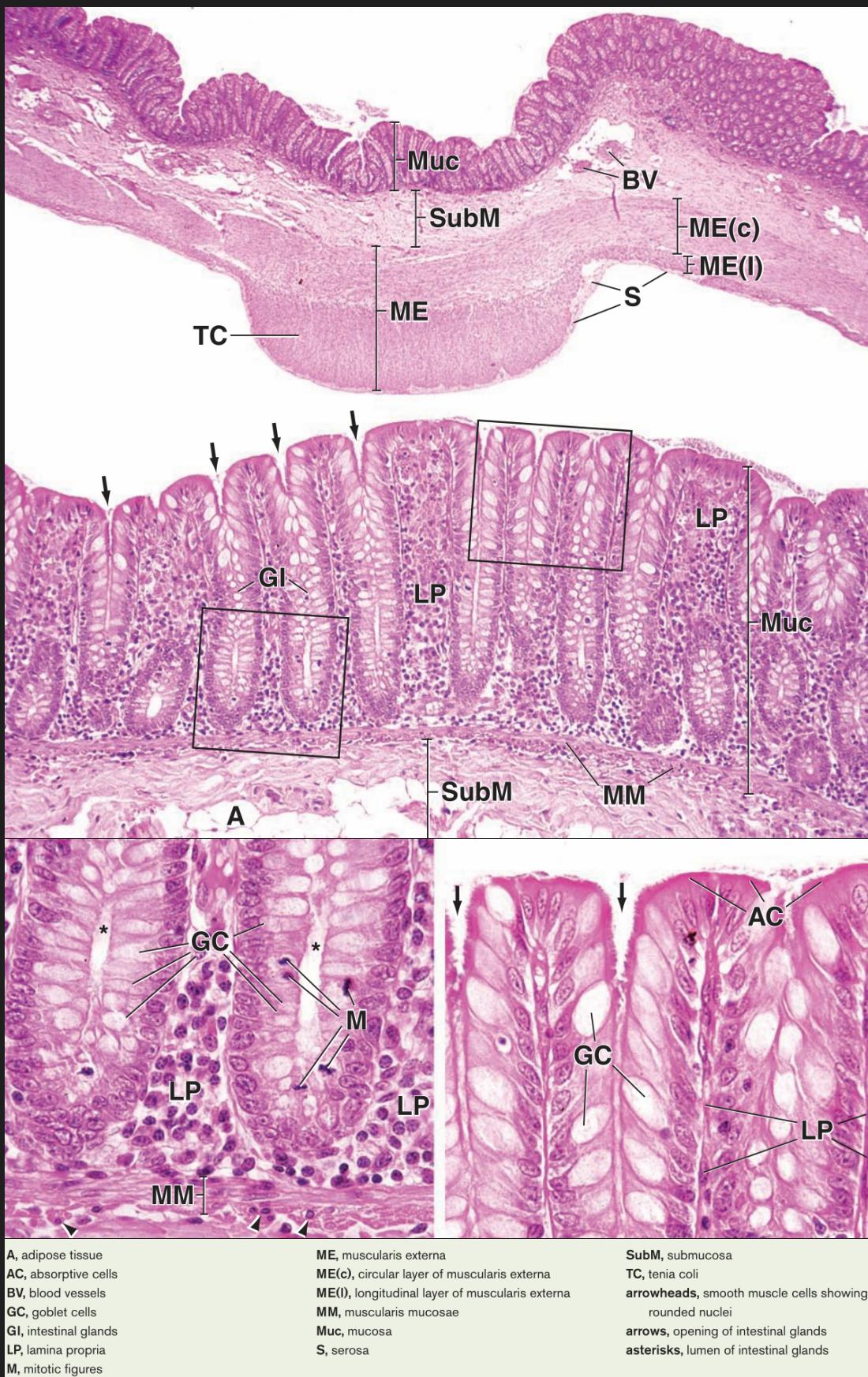
- **Longitudinal section:** cardiac muscle cells are smaller than skeletal muscle.

- **Straight intercalated disks:** specialized junctions that connect the individual cells

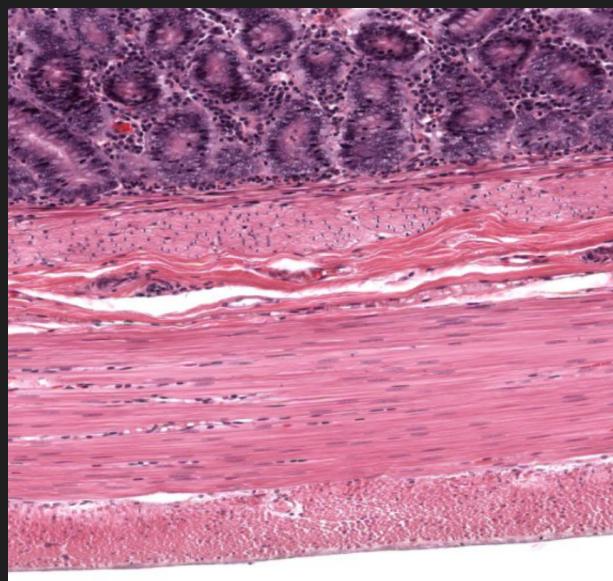


- **Stepped intercalated disks**

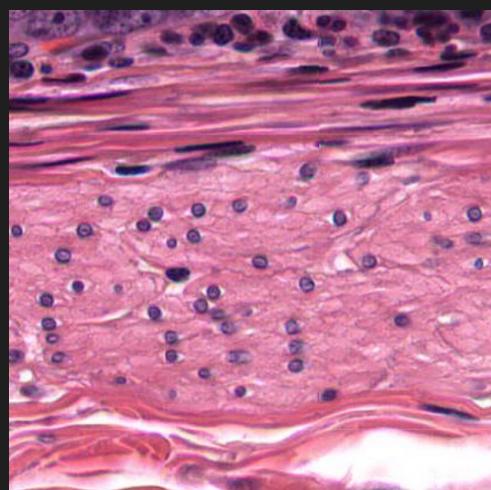


**Colon**

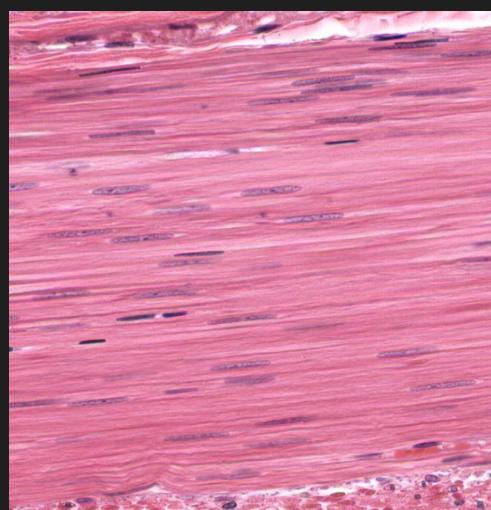
- Smooth muscle in small intestine:



- Inner layer: individual cells vary in diameter depending on their location within the cell. Cross-sections through the middle of cells have centrally located nuclei, usually surrounded by an unstained region.

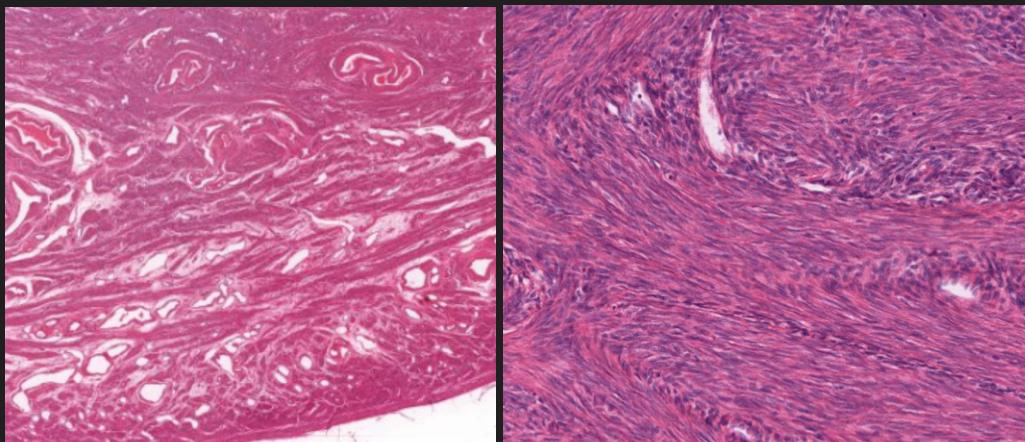


- Outer layer: in relaxed smooth muscle, the nuclei are elongated with rounded ends. When contracted, the nuclei spiral, kink, or twist. The cytoplasm is pink, unstriated and with little detail.

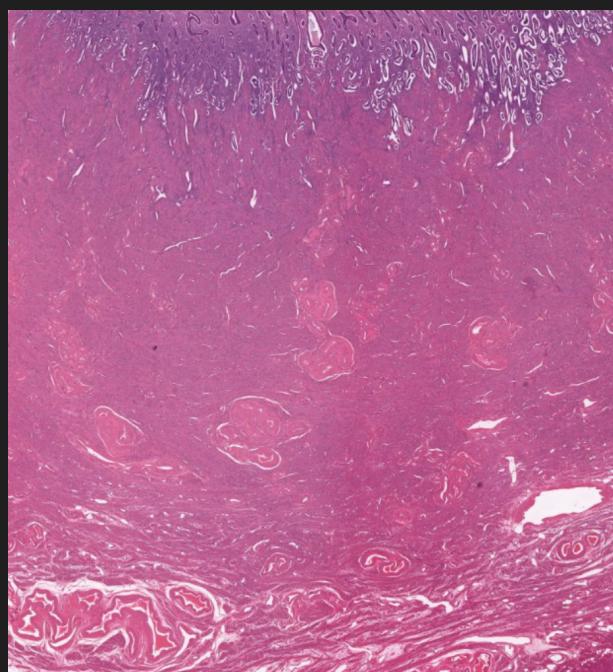
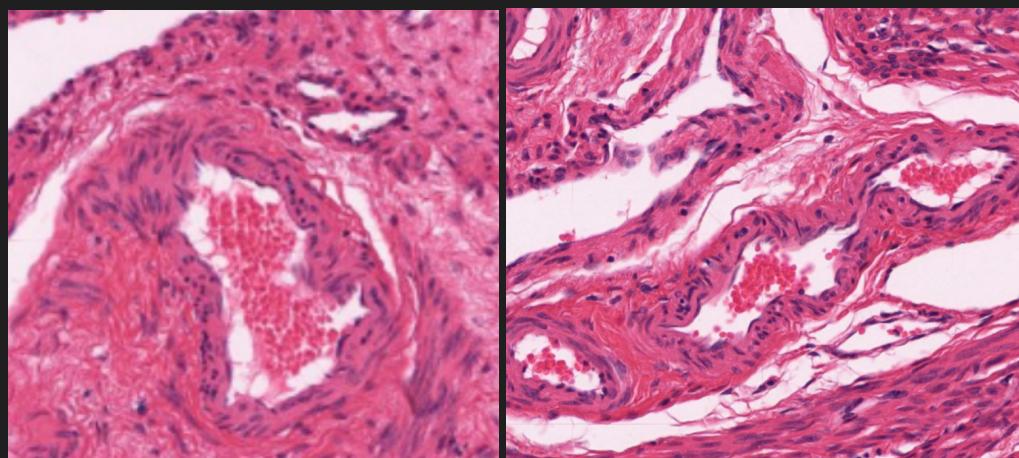


## Uterus

- **Myometrium (left) Fascicles of smooth muscle (right)**



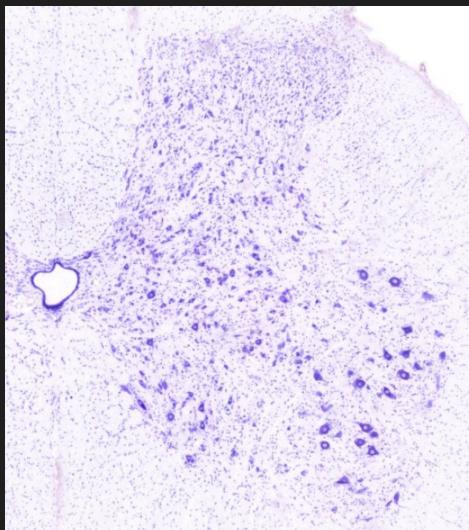
- **Blood vessels within myometrium**



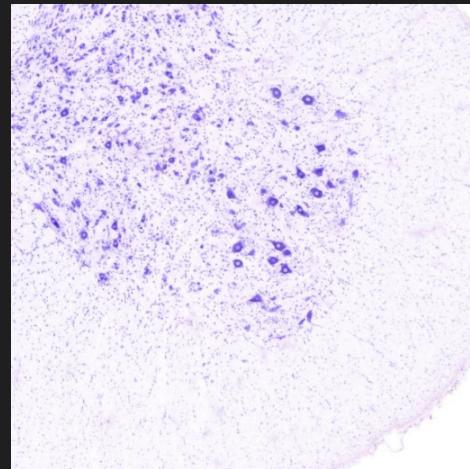
## Central Nervous System

### Spinal Cord

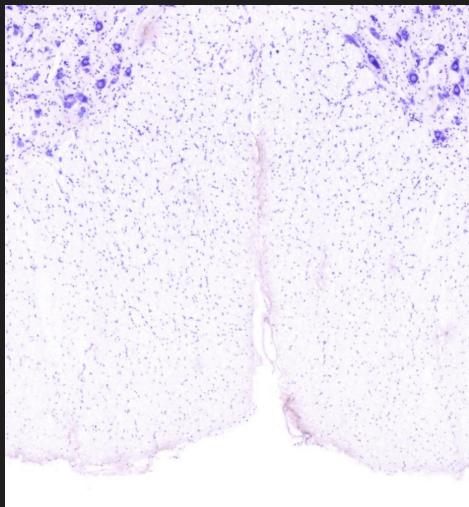
- Gray matter



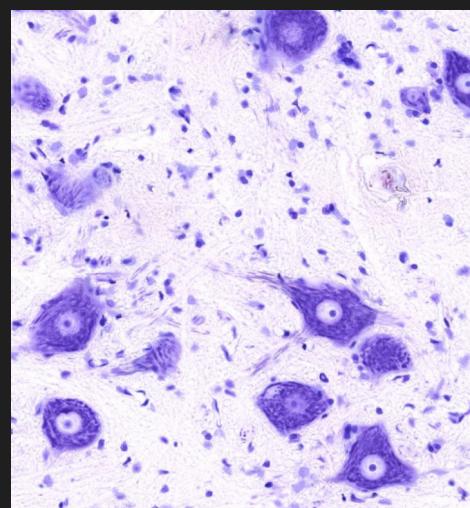
- Ventral structure



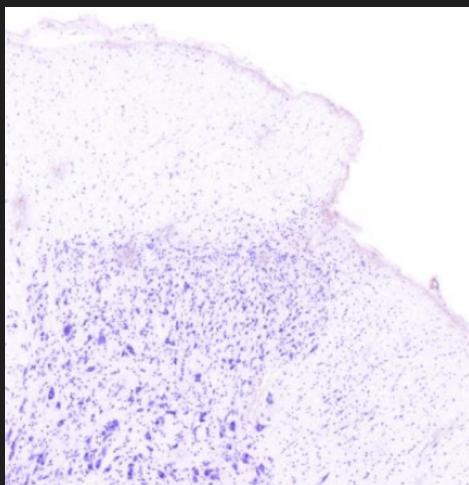
- White matter



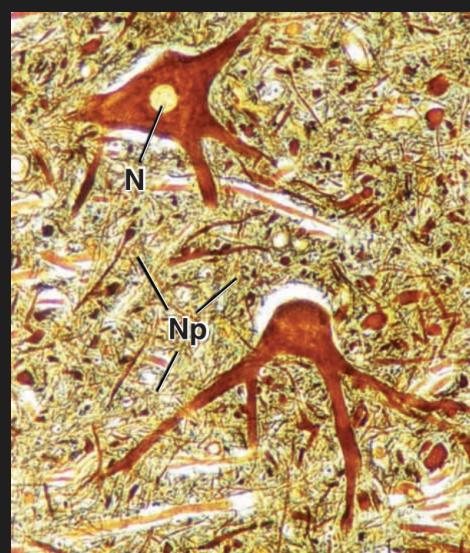
- Motor neurons in anterior horn



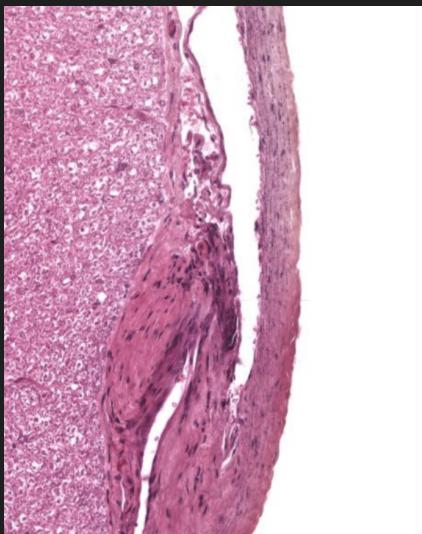
- Dorsal structure



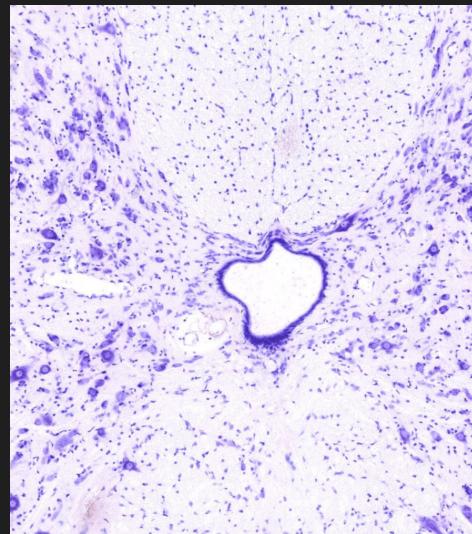
- Perikaryon, Nucleus of ventral horn cell, and neuropil



- Surrounding meninges

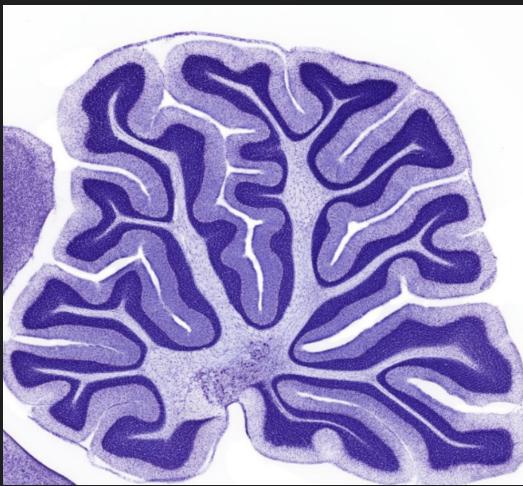


- Central canal of spinal cord

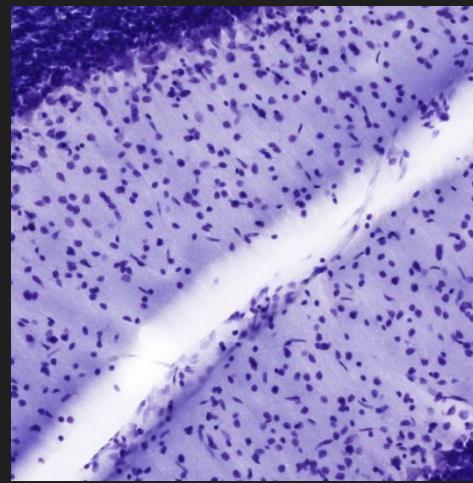


## Cerebellum

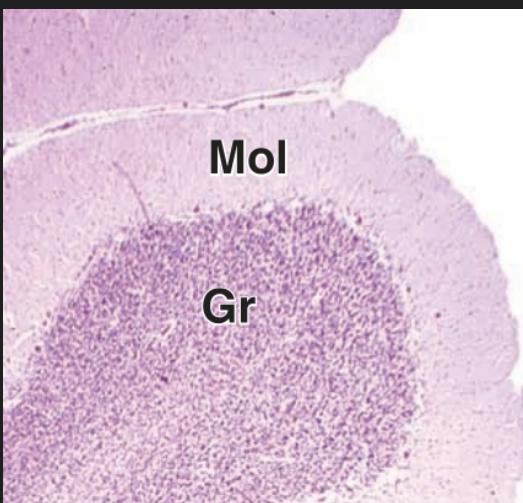
- Cerebellum



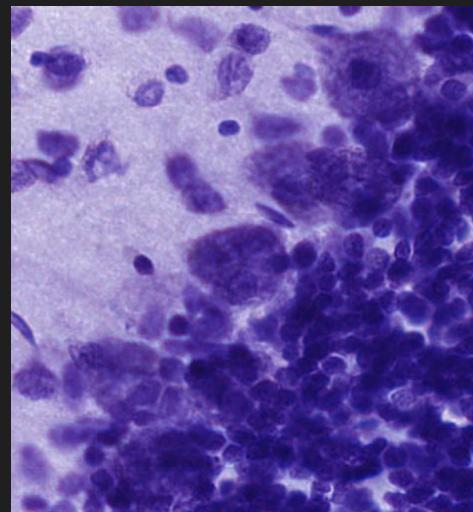
- Molecular nuclei count



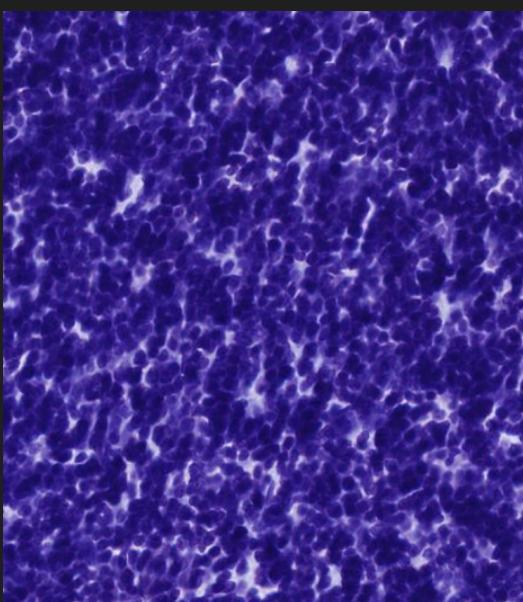
- Molecular (Mol) and granular (Gr) layer



- Purkinje cells: large neurons found at the interface between the two layers of the cerebellum.



- Granular nuclei count

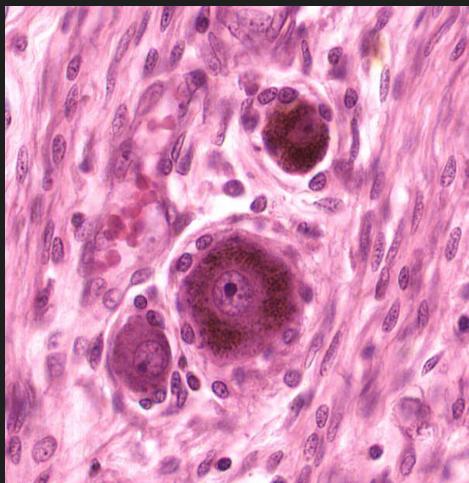


- Extension of Purkinje axons:

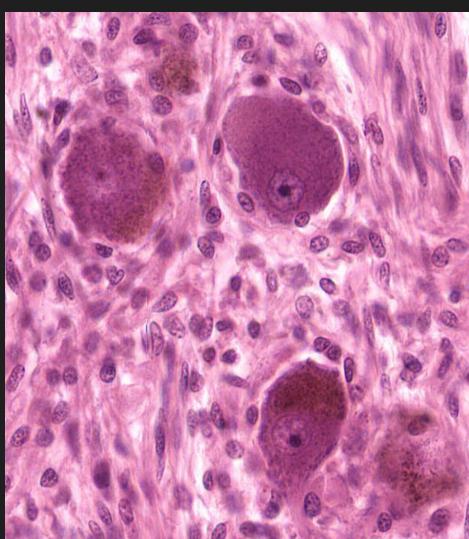


## Sympathetic Nerve

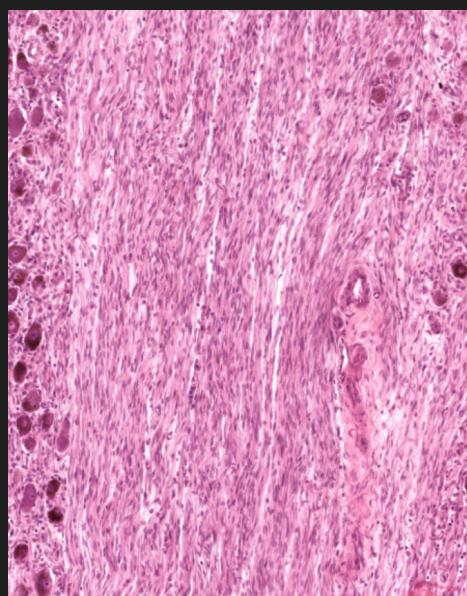
- **Satellite cells:** glial cells with small nuclei at the periphery of nerve cell bodies.



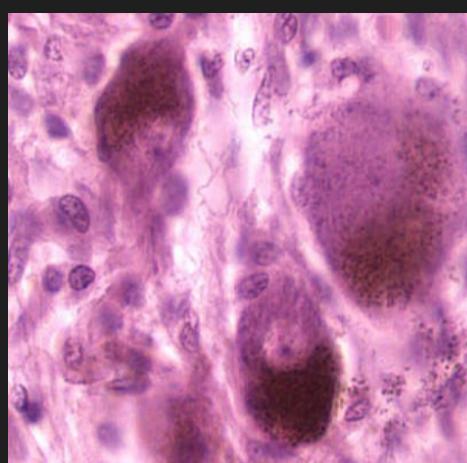
- **Ganglion Cells:** large, nerve cell bodies with prominent nuclei and nucleoli.



- **Nerves**

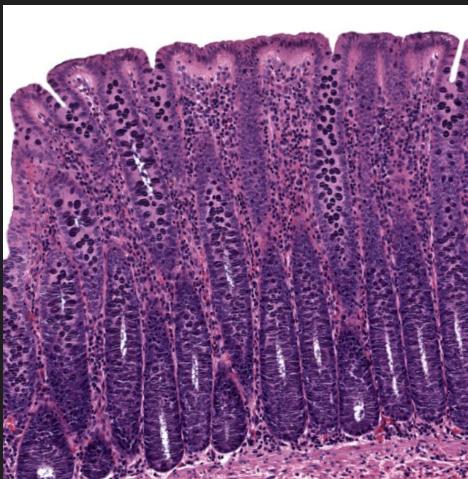


- **Lipofuscin:** yellow-brown pigment located in the cytoplasm. It is end-stage lysosomes that accumulates with age.

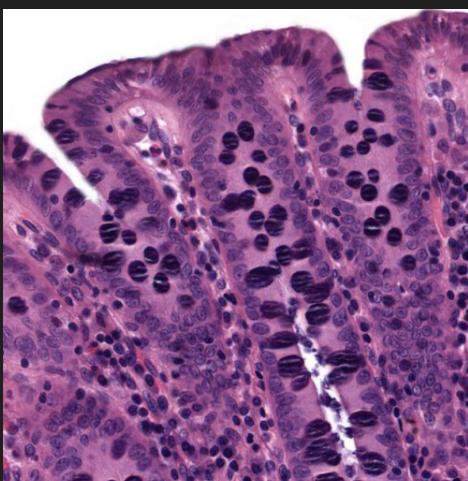


## Enteric Nervous System

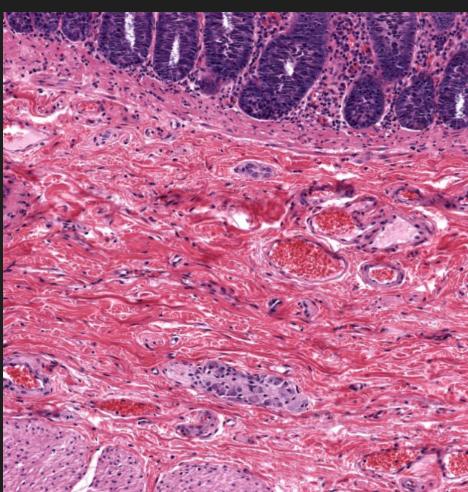
- **Mucosa**



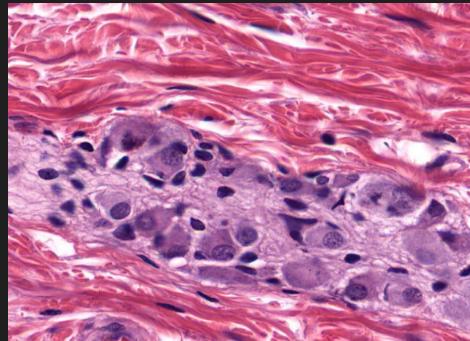
- **Epithelium**



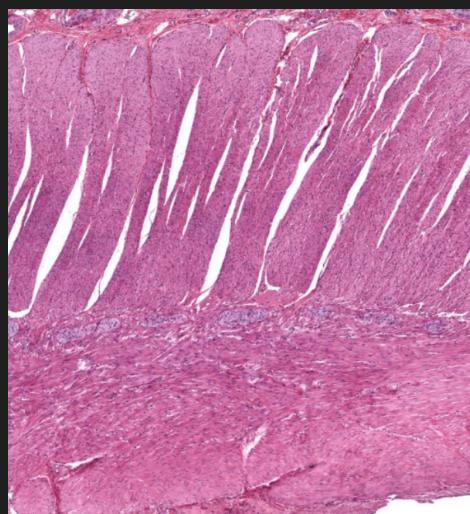
- **Submucosa:** dense irregular connective tissue.



- **Meissner's Plexus:** provides secretory innervation of goblet cells and motor innervation of the muscularis mucosae.



- **Muscularis Externa:** two orthogonal layers of smooth muscle.



- **Auerbach's Plexus:** provides motor innervation of the muscularis externa.

