

LABORATORY 24 - DIGESTIVE SYSTEM, continued - SMALL AND LARGE INTESTINE (third of three laboratories)

OBJECTIVES: **LIGHT MICROSCOPY:** Recognize structure and characteristics of the different regions of the small (duodenum, jejunum and ileum) and large (colon, appendix and rectum-anal canal) intestine. Analyze the characteristics of the four layers of each organ according to general plan of the organization of the digestive tract. Recognize the glands that occur in each region of these organs and the cell types and distribution of cells present in the glands in the different regions. Correlate observations with the functions of the organs and cells.
ELECTRON MICROSCOPY: Recognize ultrastructure of glands and the epithelial cells on the surface and that line the glands of the mucosa and submucosa of small and large intestine.

ASSIGNMENT FOR TODAY'S LABORATORY:

GLASS SLIDES

[SL 14](#) Jejunum
[SL 19](#) Jejunum (PAS-eosin-azure II)
[SL 54](#) Duodenum
[SL 11](#) Ileum
[SL 95](#) Ileum - Stained for enteroendocrine cells
[SL 73](#) Pyloric-Duodenal transition
[SL 53](#) Colon
[SL 99](#) Appendix
[SL 182](#) Rectum-Anal Canal

ELECTRON MICROGRAPHS

E.M^s. 9, 10 and 16 Small Intestine

POSTED ELECTRON MICROGRAPHS

#21 Small intestine SEM
#22 Small intestine
S-68 Paneth cell
S-72 Enteroendocrine cells

[Lab 24 Posted EMs](#)

HISTOLOGY IMAGE REVIEW - available on computers in HSL

Chapter 14, Alimentary Canal

Frames: 940-993

EXTRA CREDIT CASE ON BLACKBOARD: CELIAC SPRUE

SUPPLEMENTARY ELECTRON MICROGRAPHS

Rhodin, J. A.G., An Atlas of Histology

Copies of this text are on reserve in the HSL.

Intestines pp. 318 – 328

- F. JEJUNUM We will begin with this section from the middle of the small intestine because it is well-preserved.
1. SL 14 - H and E. Study this slide noting all characteristics of small intestine.
 - a. Grossly - plica circularis (enclosed by red line) are visible on the luminal surface (W. 14.16, 14.18). They are highly developed in this region of small intestine.
 - b. Mucosa - Note intestinal villi and crypts of Lieberkühn (simple tubular glands (villus within blue line; crypt, within red line) (W.14.19, 14.20-14.21). Compare to mucosa of stomach.
 - 1) Epithelium - simple columnar epithelium in which both enterocytes (absorptive cells) and goblet cells are evident and extend into crypts.
 - a) Paneth cells located exclusively at base of crypts (J. 15-28 to 15-30; W. 14.20-14.21, 14.26).
 - b) What cell type is found in glands of both stomach and intestine, but can be distinguished only by special staining methods? (J. 15-18; W. 14.25).
 - 2) Lamina propria - connective tissue in villi extending to muscularis mucosa. Within the lamina propria, diffuse lymphoid tissue is abundant (small nodules visible) and small bundles of smooth muscle extend from the muscularis mucosa (lymphocytes, red arrows; smooth muscle, blue arrows)
 2. SL 19 – (med) PAS-eosin-azure II (same tissue as 14). In addition to goblet cell (enclosed by green line) what structures are stained with PAS on this slide? On the apical surface of enterocytes? On the basal surface? On the lateral surface?
 3. Electron microscope - Study EM 9, 10, and 16. Review the features of enterocytes (surface absorptive cells) (J. 15-22 to 26; W. 14.23, 14.25), goblet cells and Paneth cells (J. 15-29).
- G. DUODENUM (J. 15-32; W. 14.15 to 14.19)
SL 54 (low). Note post-mortem degeneration has eroded the surface epithelium. Identify villi that lack epithelium. There is a large duct in or near the wall. What is it? Remember your gross anatomy.
1. The mucosal characteristics are similar to the jejunum.
 2. The duodenum can be identified by a component of the submucosa that may extend partially into the mucosa. These are mucous glands (enclosed by red line) that are called submucosal or Brunner's glands.
- H. ILEUM
1. Although the mucosa is similar to the other intestinal regions the villi become shorter and the plica are poorly developed.
 2. SL 11 (scan). The most significant feature of the ileum is the presence of abundant lymph nodules. Look for aggregated lymphatic nodules (red arrows) (nodules shown in W. 14.16b). Review the general features of the small intestine and compare the various segments. Do the nodules alter the structure of the mucosa? What epithelial cell type is associated with nodules (J. 15-31 to 15-33)?
 3. SL 95. (Even desks only) - Ileum - Stained for enteroendocrine cells (long, cross). (W. 14.25) – Locate cells containing black granules in the epithelium of the glands (blue arrows). A few of these cells may be evident in the epithelium of the villi. Observe that the granules are located basally. These cells secrete small peptide hormones from the basal cytoplasm. In some slides the reticular fibers may be stained and also silver grains may be apparent in the glycocalyx as well as in the apical region of the enterocytes. There are many types of enteroendocrine cells that secrete different hormones, but have similar histological characteristics. There are subtle differences between different groups of enteroendocrine cells, some of which may be distinguished by specialized staining

procedures or electron microscopy. The specific cell types may be differentiated only by immunocytochemical methods. Most histological methods use silver nitrate to distinguish between two classes of enteroendocrine cells. (Cells containing granules that reduce ammoniacal silver nitrate solutions and therefore stain black are enteroendocrine cells, also called argentaffin cells. If sections are treated with a reducing agent before being exposed to silver nitrate additional cells, called argyrophilic, can be stained. These two classes of cells are widely distributed in the G.I. tract and other organ systems.)

I. PYLORIC-DUODENAL TRANSITION (W. 14.15)

1. [SL 73](#). In this slide distinguish between pylorus of stomach and duodenum and find the region of [transition](#). What are the different characteristics of these two regions that allow them to be distinguished?
2. The pyloric sphincter is a thickened muscle that is part of the muscularis externa. Locate this structure ([muscle of sphincter outlined, blue line](#)). From which layer of the externa does it arise mainly?

J. COLON (J. 15-38 to 15-40, 15-42; W. 14.29, 14.31)

1. [SL 53](#) ([low](#)). Mucosa - Villi are absent in the colon. The crypts of Lieberkühn are somewhat longer than in the small intestine.
 - a. Epithelium. Enterocytes are similar in appearance to those found in small intestine. Goblet cells are more numerous, but Paneth cells are absent essentially.
 - b. The lamina propria contains many lymph nodules.
 - c. Muscularis mucosa is composed of two layers of smooth muscle
2. Muscularis Externa
 - a. The muscularis externa has [teniae coli](#) (J. p. 320; W. 14.29a). These are three thickened bands of longitudinal smooth muscle that extend throughout the colon. Compare this slide with [SL 11](#).
 - b. On these slides be sure to review the structure and functions of the components of the enteric nervous system (Auerbach's, myenteric, plexus and Meissner's, submucosal, plexus) that is found between the circular and longitudinal layers of smooth muscle J. 15-37).

K. APPENDIX (W. 14.31)

[SL 99](#) ([scan](#)). In this "normal" appendix the lining epithelium has been sloughed off. Compare the appendix to the colon ([SL 53](#)). The mucosa is similar, however, lymph nodules are more numerous. Teniae coli are absent and in general the muscularis externa is less well developed.

L. RECTUM-ANAL CANAL; cutaneous junction (infant) (W. 14.32)

1. [SL 182](#) ([scan](#), [low](#)). Note that the epithelium of the surface and glands of the rectum show post mortem degeneration.
2. Find the transition regions in the mucosa. The epithelium changes from columnar to stratified squamous ([blue arrow](#)) and finally becomes keratinized. The crypts of Lieberkühn disappear and the connective changes from lamina propria to dermis ([med](#)).
3. The muscularis externa undergoes changes, the circular muscle becomes thicker and forms the internal anal sphincter ([internal anal sphincter within blue line; external anal sphincter within red line](#)) and the longitudinal muscle forms separated bundles and ends. Skeletal muscle forms the external anal sphincter. Try to identify the different muscular structures on the slide. The diagram in the lecture handout may be helpful.

M. Compare the different regions of the G.I. system, using Figure 14.31 in Wheater's Atlas.

OBJECTIVES FOR LABORATORY 24: INTESTINES

1. Using the light microscope or digital slides, identify:

Review overall structure of digestive tract (e.g. mucosa, submucosa), see lab 23

Small intestine

Structures

Plica circularis

Villi

Intestinal crypts (of Lieberkühn)

Enterocytes (absorptive cells)

Brush border / microvilli

Cells

Paneth cells

Goblet cells

Enteroendocrine cells (on slides with special staining)

Regions

Duodenum

Submucosal (Brunner's) glands

Ampulla of Vater

Pyloric-duodenal junction

Pyloric sphincter

Jejunum

Ileum

Peyer's patches

Large intestine

Structures

Intestinal crypts (of Lieberkühn)

Teniae coli

Cells

Enterocytes (absorptive cells)

Goblet cells

Appendix

Rectum-anal canal

Transition of epithelium

Internal anal sphincter

External anal sphincter

2. On electron micrographs, identify:

Small intestine

Enterocytes

Microvilli

Goblet cells

Paneth cells

Secretory granules

Enteroendocrine cells

Secretory granules

Large intestine

Enterocytes

Goblet cells

Enteroendocrine cells

REVIEW

1. Briefly describe the types of ducts that are found in the salivary glands. What are their functions?
2. In what ways is the formation of dentin similar to the formation of bone? Compare to the formation of enamel.
3. Review the types and arrangement of muscle in the lip and tongue. How is this correlated with function?
4. Describe the muscle layers that occur in the mucosa and externa of the esophagus.
5. What are the different cell types that may be distinguished in gastric glands? How do they appear in the light microscope? What are their functions?
6. Compare a plica and a villus in the jejunum.
7. Where are M cells located?
8. What cell types occur in the crypts of Lieberkühn of the colon?