

Gastrointestinal Tract

Slide 126

This section through the esophagus shows the characteristic layers of the gastrointestinal tract. Examine the non-keratinized stratified squamous epithelium that lines the lumen. Notice the loose tissue of the lamina propria beneath the epithelium. Identify patches of muscularis mucosa and also the very extensive venous plexus within the sub mucosa. There are few, if any sub mucosal glands in this particular section. Next, focus on the muscle layers. Are these smooth or striated muscles at this level of the esophagus? What does that tell you about the level of the esophagus this is from? Finally, focus on the adventitia.

Slide 127

This is another section through the esophagus. Again, examine the mucosa, lamina propria with muscularis mucosa and the muscularis layers, as well as the adventitia.

Slide 128

Examine the mucosa of this section and determine the point of transition between the esophagus and stomach. There are multiple mucus glands in the lamina propria of the lower esophagus. Next, examine the gastric mucosa on the left of this slide with surface mucous cells. The gastric glands begin at the bottom of the gastric pits. These glands extend all the way down to the muscularis mucosa with loose connective tissue of the lamina propria in between the glands. Try to identify mucus neck cells, chief cells and parietal cells within these glands. Check out the large number of lymphocytes present within this loose connective tissue of the lamina propria. Finally, examine the muscular layers of the stomach as they blend with the esophagus and also examine the outer covering which here is a serosa lined by mesothelium.

Slide 129

This slide shows the layers of the stomach very well. Study the gastric pits, covered by surface mucous cells that are quite uniformly columnar. Notice that there are no goblet cells. Then follow the pits down to the gastric glands and again study the types of cells present in the glands. The parietal cells are much more evident in this section. Notice that since the gastric glands are tubular indentations, it's rare that you can follow one all the way down from its opening into the pit to the muscularis mucosa. Since the glands are very dense in this area, there is little loose connective tissue in the lamina propria in between glands. The muscularis mucosa is very prominent, and the submucosa, which is immediately subjacent, is highly vascular and contains somewhat thicker collagen bundles. The muscular layers of the stomach are more complex, and three layers have been described. *You'll not be responsible for identifying the individual layers of stomach muscle.* The serosa is on the outside of the organ.

Slide 130

The pyloric sphincter is the thickening of smooth muscle seen on the lower right portion of this slide. On the right side the epithelium is simple columnar with uniform surface mucous cells. On the left side of the slide, the muscular layer is much thinner and the columnar epithelium contains goblet cells (you have to look carefully). This portion is the proximal duodenum. Notice that the glands in this area do not contain parietal and chief cells. There is a thin muscularis mucosa and many submucosal glands. There are neurons of the enteric nervous system visible between longitudinal and circular layers of muscle.

Slide 131

This is a classic picture of the duodenum, with short villi, prominent intestinal glands (which extend down to the level of the muscularis mucosa), and submucosal glands deep to the muscularis mucosa. Notice the lamina propria with blood vessels and many lymphocytes extending into the villi. The 2 layers of the muscularis externa are very evident, as is some serosa on the upper side of this slide, and adventitia on

other portions of this duodenal section. Notice the pancreas attached to the lower side of the specimen.

Slide 132

At low power view the long delicate villi of the jejunum, with shorter glands beginning at the base of the villi. What's the function of villi? Next, view the epithelium at higher power and note the goblet cells present amongst the columnar epithelium. The lamina propria extends between glands and into the villi. There is a thin muscularis mucosa separating the lamina propria from the sub mucosa. There are a fair number of ganglion cells visible in the submucosa. Next examined the thick muscularis externa layers, which surround the organ, as well as the thin serosa on its surface. Which side of this specimen was attached to the mesentery?

Slide 62

This is also jejunum. The epithelium is quite well preserved, and it is much easier to see the goblet cells. You can also see the plicae circulares. Differentiate them from villi in the specimen.

Slide 134

At low-power, view the plicae circularis and the short villi of the ileum, as well as the glands. This is an excellent section to show the columnar epithelium and goblet cells. The muscularis mucosa is well defined and you can see the extensive number of lymphocytes in the lamina propria. Notice that in some places the lamina propria is thickened dramatically by collections of lymphoid nodules.

Slide 135

This is a mucus stained slide of the colon. You can see the vast number of goblet cells and also that the glands begin at the surface (there are no villi). There are a couple of collections of lymphocytes, suggesting some inflammation. In the muscularis, notice that there are discontinuities in the longitudinal layer, because the muscle fibers are segregated into taeniae coli.

Slide 136

This is another slide of the colon. Notice the mucosa with goblet cells. Realize that there are glands but no villi and a very evident lamina propria with a thin muscularis mucosa. The submucosa leads to a muscularis externa layer that has circular muscle and then longitudinal muscle. Notice that the longitudinal muscle is very thick in some places and thin in others.

Slide 137

This is a slide through the appendix. Notice that the mucosa has glands with goblet cells but no villi. There are multiple lymphoid collections with very evident germinal centers in the submucosa. The muscularis externa layer has both longitudinal and circular muscle layers.

Gastrointestinal Glands

Slide 140

This is a section of parotid gland. The great majority of the section is dominated by serous alveoli. Inspect these cells and their organization. There are areas of ducts within the center of collections of alveoli. Smaller ducts with very low cuboidal epithelium are intercalated ducts. There are larger intra-lobular ducts, most of which are striated. It is difficult to detect striations on these sections and somewhat easier on a microscope where one can focus up and down. However, notice that the epithelial cells of these ducts are rather tall and the nucleus is located close to the lumen of the duct (the apex of the cell). This is unusual for a tall cell, which normally has the nucleus close to the base of the cell. The nucleus is in this position due to

the cellular elements that make up the striations at the base of the cell. What is it that makes up the striations at the base of these cells? Notice that connective tissue divides the gland into lobes, with larger interlobar ducts within the connective tissue.

Slide 141

All of the same features can be seen in this submandibular salivary gland as were seen in the parotid. Additionally, many of the alveoli are mucus alveoli. You may be able to find some serous demilunes, as well, although don't spend too long looking for them.

Slide 142

This section through the pancreas looks a lot like the parotid gland. Notice the serous cells with basal basophilia and secretory granules on the apical side. Notice that the round, lighter-staining regions are actually collections of endocrine cells, the pancreatic islets. The intralobular ducts are harder to see because the epithelium is not as tall as it is in the salivary glands. Identify interlobular ducts as well as blood vessels. Focus on a couple of acini and see if you can identify any centroacinar (lighter staining) cells.

Slide 143

This slide of the pancreas stained with chrome alum phloxine shows the cells of the pancreatic islets better. We will come back to this slide in the endocrine lab.

Slide 144

This slide of pig liver shows classic liver lobules quite well because they're outlined by connective tissue. Notice the large vein at the center of a couple of these lobules and also notice the portal triads at the corners. There's usually a large vein, which is a branch of the portal vein, a much smaller artery, with smooth muscle in the wall, and a part of the bile duct system. The duct system can be identified because of the cuboidal epithelium (the blood vessels are lined by endothelium). The hepatocytes are not well preserved in the specimen, though you should be able to identify cords of the hepatocytes with blood sinusoids in between. These sinusoids lead from the area of the portal triads towards the hepatic vein at the center of the lobule.

Slide 145

It's not as easy to make out the liver lobules, but the histology of the cells is much better preserved in this specimen. Identify a portal triad and study its components. Follow cords of liver cells surrounding the sinusoid. Notice that the cells appear somewhat foamy. This is because they contained glycogen granules, which dissolve during preparation. There are some thinner, dark nuclei associated with sinusoids. These are Kupffer cells. Observe a central vein at the center of a lobule. This is the tributary of the hepatic vein.

Slide 61

Under high power notice the black pigment-containing Kupffer cells in the walls of the sinusoids. These are the "resident" macrophages of the liver.

Slide 147

The liver lobules are harder to make out, but the structure of cells is well preserved. Identify some portal triads and hepatic vein. Identify cords of liver cells and look for Kupffer cell nuclei.

Slide 148

This slide of the gallbladder shows mucosal folds. These are actually not villi since, if they were villi, you

would see some completely detached from the wall of the organ. Focusing in on the epithelium, note that there are no goblet cells. Also notice that there is no muscularis mucosa to separate a lamina propria from submucosa. The muscularis layer is irregularly organized and, therefore, you don't see two clear layers as is present through most of the gastrointestinal tract.

Slide 150

This slide of the gallbladder wall shows the same features that were shown in the last slide. It's easy to see that the epithelium consists of a single cell type, without goblet cells.

Endocrine System

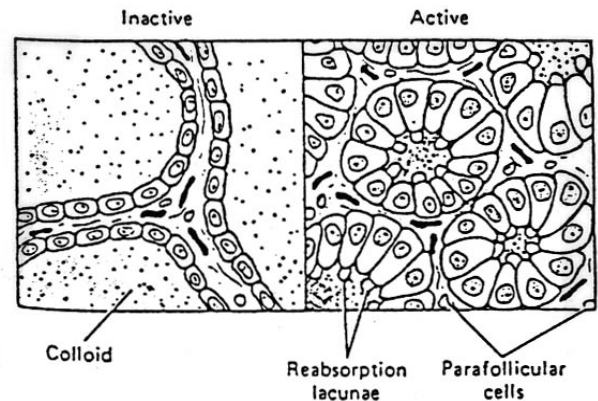
Slide 158 and 158B

This is a slide of the pituitary gland. Begin by identifying the **capsule (dura mater)**, **pars distalis**, **pars intermedia**, **pars nervosa**. Note the colloid-filled cysts in the pars intermedia. Now study the pars distalis at higher magnification, identifying **blood sinusoids**, and the characteristic secretory cells: **acidophils**, **basophils**, and **chromophobes**. In both slides the acidophils stain distinctly red, basophils blue, and chromophobes are weakly stained. The staining used in slide 158B shows the distinction between cell types even more dramatically. Which hormones are produced by each of the cell types?

Next, study the pars nervosa in detail. Note the strikingly different appearance from the pars distalis. Refresh your memory as to the significance of the **hypothalamo-hypophyseal tracts**. Stored neurosecretory substance (Herring bodies) is not visible unless special staining techniques are used. Most of the nuclei seen in this region are those of specialized glial cells ("**pituicytes**").

Slide 159

Thyroid parenchymal cells characteristically are arranged in a cyst-like fashion around a central storage vacuole usually filled with a highly eosinophilic secretory product called **colloid**. (The parallel cracks in the colloid are preparation artifacts). The colloid consists mainly of **thyroglobulin**, the storage form of the hormones **T₃** and **T₄**. The cyst-like bodies are called **follicles**. Study the follicles in detail. The size of the follicles varies with their physiological activity as well as with the plane of sectioning. Note the more or less simple cuboidal **follicular epithelium**. The height of the epithelium also varies with physiological activity; in general, the higher the epithelium the greater the activity. Look for "active follicles" showing "**reabsorption lacunae**"



Thyroid histology. Note the small, punched-out "reabsorption lacunae" in the colloid next to the cells in the active gland.

Slide 160

This slide of plastic embedded thyroid tissue shows some cytological details better than the previous slide. Look for the same general features as described above. There is a bit of an associated parathyroid gland on the left. **Parafollicular ("C") cells** may occur singly among the follicular epithelial cells, inside the follicular basal lamina but not making contact with the colloid, or in clusters outside the follicles, but their positive identification requires immunocytochemical techniques. What hormone do these cells secrete and what are its physiological effects?

Slide 161

Look for the parathyroid gland embedded in this section of thyroid gland. The gland consists mostly of closely-packed cords or clumps of small, basophilic, secretory **chief (principal) cells**. The gland has a connective tissue capsule of its own. Connective tissue stroma is minimal but contains many blood capillaries. Look for small clusters of larger, eosinophilic **oxyphil cells**. These cells usually do not appear until after puberty, and increase in numbers with age. Their function is still uncertain. Finally, check out the well-preserved brown adipose tissue, vessels and myelinated nerve trunks in the adjacent tissue at the top of the section.

Slide 162

The amount of adipose tissue in the human parathyroid is variable. The section seen here contains a good deal of adipose tissue, but the parenchymal cells, both chief cells and oxyphil cells, are well preserved and easily distinguished.

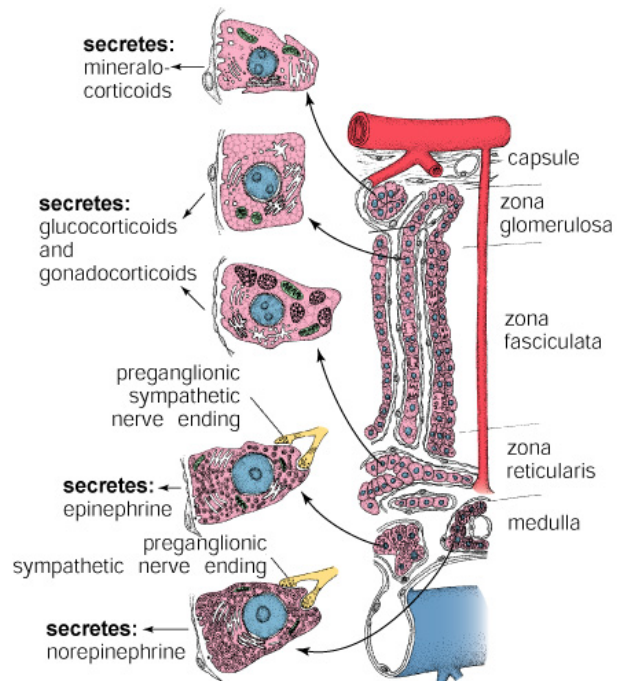
Slide 163

First identify **capsule, cortex and medulla**. You should have no trouble distinguishing the cortical zones, from outer to inner: **zona glomerulosa, zona fasciculata, zona reticularis**. Note the characteristic arrangement of parenchymal cells in each zone and the intervening blood sinusoids. You should know the hormones produced in each zone.

Now study the medulla noting the characteristic **chromaffin cells** (modified sympathetic ganglion cells) and abundant blood sinusoids. (Review the blood supply to the cortex and medulla). Note the peculiar large, veins of the medulla.

Slide 164

This plastic-embedded thin section of the adrenal gland permits a more detailed study of the cytological features of the cortex and medulla components. Note especially the highly vacuolated appearance of the cells of the zona fasciculata. What is producing this vacuolated appearance?



Adrenal Gland

Slide 142

Study the distribution of islets in this relatively thick but typical H&E section of the pancreas.

Slide 143

Distinguish exocrine from endocrine parts of the pancreas. Study several islets at higher magnification. With this special stain, glucagon producing **alpha cells** stain red and insulin producing **beta cells** stain blue (the blue staining of the beta cells is not dramatic in this slide). Alpha and beta cells represent 20 and 75 percent of the islet cell population respectively. With more complex staining procedures two other cells can be identified: somatostatin secreting **delta cells** and **clear cells** without stainable granules. Another islet cell type located preferentially in the head region secretes **pancreatic polypeptide (PP)** in response to food ingestion. This hormone stimulates gastric secretion while inhibiting bile secretion and intestinal peristalsis.

Slide 162

Examine the pineal gland (right at the center of this section), which is an organ that is comprised of modified retinal cells (pinealocytes) and glial cells. The pinealocytes release melatonin into the circulation in a circadian fashion, under the control of the sympathetic nervous system (in lower species they directly respond to light). The most striking histological features of the pineal are the concretions surrounded by parenchymal cells of the pineal gland, known as pinealocytes, together with their supporting glial cells.