Medical School Histology Basics
Digestive System

VIBS 289 lab

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Objectives

To understand the general organization of organs of the digestive system and how they function to obtain metabolites necessary for growth and energy for the body, yet maintain a barrier between the environment and the internal milieu of the body.

To identify and describe functions of cellular structures, cells, and groups of cells in the digestive system.
Function of the Digestive System

Movement of food

Secretion of digestive juices

Absorption of digested foods, water, and electrolytes
Adaptation of G.I. Tract for Specific Function

<table>
<thead>
<tr>
<th>Function</th>
<th>Organ</th>
</tr>
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<tbody>
<tr>
<td>Simple passage from one part to another</td>
<td>Esophagus</td>
</tr>
<tr>
<td>Storage of food or feces</td>
<td>Stomach or distal colon</td>
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<tr>
<td>Digestion</td>
<td>Stomach, small intestine</td>
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<tr>
<td>Absorption of end products</td>
<td>Small intestine, proximal colon</td>
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</tbody>
</table>
Small intestine
Large intestine
General Structure of the Digestive Tract

- Epithelium
- Lamina propria
- Muscularis mucosa
- Submucosa
- Muscularis externa
- Serosa
General Structure of the Digestive Tract

- Epithelium
- Lamina propria
- Submucosa
- Muscularis externa
- Serosa

Small intestine
General Structure of the Digestive Tract

Epithelium
Lamina propria
Muscularis mucosa
Submucosa
Muscularis externa

Large intestine
Stomach
Large intestine

Serosa

Muscularis externa

Mesothelium

Inner, thicker circular layer

Outer longitudinal layer of the muscularis externa

Stomach

Muscularis externa

Serosa

Inner, thicker circular layer

Outer longitudinal layer of the muscularis externa
Fig. 10-2  Tongue: Apex (longitudinal section, panoramic view). Stain: hematoxylin and eosin. Low magnification.
Non-keratinized stratified squamous epithelium, Mucus and Serous glands, Skeletal muscle,
FILIFORM PAPILLAE

Figure 23–6. Scanning electron micrograph of the filiform papillae of rabbit tongue. (Micrograph courtesy of F. Fujita.)
Slide #12 (1101). Tongue, rabbit.

- Filiform papillae
- Foliate papillae
- Skeletal muscle
- Foliate papillae that possess Taste buds
- Serous glands
- Taste buds
Chapter 11: Digestive System. Esophagus and Stomach

Fig. 11-1  Upper Esophagus: Wall (transverse section). Stain: hematoxylin-eosin. Low magnification.
Esophagus

Non-keratinized stratified squamous epithelium.

Sub-mucosal glands
Skeletal muscle

Muscularis externa
Esophagus – skeletal and smooth muscle

- **Epithelium**
- **Lamina propria**
- **Muscularis mucosa**
- **Submucosa**
- **Muscularis externa**
- **Serosa**
Lamina propria
Muscularis mucosa
Non-keratinized stratified squamous epithelium
Submucosa
Muscularis externa
Sub-mucosal Mucus and Serous glands
Skeletal muscle,
If outer layer is not covered by mesothelium = adventitia
Muscularis externa of the upper esophagus is composed mostly of skeletal muscle.

The muscularis externa in middle to lower esophagus is composed mostly of smooth muscle.
Cardio-esophageal junction

Luminal epithelium changes from stratified squamous to simple columnar epithelium in the cardiac region.
The stomach have no goblet cells, no brush border on surface cells, and no villi.
Dog cross section of body

- Liver
- Stomach
- Pancreas
- Esophagus
- Intestine
Fundic stomach

- Mucosa
- Antibody-producing plasma cells
- Submucosa
- Gastric pits
- Ganglion cells of the Auerbach's plexus regulate the muscularis externa
- Ganglion cells of the Meissner's plexus regulates muscularis mucosa
- Muscularis externa
Fundic stomach

- Gastric pits and gastric glands
- Surface mucous cells
- Mucous neck cells
- Chief cells and parietal cells
- Enteroendocrine cells
Mucus neck cells Fundic stomach, rabbit (toluidine blue)

Chief cells

Enteroendocrine cells

Parietal cell
EM 15 Parietal cell produces

1. HCl

2. Bicarbonate

3. **Intrinsic factor** for vitamin B12 absorption by gut: needed in red blood cell formation
Fundic stomach, monkey (PAS)

- Mucous neck cells
- Parietal cells
- Chief cells
- Enteroendocrine cells
- Surface mucous cells
Fundic stomach, rabbit (toluidine blue)

Parietal cells

Gastric pits

Mucous neck cells

Surface mucous cells

Lumen

Enteroendocrine cells

secretory canalicus

mitochondria
Granules of surface mucous cells

Mitochondria

Nuclei

Lumen

PAS

H&E

Toluidine blue

Surface mucus cells

interdigitations of plasma membrane

apical mucous granules

desmosome

tight junction

RER

basal lamina
EM 14

- Large granules of chief cell
- Granules of an argentaffin cell
- Lamina propria
- Nuclei
Pyloric glands of the stomach contain mucous cells
Fig. 11-11  Pyloric–Duodenal Junction (longitudinal section). Stain: hematoxylin-eosin. Low magnification.
147  Pyloroduodenal junction, baboon

- **Intestine**
- **Stomach**
- **Muscularis mucosa**
- **Lamina propria**
- **Muscularis externa**
- **Lymphoid nodule**
146 Duodenum, monkey

Crypts of Lieberkühn

Enteroendocrine cell

Goblet and absorptive cells,

Lamina propria.

Muscularis mucosa

Submucosa

Submucosal Brunner's glands.
Duodenum

- Brunner’s glands
- Absorptive cells
- Goblet cells
- Paneth cell
- Enteroendocrine cell
- Intestinal villus
Mucus of goblet cells and the carbohydrates in the brush border are PAS positive for sugars.
EM 17 Basal portion of intestinal absorptive cell

1. Plasma cell
2. Lymphocyte
3. Smooth muscle
4. Intestinal absorptive cell
5. Macrophage
6. Lumen of capillary
7. Pericyte of capillary
EM 4. Apical portion of intestinal absorptive cell

1. Microvilli of brush border
2. Droplets of goblet cell
3. Terminal web
4. Lipid in SER
5. lumen
Basal portion of intestinal absorptive cell
1. Mitochondria
2. Nuclei of intestinal absorptive cell
3. Smooth muscle of muscularis mucosa
4. Basal lamina
EM 4b

Brush border of intestinal absorptive cells

Mitochondria
Intestinal absorptive cells in cytoplasm just above the nucleus
Duodenum (small intestine)

Auerbach's plexus, found in between the circular and longitudinal smooth muscle layers in small intestine

Auerbach's plexus
Nerve cell bodies
Ileum

Meissner’s plexus cell bodies in submucosa

Paneth cell

Small intestinal villi

Submucosa
Argentaffin cells of Ileum, monkey

Paneth cell

Enteroendocrine cells also called Argentaffin cells
Compare luminal surfaces of the small and large intestines
Fig. 12-6  Large Intestine: Colon and Mesentery (panoramic view, transverse section). Stain: hematoxylin-eosin. Low magnification.
Large intestine or Colon, monkey
Solitary lymph follicles in the lamina propria seen throughout the GI tract help the immune system maintain a barrier between the environment and the internal milieu of the body. Other contributors include luminal epithelium, HCl in the stomach, and mucus produced by many goblet cells in the intestines.
Fig. 12-7  Large Intestine: Colon Wall (transverse section). Stain: hematoxylin-eosin. Medium magnification.

Fig. 12-10  Anal Canal (longitudinal section). Stain: hematoxylin-eosin. Low magnification.
Large intestines

Anal skin
In summary

Function of the Digestive System

Movement of food

Secretion of digestive juices

Absorption of digested foods, water, and electrolytes

The digestive system functions to obtain metabolites, yet maintain a barrier between the environment and the internal milieu of the body.
Questions on the Digestive system

1. Which of these cells is/are found both in the stomach and intestines?
   a. enteroendocrine (argentaffin cells)
   b. fibroblasts
   c. goblet cell
   d. **a and b**
   e. a, b, and c

2. The digestive system functions to obtain metabolites necessary for growth and energy needs; however, it must maintain a barrier between the environment and the internal milieu of the body. Which of the following is the least effective feature of this barrier?
   a. composition of saliva
   b. acid environment of the stomach
   c. large volume of mucus produced into the lumen of the large intestine
   d. **the chylomicron fat absorption mechanism via central lacteal**
   e. nearby and abundant immune defense structures and mechanisms
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The end of

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