

Lab Practical Two

Week 6: Lymphatic, Digestive

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Week 7: Respiratory, Integument, Urinary

Week 8: Endocrine, Male Reproductive

Week 9: Female Reproductive, Eye, Ear

Week 6: Lymphatic, Digestive

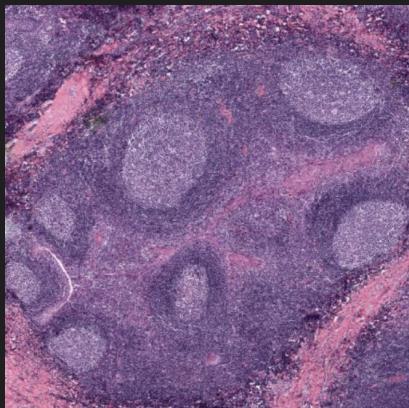
Lymphatic

Tonsils

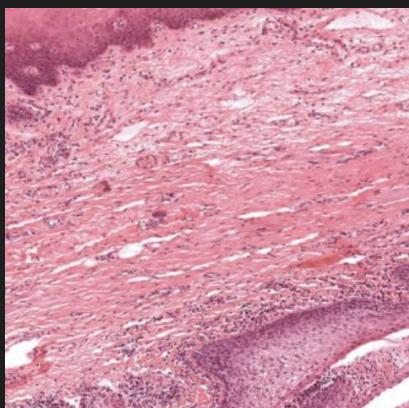
- Tonsils are examples of mucosa-associated lymphoid tissue (**MALT**). The lymphocytes are distributed as diffuse, non-encapsulated nodules in the underlying connective tissue.
- **Stratified Squamous Non-Keratinized Epithelium:** covers the numerous nodules that comprise the palatine tonsil.



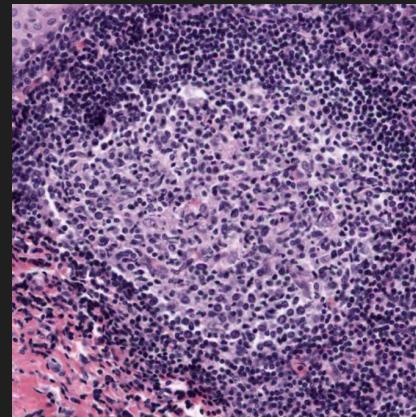
- **Lymph Nodules:** spherical aggregations of lymphocytes that usually have germinal centers.



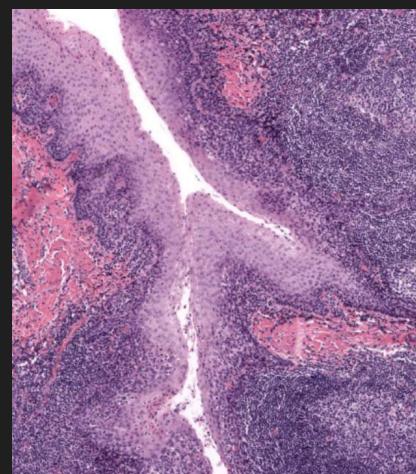
- **Submucosa**



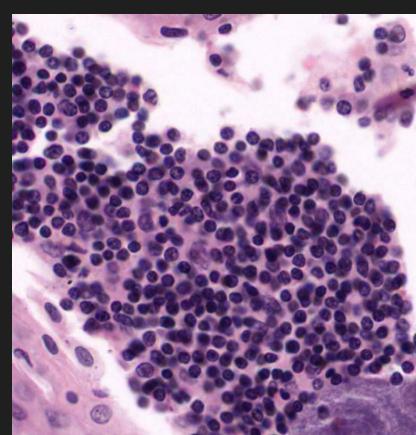
- **Germinal centers**



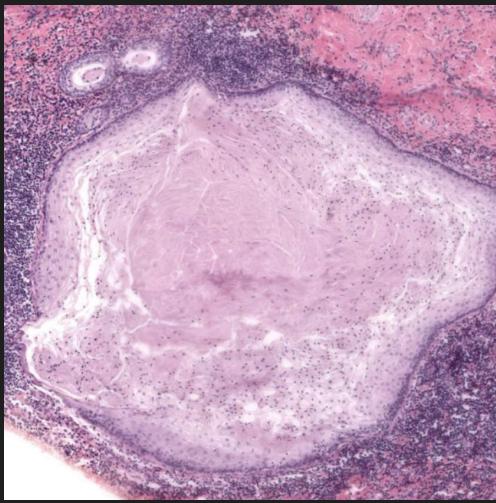
- **Crypts:** infoldings of the epithelium into the underlying connective tissue.



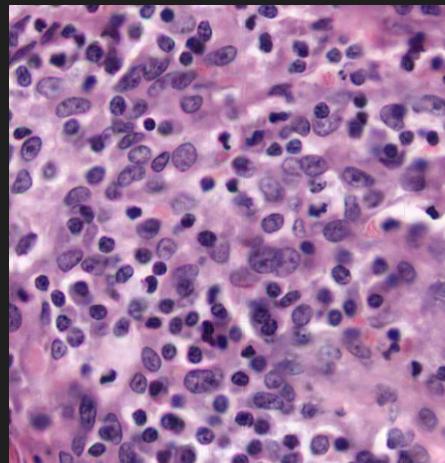
- **Lymphocytes**



- **Sequestered crypts:** usually inflamed and filled with debris and lymphocytes

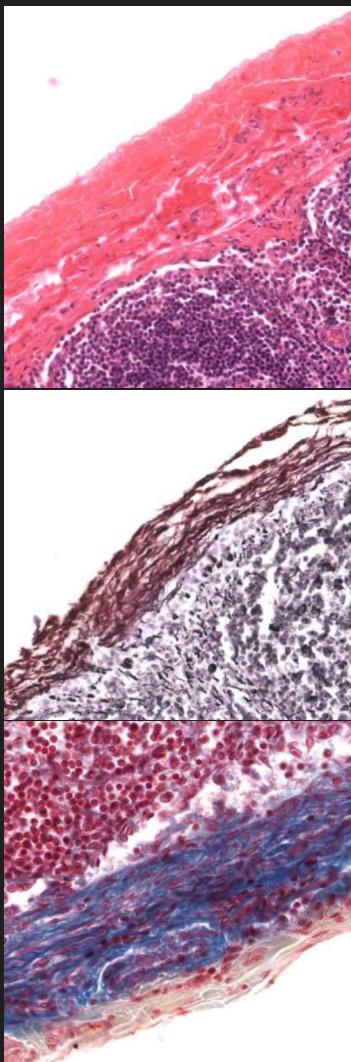


- **Plasma cells:** large numbers of plasma cells are usually seen in the underlying connective tissue near the epithelium.

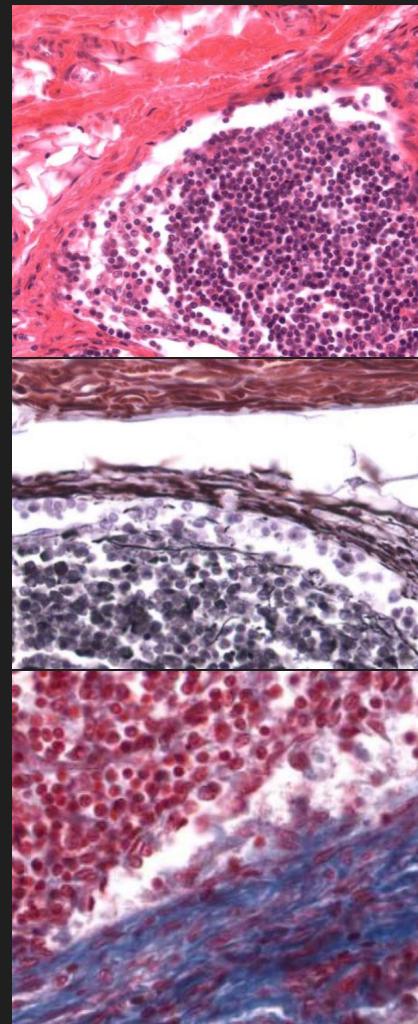


Lymph Nodes

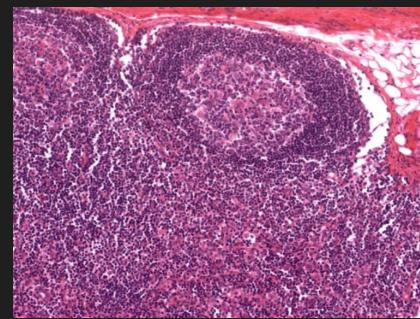
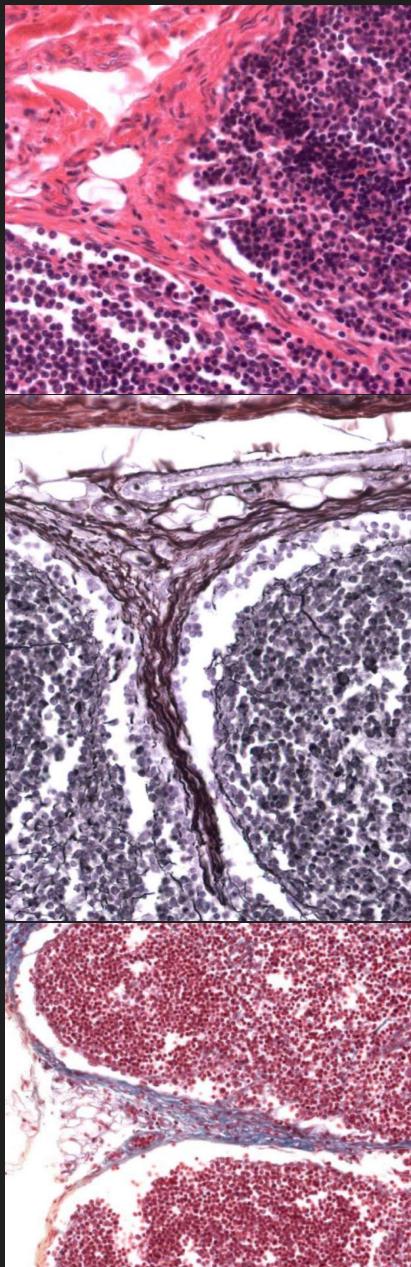
- **Capsule:** dense connective tissue enclosing the node.



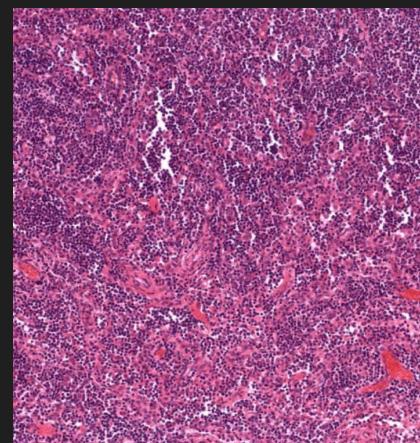
- **Subcapsular Sinus:** space underneath the capsule that receives lymph from afferent lymphatic vessels.



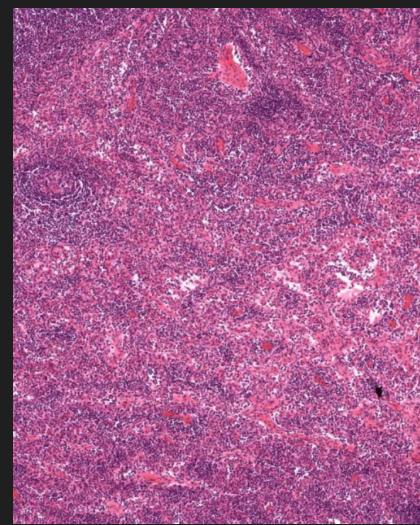
- **Trabeculae:** connective tissue that extends inward from the capsule.



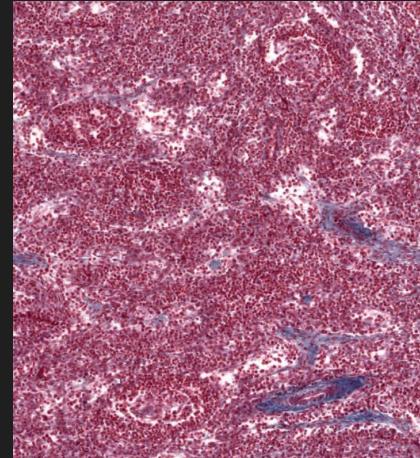
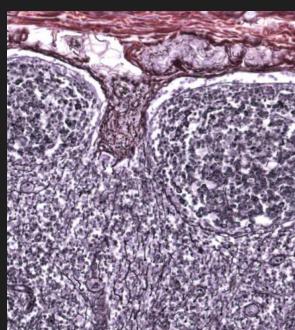
- **Inner Cortex:** region between the outer cortex and the medulla that is free of nodules.



- **Medulla:** inner part of the node.

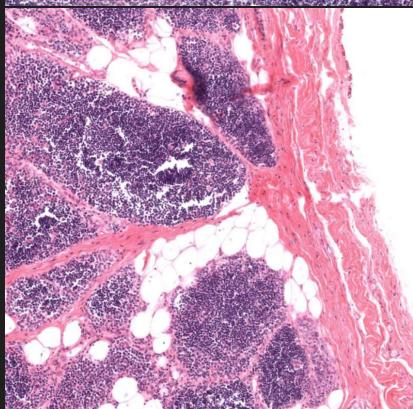
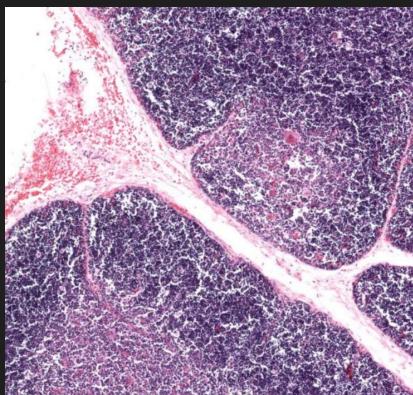


- **Cortex:** reticular fibers form an irregular, anastomosing network in the outer region of the node. Nodules are enclosed by reticular fibers.

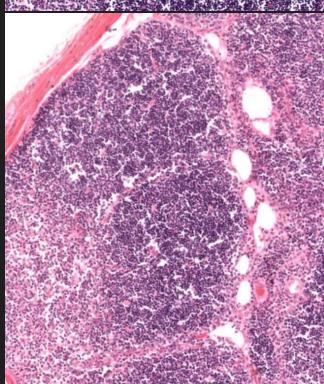
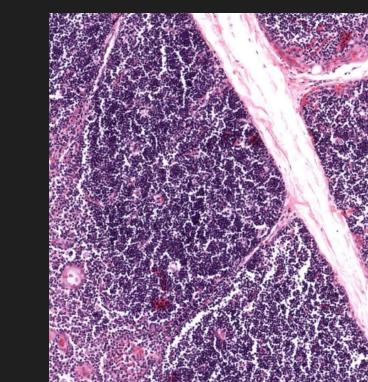


Thymus

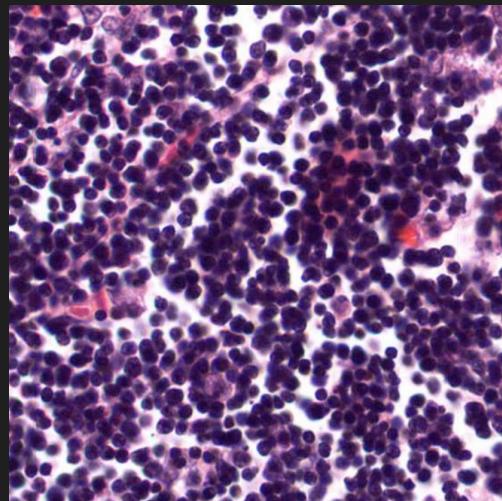
- **Capsule (neonatal/adult)**: thin connective tissue layer surrounding the thymus that extends inwards to form incomplete lobules.



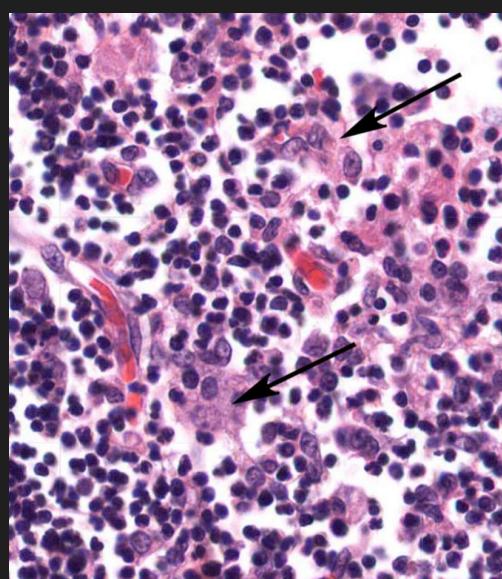
- **Cortex (neonatal/adult)**: outer darker, region of small lymphocytes.



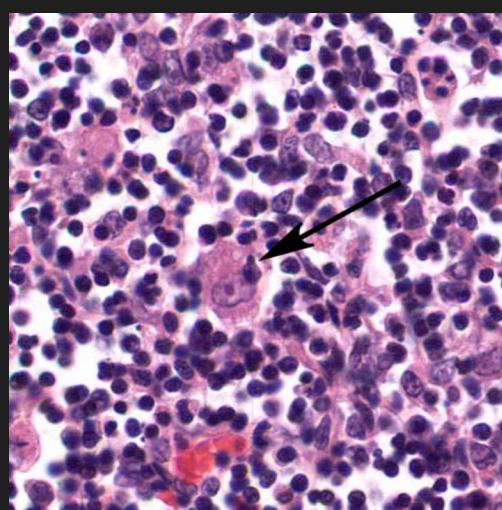
- **T Lymphocytes**: small nuclei of condensed chromatin.



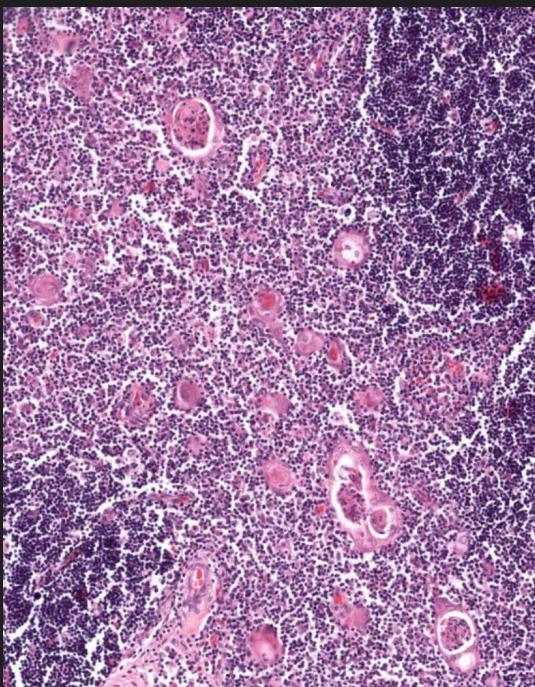
- **Epithelial Reticular Cells**



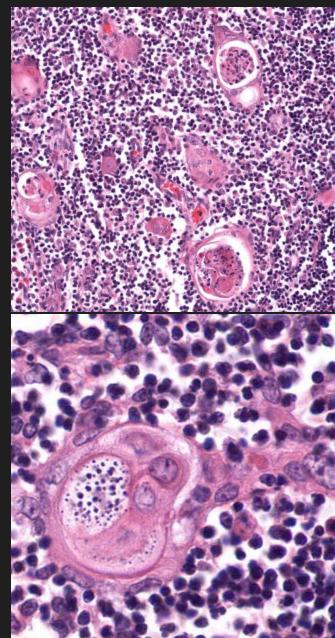
- **Macrophages**: large cells that phagocytize T cells marked for removal.



- **Medulla:** inner, lighter region of larger lymphocytes.

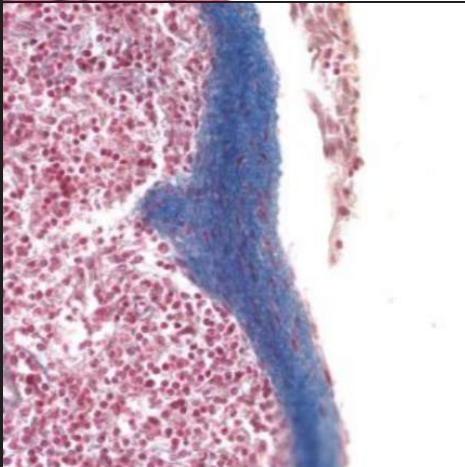
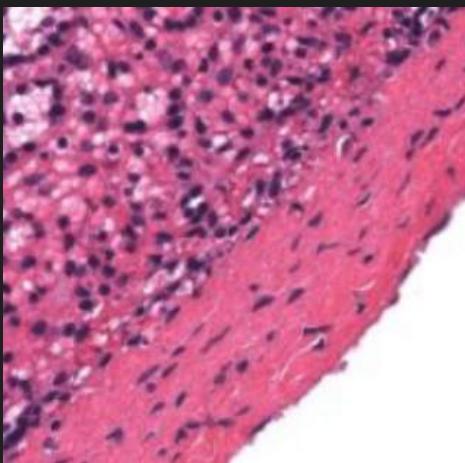


- **Hassal's Corpuscles:** closely packed, concentrically arranged epithelial reticular cells.

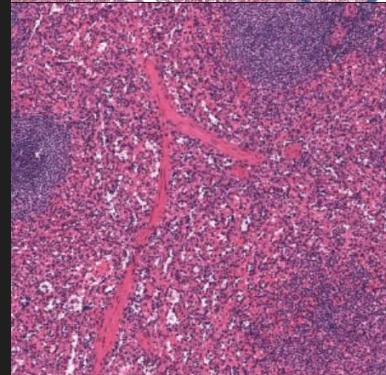
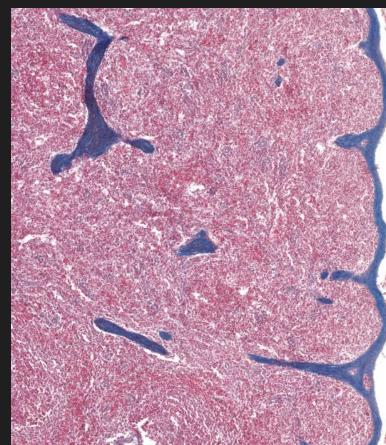


Spleen

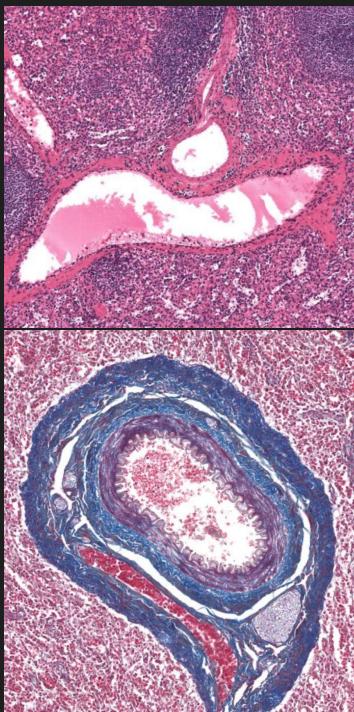
- **Capsule:** dense connective tissue enclosing the organ.



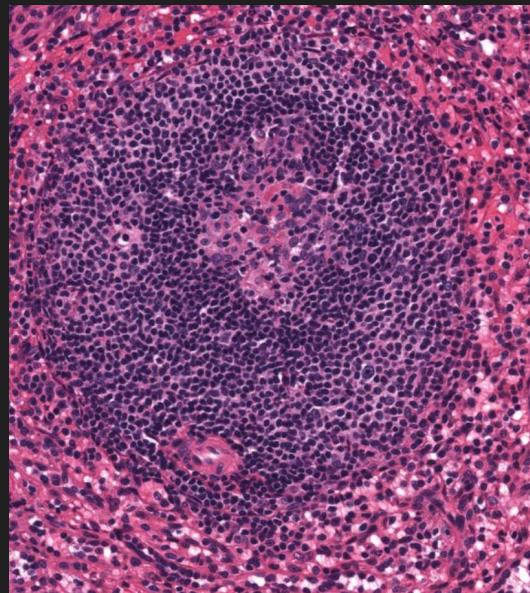
- **Trabeculae:** connective tissue that extends inward from the capsule through which blood vessels enter the pulp



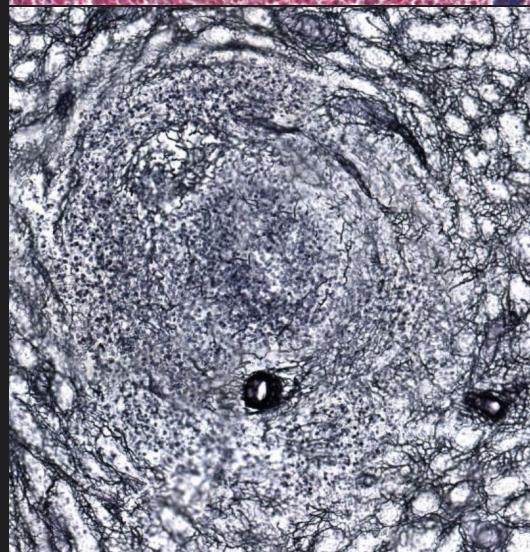
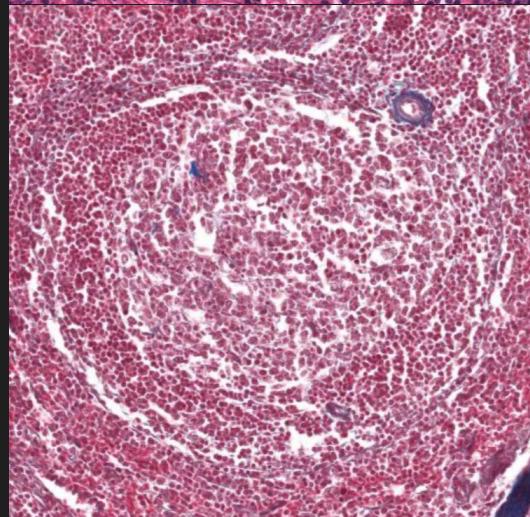
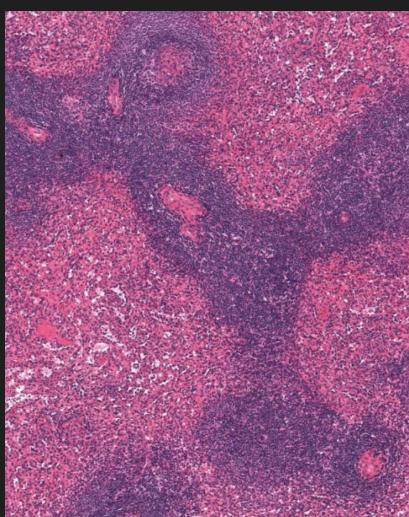
- **Blood vessels**



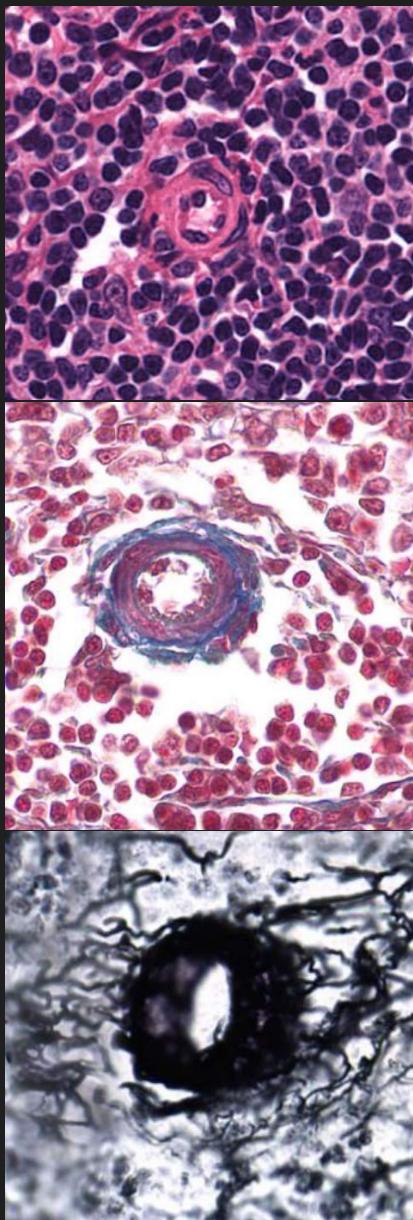
- **Splenic Nodules:** clusters of B lymphocytes located on central arterioles. They usually contain a germinal center of activated B lymphocytes.



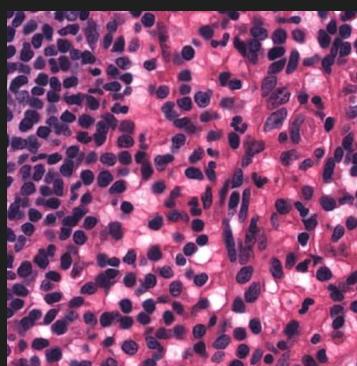
- **White Pulp:** composed of lymphatic tissue. It appears basophilic due to the large number of nuclei.



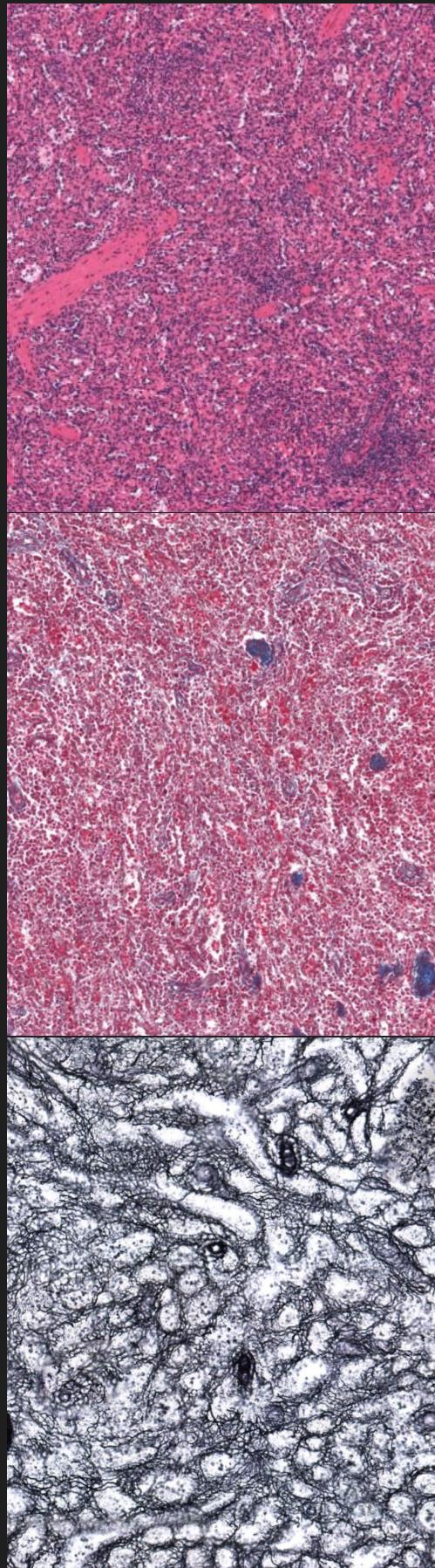
- **Central Arterioles** branches of trabecular arteries coated by PALS and adjacent to nodules.



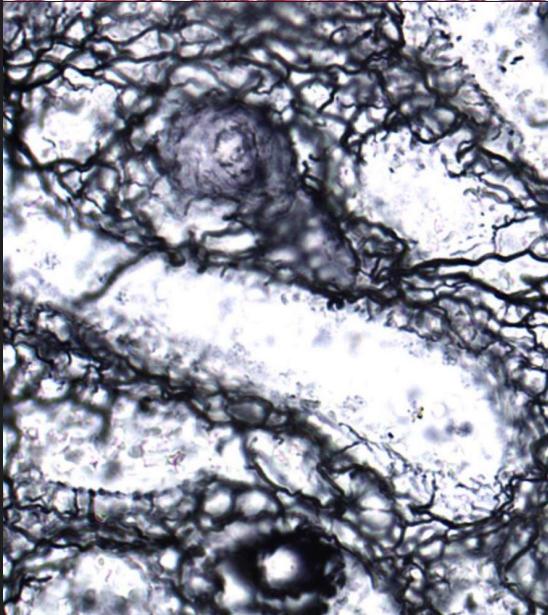
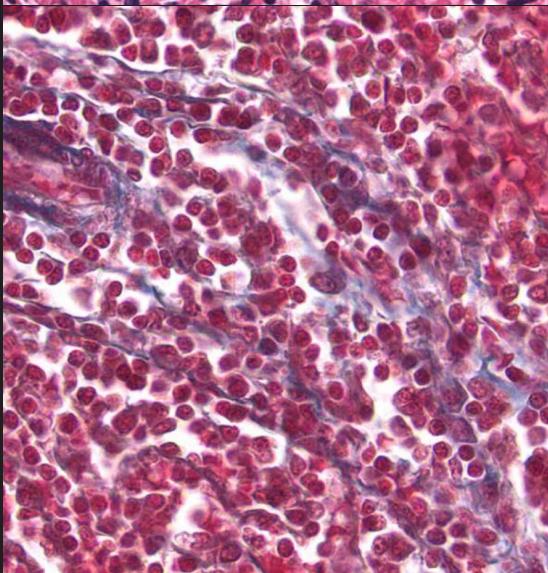
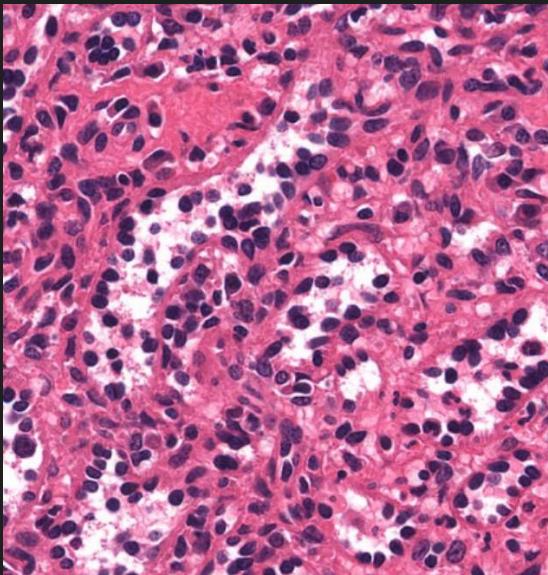
- **Marginal Zone:** region between white and red pulp where macrophages, dendritic cells, and lymphocytes interact.



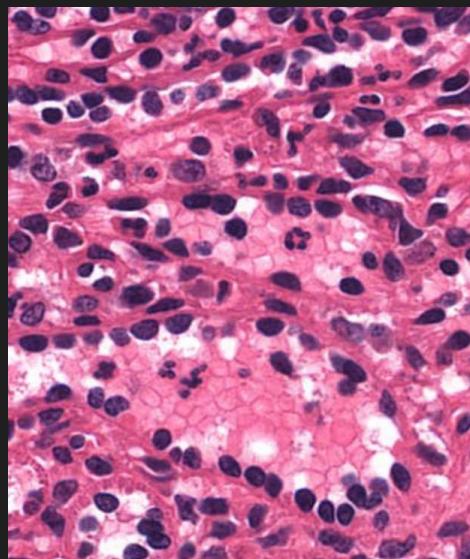
- **Red pulp:** filters and degrades red blood cells (RBCs). It appears eosinophilic due to the large number of RBCs.



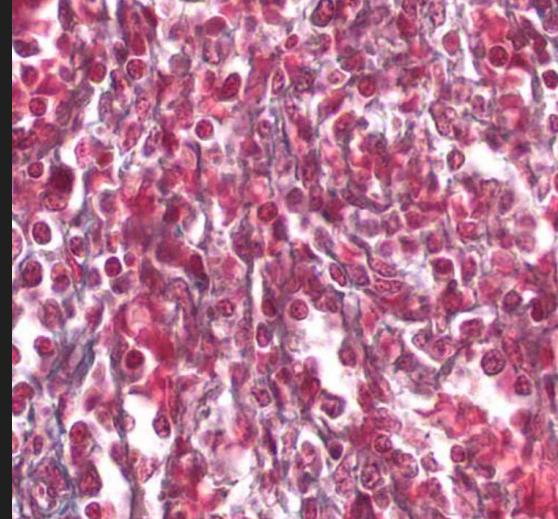
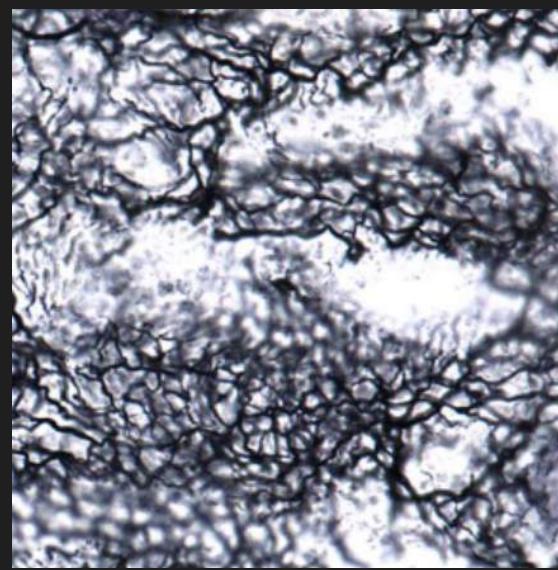
- **Splenic Sinusoids:** vascular spaces lined by specialized endothelial cells that filter RBCs.



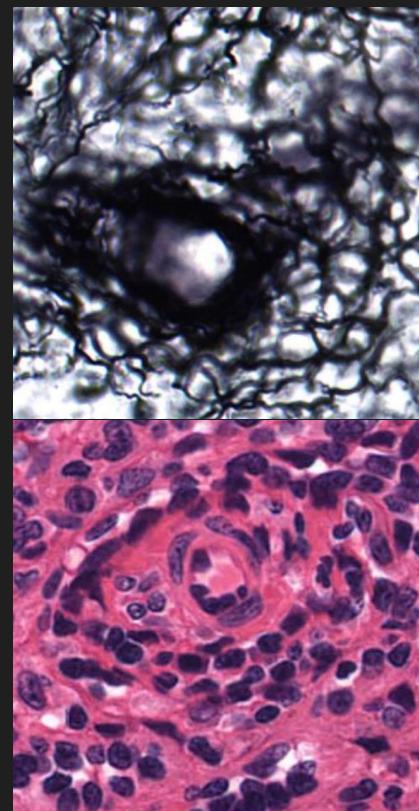
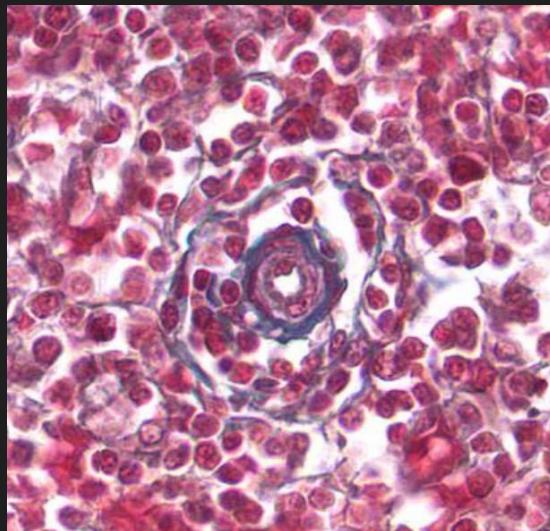
- **Specialized Endothelial Cells**



- **Splenic Cords:** loose connective tissue supported by a meshwork of reticular fibers, and contains loose connective tissue supported by a meshwork of reticular fibers.



- **Pulp Arterioles:** not surrounded by lymphocytes like central arterioles in white pulp and surrounded by layer of reticular fibers.

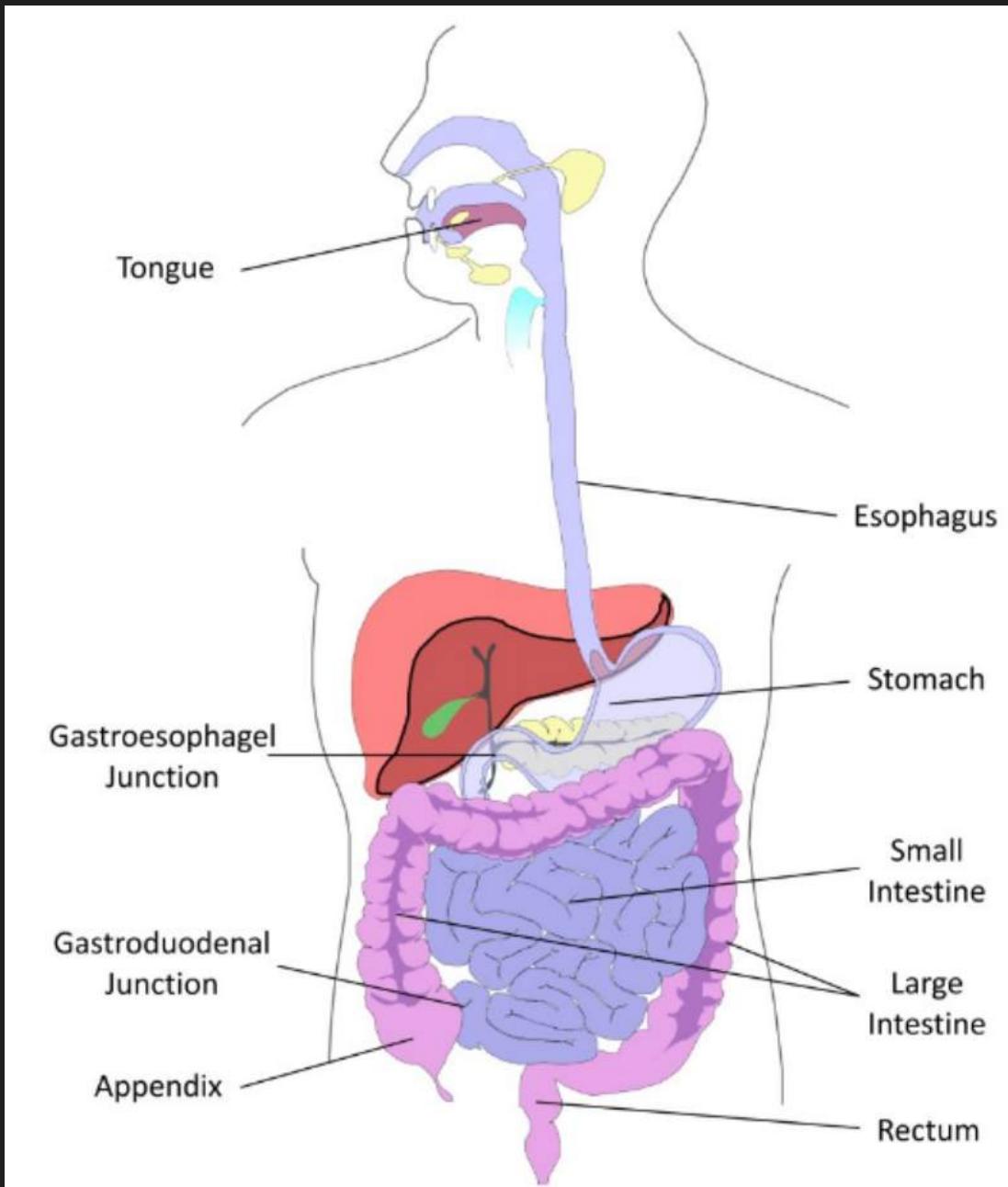


Questions

1. Which lymphatic organs have afferent lymphatic vessels?
 - Found only in lymph nodes; efferent are found in thymus and spleen.
2. How do lymphocytes enter:
 - (a) Lymph nodes?
 - Via blood vessel walls or afferent lymphatic vessels.
 - (b) MALT?
 - Via efferent lymphatic vessels.
3. What are the components of the blood thymic barrier?
 - Epithelial reticular cells, basal laminae, and endothelial cells joined by tight junctions.
4. Which of the lymphatic organs filters blood?
 - Spleen.

Digestive

- **Gastrointestinal Tract**



Tongue

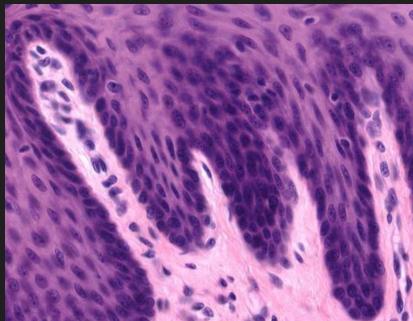
- **Overview of the Tongue**



- **Stratified Squamous Non-Keratinized Epithelium**



- **Dermal Papillae:** ridges of connective tissue that project into the epithelium that reduce its mobility and brings blood vessels in close contact with the epithelial cells.



- **Foliate Papillae:** parallel ridges on the lateral edges of the tongue separated by deep mucosal furrows.



- **Furrows:** separate each papillae and receive saliva from the minor lingual glands.



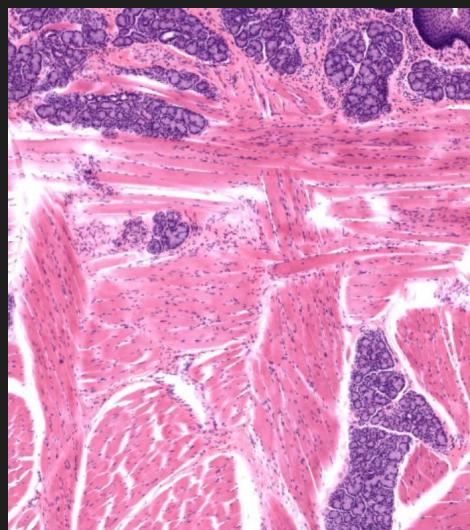
- **Taste Buds:** elliptical structures found in the epithelium of the furrows that contain cells with taste receptors. The circular opening at its apex is the taste pore.



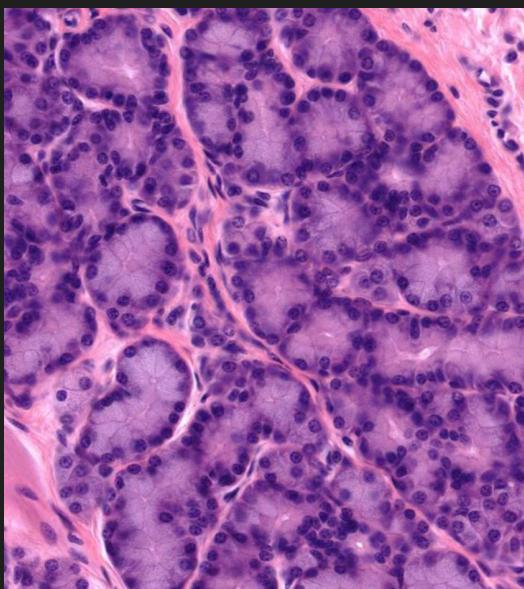
- **Taste Pore**



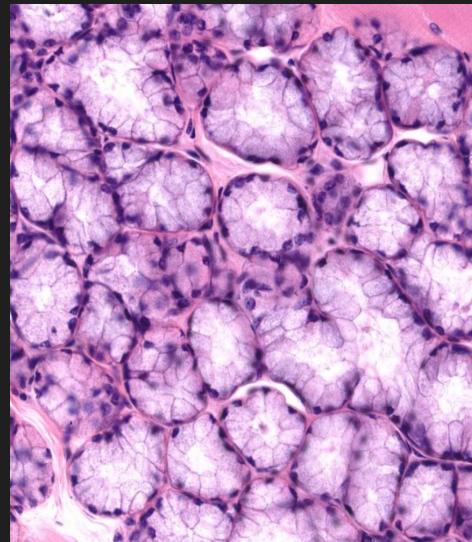
- **Skeletal Muscle:** arranged in three bundles at right angles to each other to allow flexibility and precision in movements of the tongue.



- **Serous Glands:** secrete a fluid that contains digestive enzymes.



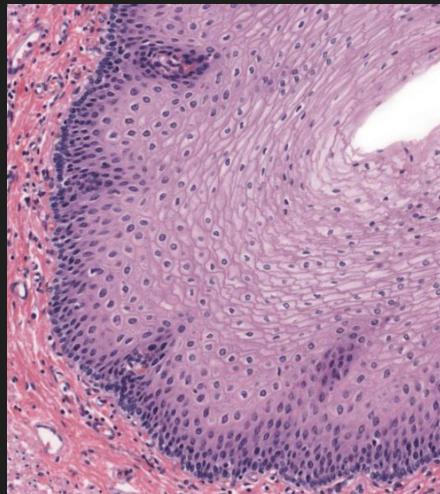
- **Mucous Glands:** secrete a fluid that contains mucus (glycoproteins known as mucins).



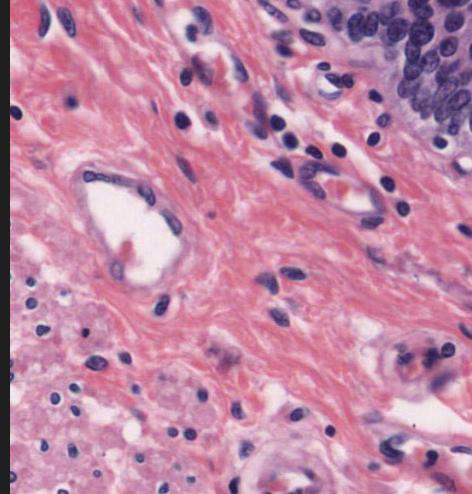
Esophagus



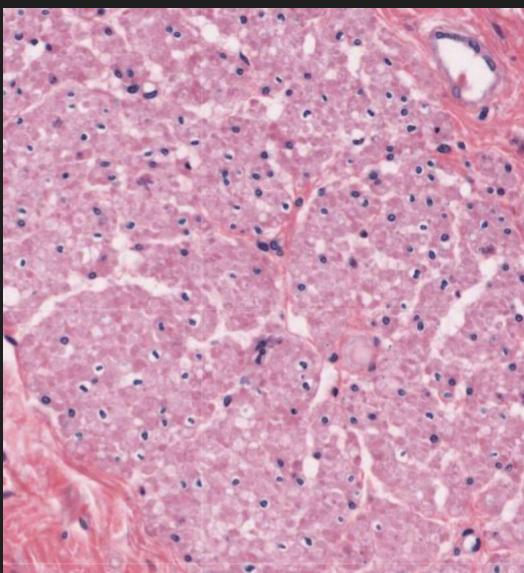
- **Stratified Squamous Non-Keratinized Epithelium:**



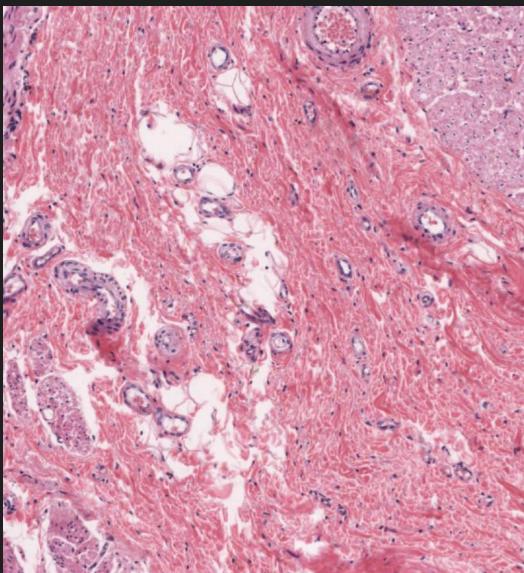
- **Lamina Propria:** dense irregular connective tissue.



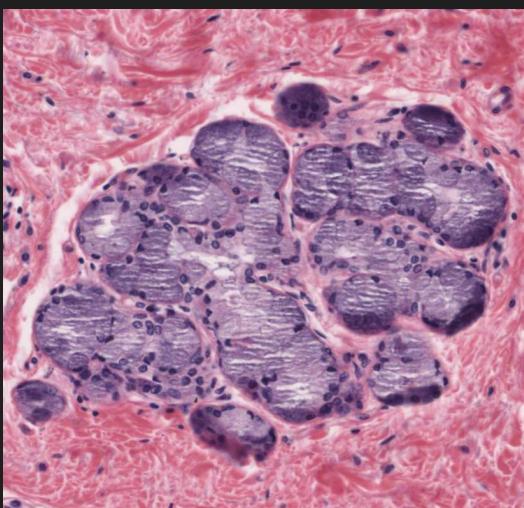
- **Muscularis Mucosae:** smooth muscle.



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



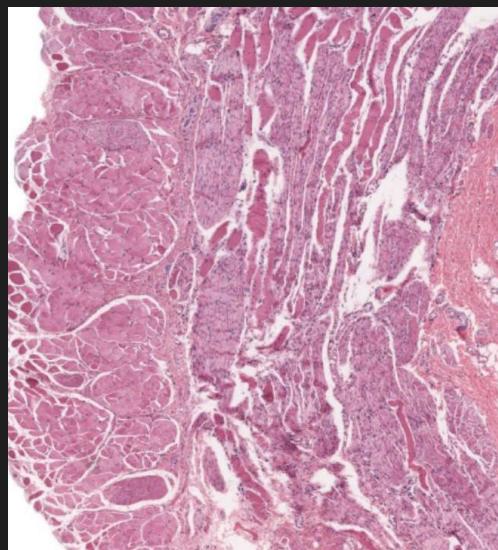
- **Mucus Glands:** only the esophagus and the duodenum have glands in the submucosa.



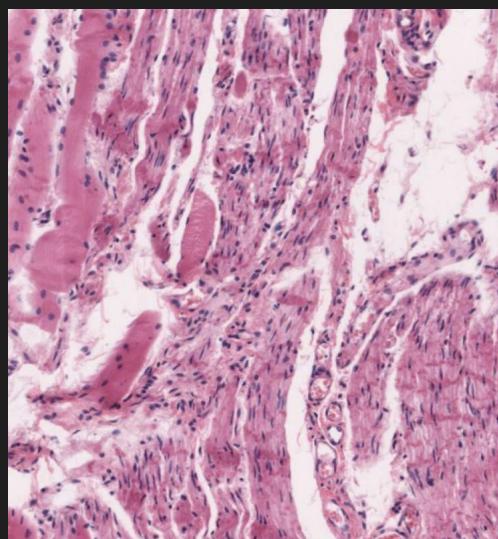
- **Ducts:** usually have cuboidal or stratified cuboidal epithelium.



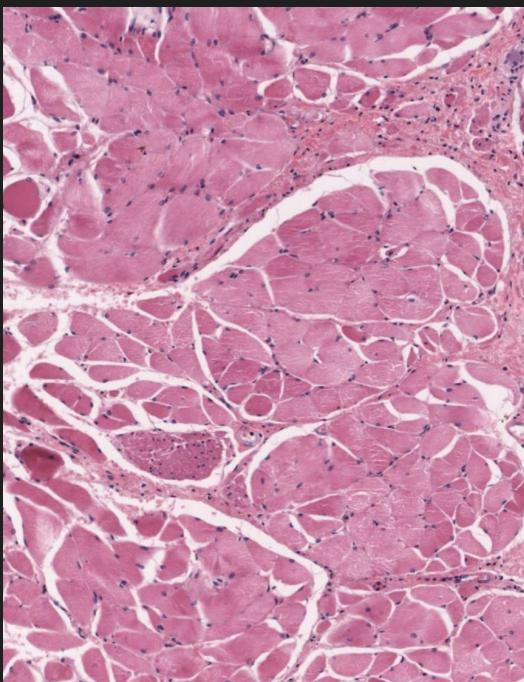
- **Muscularis Externa:** contains both smooth and skeletal muscle because this specimen is from the middle third of the esophagus.



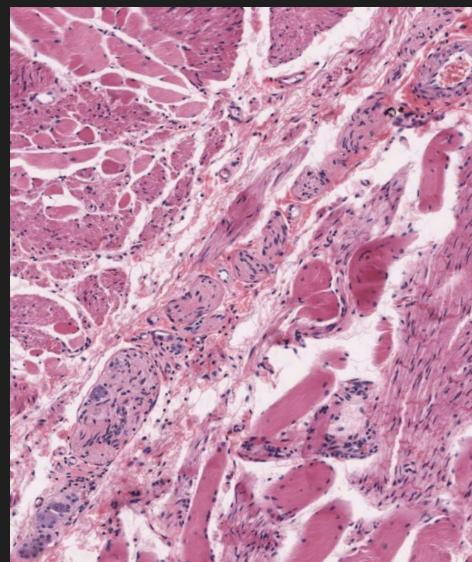
- **Inner Layer**



- **Outer Layer**

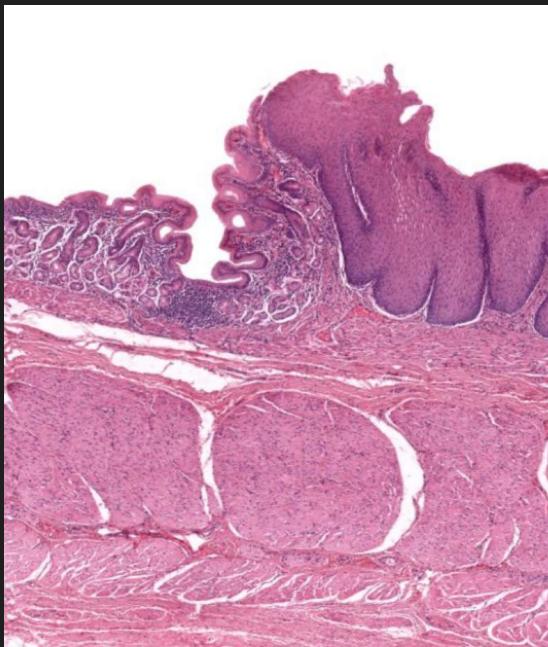


- **Auerbach's plexus:** is found between the inner and outer layers of the muscularis externa. Ganglia with prominent capsule cells can be seen.

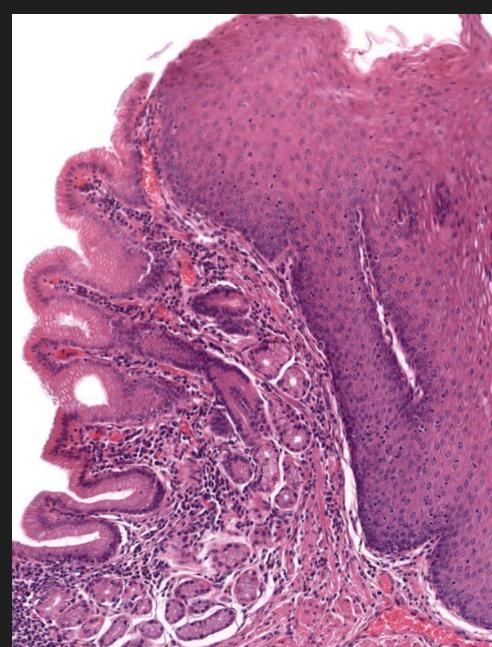


Gastroesophageal Junction

- **Gastroesophageal Junction**



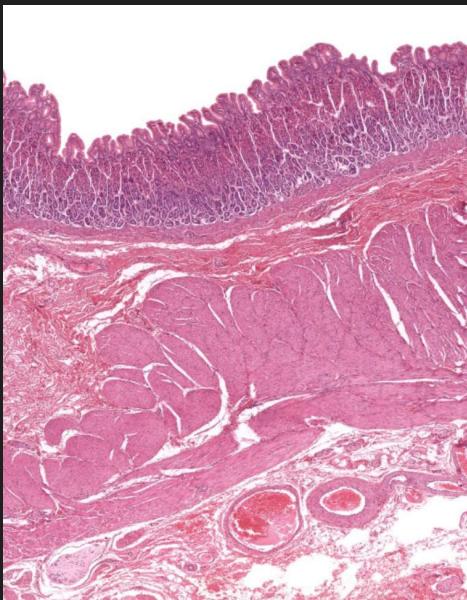
- **Change in Epithelium**



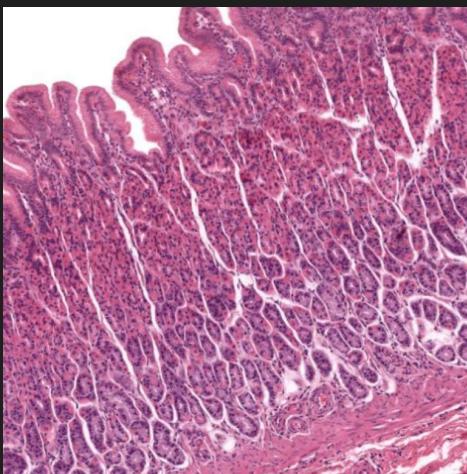
- How can you diagnose whether you are looking at the upper or lower portion of the esophagus?
 - The best way to tell is to look at the epithelium; the upper portion of the esophagus has stratified squamous while the lower portion (stomach) has simple columnar epithelium with long linear or coiled glands.

Stomach

- **Stomach**



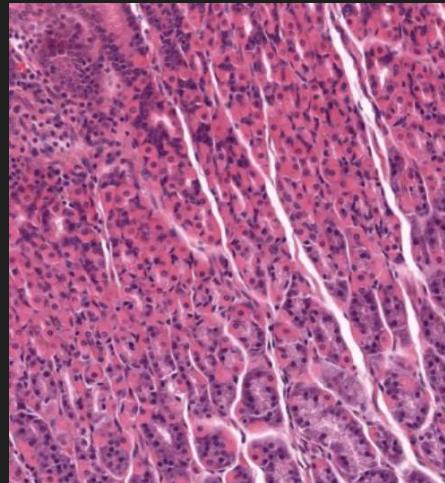
- **Mucosa:** composed of the epithelium, lamina propria, and muscularis mucosae.



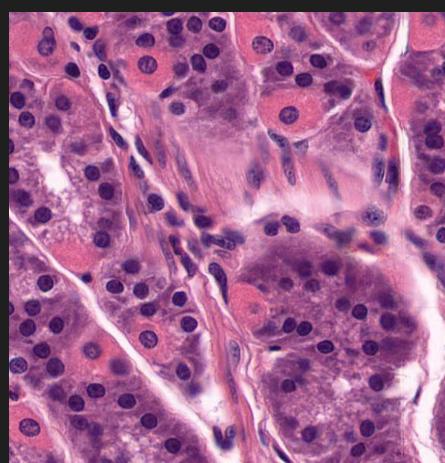
- **Gastric Pits:** invaginations of the surface epithelium.



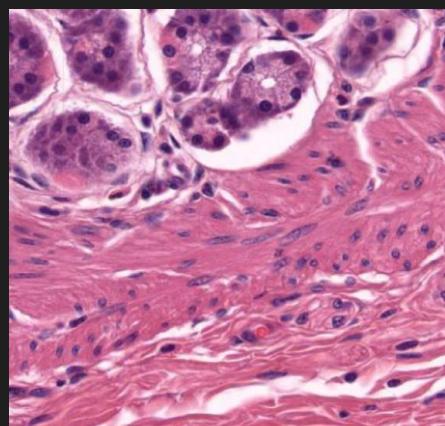
- **Gastric Glands:** tubular glands that extend from the base of the gastric pits to the muscularis mucosae.



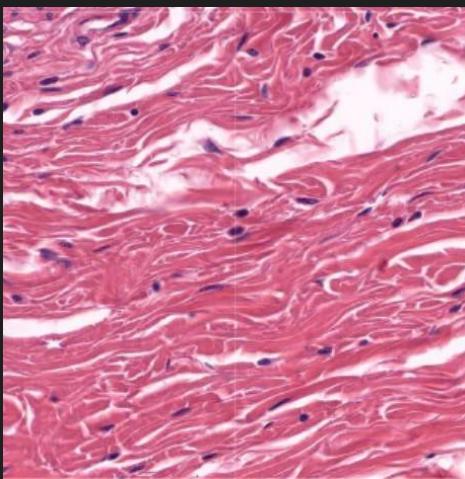
- **Lamina Propria:** reduced to small amounts of connective tissue found between gastric pits and glands.



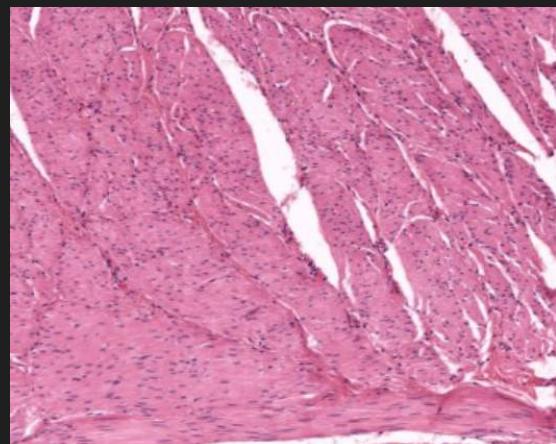
- **Muscularis Mucosae:** narrow layer of smooth muscle cells at the base of the mucosa.



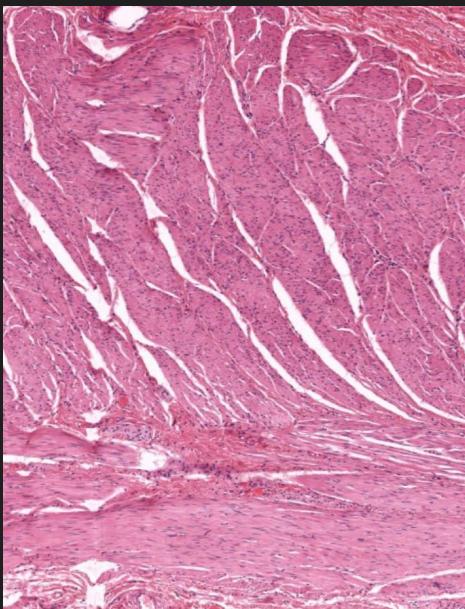
- **Submucosa:** dense irregular connective tissue.



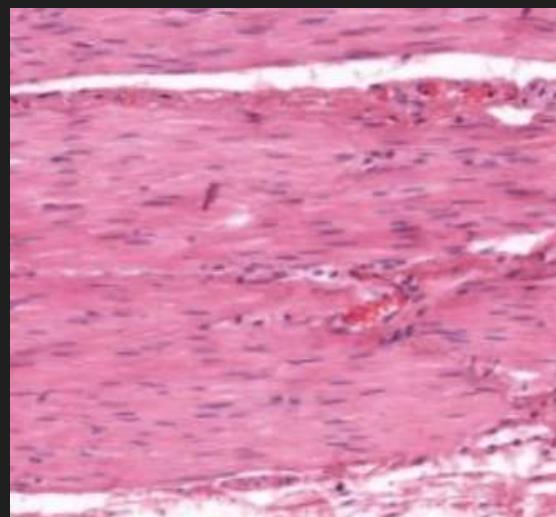
- **Middle Circular Layer:**



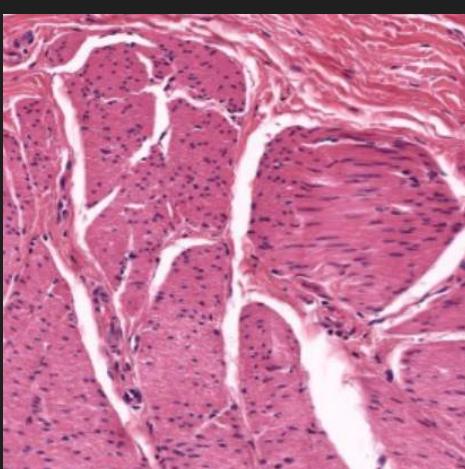
- **Muscularis Externa:** three layers of muscle cells rather than two layers found elsewhere in the GI tract.



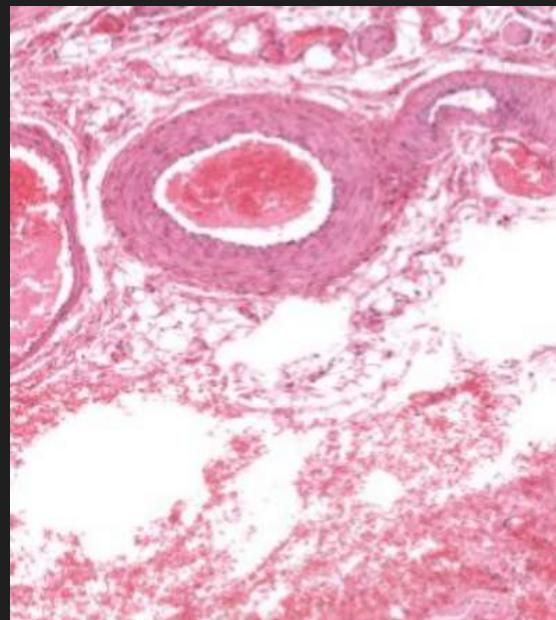
- **Outer Longitudinal Layer:**



- **Inner Oblique Layer:** this layer is unique to the stomach and is found near the boundary with the submucosa.

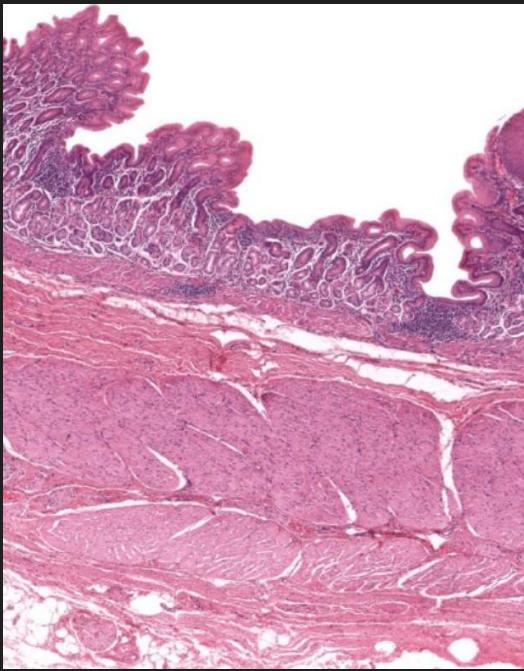


- **Adventitia:** loose irregular connective tissue.

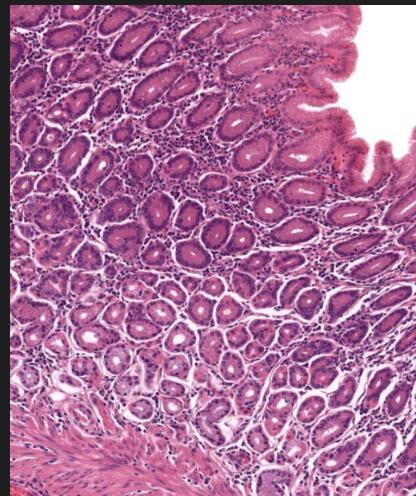


- **Cardiac Stomach:** the narrow region surrounding the opening of the esophagus that contains cardiac

glands in the mucosa.

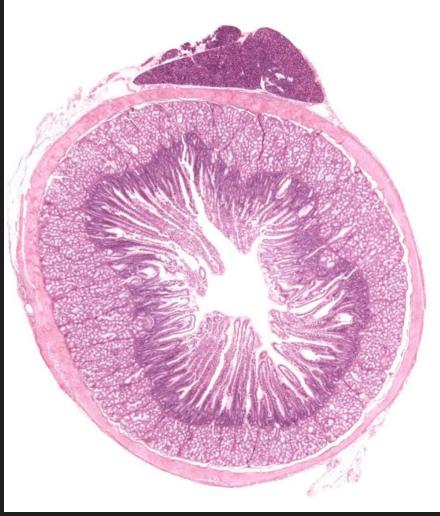
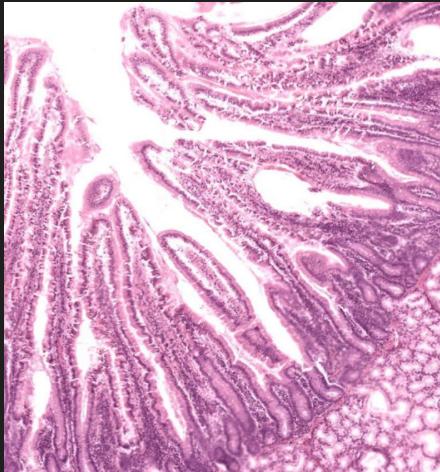
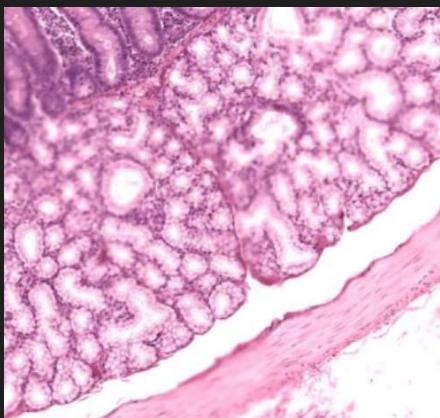
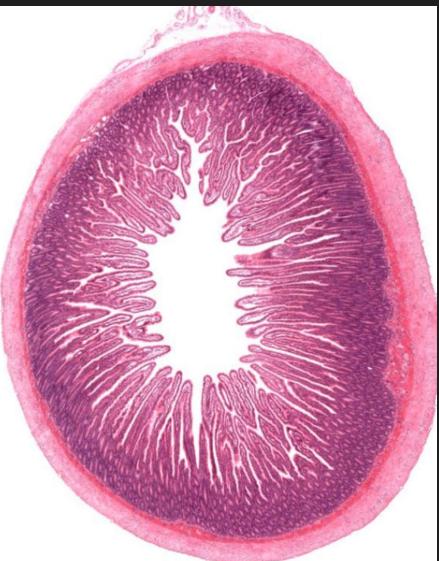
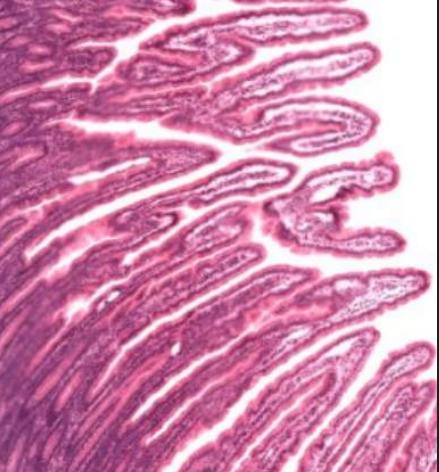
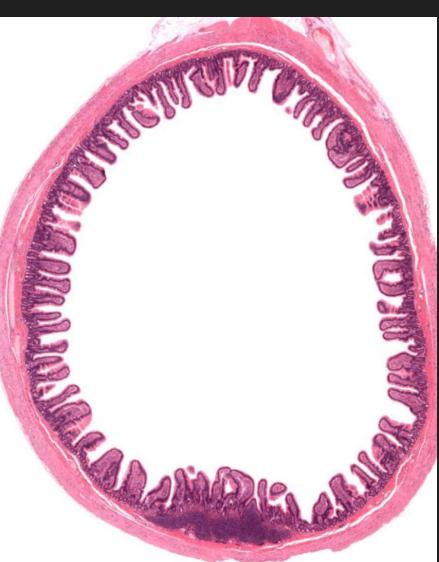


- **Cardiac Glands:** appear as cross-sections of the coiled tubular glands of mostly mucus secreting cells that empty into the bottom of gastric pits.

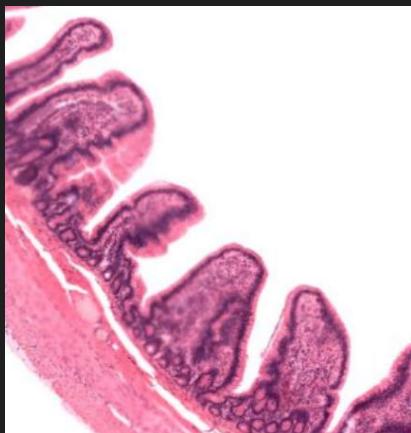


- To what ultrastructural feature does the brush border correspond?
 - The presence of mucous-secreting duodenal glands in its submucosa.

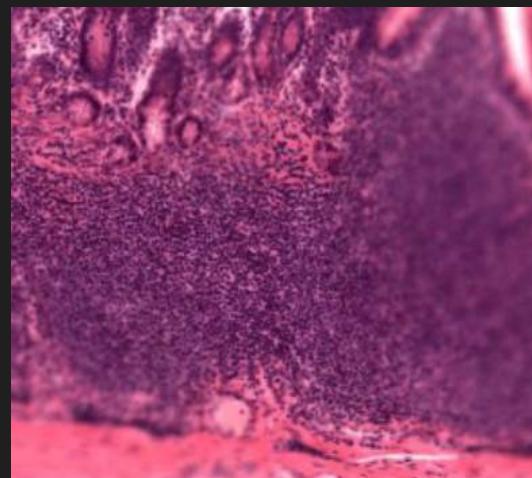
Small Intestine

- **Duodenum:** proximal portion adjacent to the stomach.

- **Villi (Duodenum):** tall, slender finger-like projections that extend into the lumen.

- **Brunner's Glands:** only region of the gastrointestinal tract (along with the esophagus) with glands in the submucosa.

- **Jejunum:** middle portion.

- **Villi (Jejunum)**

- **Ileum:** distal portion adjacent to the large intestine.


- **Villi (Ileum)**: short, broad finger-like projections with blunt ends that extend into the lumen.

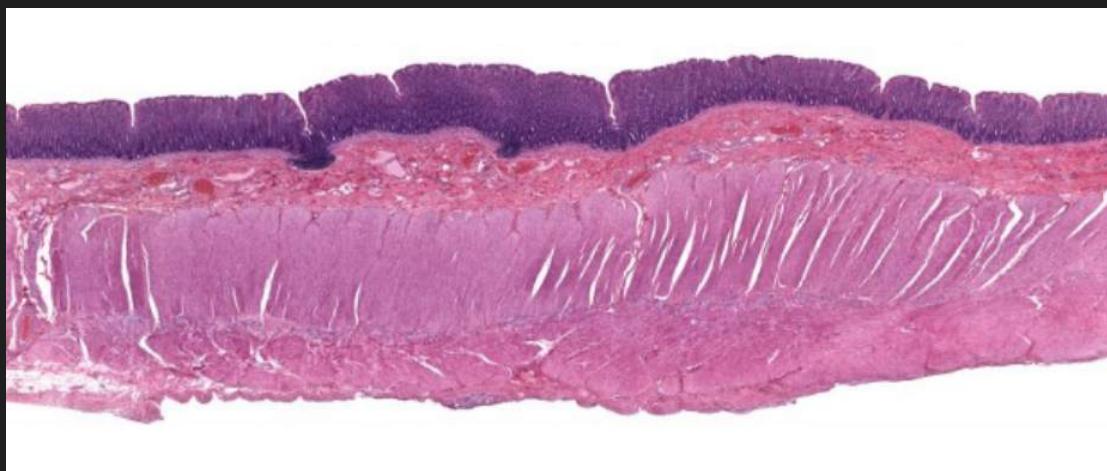


- **Peyer's Patches**: diffuse aggregations of lymphoid cells in the lamina propria.

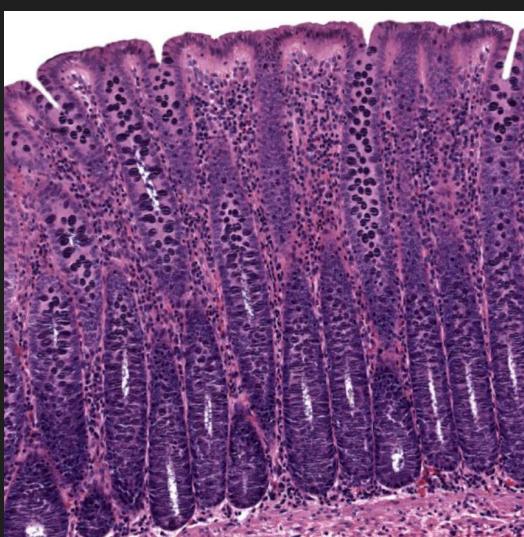


Large Intestine

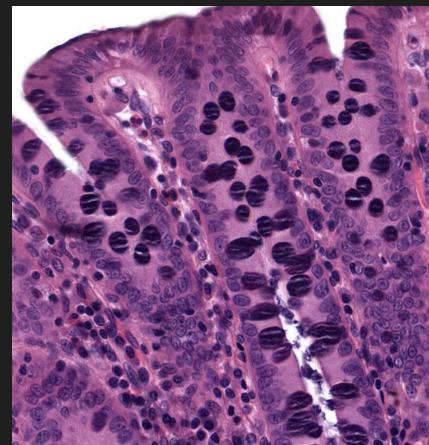
- **Colon**: The colon is composed of the four layers characteristic of the gastrointestinal tract. However, neither villi nor plicae circulares are present and goblet cells become more frequent.



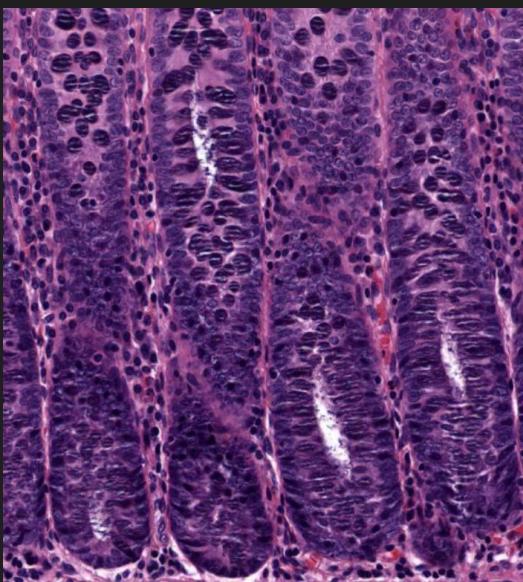
- **Mucosa**: mucous membrane.



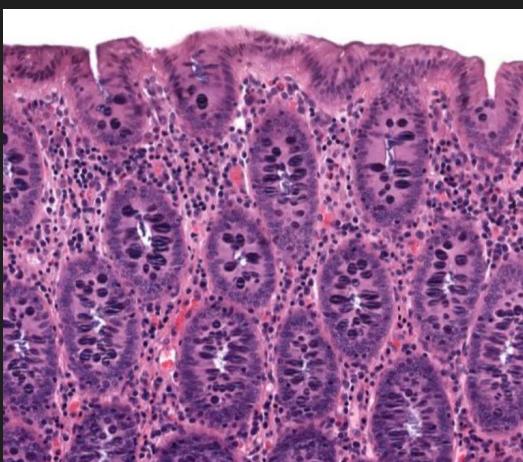
- **Epithelium**: with enterocytes (simple columnar cells with microvilli; i.e., the brush border) and goblet cells.



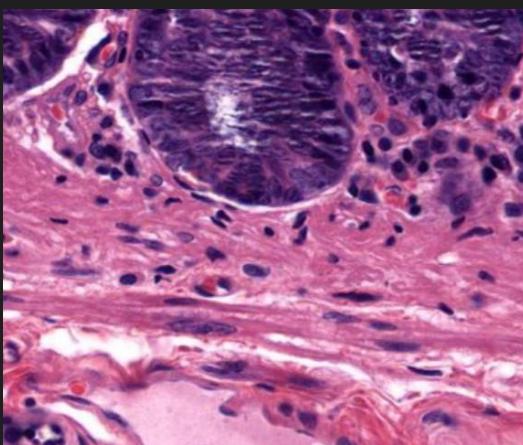
- **Intestinal Crypts of Lieberkuhn:** straight, unbranched, tubular glands.



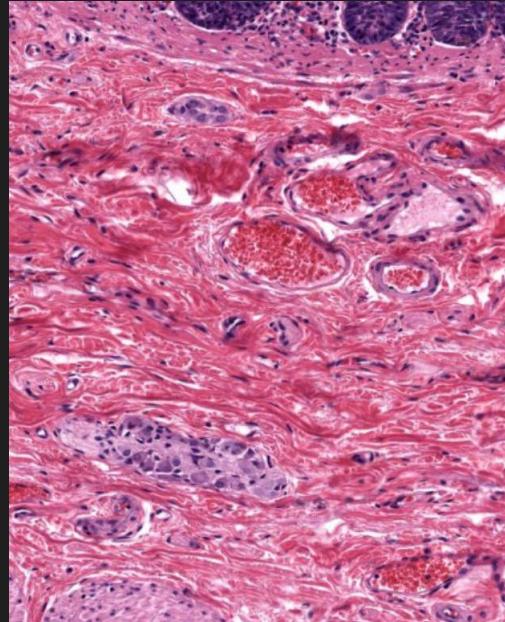
- **Lamina Propria:** abundant between cross-sections of the crypts. Many including cell types plasma cells, lymphocytes, eosinophils and macrophages can be seen.



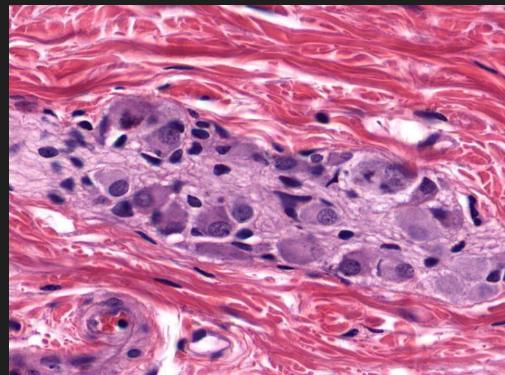
- **Muscularis Mucosae:** layer of smooth muscle.



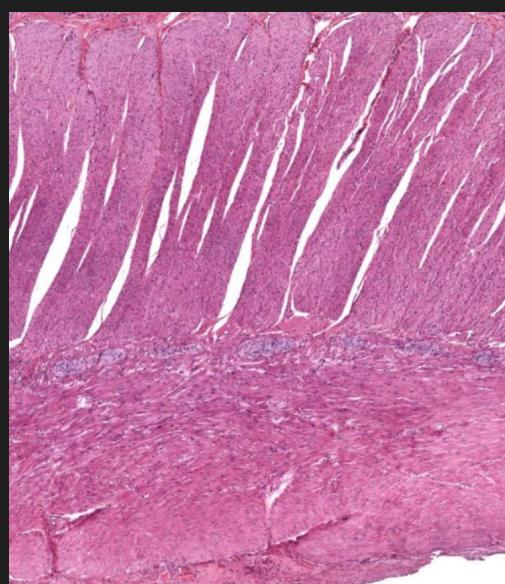
- **Submucosa:** dense irregular connective tissue.



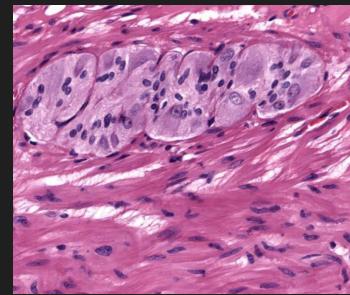
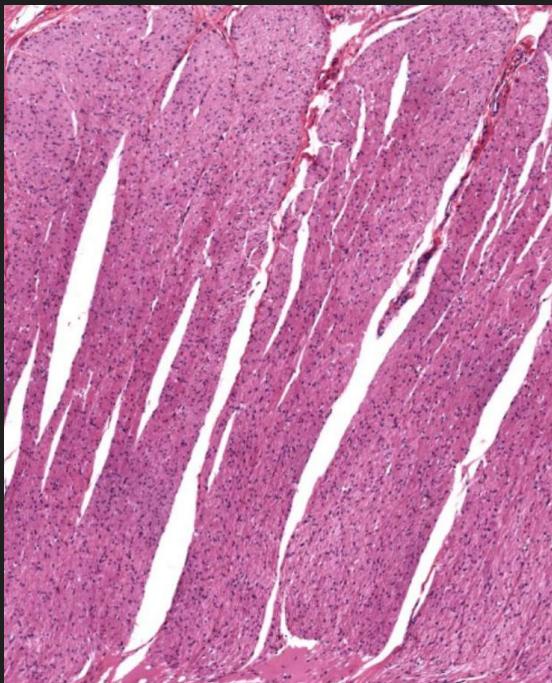
- **Meissner's Plexus:** provides secretory innervation of goblet cells and motor innervation of the muscularis mucosae.



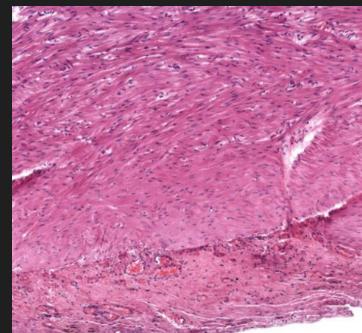
- **Muscularis Externa:** two orthogonal layers of smooth muscle.



- **Inner Circular Layer:** smooth muscle.
- **Auerbach's Plexus:** provides motor innervation of the muscularis externa.

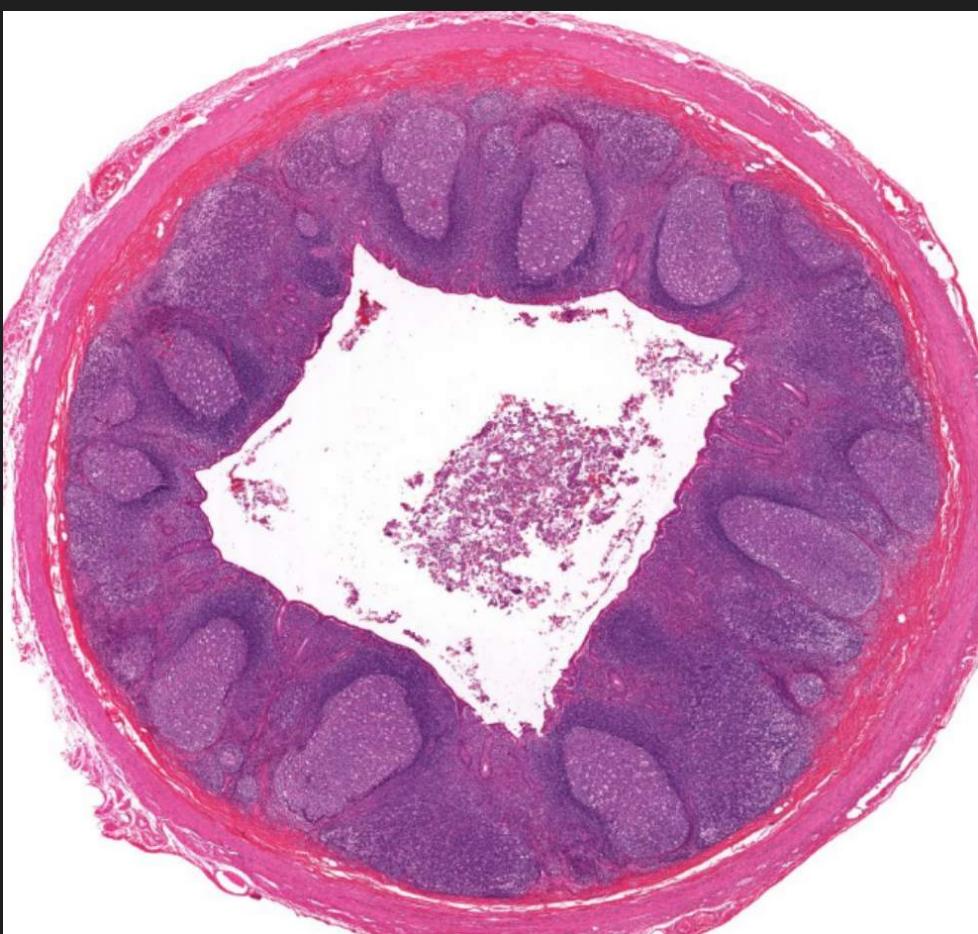


- **Outer Longitudinal Layer:** smooth muscle.

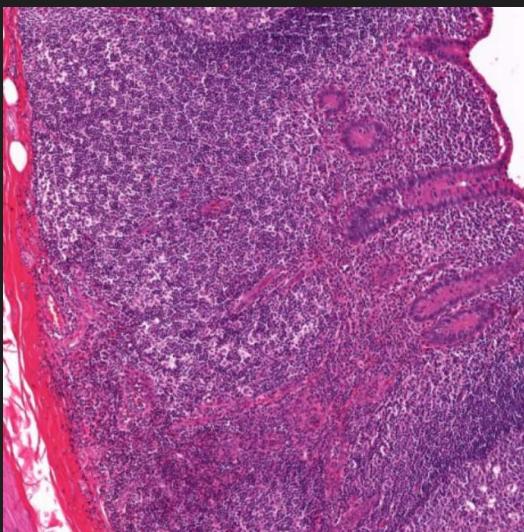


Appendix

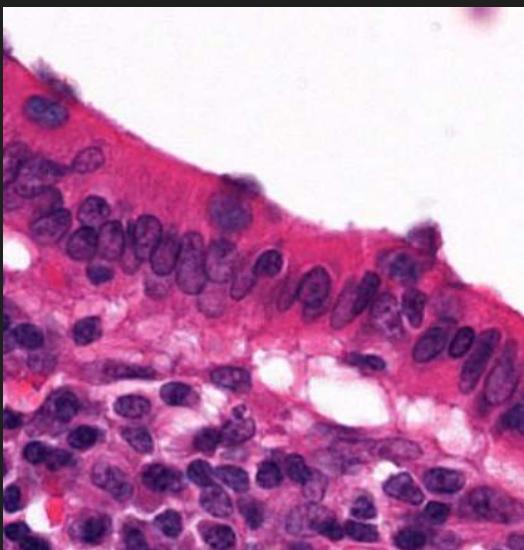
- **Appendix:** the appendix is composed of the four layers characteristic of the gastrointestinal tract.



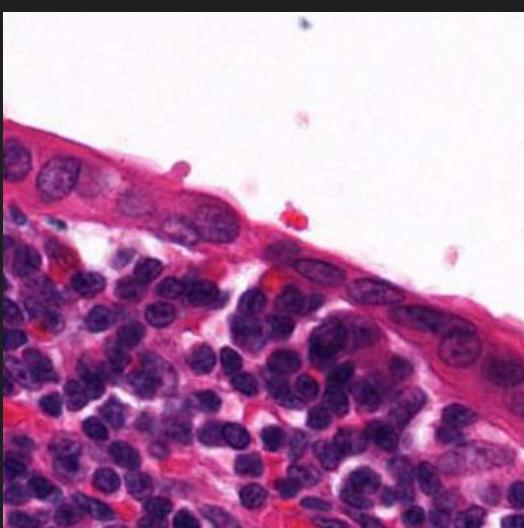
- **Mucosa**



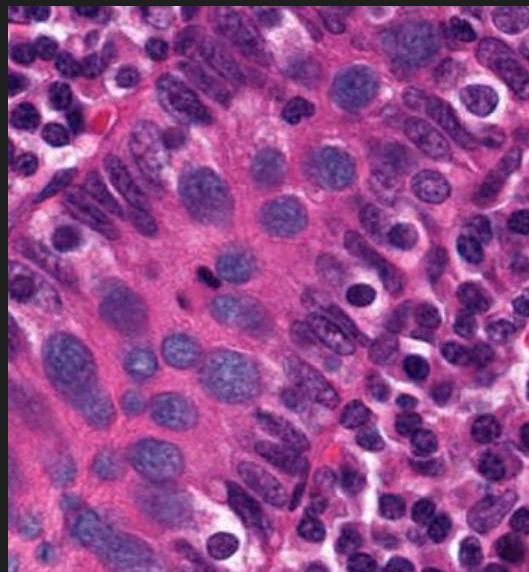
- **Enterocytes**: simple columnar cells with microvilli (or brush border).



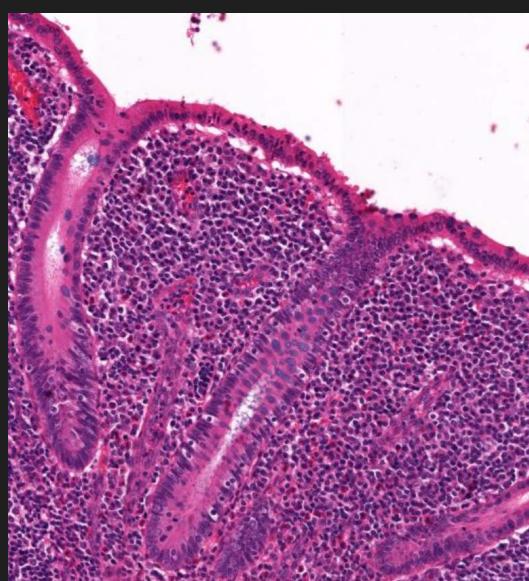
- **M-Cells**: cover nodules and have a lower profile than absorptive cells (small folds on their surface versus microvilli on absorptive cells).



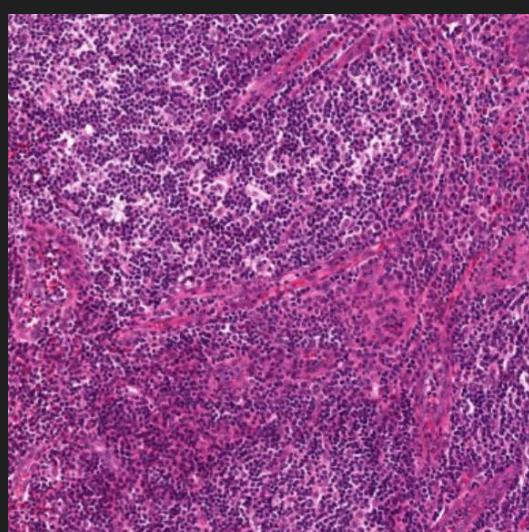
- **Goblet Cells**: secrete mucus for lubrication



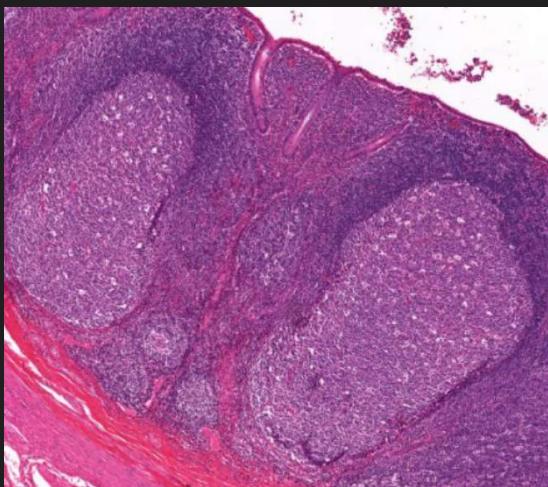
- **Crypts**: very few.



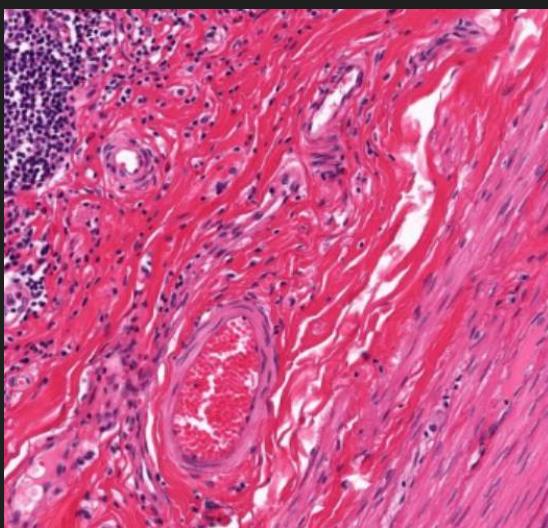
- **Lamina Propria**: comprises almost the entire mucosa.



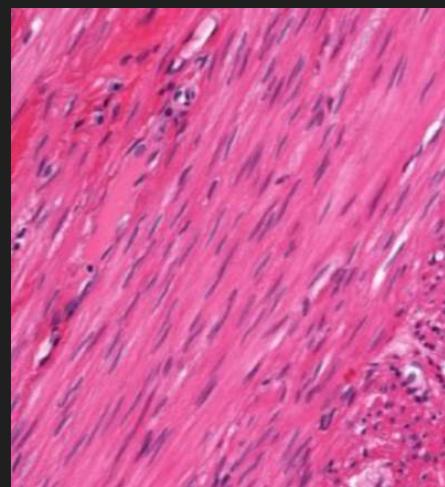
- **Nodules:** fill the lamina propria.



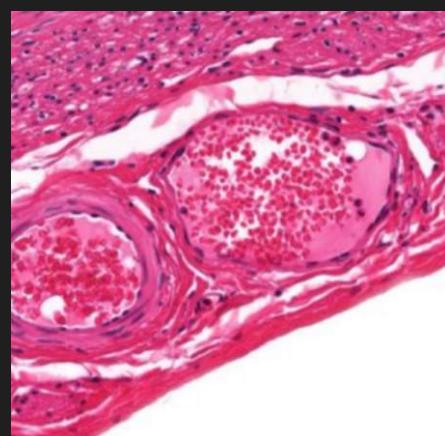
- **Submucosa:** nodules may extend into the submucosa



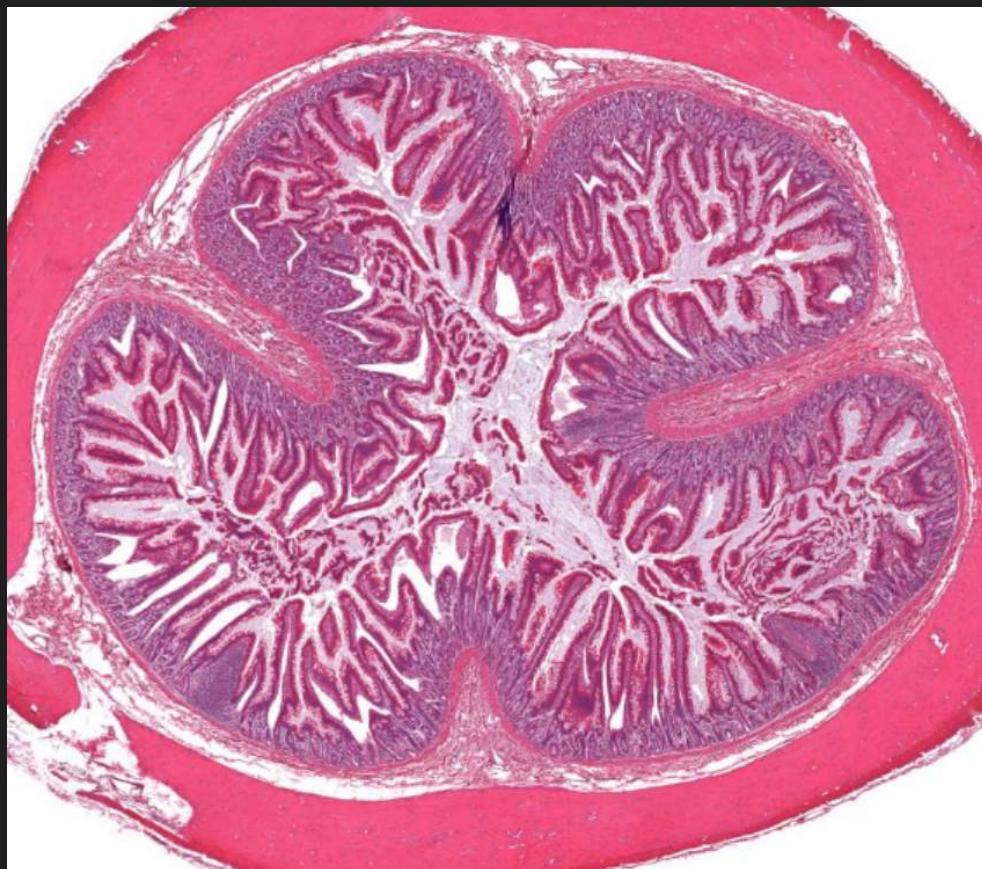
- **Muscularis Externa:** two orthogonal layers of smooth muscle (inner circular and outer longitudinal).



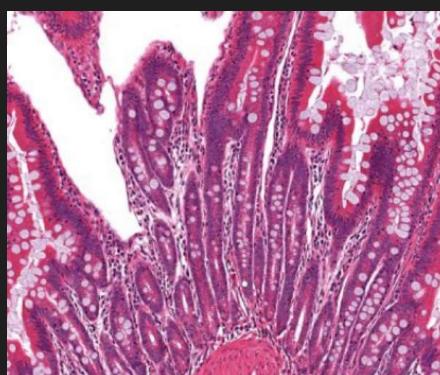
- **Serosa:** covers the outer surface of the appendix.



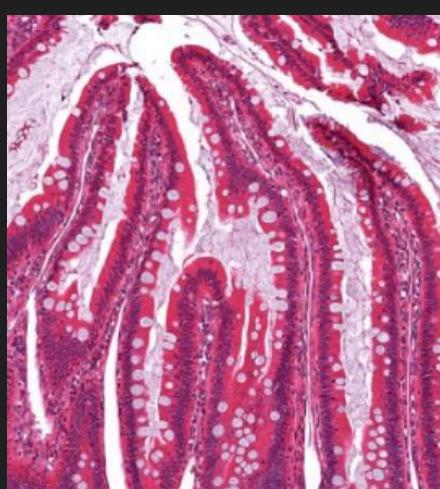
Rectum



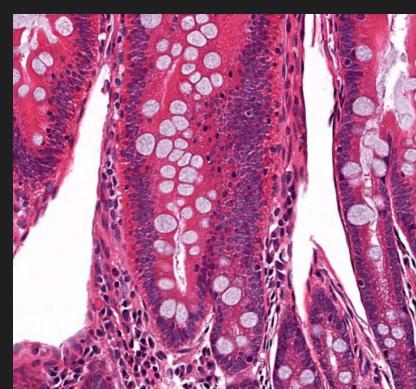
- **Mucosa:**



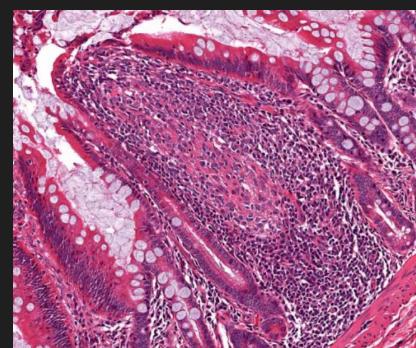
- **Villi:** cover the surface of the mucosa.



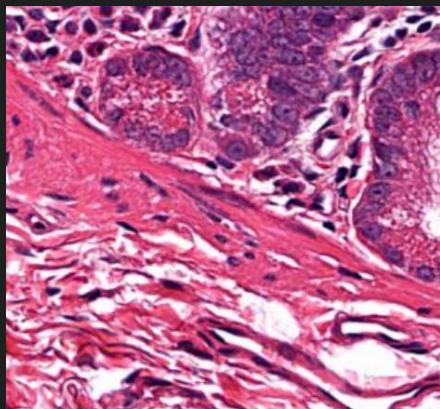
- **Crypts:**



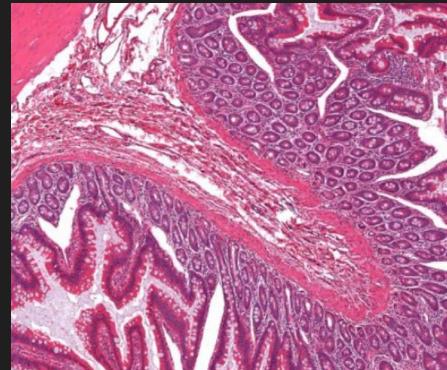
- **Lamina Propria:** loose connective tissue that supports the epithelium and forms the core of villi.



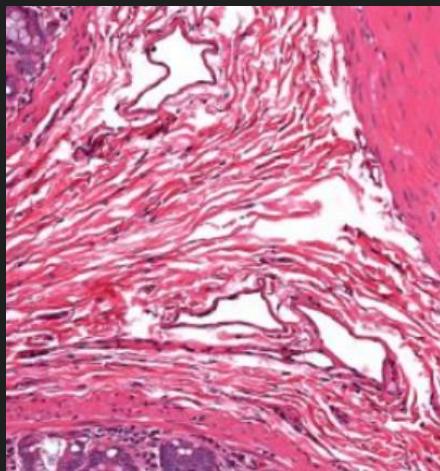
- **Muscularis Mucosae:** layer of smooth muscle



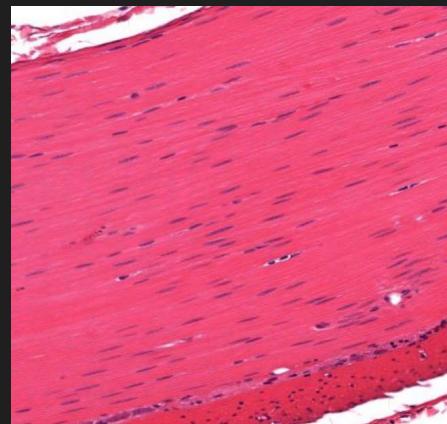
- **Anal Columns:** vertical folds of the mucosa and submucosa that project into the lumen.



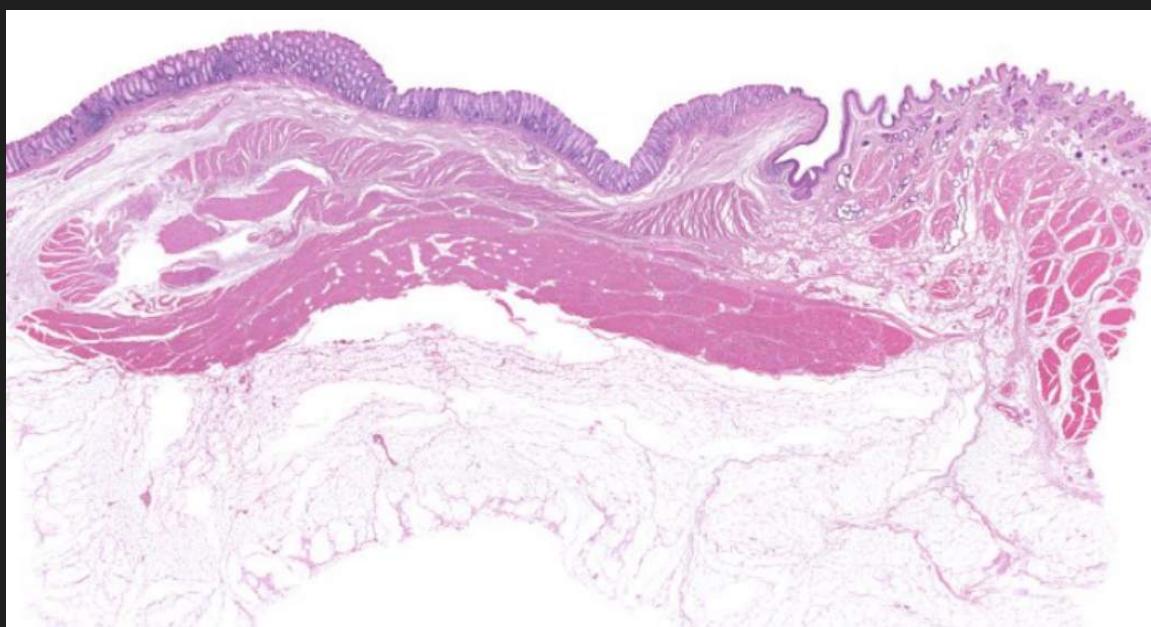
- **Submucosa:** dense irregular connective tissue.



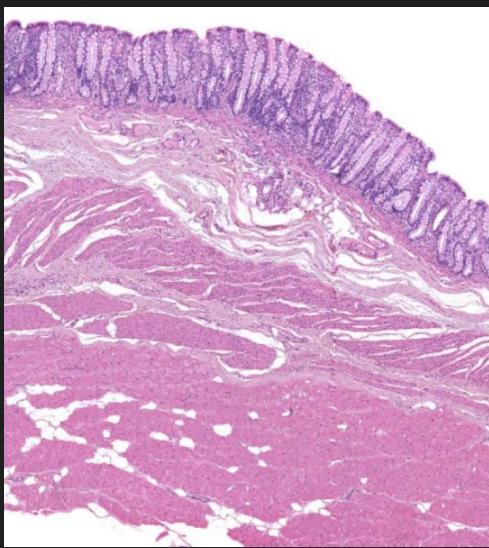
- **Muscularis Externa:** two orthogonal layers of smooth muscle (inner circular and outer longitudinal).



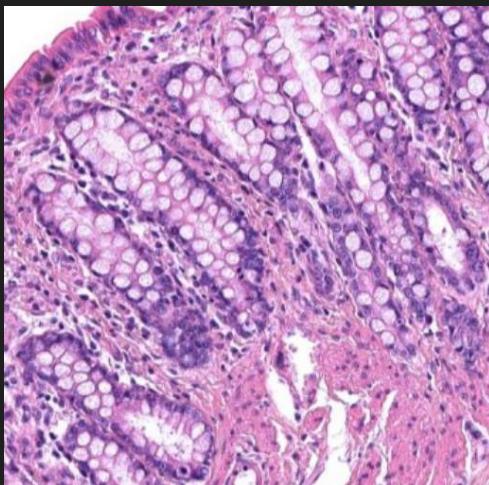
Recto-Anal Junction



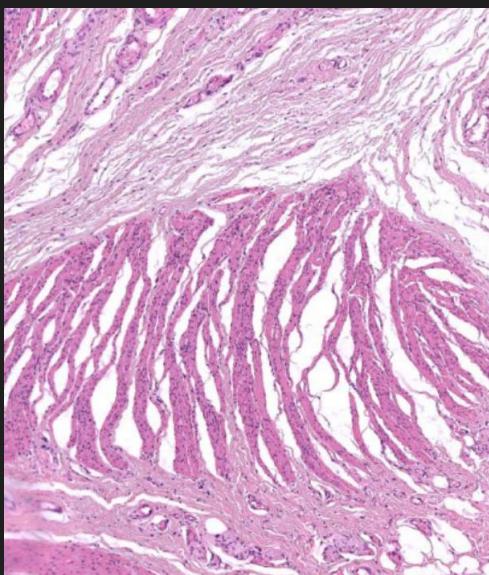
- **Colorectal Zone:** left side of the specimen



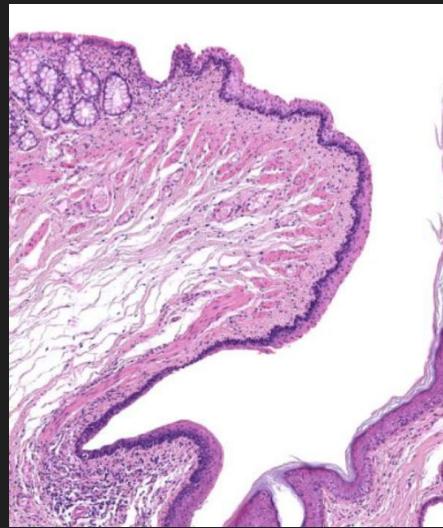
- **Anal Glands:** secrete mucus into the anal canal



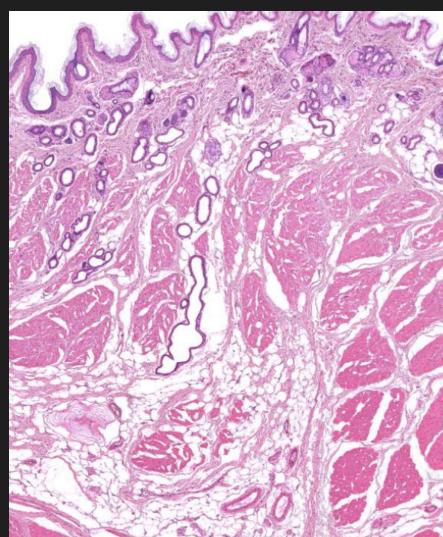
- **Internal Anal Sphincter:** an expansion of the inner circular layer of the muscularis externa



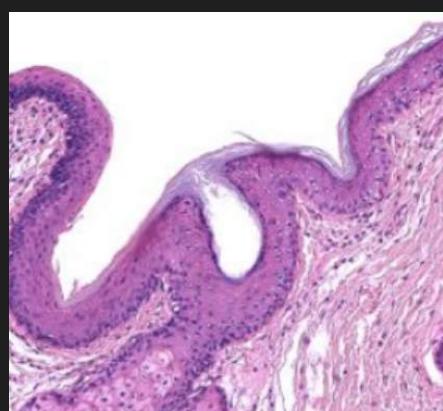
- **Pectinate Line:** junction between the simple columnar epithelium of the colon and the stratified squamous epithelium of the skin



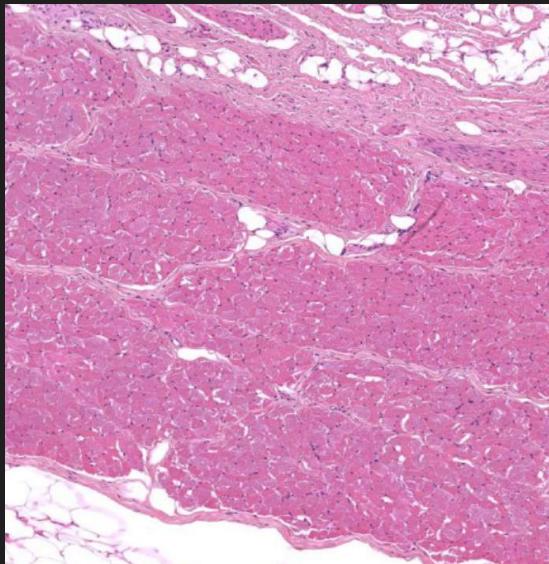
- **Squamous Zone of the Anal Canal:** right side of the specimen.



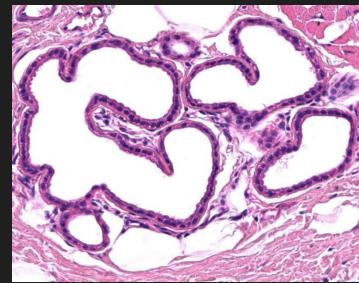
- **Stratified Squamous Epithelium:** initially is non-keratinized but becomes keratinized within a few millimeters.



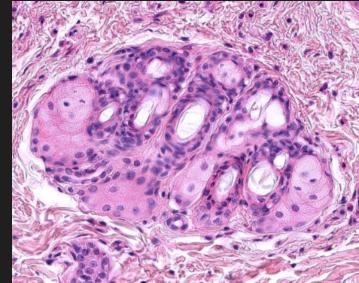
- **External Sphincter:** skeletal muscle that is part of the pelvic floor.



- **Circumanal Glands:** apocrine glands.



- **Sebaceous Glands:**



Parotid Gland

-
-

Liver

-

Gall Bladder

-

Pancreas

- Why can the liver be characterized as both an exocrine and endocrine organ?
- What are the secretory products of the exocrine pancreas?
- What is the major factor controlling insulin secretion?

Week 7: Respiratory, Integument, Urinary

Week 8: Endocrine, Male Reproductive

Week 9: Female Reproductive, Eye, Ear
