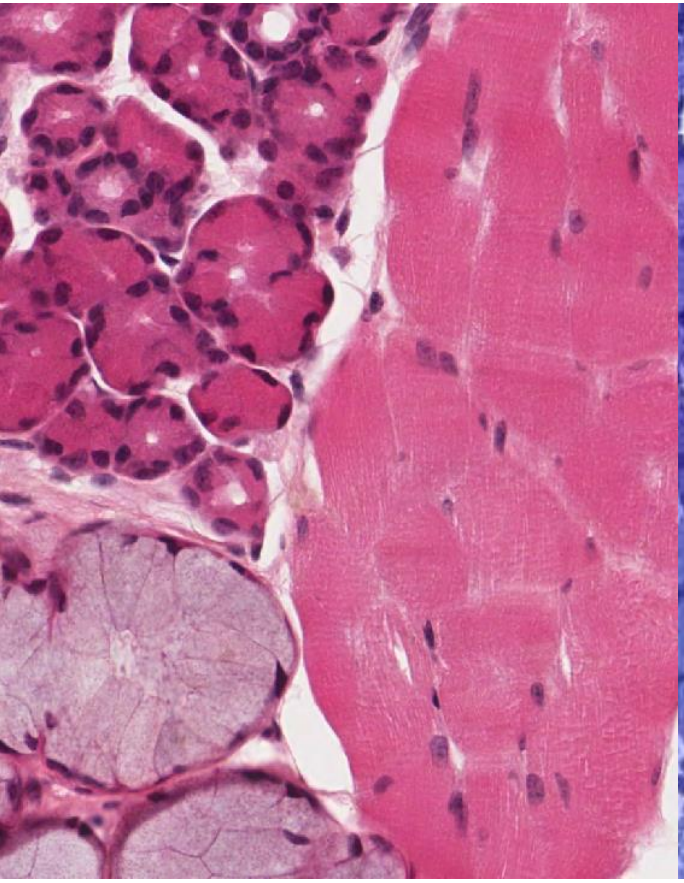
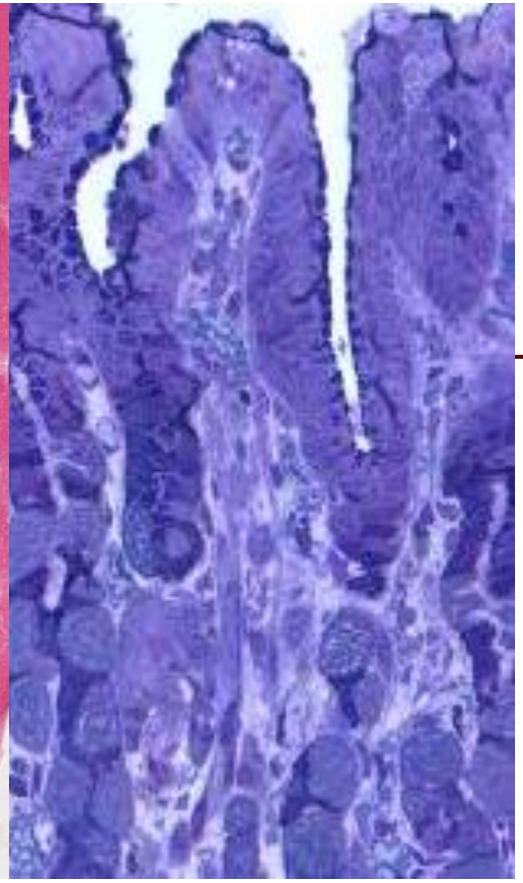
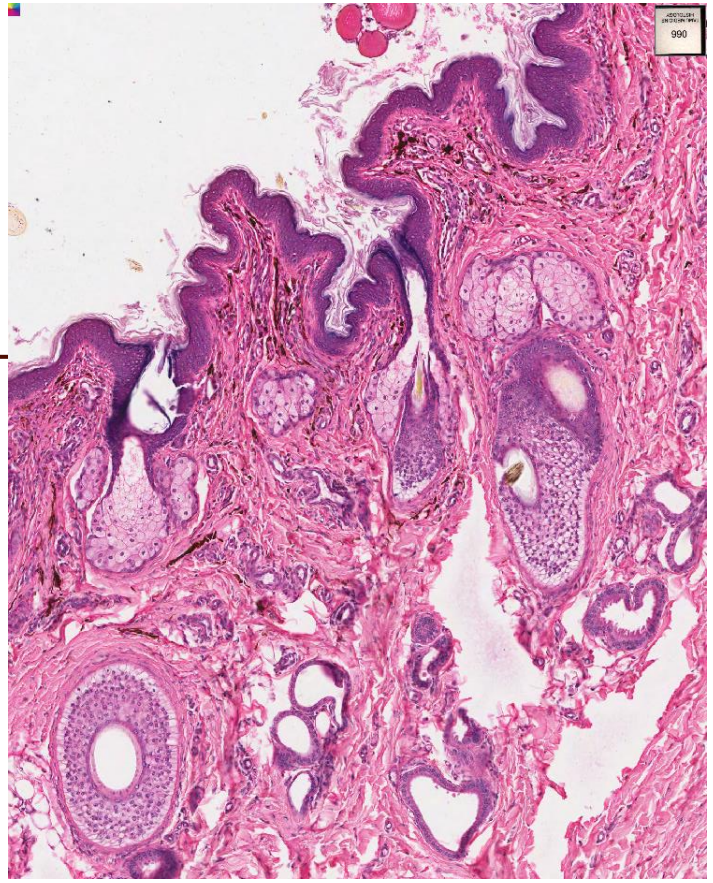
DIGESTIVE SYSTEM I GASTROINTESTINAL TRACT PART 1: CELLS







Dr. Larry Johnson

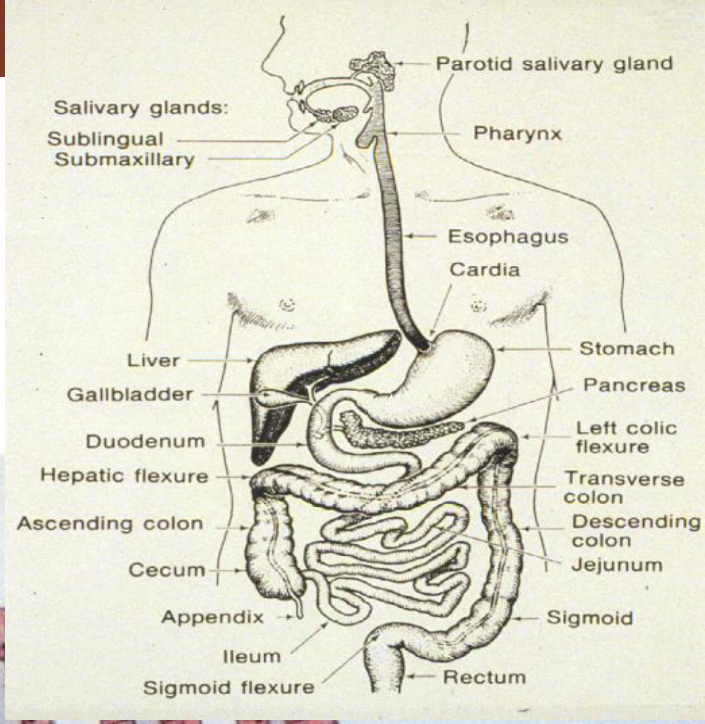
Texas A&M University

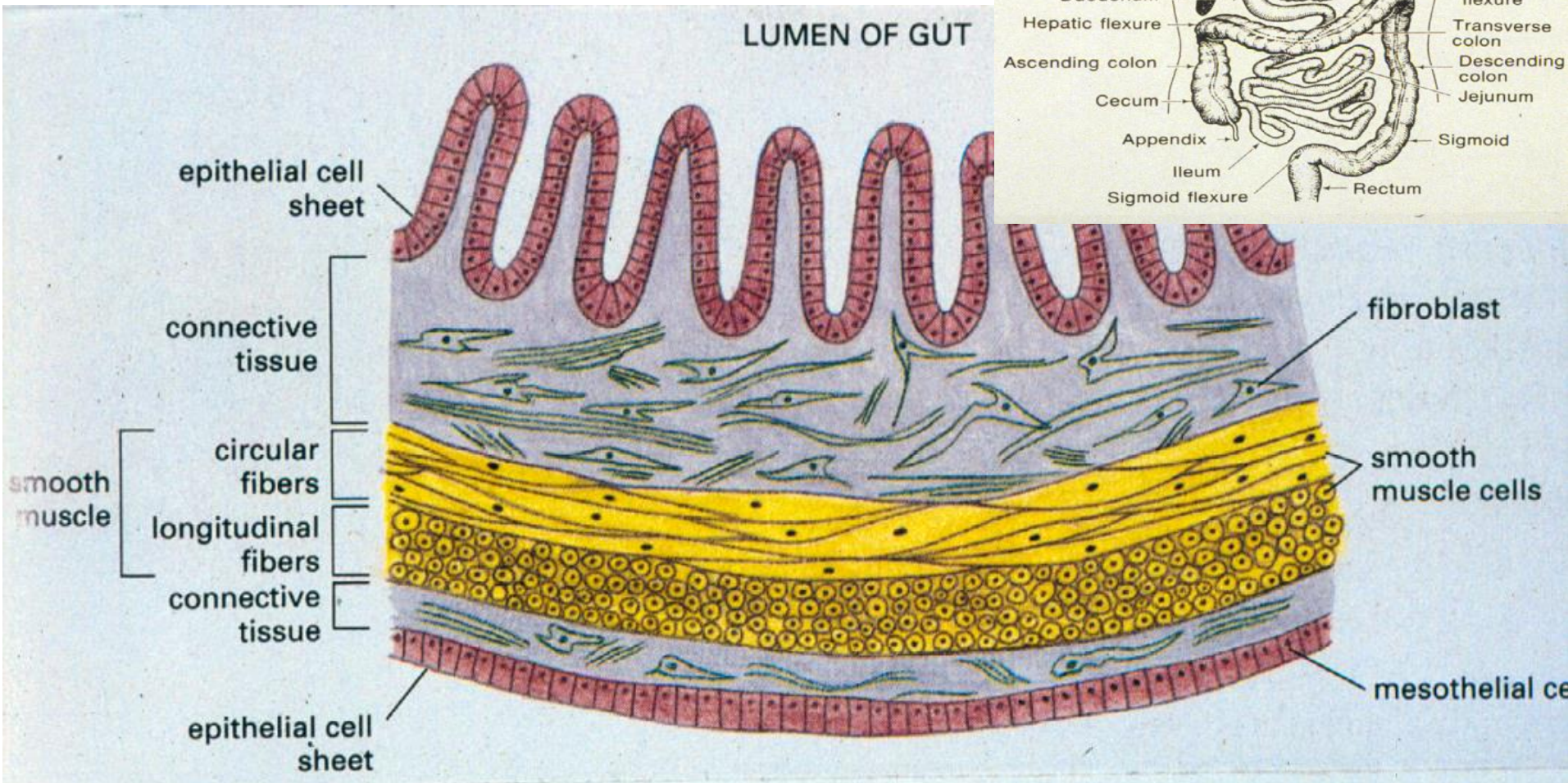
Objectives Digestive System I

- Name the parts of the digestive tract.
- Identify the four layers that form the walls of the tubular organs of the digestive tract and the tissue types found in each layer.
- Identify and know the distinguishing structural features of the various regions of each of the tubular organs of the digestive tract.
- Identify the organ region and cell types present from a slide or photomicrograph of a section of any part of the digestive tract

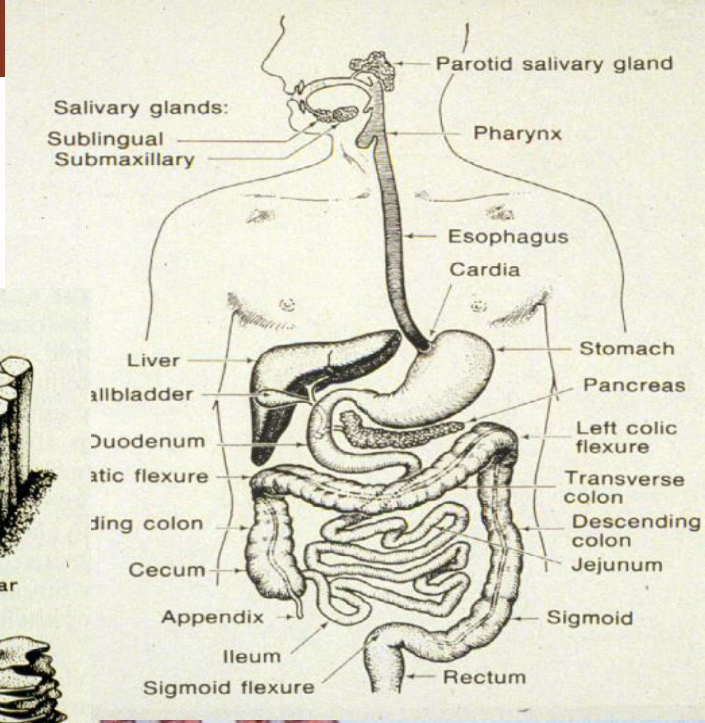
- Part 1: Cells of the digestive system
- Part 2: Oral cavity to stomach
- Part 3: Small and large intestines

CELLS, CELLULAR STRUCTURES, AND GROUPS OF CELLS IN THE DIGESTIVE SYSTEM

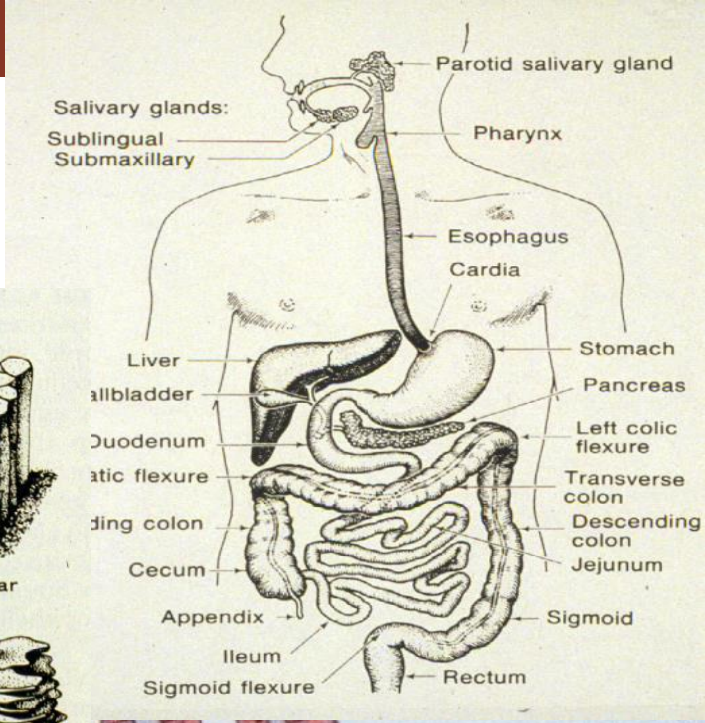


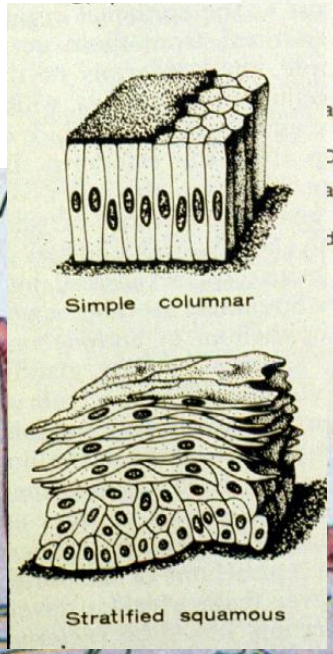


CELLS, CELLULAR STRUCTURES, AND GROUPS OF CELLS IN THE DIGESTIVE SYSTEM

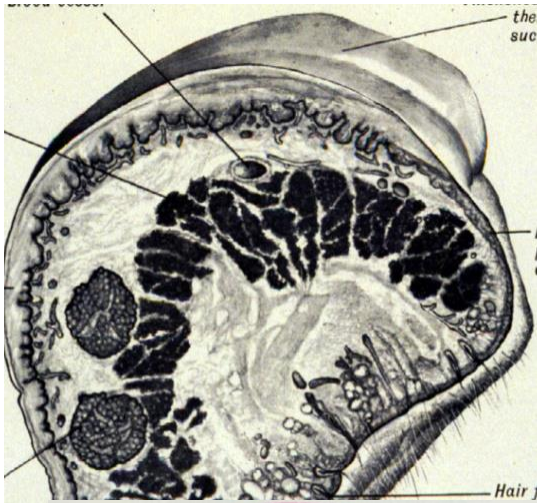


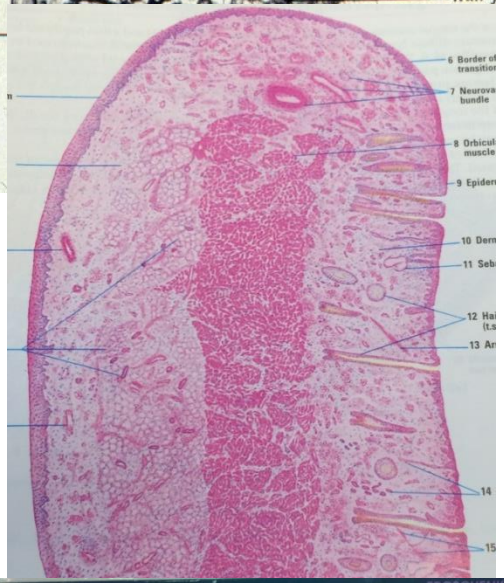
CELLS, CELLULAR STRUCTURES, AND GROUPS OF CELLS IN THE DIGESTIVE SYSTEM

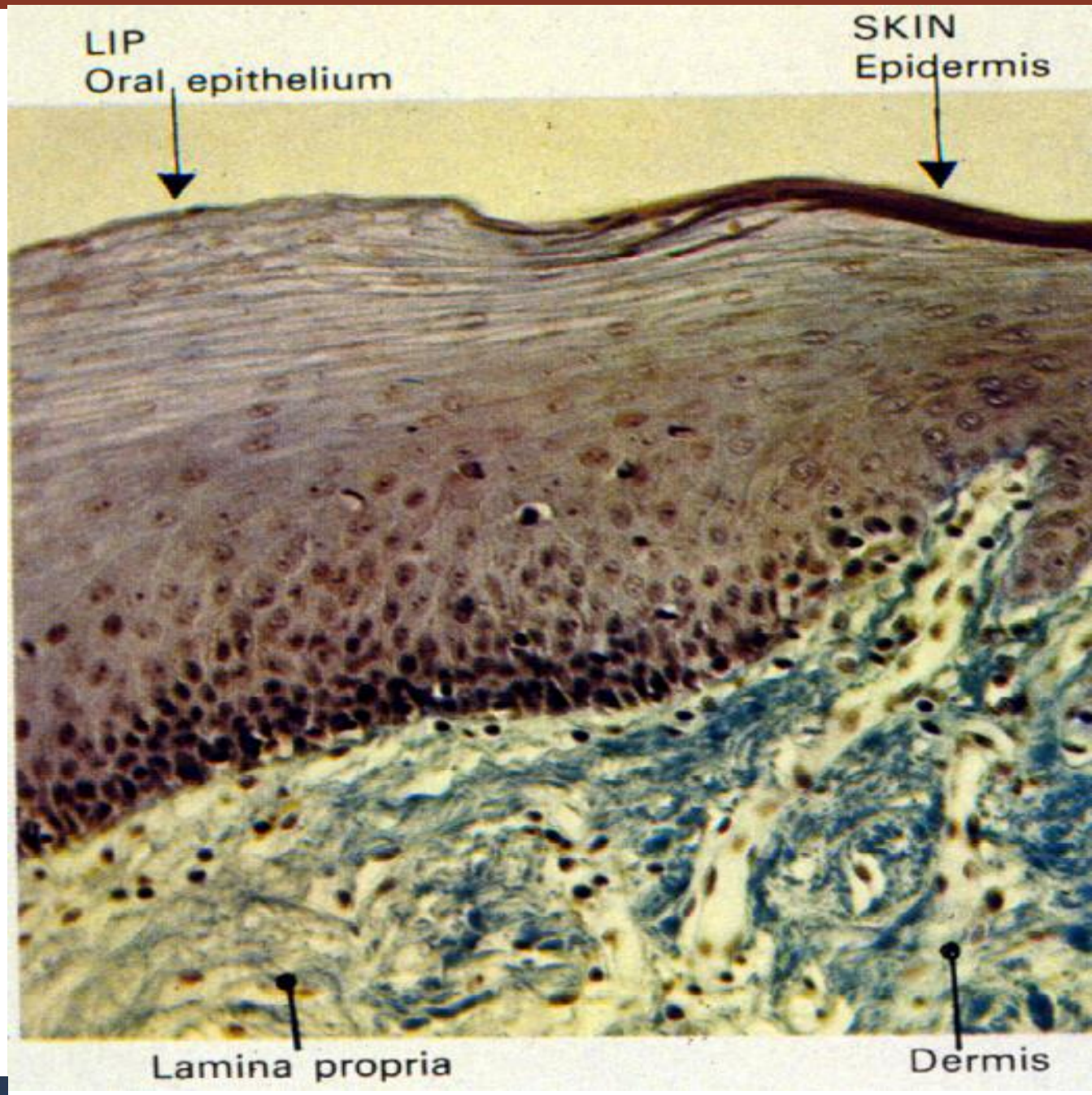




MUCOCUTANEOUS JUNCTIONS







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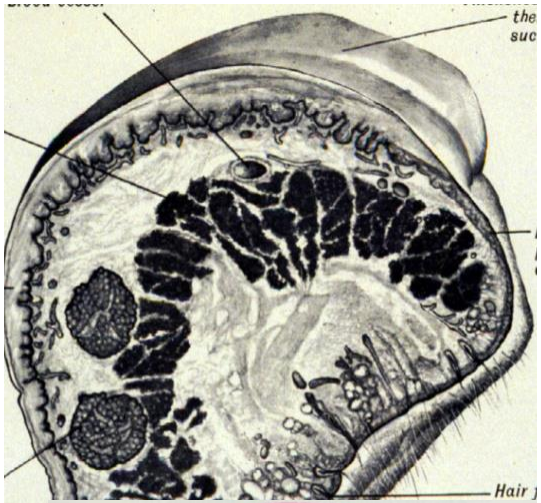

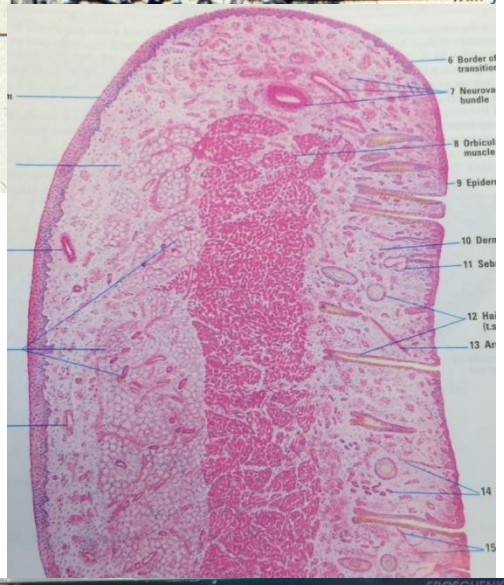

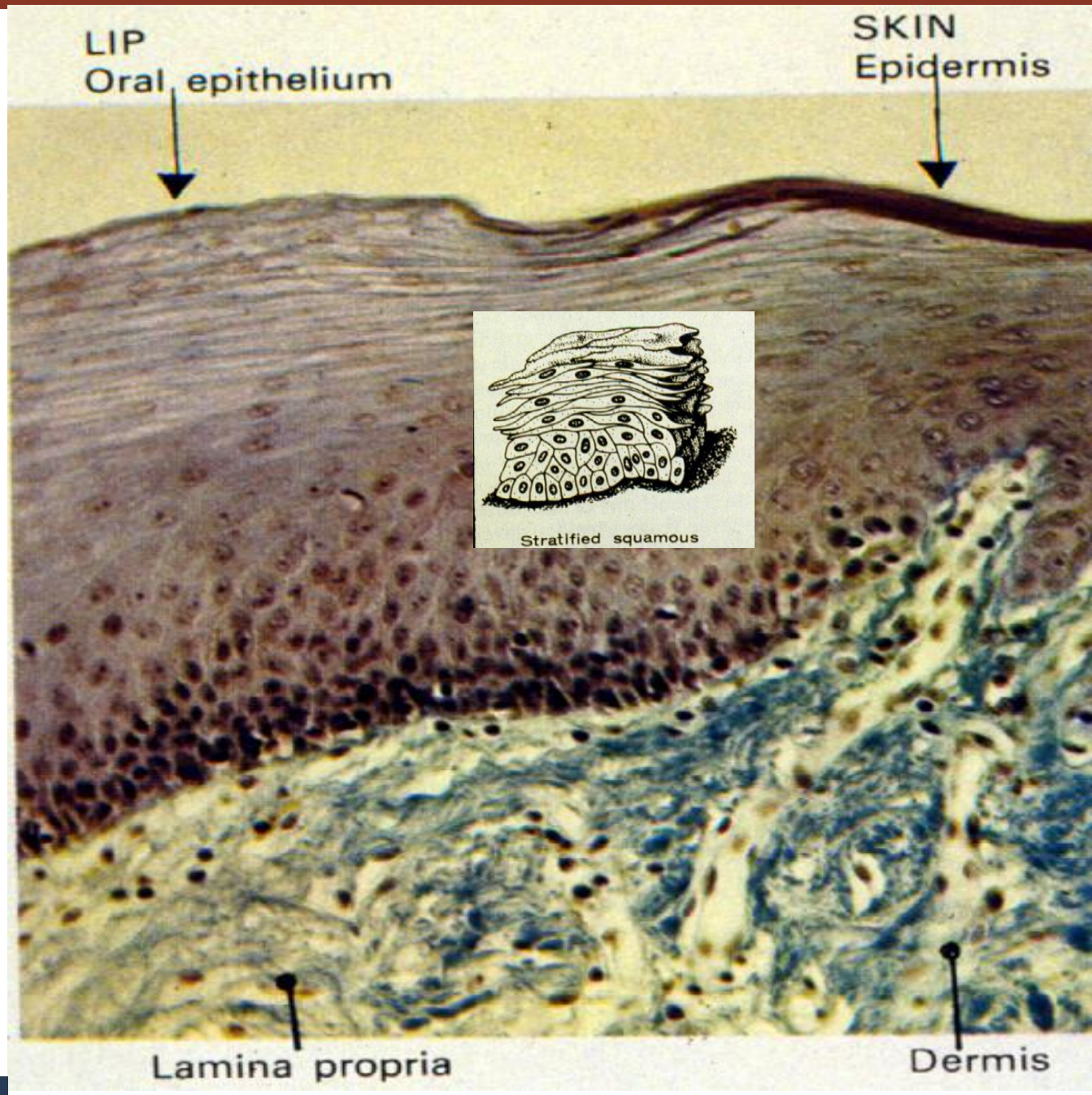

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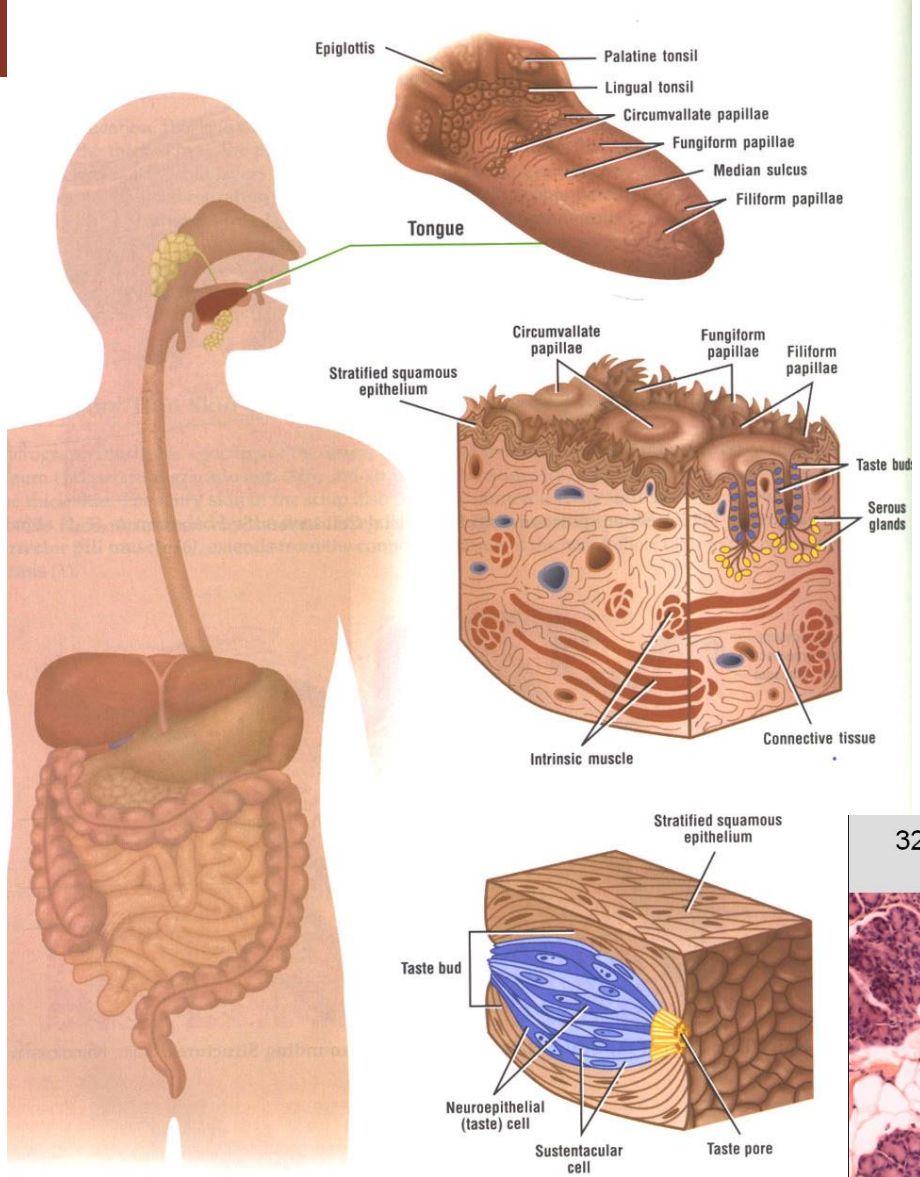


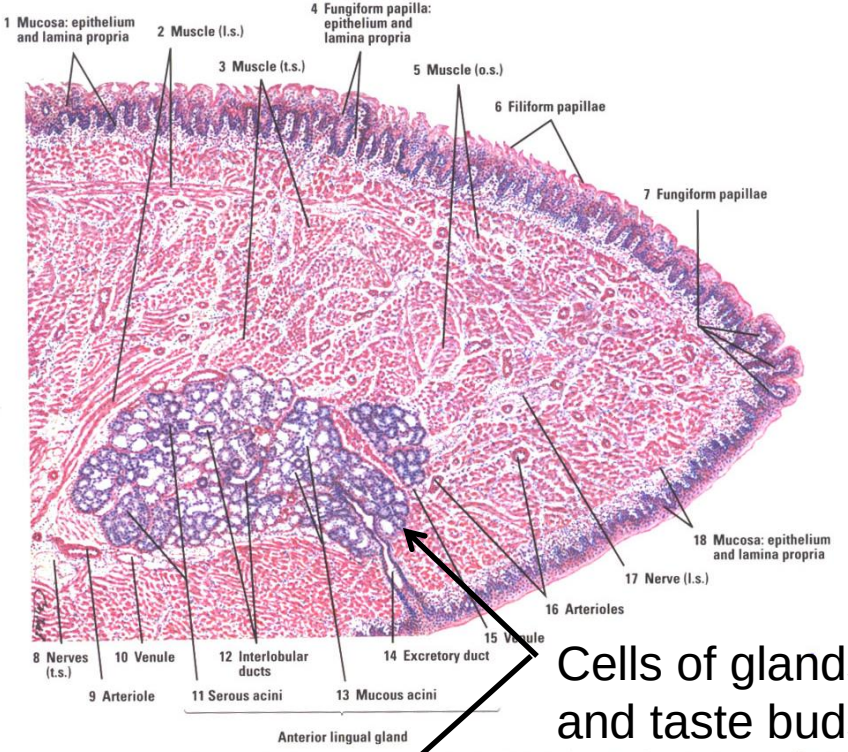
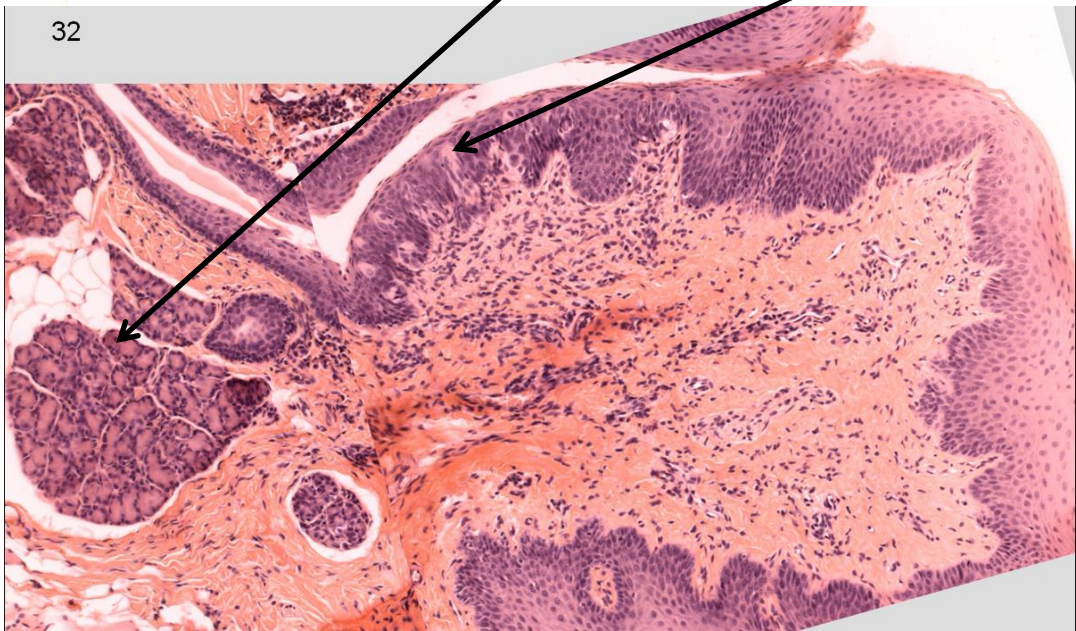


Fig. 10-2 Tongue: Apex (longitudinal section, panoramic view). Stain: hematoxylin-eosin. Low magnification.

Cells of glands and taste buds



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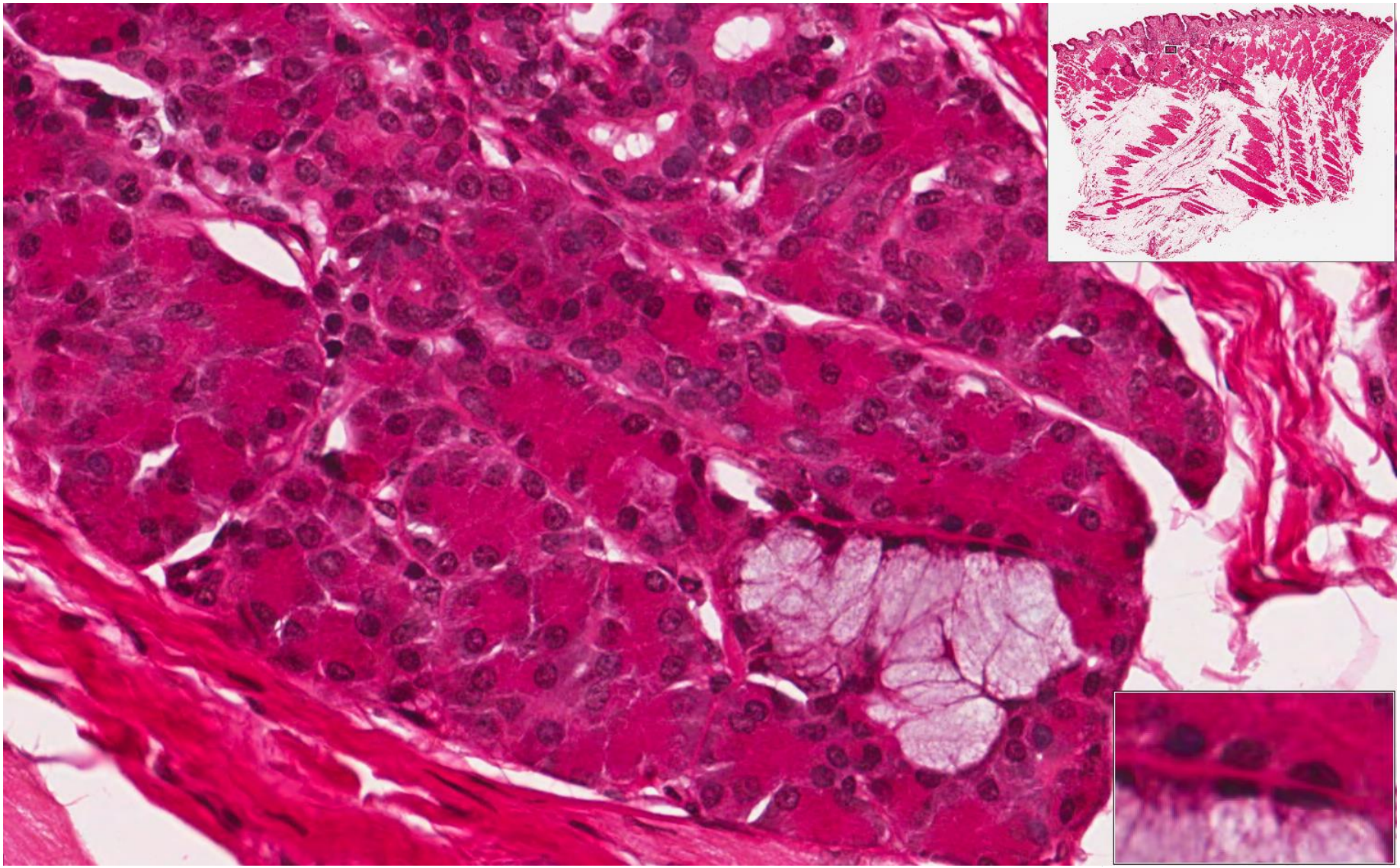
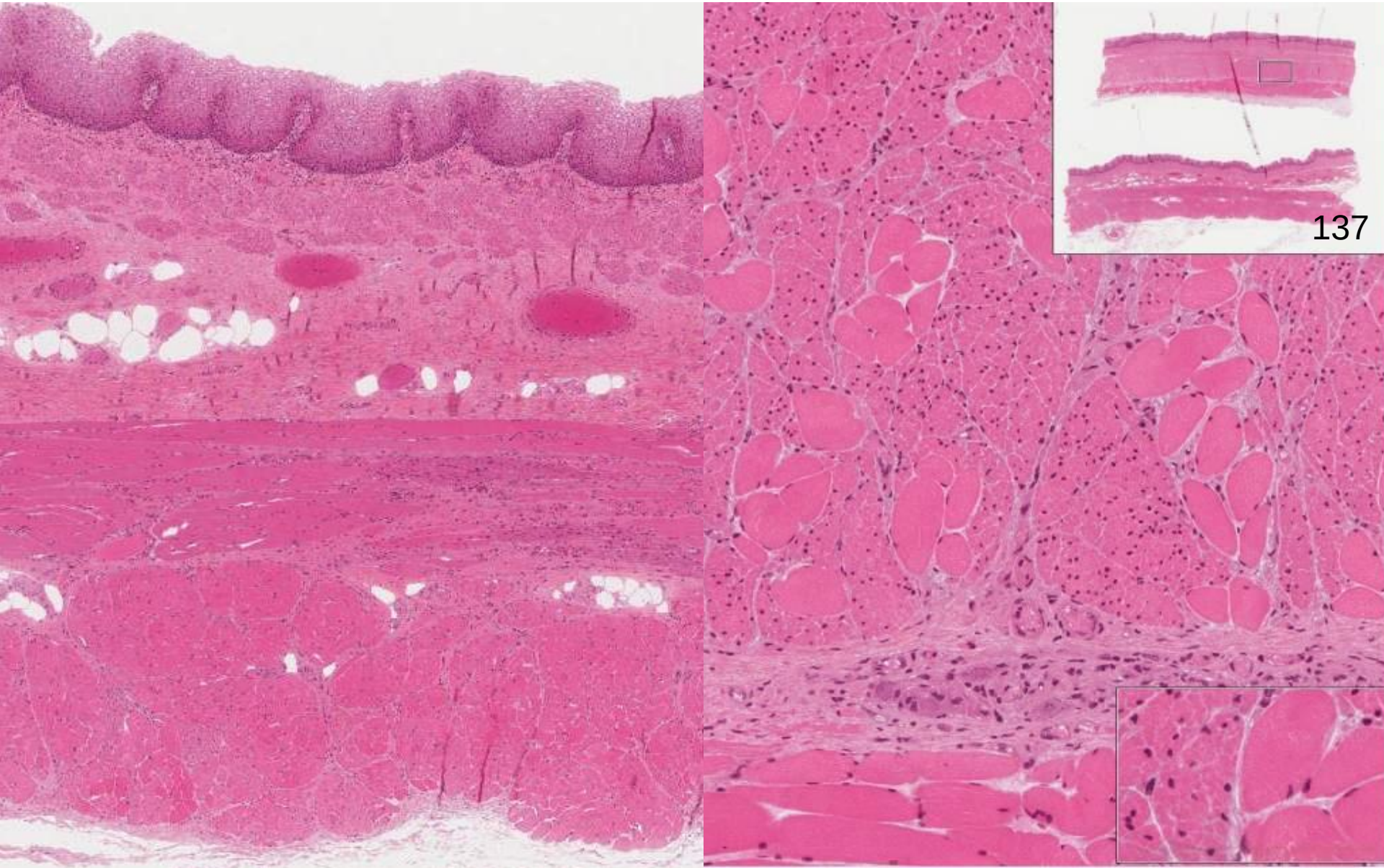
Slide 51: Tongue (secretion)

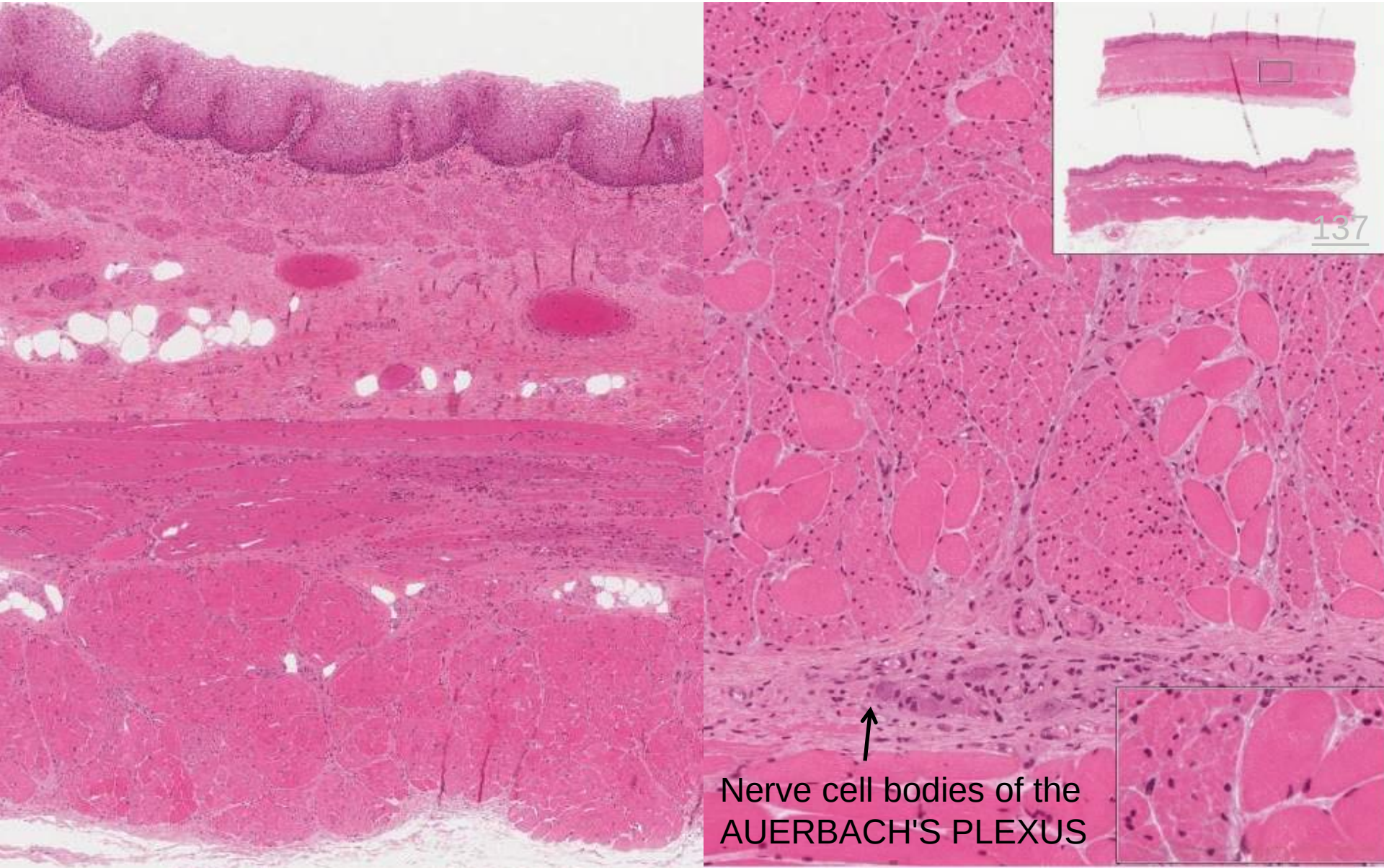
Serous and mucous glands



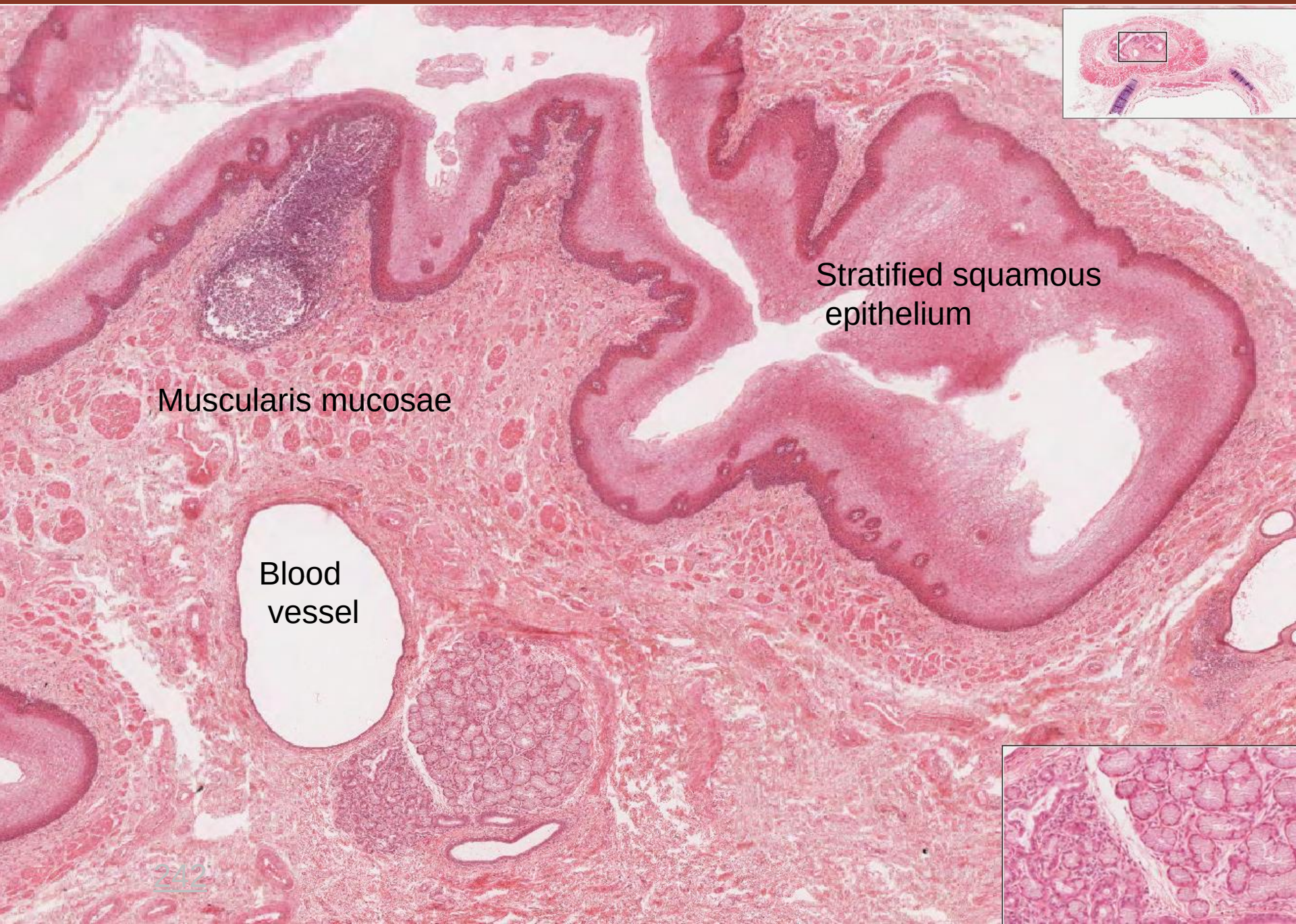
Esophagus – skeletal and smooth muscle



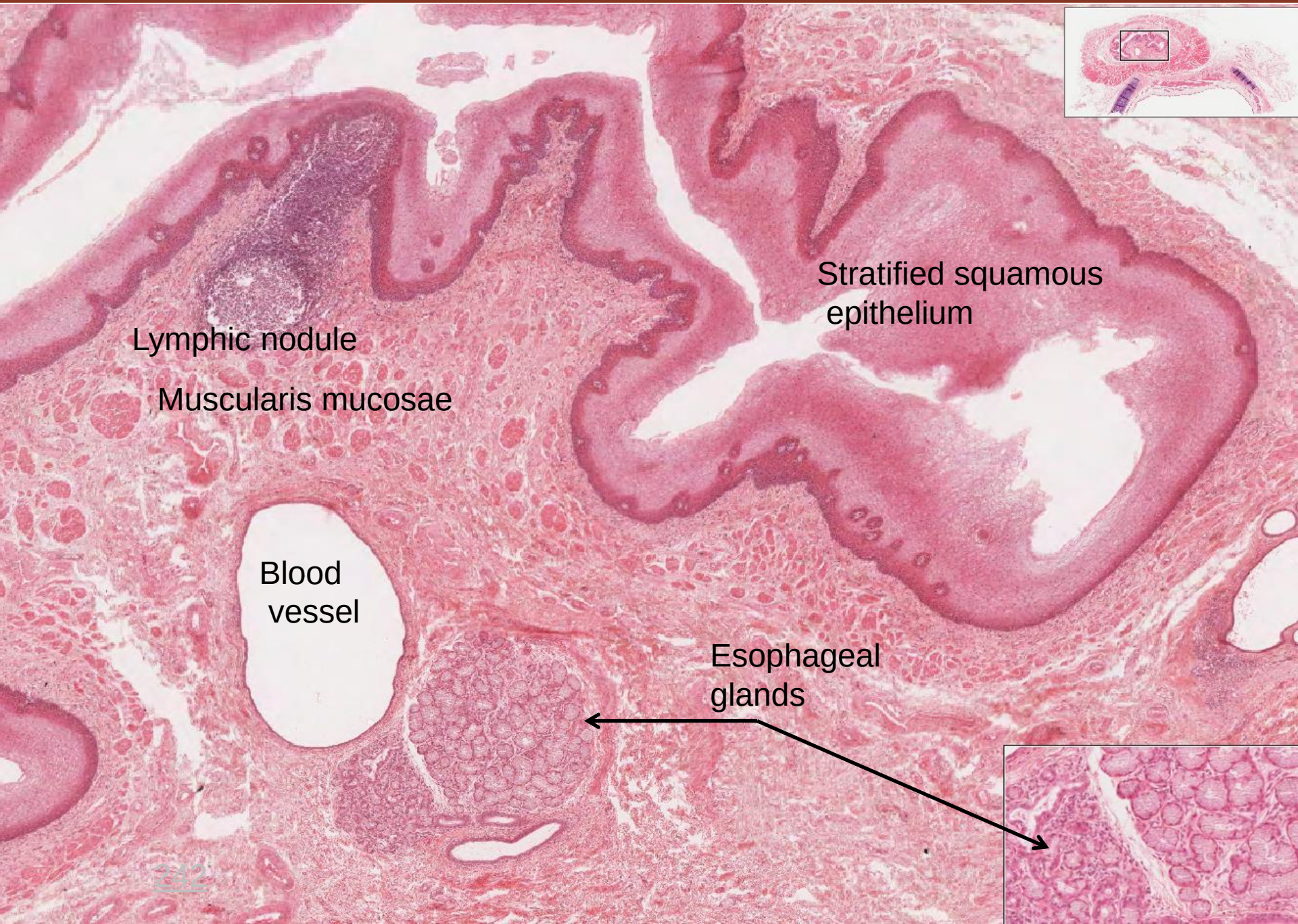
Esophagus – skeletal and smooth muscle

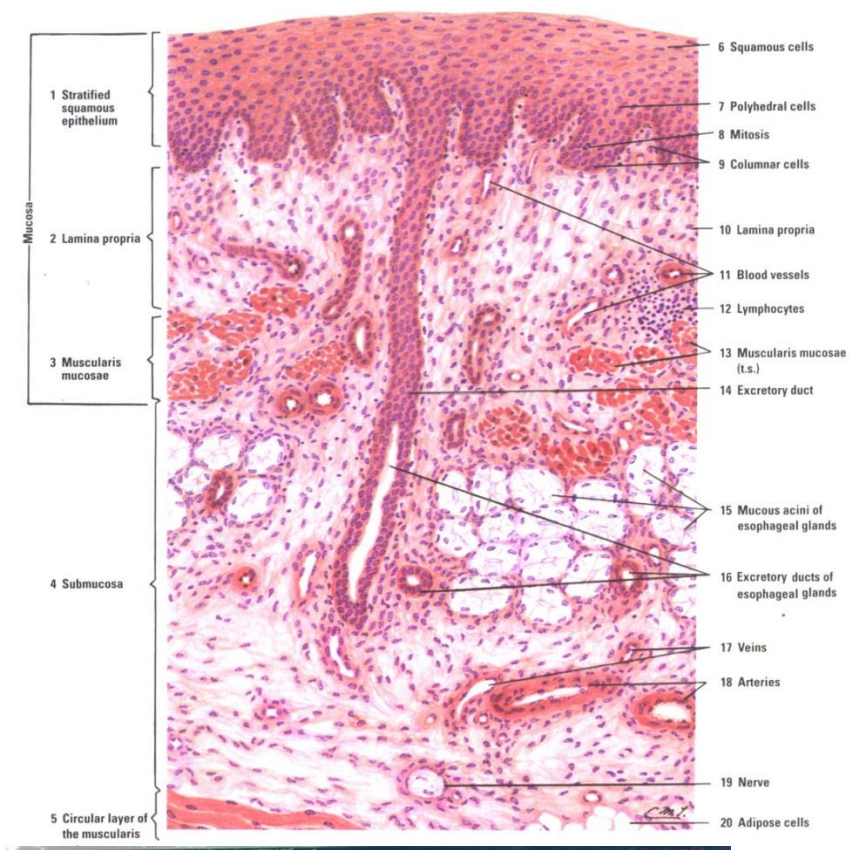


Monkey Esophagus



Monkey Esophagus





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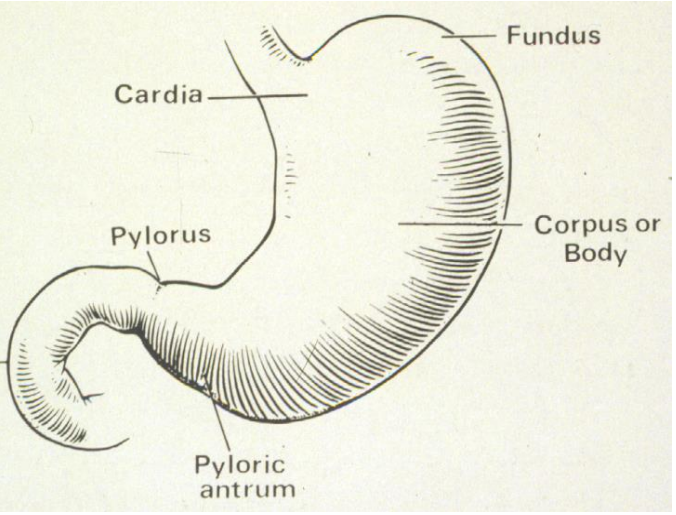


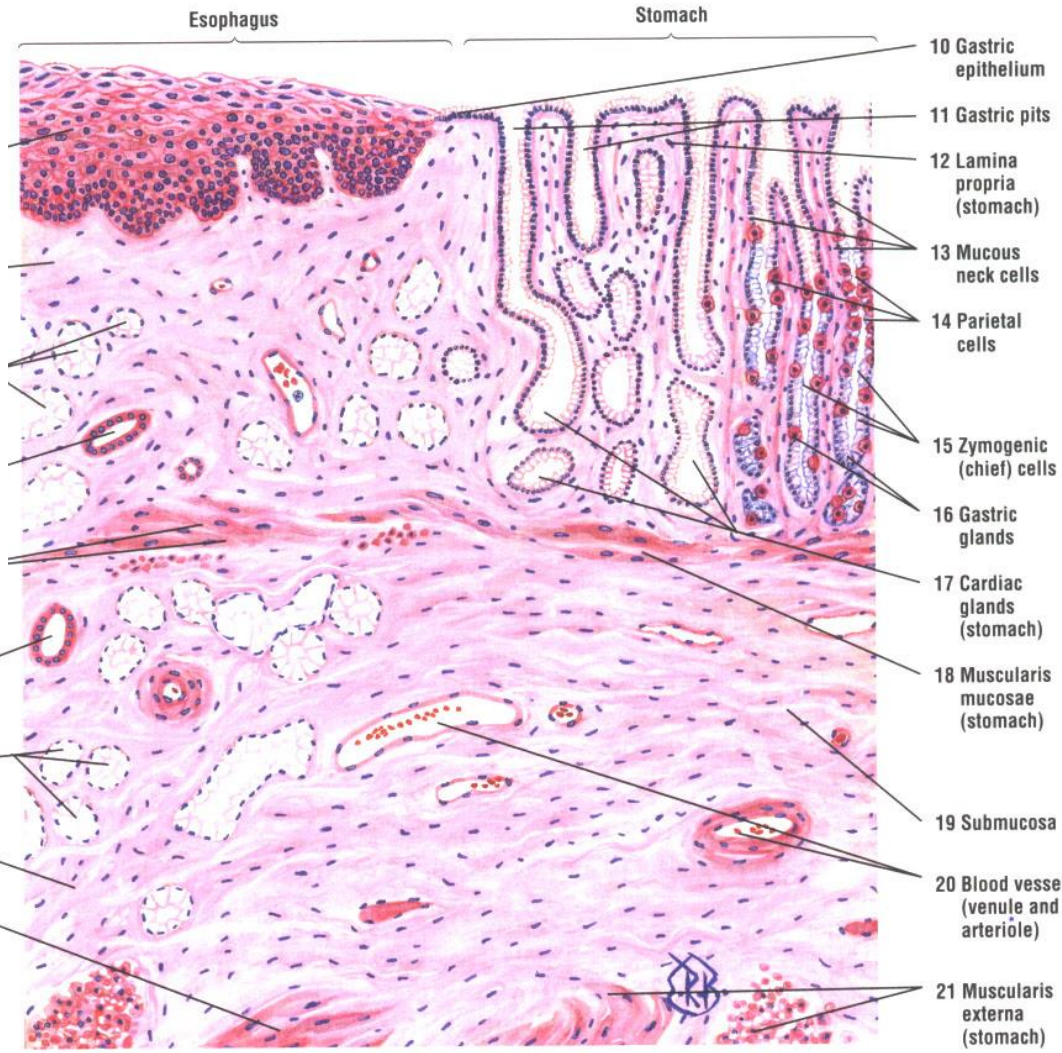
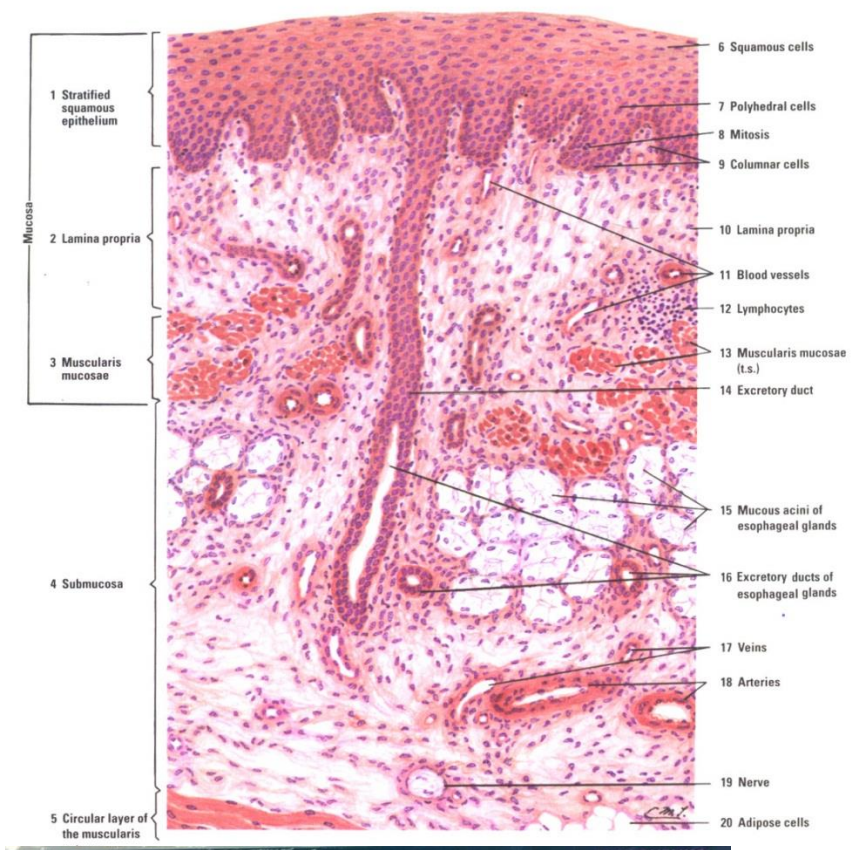


Fig. 11-5 Esophageal–Stomach Junction. Stain: hematoxylin-eosin. Low magnification.



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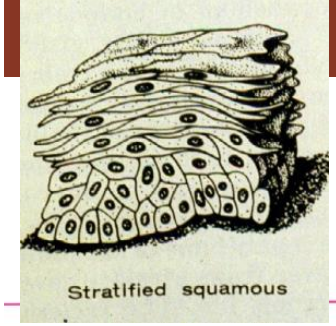
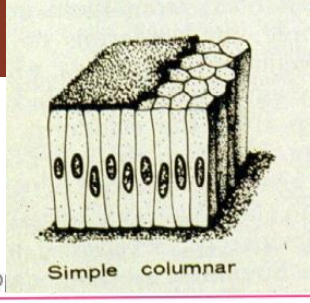
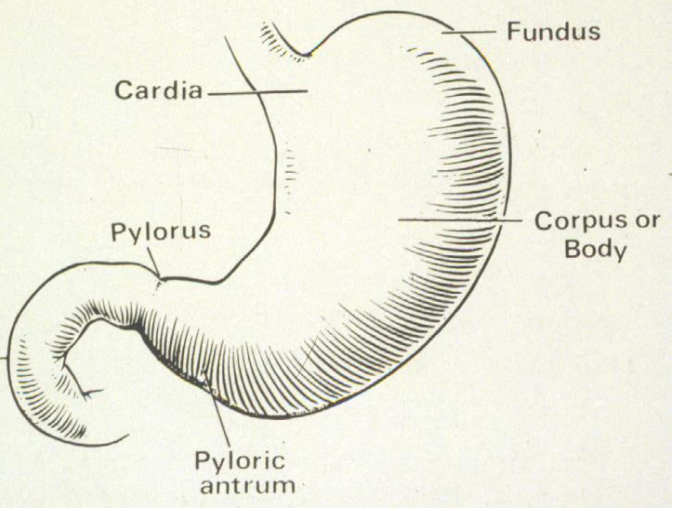






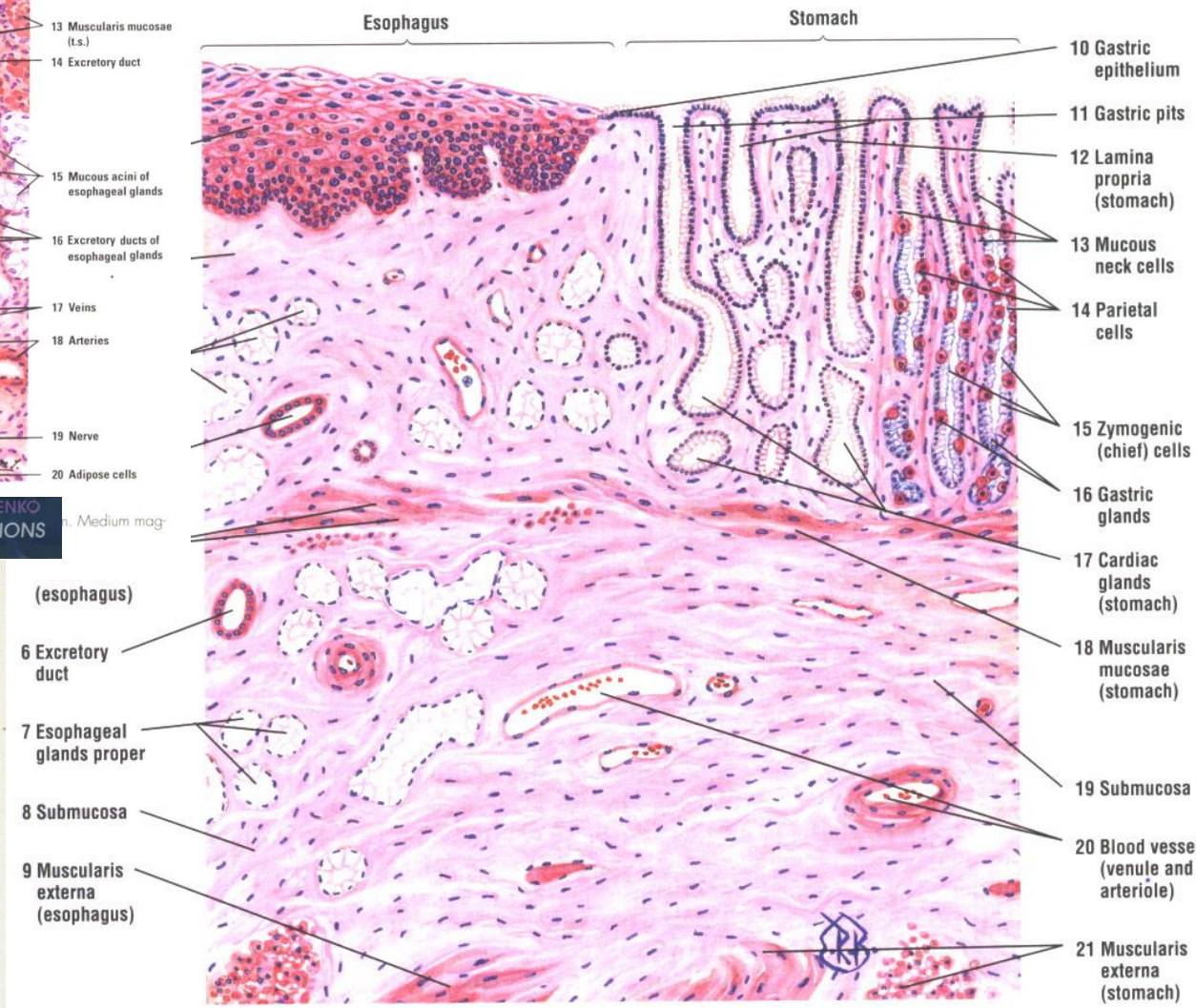
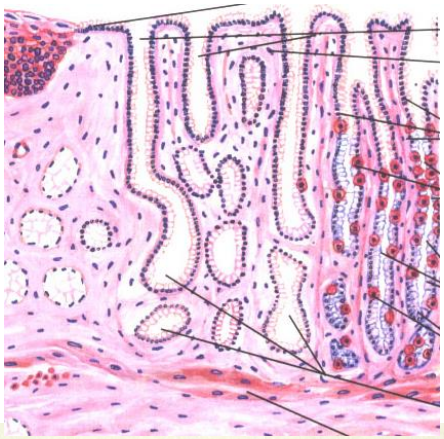


Fig. 11-5 Esophageal–Stomach Junction. Stain: hematoxylin-eosin. Low magnification.

CARDIAC GLANDS



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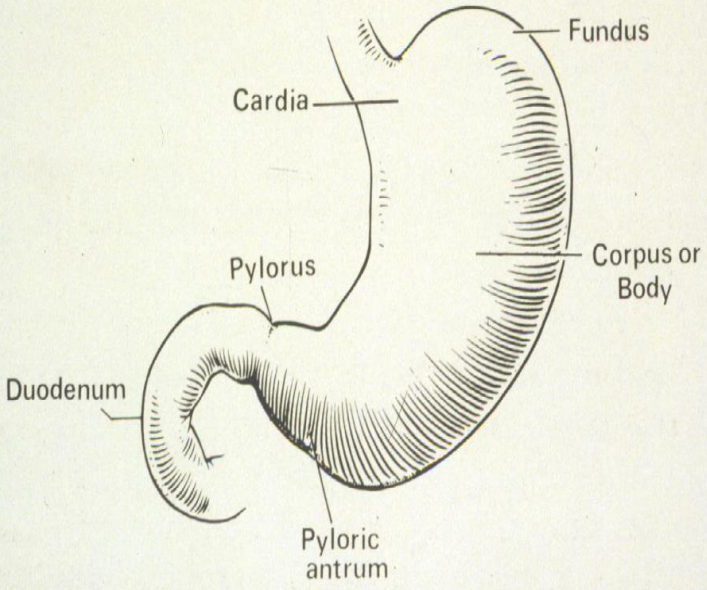
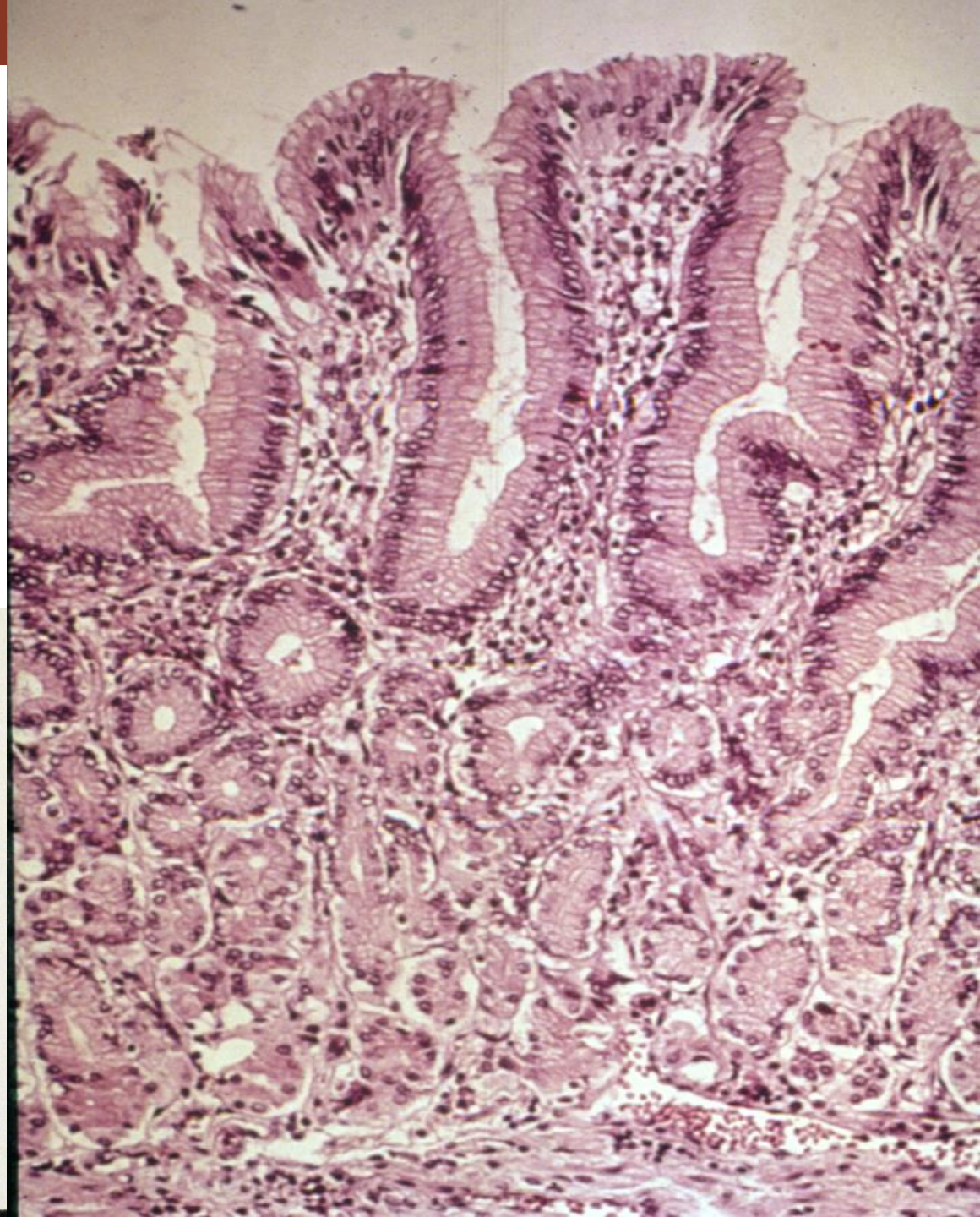
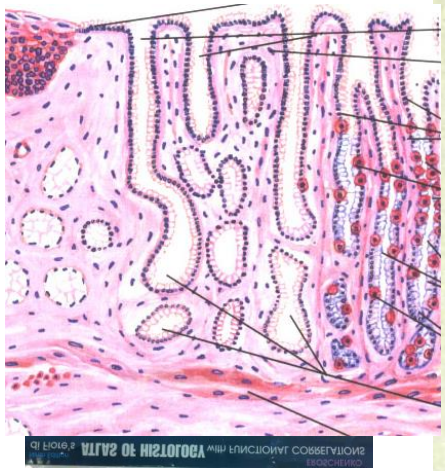


Figure 25–6. Drawing of the human stomach presenting



Glandular epithelial cells of the fundic stomach



- SURFACE MUCOUS CELLS

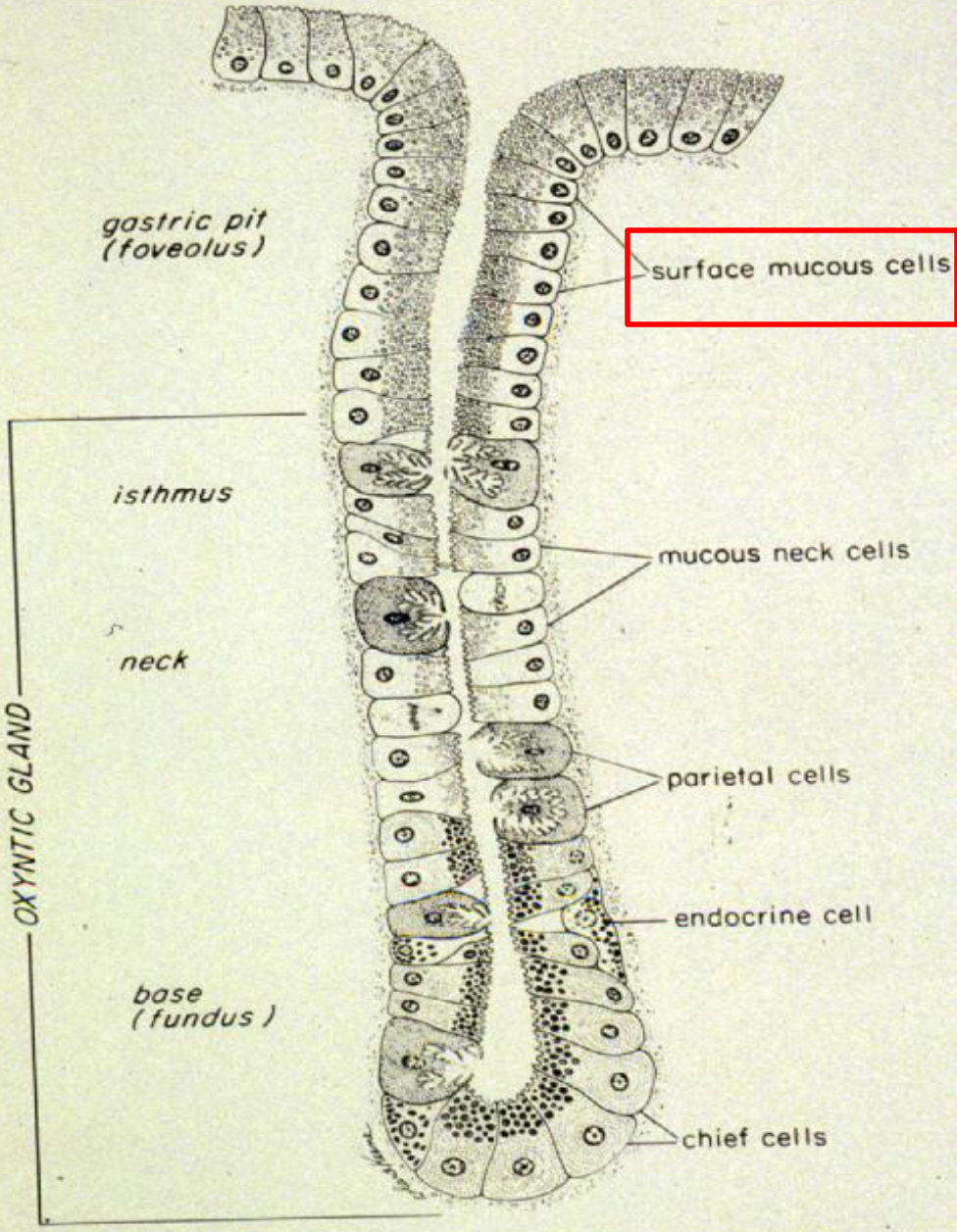
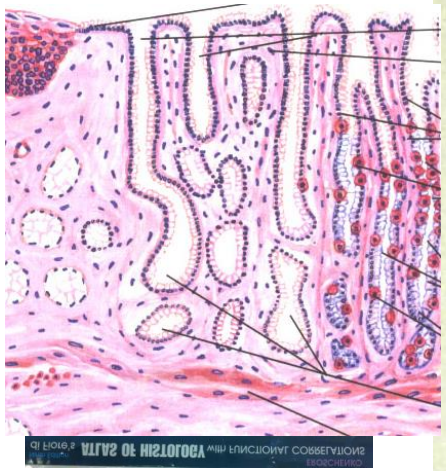
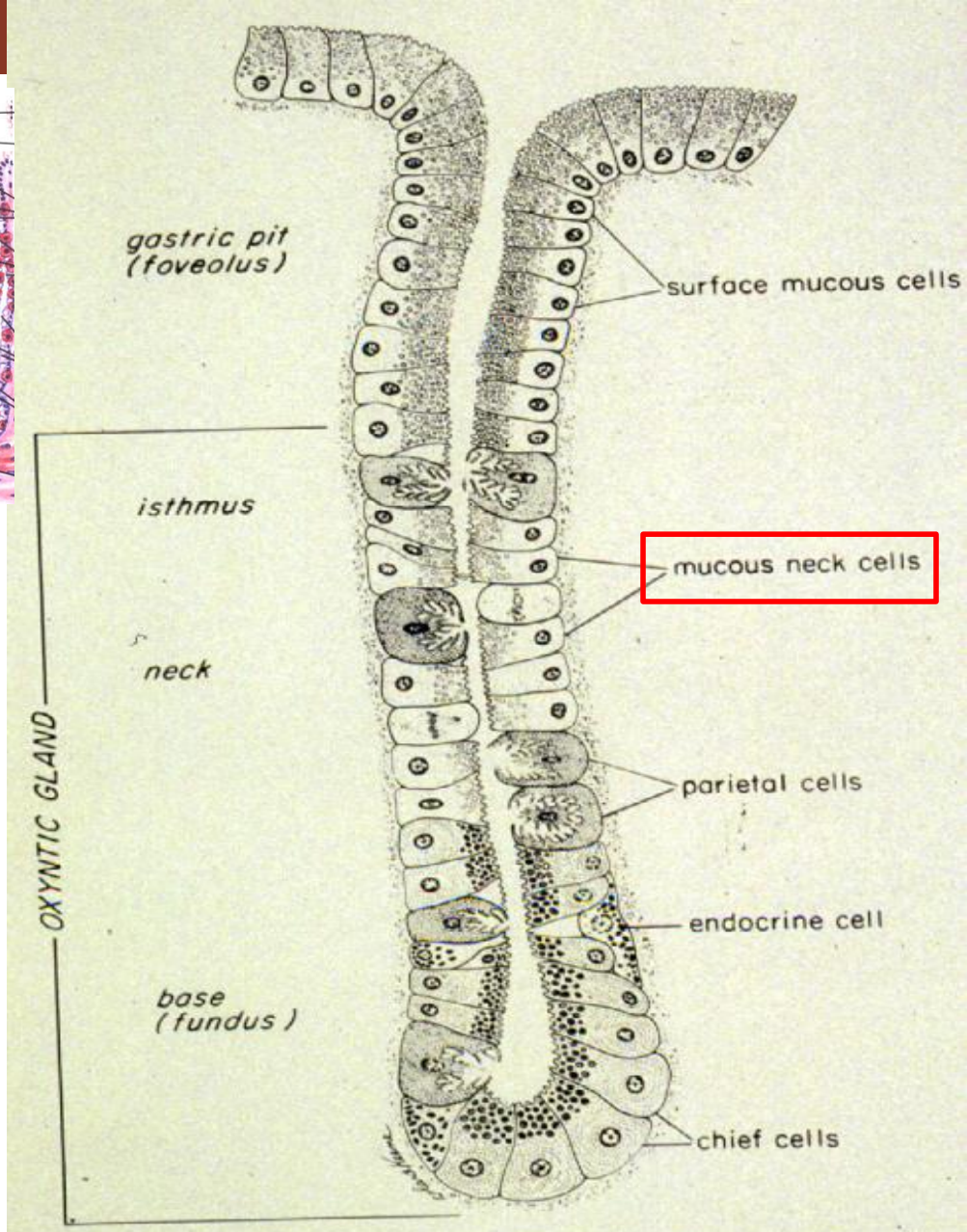


Figure 25–13. Diagram of an oxyntic gland from th corpus of a mammalian stomach. (From Ito, S. *In* Johnso L. R., ed.: Physiology of the Gastrointestinal Tract. Ne York, Raven Press, 1981.)

Glandular epithelial cells of the fundic stomach



- SURFACE MUCOUS CELLS
- MUCOUS NECK CELL



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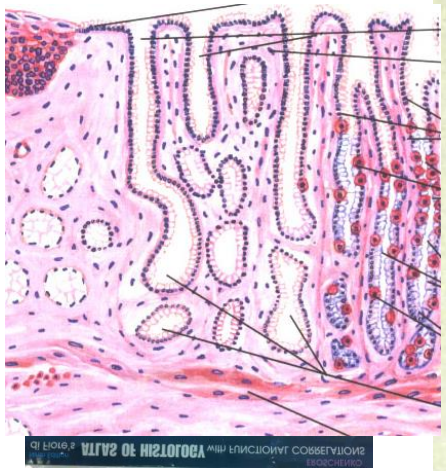
Glandular epithelial cells of the fundic stomach



- SURFACE MUCOUS CELLS
- MUCOUS NECK CELL
- CHIEF CELL (ZYMOGENIC CELL)

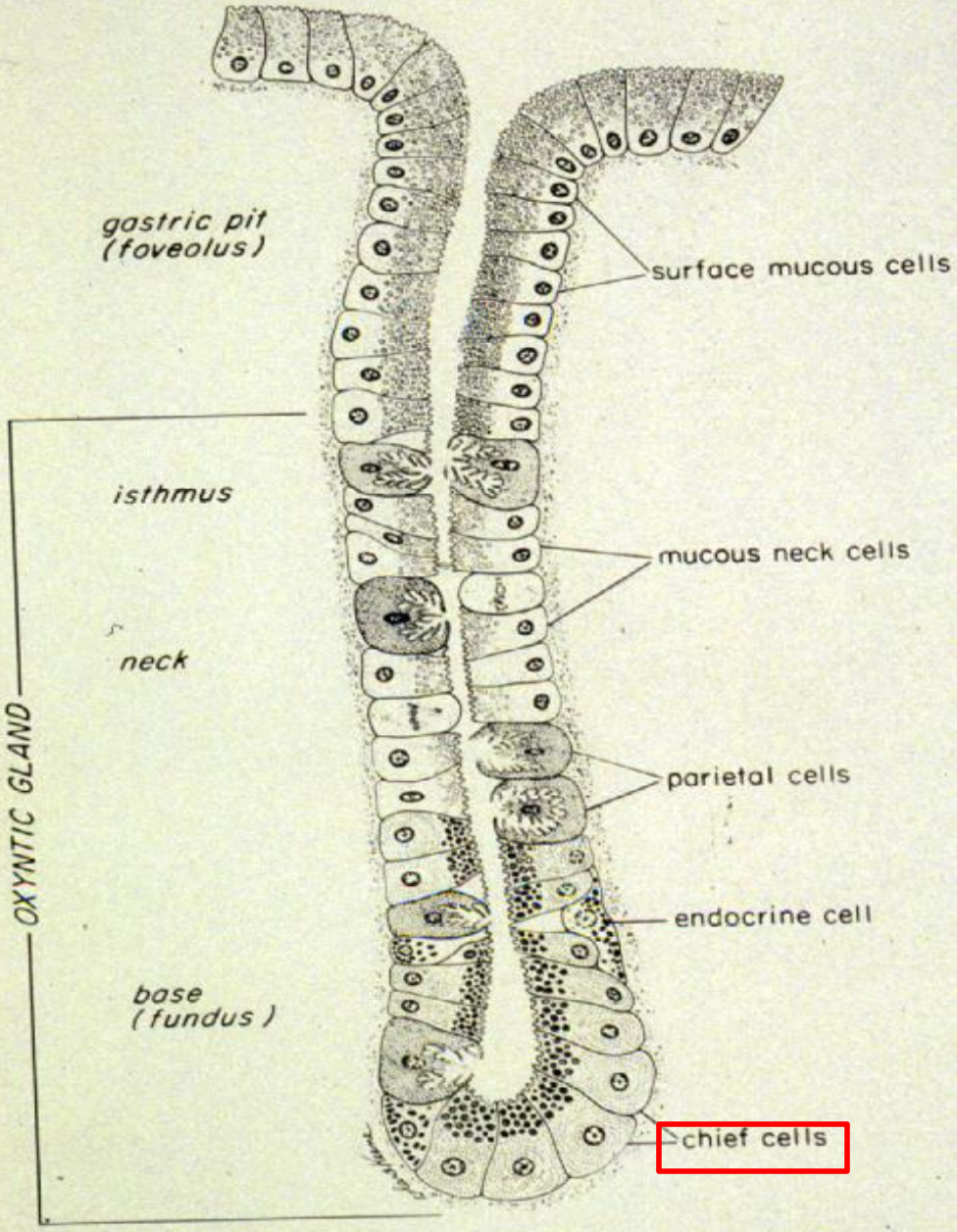
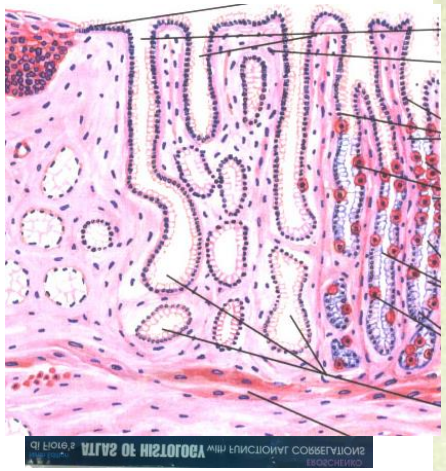
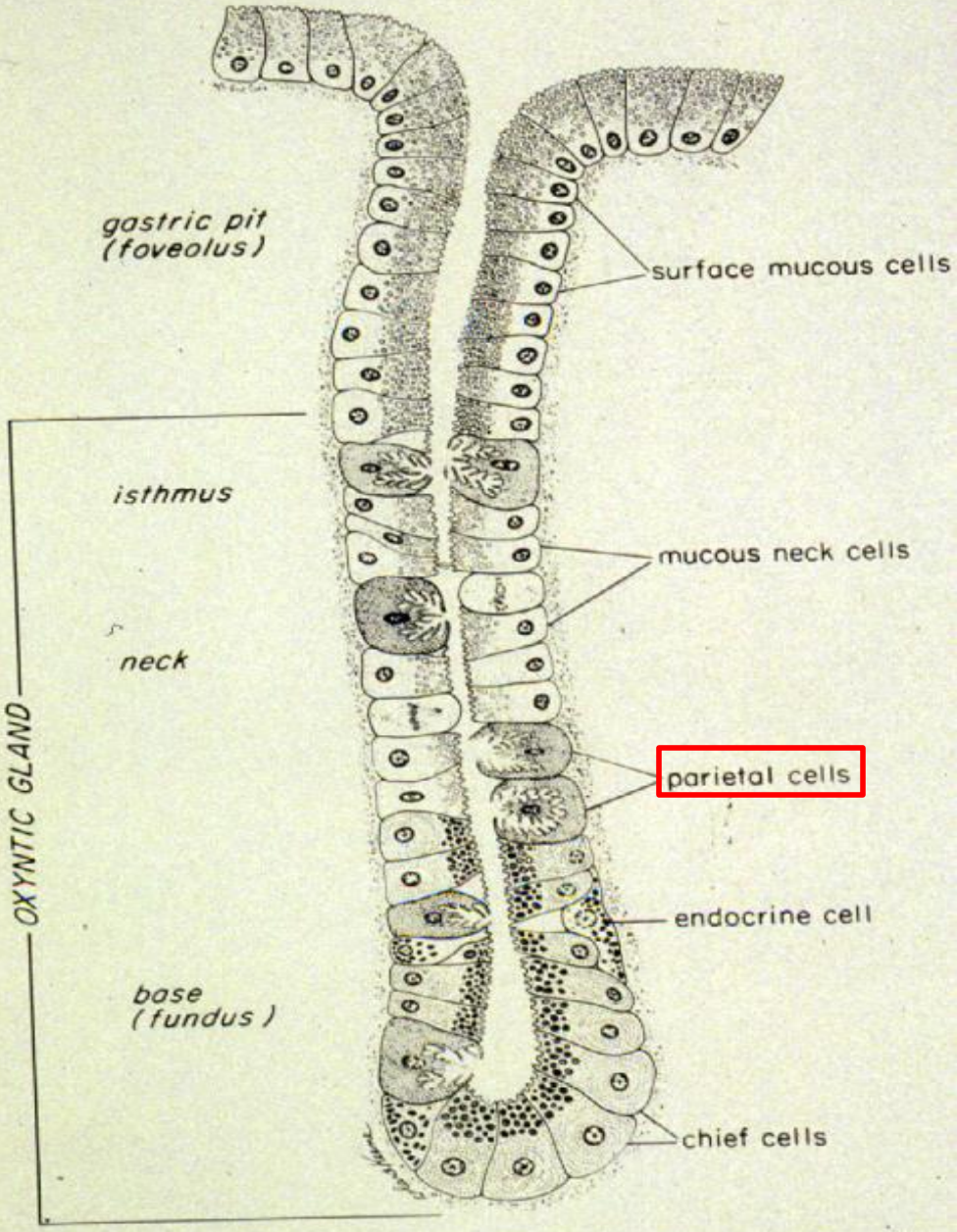


Figure 25–13. Diagram of an oxyntic gland from th corpus of a mammalian stomach. (From Ito, S. *In* Johnso L. R., ed.: Physiology of the Gastrointestinal Tract. Ne York, Raven Press, 1981.)

Glandular epithelial cells of the fundic stomach



- SURFACE MUCOUS CELLS
- MUCOUS NECK CELL
- CHIEF CELL (ZYMOGENIC CELL)
- PARIETAL CELL (OXYNTIC CELL)



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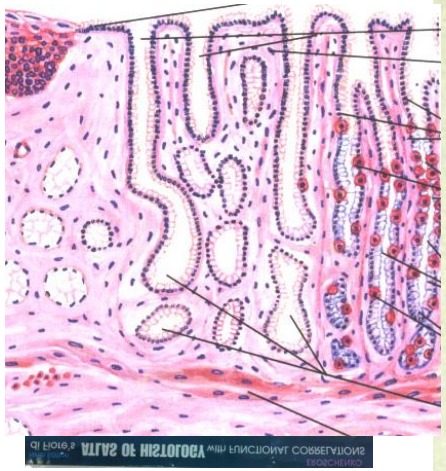
Glandular epithelial cells of the fundic stomach



- SURFACE MUCOUS CELLS
- MUCOUS NECK CELL
- CHIEF CELL (ZYMOGENIC CELL)
- PARIETAL CELL (OXYNTIC CELL)
- ENDOCRINE CELL (ARGENTAFFIN OR ENTROCHROMAFFIN CELL)

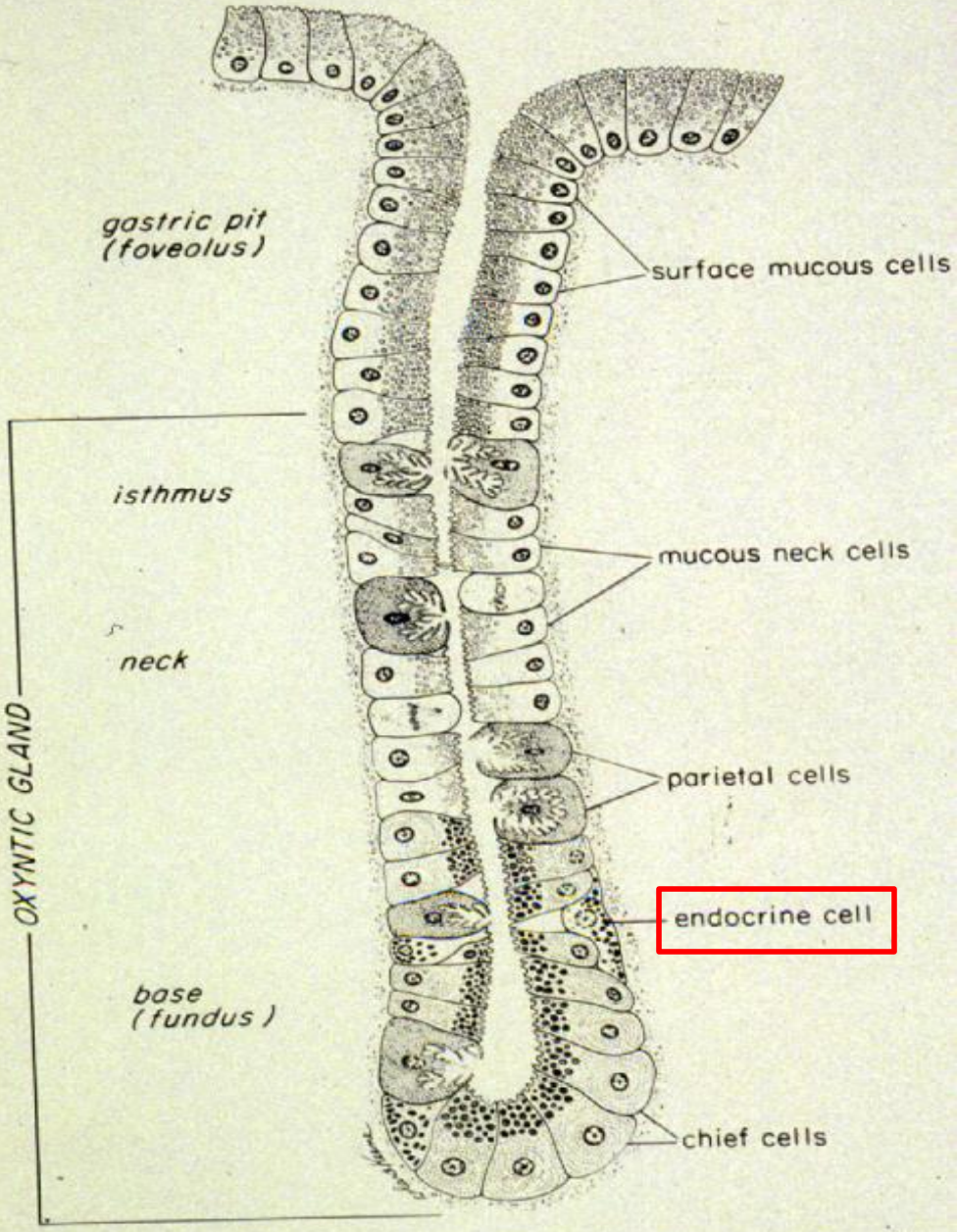
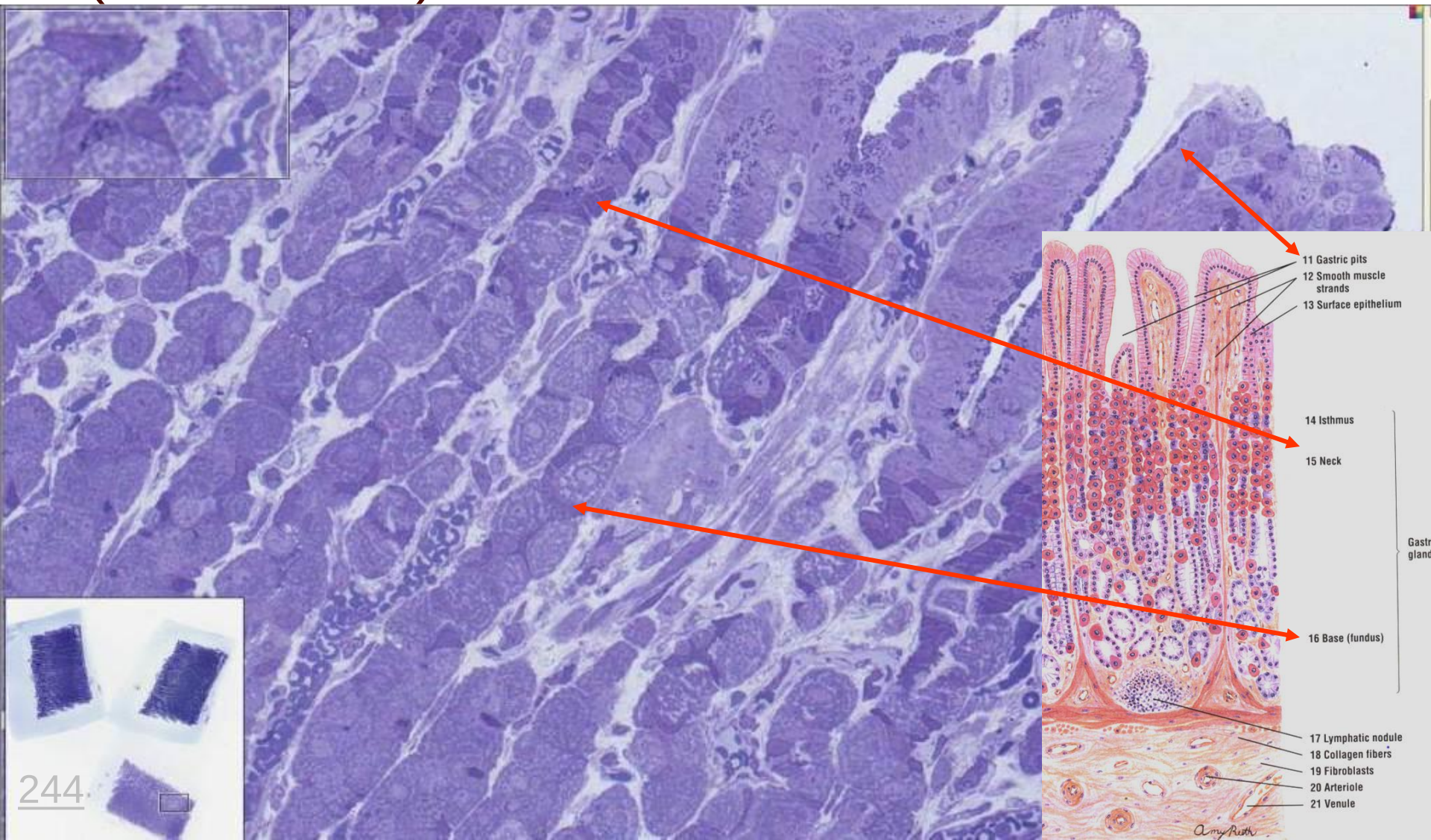
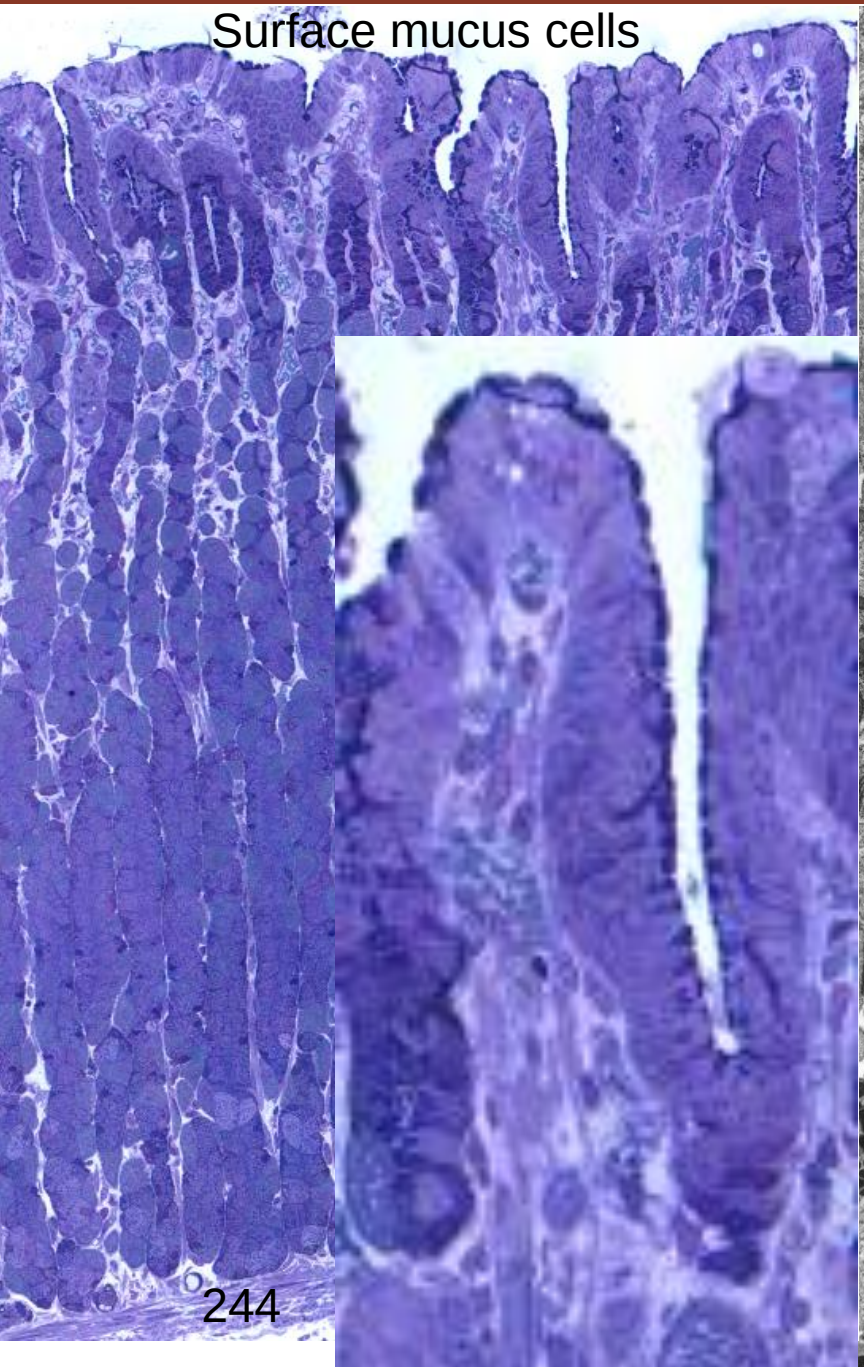


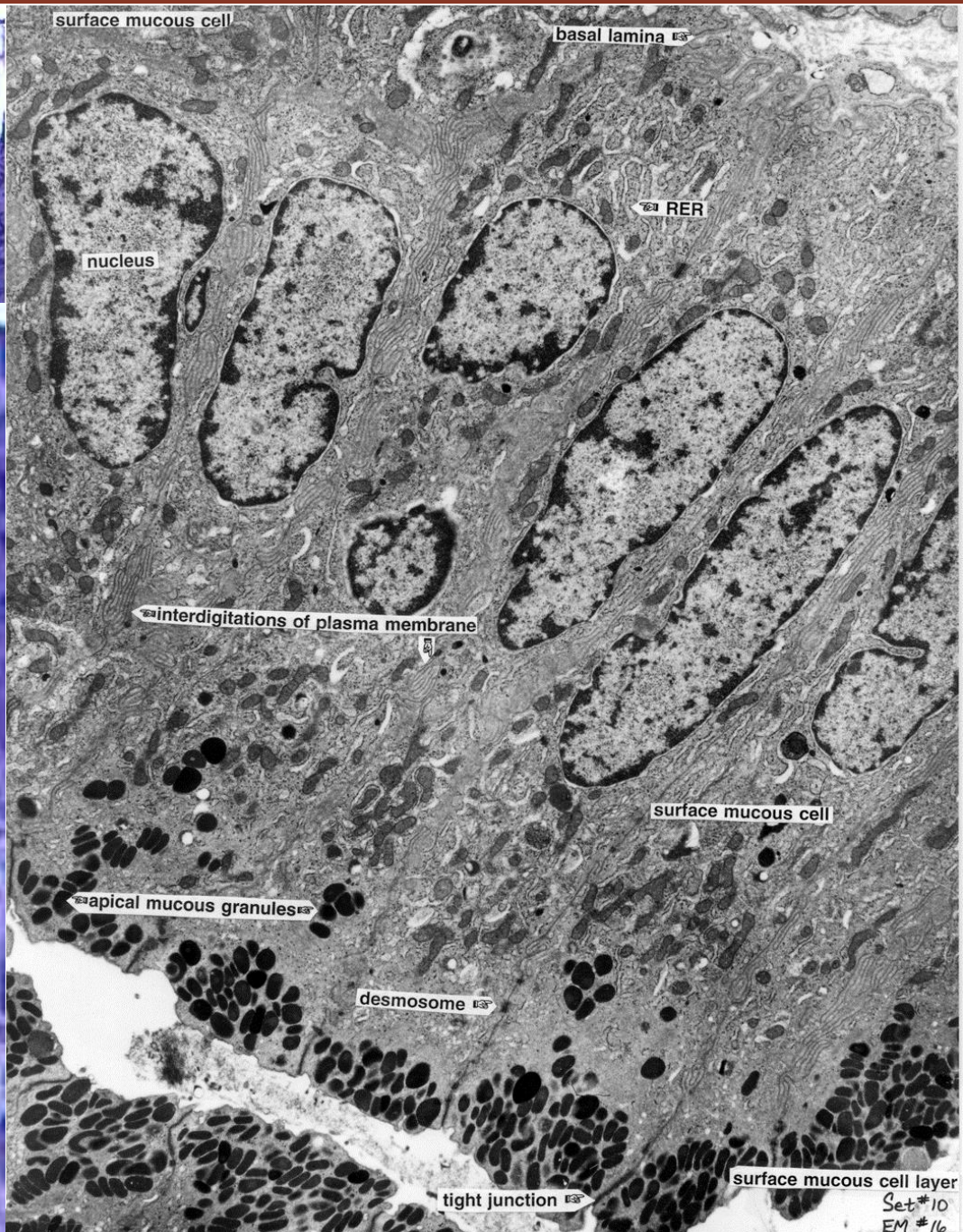
Figure 25–13. Diagram of an oxyntic gland from th corpus of a mammalian stomach. (From Ito, S. *In* Johnso L. R., ed.: Physiology of the Gastrointestinal Tract. Ne York, Raven Press, 1981.)

Mucus neck cells Fundic stomach, rabbit (toluidine blue)

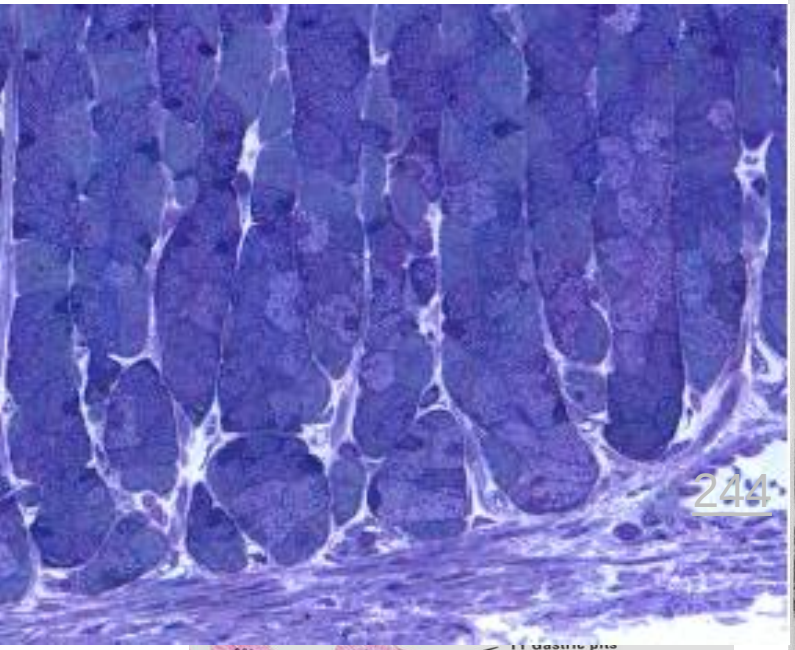


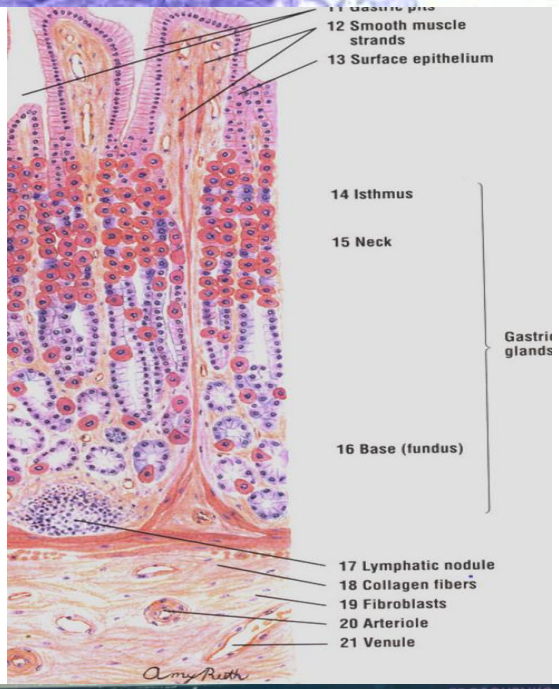
Surface mucus cells

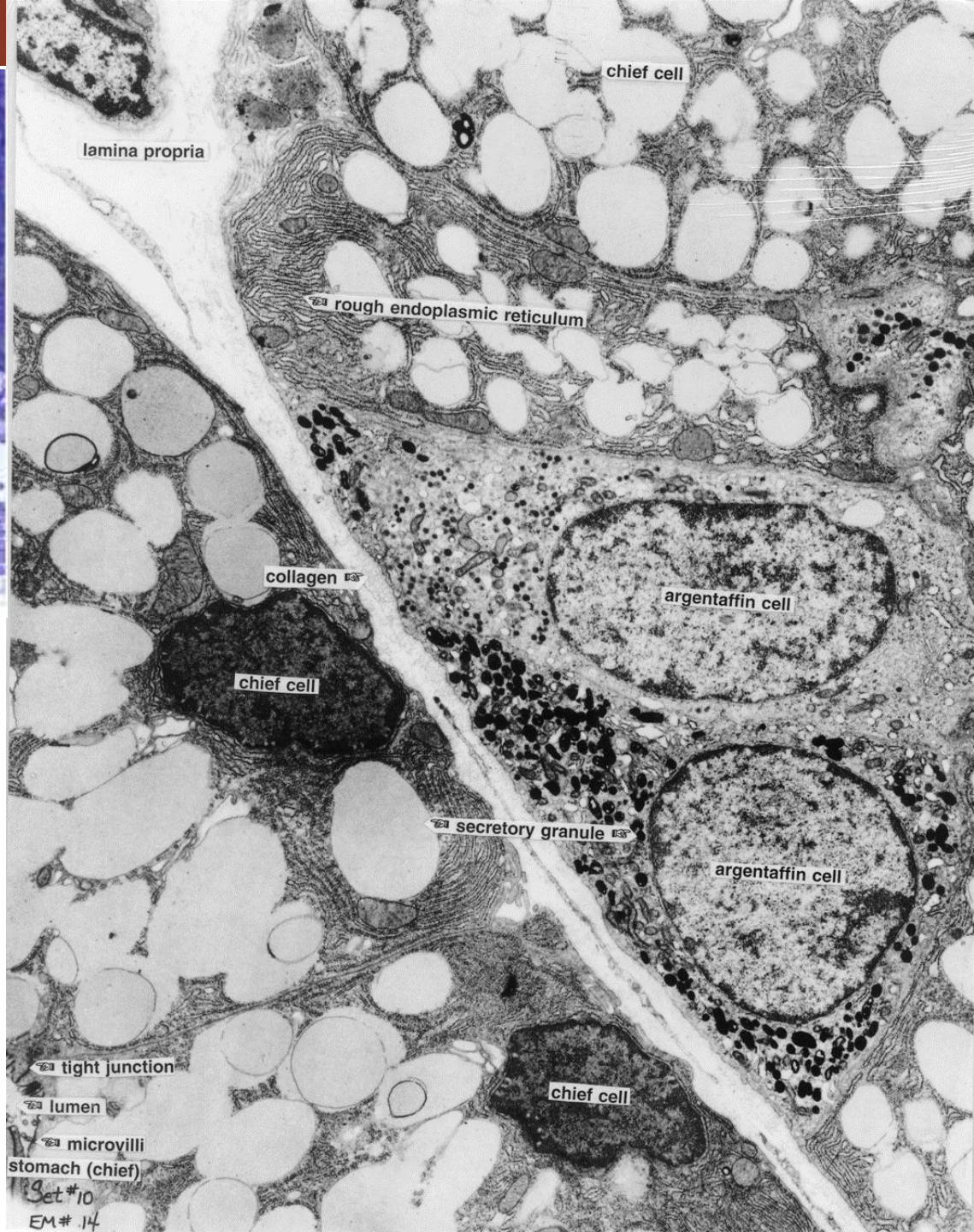




stomach







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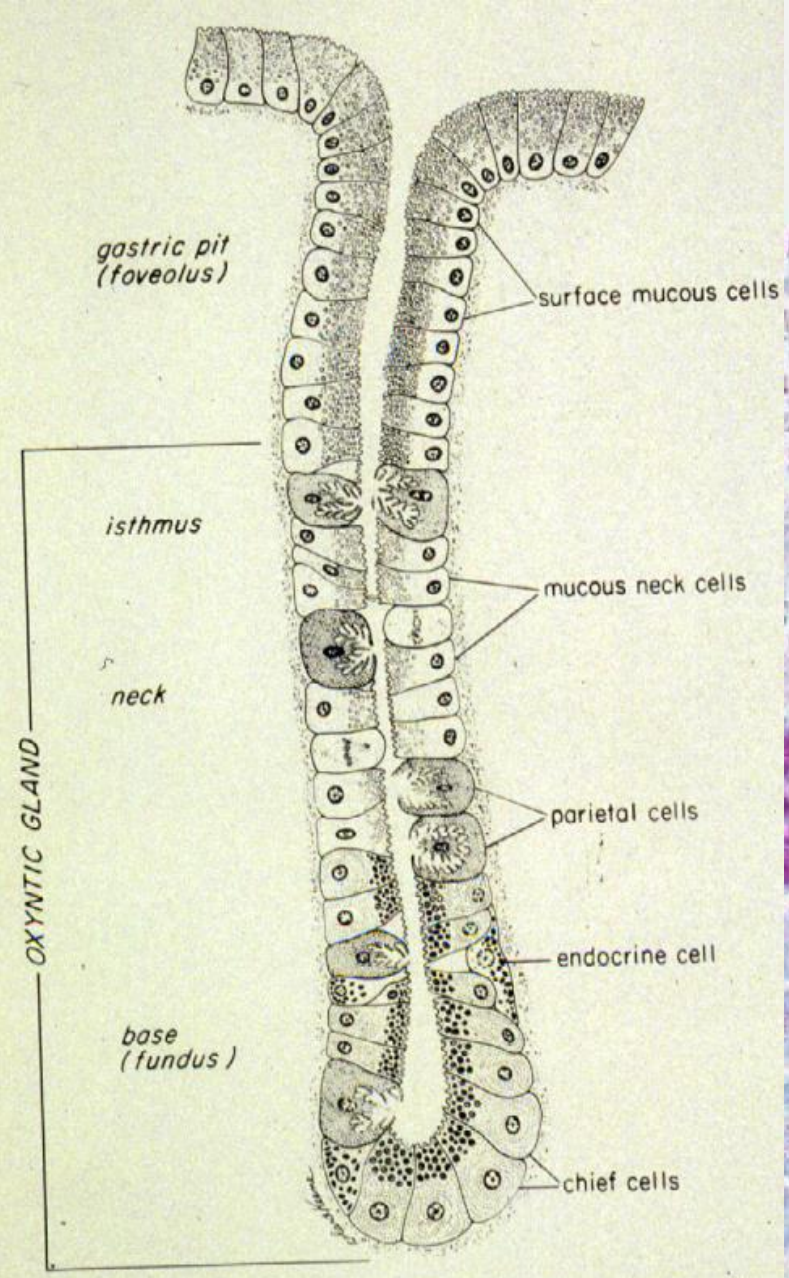

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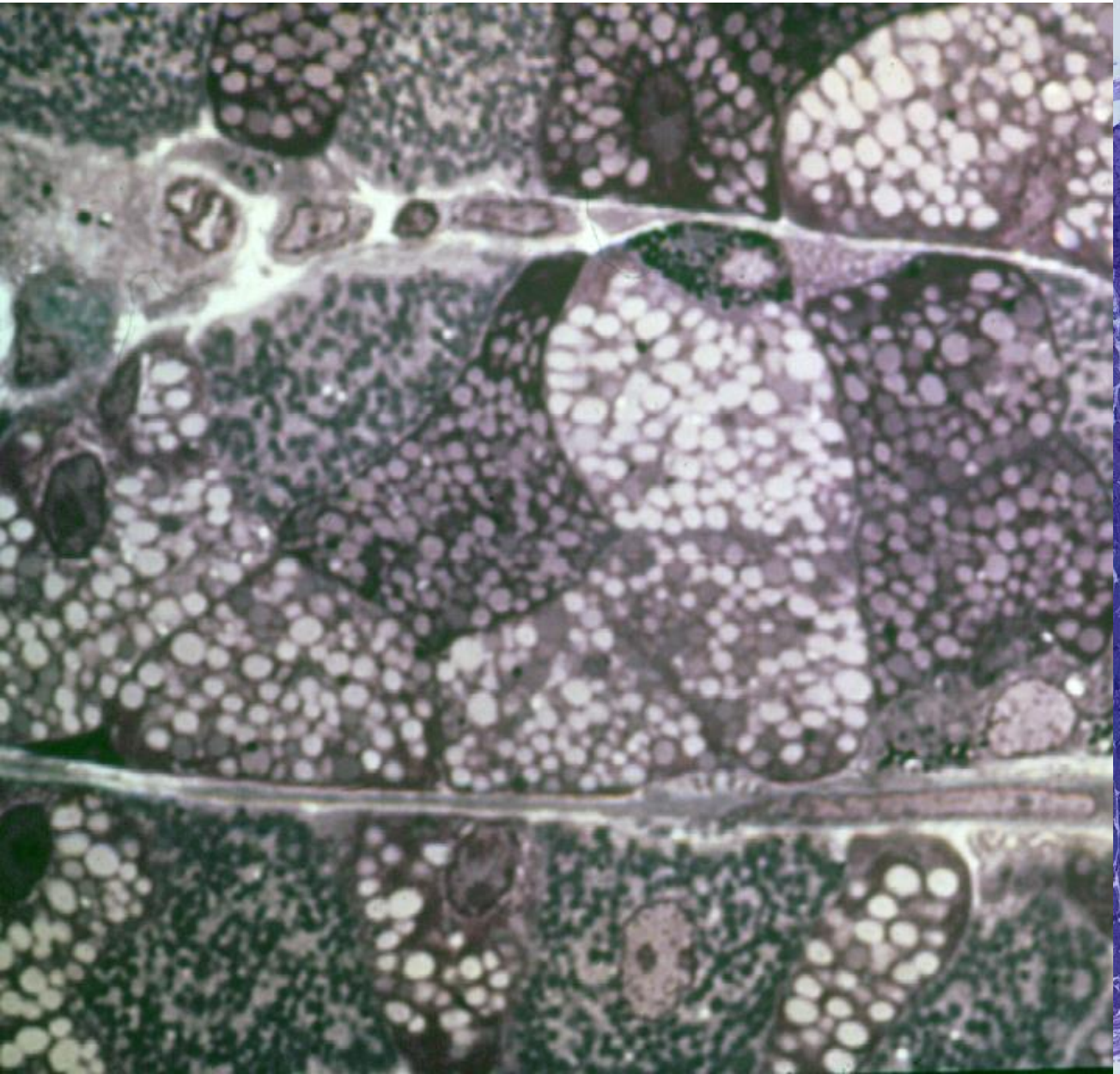
stomach

CHIEF CELL PARIETAL CELL ARGENTAFFIN CELL

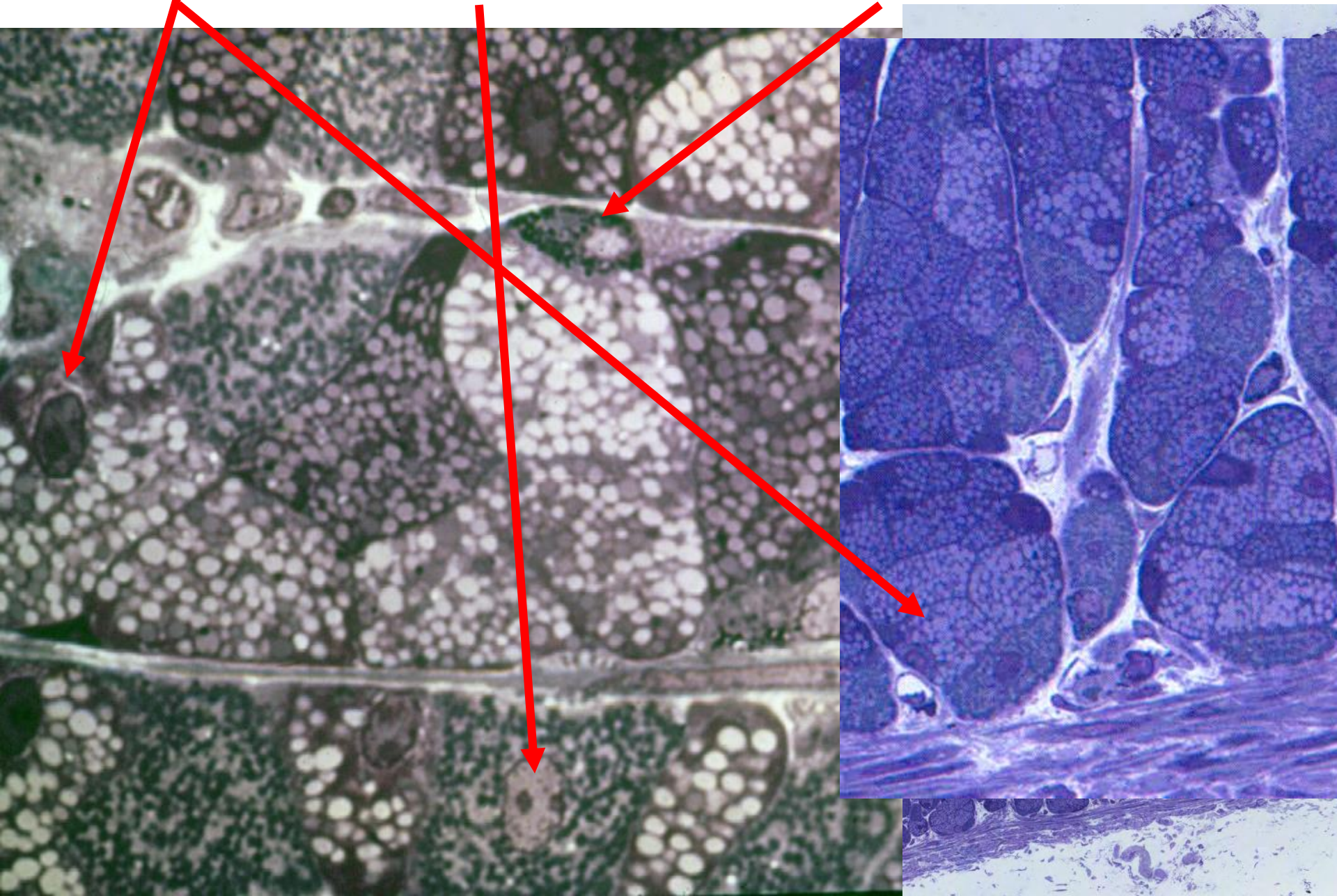


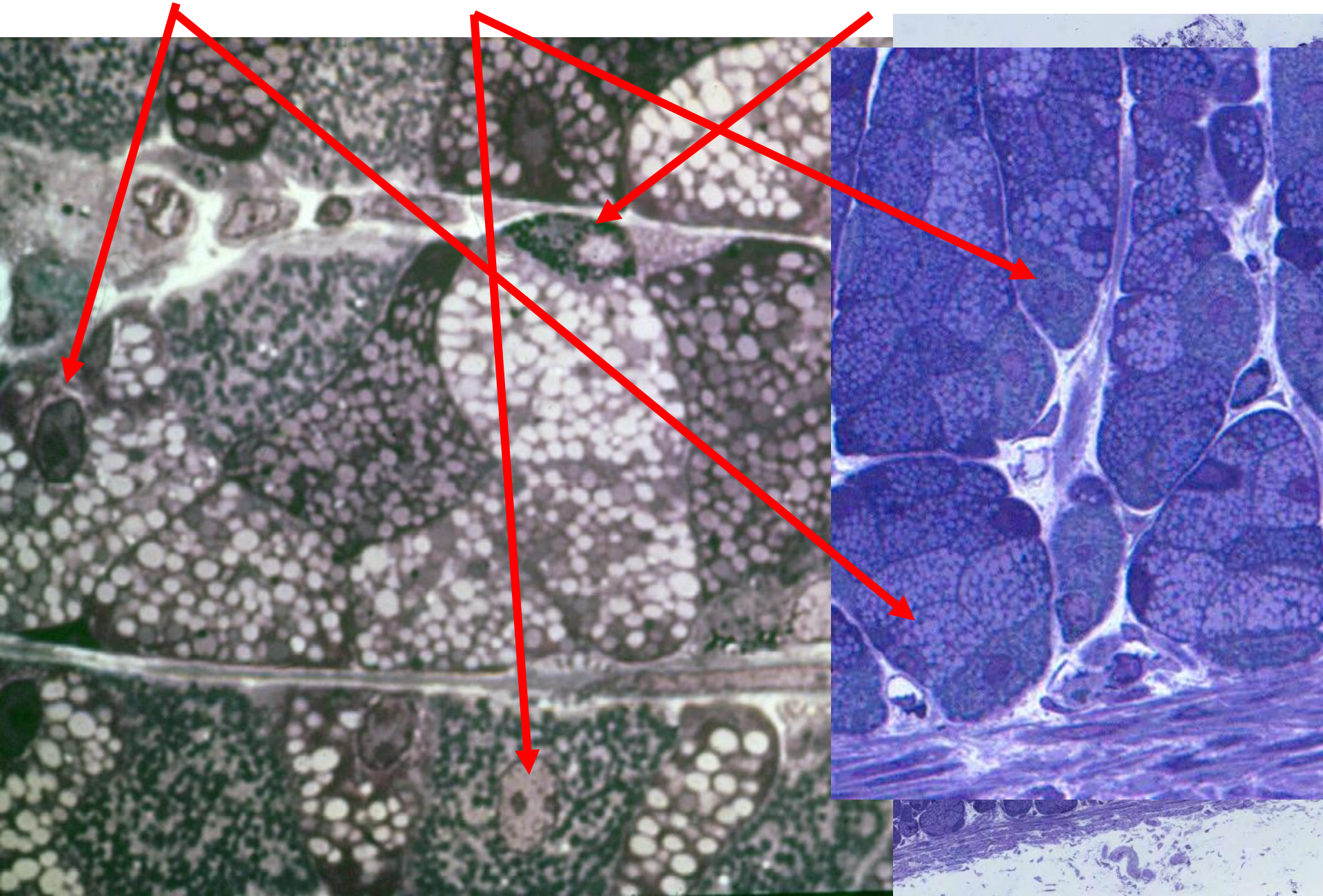
CHIEF CELL PARIETAL CELL ARGENTAFFIN CELL

CHIEF CELL PARIETAL CELL ARGENTAFFIN CELL

CHIEF CELL PARIETAL CELL ARGENTAFFIN CELL

CHIEF CELL PARIETAL CELL ARGENTAFFIN CELL




CHIEF CELL
PARIETAL CELL
ARGENTAFFIN CELL

CHIEF CELL

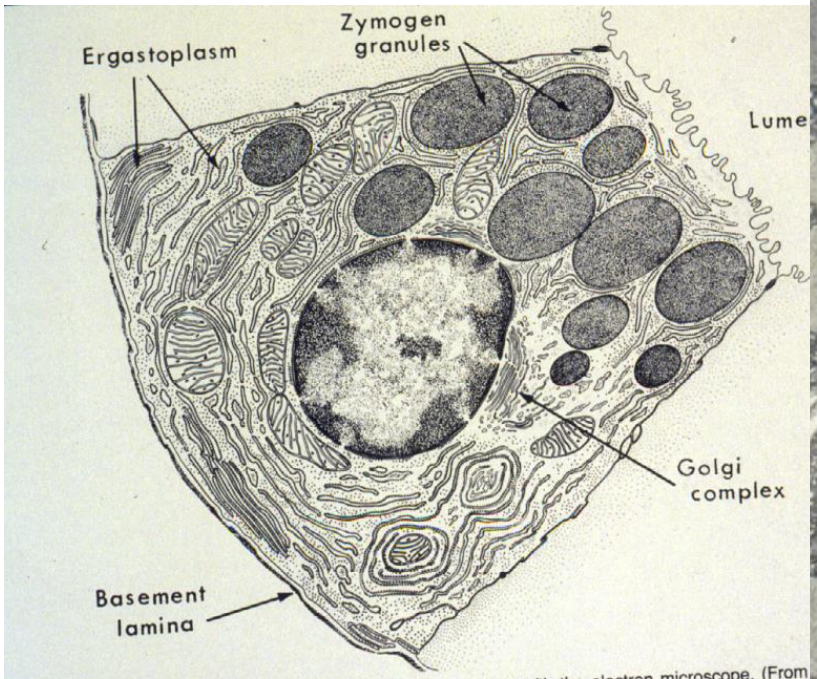
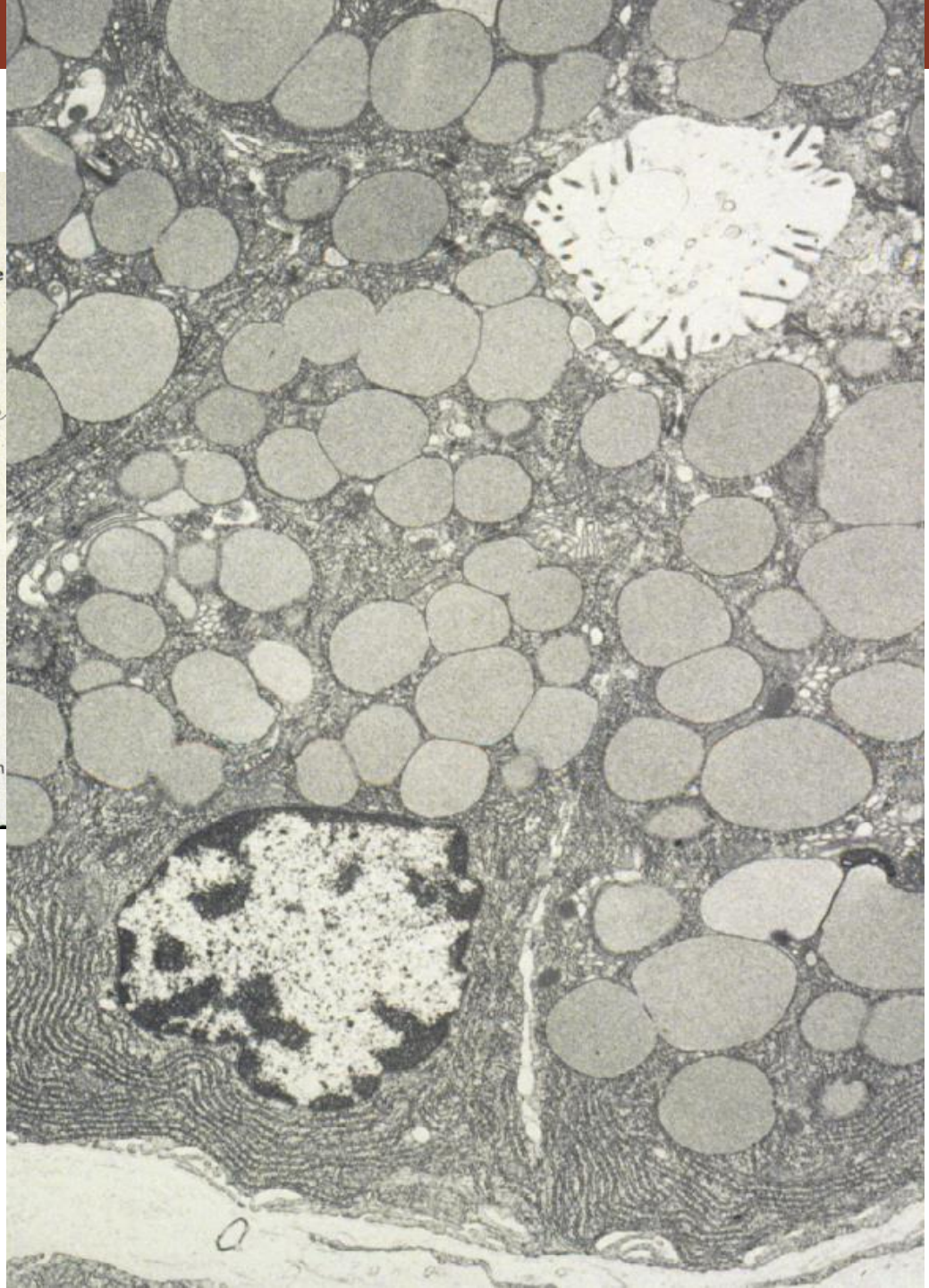
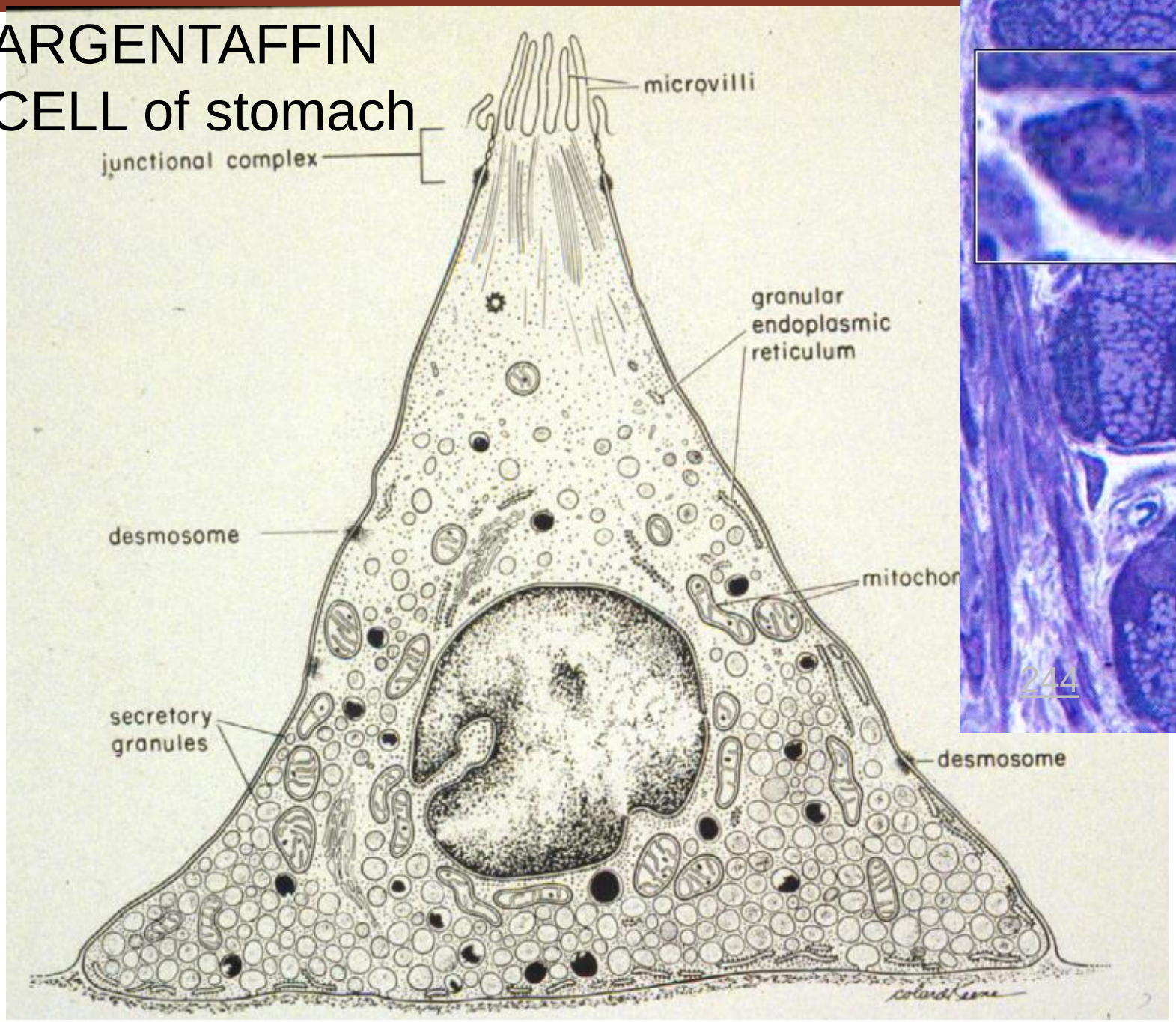


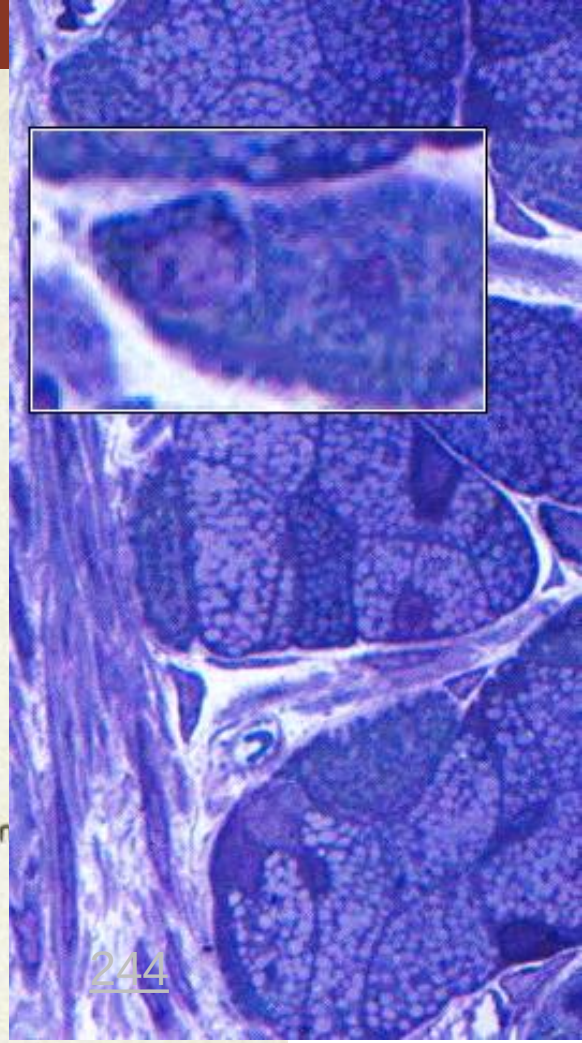
Figure 25–12. Drawing of the chief or zymogenic cell as seen with the electron microscope. (From Winchester. J. Cell Biol. *16*:541, 1963.)

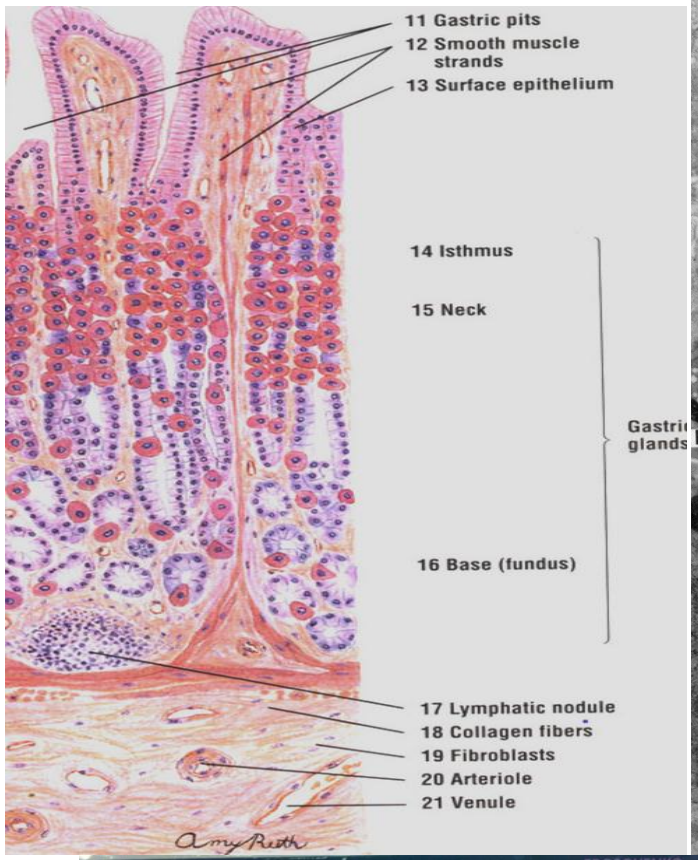
The zymogen granules in chief cells contain inactive enzyme pepsinogens, precursors which are converted in the acid environment of the stomach into active pepsins. Pepsins initiate the hydrolysis of ingested protein in the stomach.



ARGENTAFFIN CELL of stomach

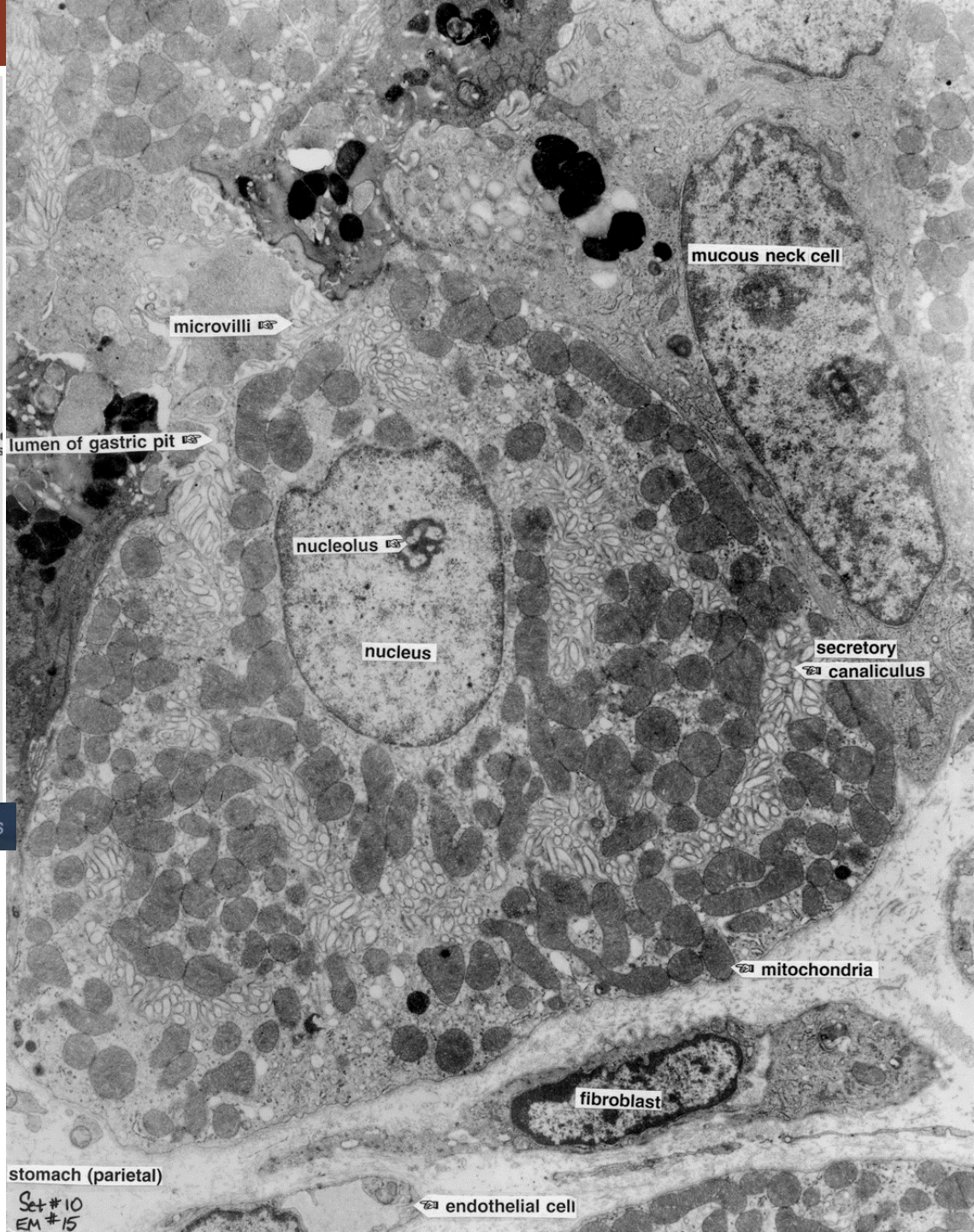






EM 15 Parietal cell produces

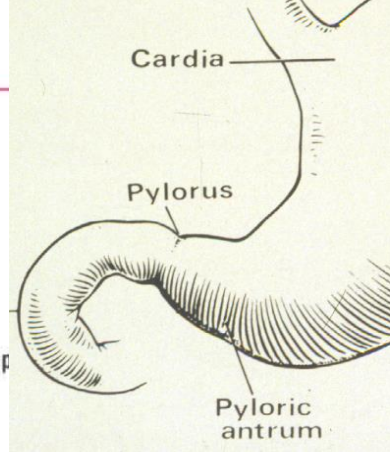
1. HCl
2. Bicarbonate
3. Intrinsic factor for vitamin B12 absorption by gut: needed in red blood cell formation



Gastric atrophy

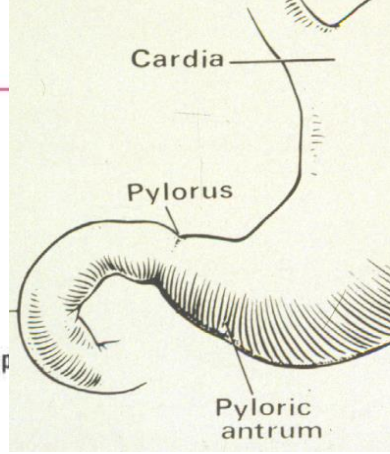
- Gastric atrophy is characterized by chronic inflammation of the gastric mucosa, resulting in loss of gastric glandular cells, and overall atrophy of the gastric mucosa.

- Gastric atrophy may result in extensive loss of parietal cells. This loss of parietal cells may result in decreased secretion of intrinsic factor, which is necessary for vitamin B12 absorption. Vitamin B12 is a necessary cofactor required for DNA synthesis; low levels of vitamin B12 can reduce proliferation of erythroblasts, producing pernicious anemia.



1 Pylorus
11 Duodenum
2 Stomach epithelium
3 Gastric pits
4 Mucosal ridges
5 Lamina propria (stomach)
6 Pyloric glands
7 Muscularis mucosae
8 Pyloric sphincter
9 Muscularis externa (stomach)
10 Myenteric nerve plexus (stomach)
12 Intestinal ep
13 Villi
14 Intervillous spaces
15 Intestinal glands
16 Lymphatic nodule
17 Muscularis mucosae
18 Duodenal glands
19 Submucosa
20 Muscularis externae (duodenum)
21 Myenteric nerve plexus (duodenum)

Fig. 11-11 Pyloric–Duodenal Junction (longitudinal section). Stain: hematoxylin-eosin. Low magnification.



1 Pylorus
11 Duodenum
2 Stomach epithelium
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5 Lamina propria (stomach)
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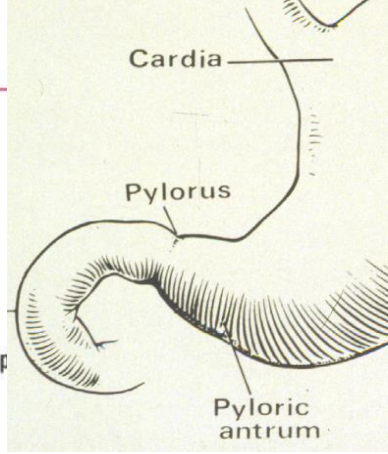
8 Pyloric sphincter
9 Muscularis externa (stomach)
10 Myenteric nerve plexus (stomach)
12 Intestinal ep
13 Villi
14 Intervillous spaces
15 Intestinal glands
16 Lymphatic nodule
17 Muscularis mucosae
18 Duodenal glands
19 Submucosa
20 Muscularis externae (duodenum)
21 Myenteric nerve plexus (duodenum)

Pyloric glands

Fig. 11-11 Pyloric–Duodenal Junction (longitudinal section). Stain: hematoxylin-eosin. Low magnification.

Simple columnar glandular epithelial cells



Pyloric glands

1 Pylorus
11 Duodenum
2 Stomach epithelium
3 Gastric pits
4 Mucosal ridges
5 Lamina propria (stomach)
6 Pyloric glands
7 Muscularis mucosae
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20 Muscularis externae (duodenum)
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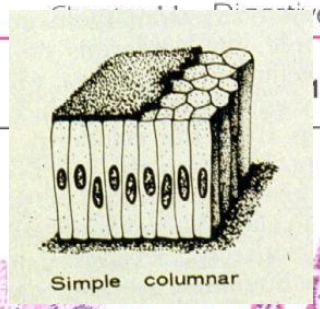
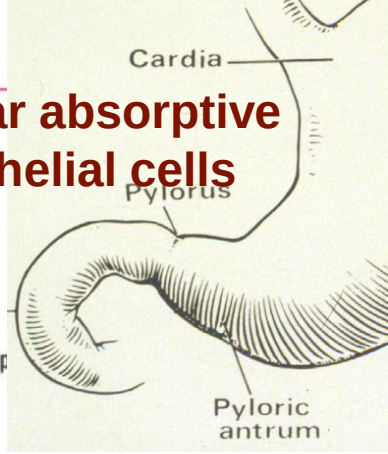
Fig. 11-11 Pyloric–Duodenal Junction (longitudinal section). Stain: hematoxylin-eosin. Low magnification.

Simple columnar glandular epithelial cells



Simple columnar absorptive and goblet epithelial cells



Pyloric glands

1 Pylorus

1 Duodenum

2 Stomach epithelium

3 Gastric pits

4 Mucosal ridges

5 Lamina propria (stomach)

6 Pyloric glands

7 Muscularis mucosae

8 Pyloric sphincter

9 Muscularis externa (stomach)

10 Myenteric nerve plexus (stomach)

12 Intestinal ep

13 Villi

14 Intervillous spaces

15 Intestinal glands

16 Lymphatic nodule

17 Muscularis mucosae

18 Duodenal glands

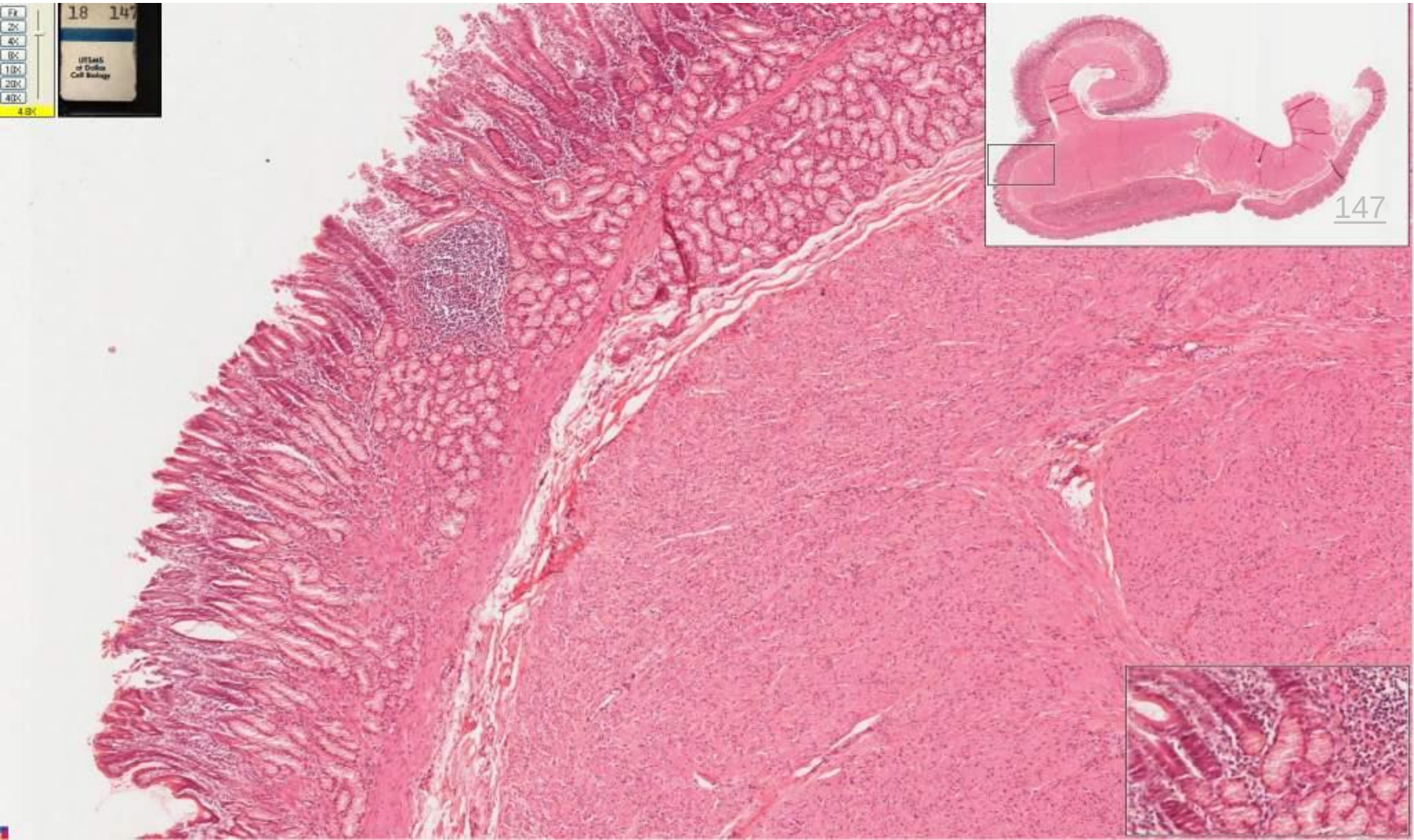
19 Submucosa

20 Muscularis externae (duodenum)

21 Myenteric nerve plexus (duodenum)

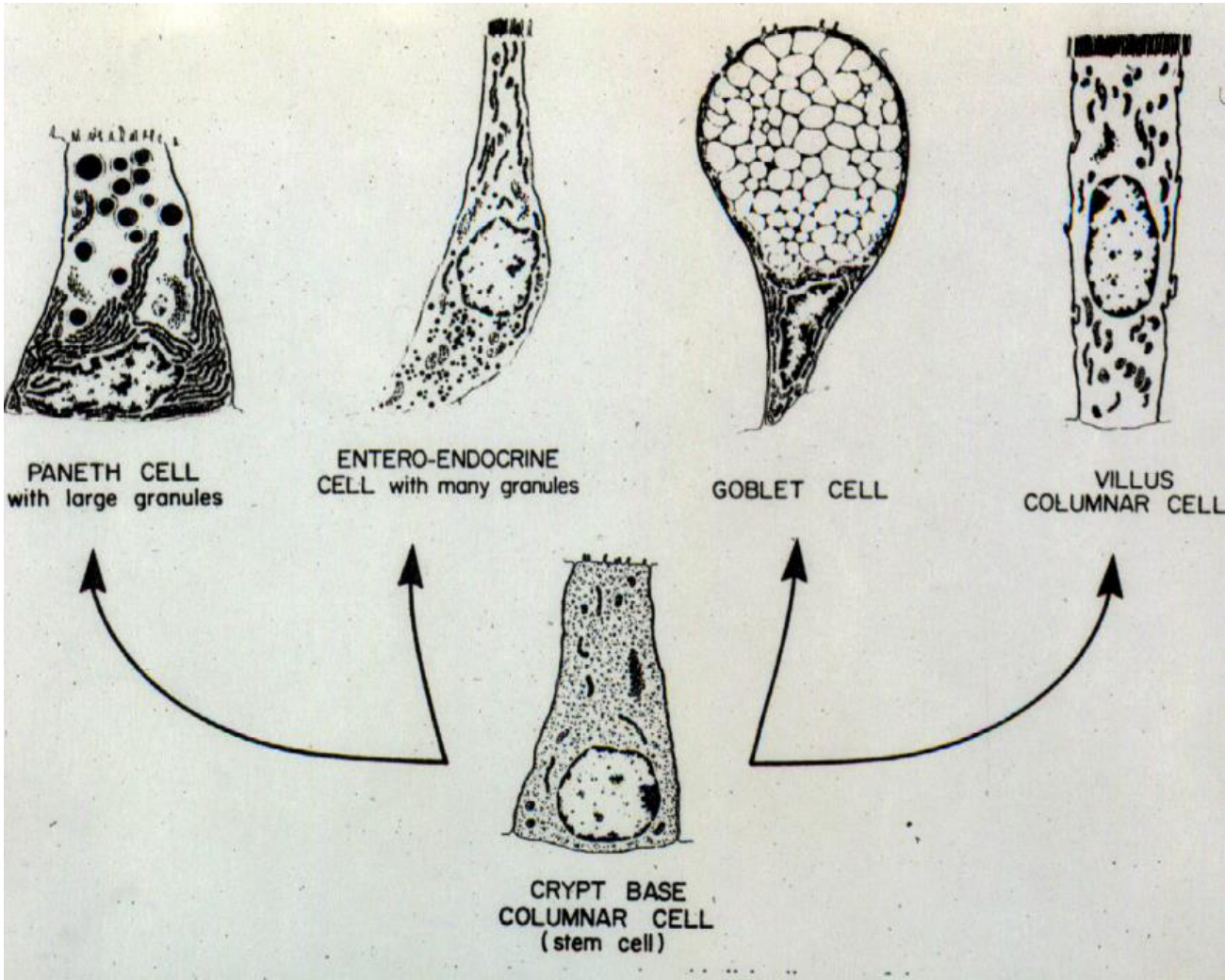
Fig. 11-11 Pyloric–Duodenal Junction (longitudinal section). Stain: hematoxylin-eosin. Low magnification.

Pyloroduodenal junction, baboon



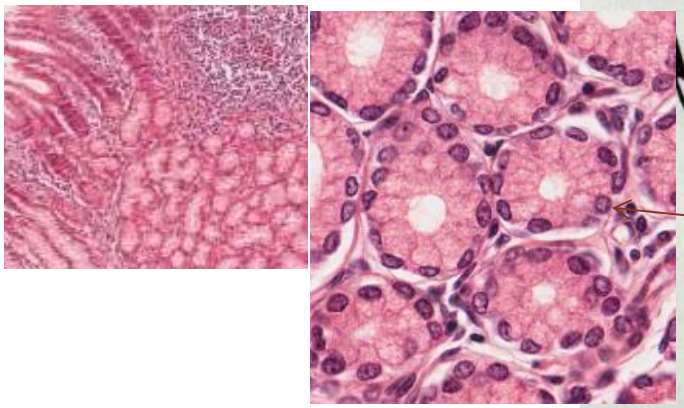
EPITHELIUM of the intestine - SIMPLE COLUMNAR

ABSORPTIVE CELLS
GOBLET CELLS
ARGENTAFFIN CELLS
PANETH CELLS
and cells of duodenal glands

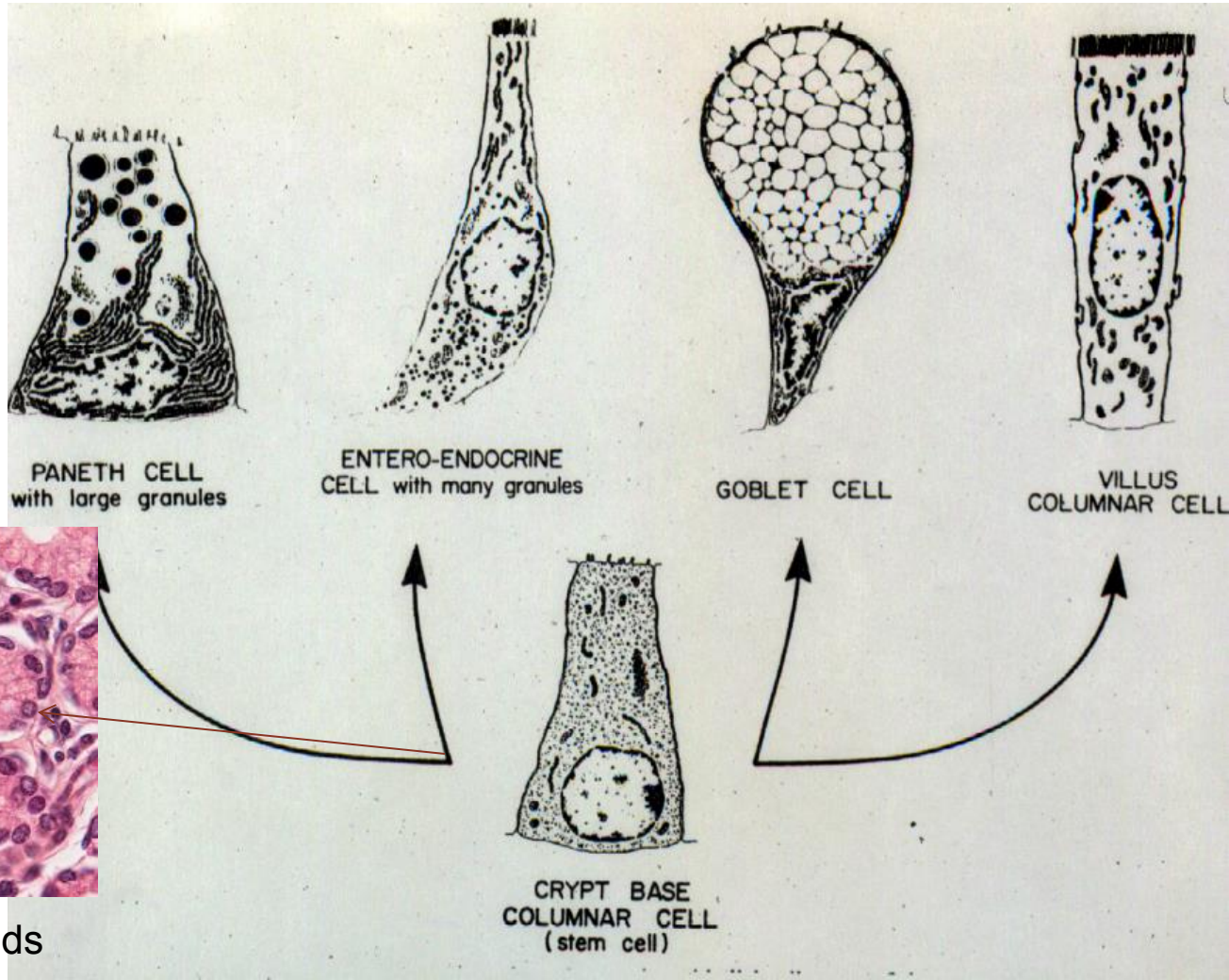


EPITHELIUM of the intestine - SIMPLE COLUMNAR

ABSORPTIVE CELLS
GOBLET CELLS
ARGENTAFFIN CELLS
PANETH CELLS
and cells of duodenal glands



Submucosal Brunner's glands



ABSORPTIVE CELL

BRUSH BORDER

GLYCOCALYX

- **PROTECTION AGAINST ENZYMES**
- **ACTIVE IN DEIGESTION**

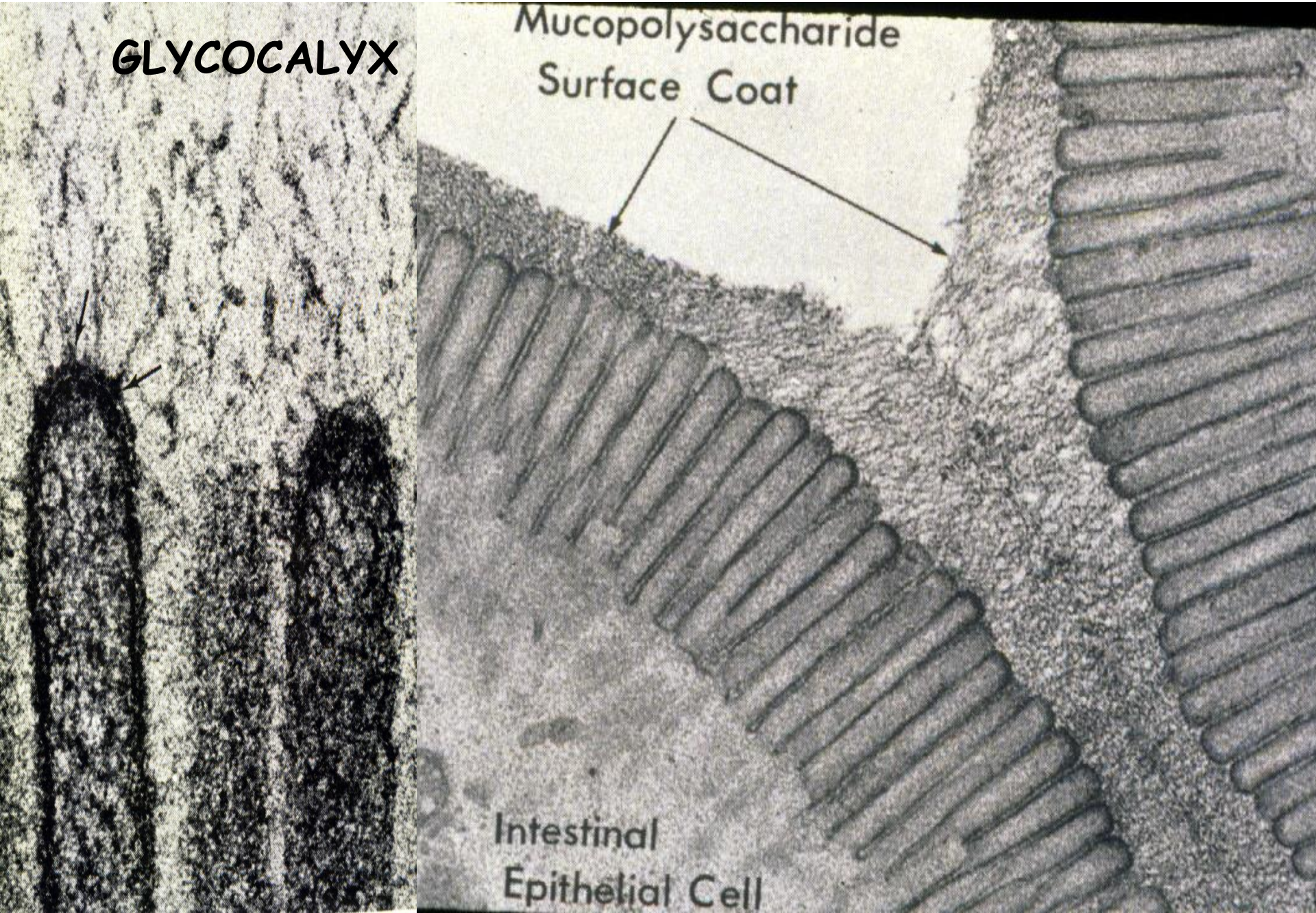
TERMINAL WEB

ELONGATED MITOCHONDRIA

GOLGI COMPLEX LARGE

SER & RER

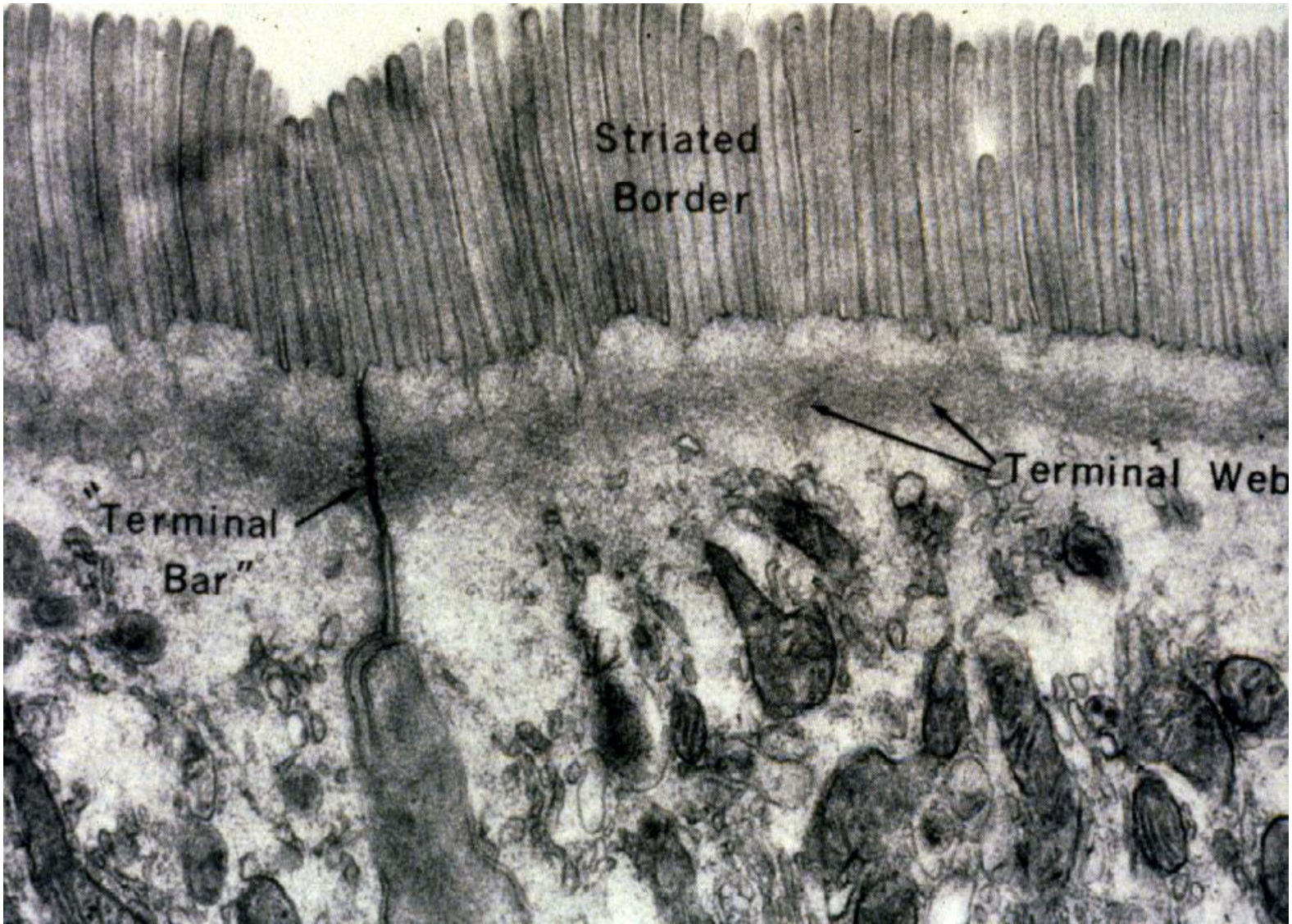
LATERAL SURFACES - INTERDIGITATION


GLYCOCALYX
Mucopolysaccharide
Surface Coat
Intestinal
Epithelial Cell

BRUSH BORDER

GLYCOCALYX

- PROTECTION AGAINST ENZYMES
- ACTIVE IN DEIGESTION



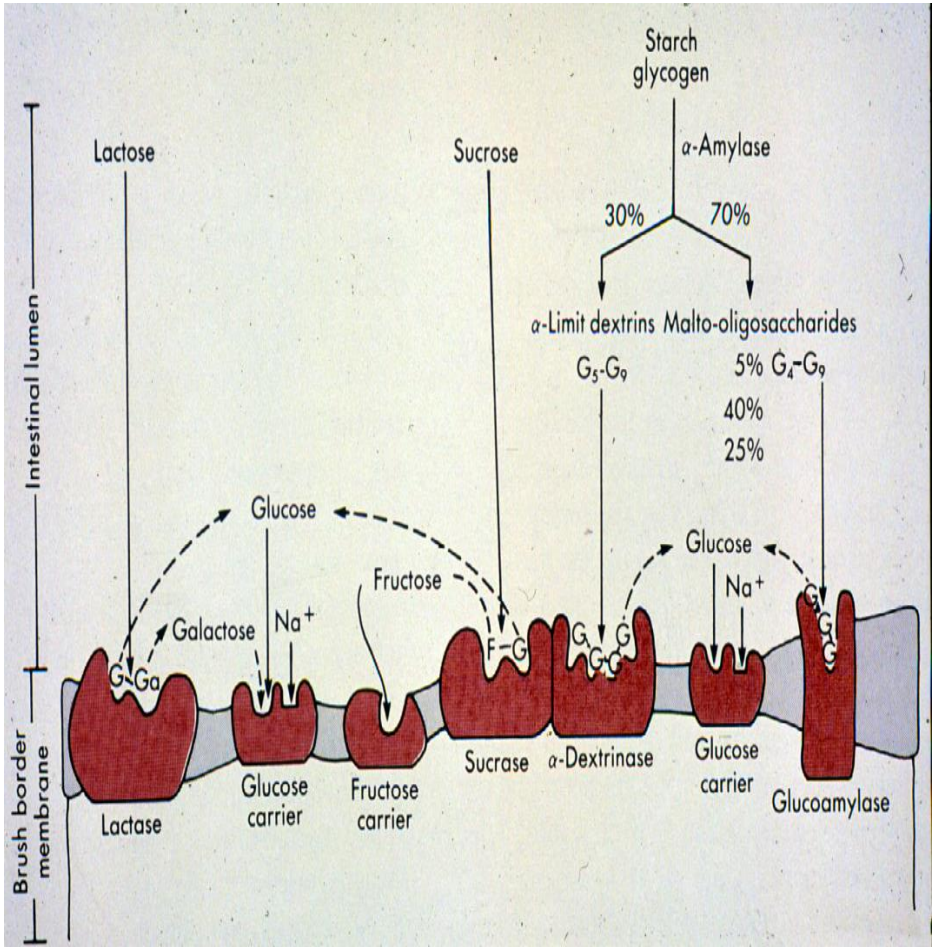
ENZYMES OF INTESTINAL ABSORPTIVE CELL

SEVERAL PEPTIDASES
- POLYPEPTIDES TO AMINO ACIDS

FOUR DISACCHARIDASES
- DISACCHARIDES TO MONOSACCHARIDES

LIPASE
- NEUTRAL FATS TO GLYCEROL AND FATTY ACID

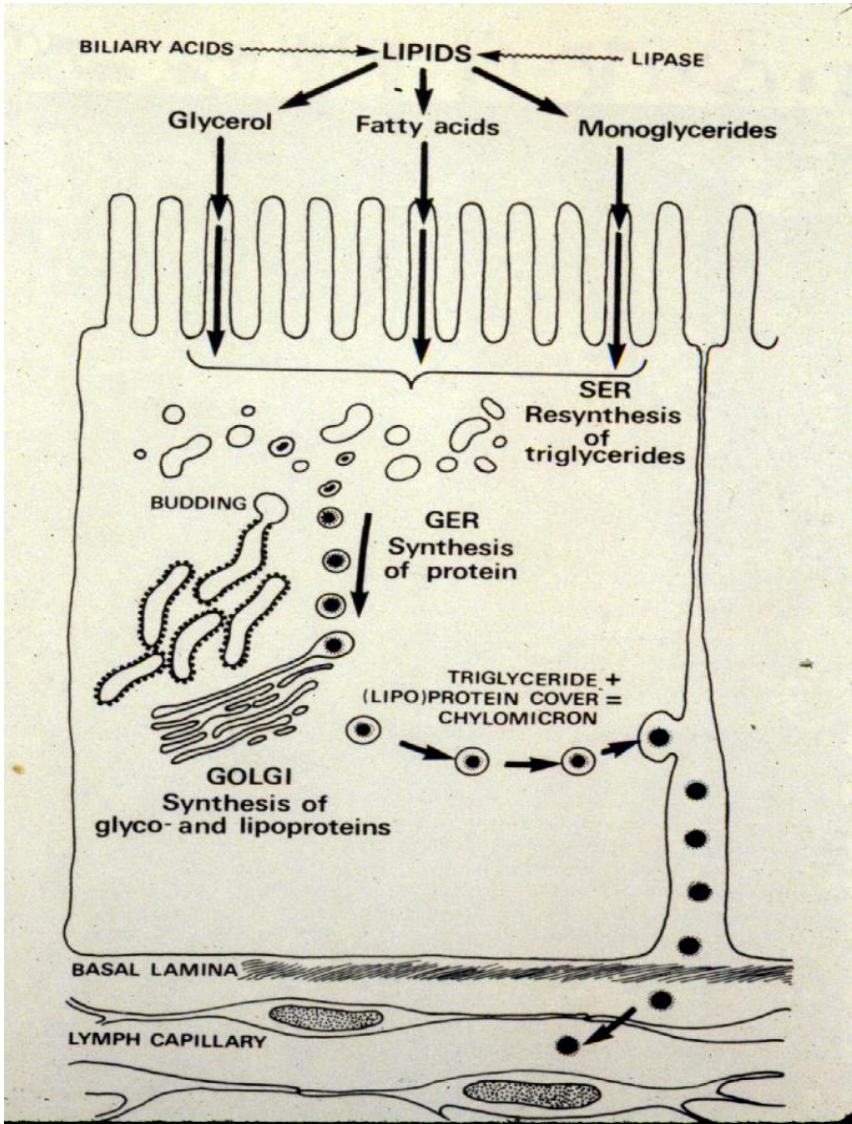
CARBOHYDRATASES
- SMALL AMOUNT OF AMYLASE

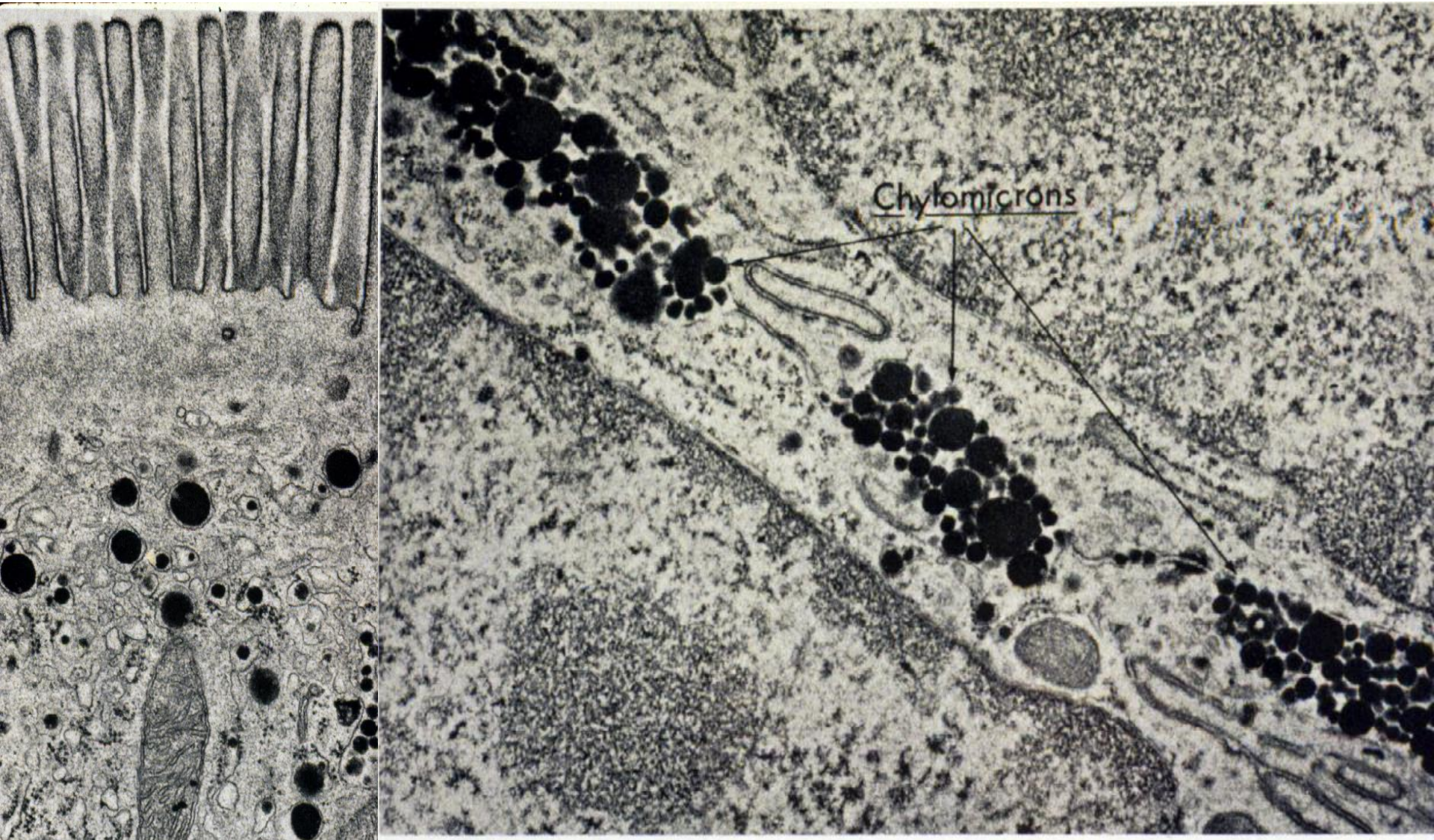


BASIC MECHANISM OF ABSORPTION

ACTIVE TRANSPORT
- **MONOSACCHARIDES**
- **AMINO ACIDS**

PASSIVE DIFFUSION
- **FATTY ACIDS**
- **MONOGLYCERIDES**

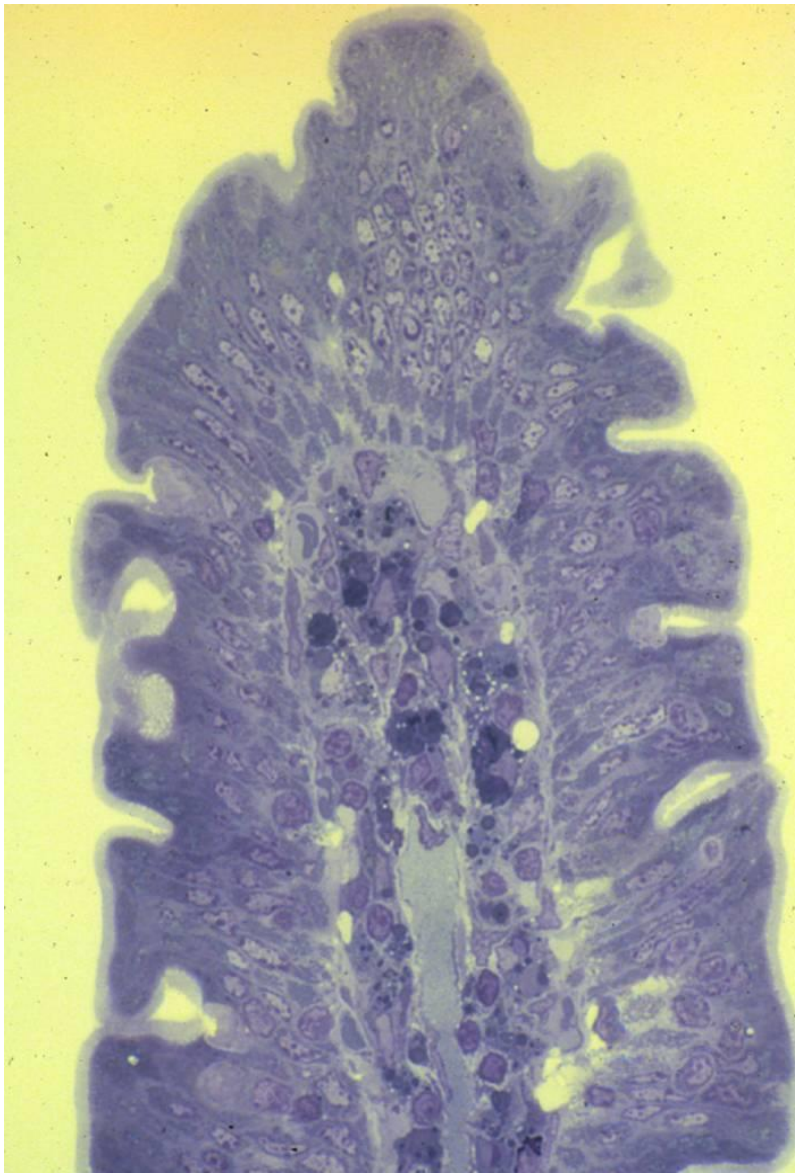


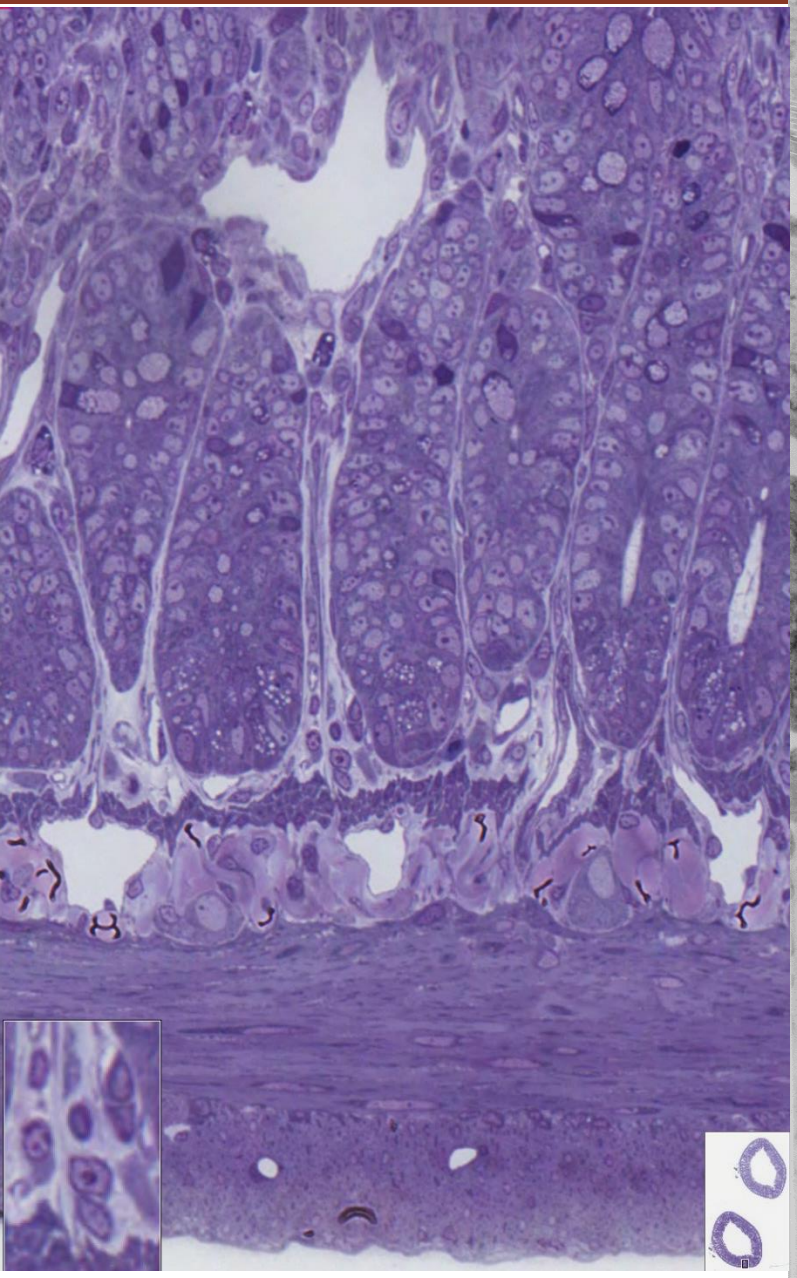


gure 26–29. Electron micrograph of the boundary between two rat intestinal epithelial cells during lipid absorpt
e absorbed lipid has been discharged through the lateral cell surfaces and is seen to have accumulated here

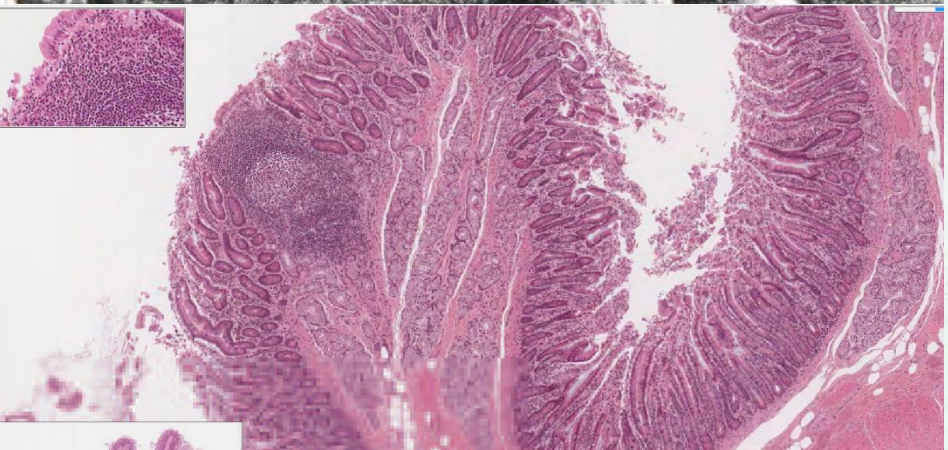
LAMINA PROPRIA

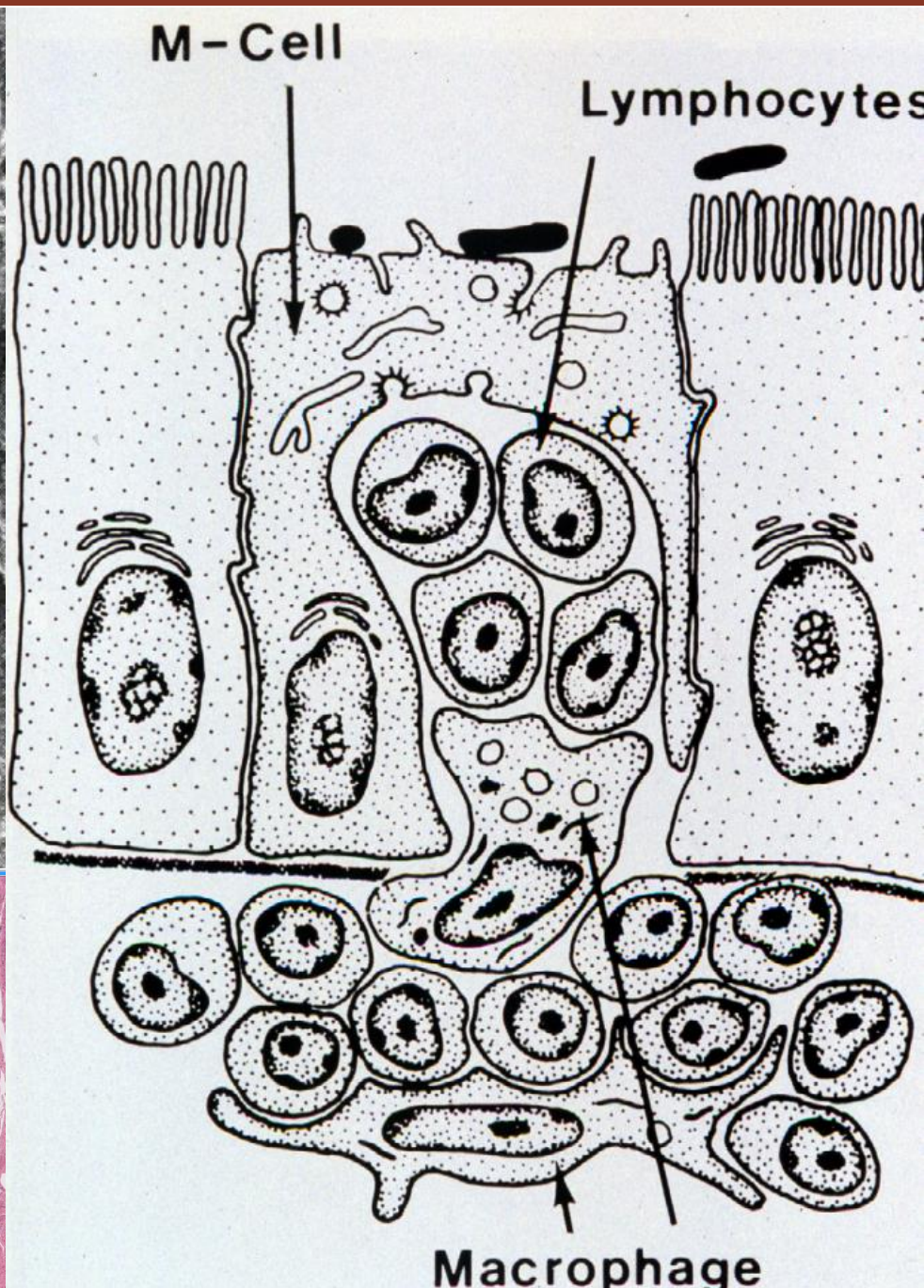
- CONNECTIVE TISSUE BETWEEN INTESTINAL GLANDS AND FORMS CORES OF INTESTINAL VILLI
- CENTRAL LACTEAL
- LARGE NUMBERS OF LYMPHOCYTES, PLASMA CELLS, EOSINOPHILS, MAST CELLS, AND MACROPHAGES
- SMOOTH MUSCLE INNERVATED BY MEISSNER'S PLEXES

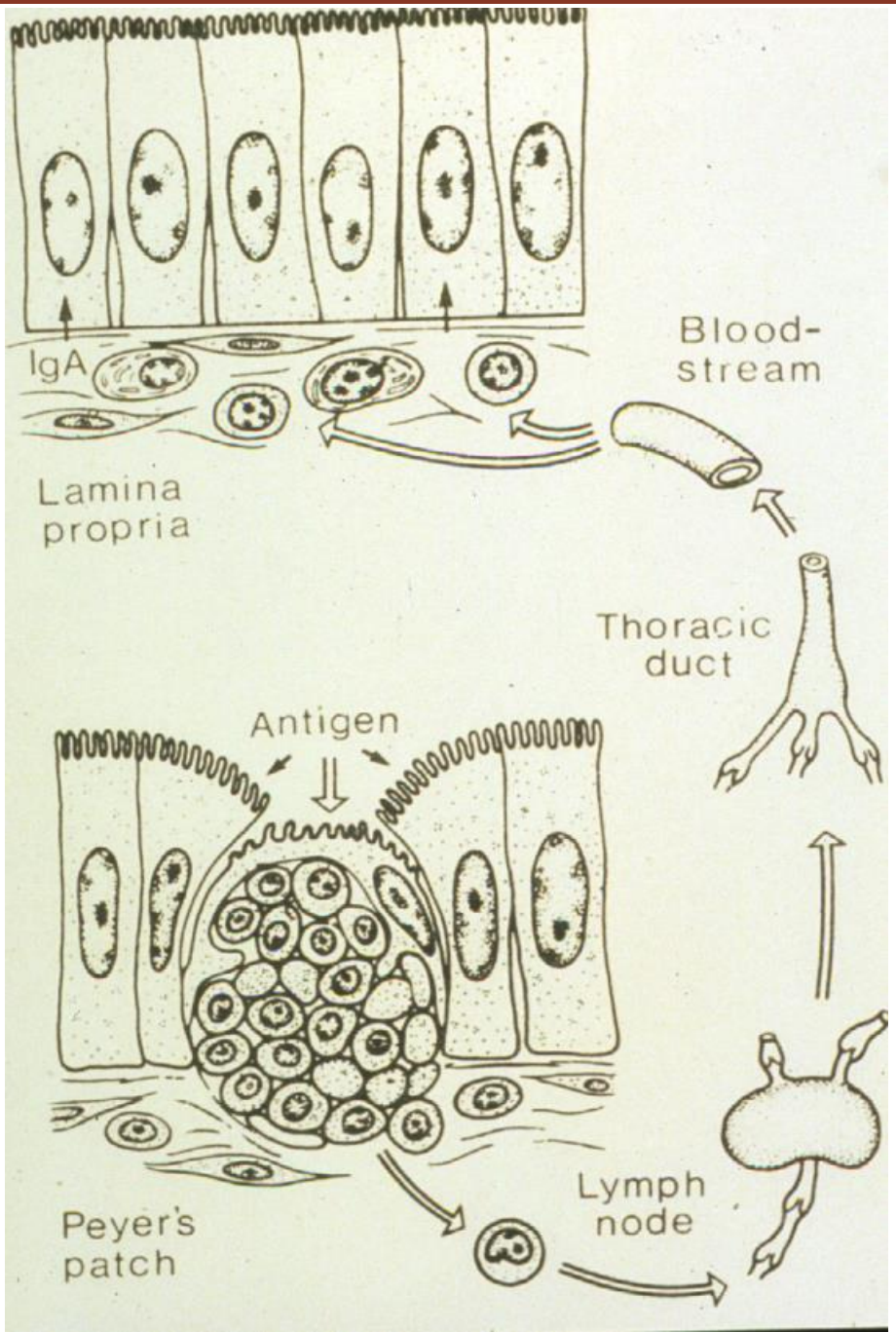


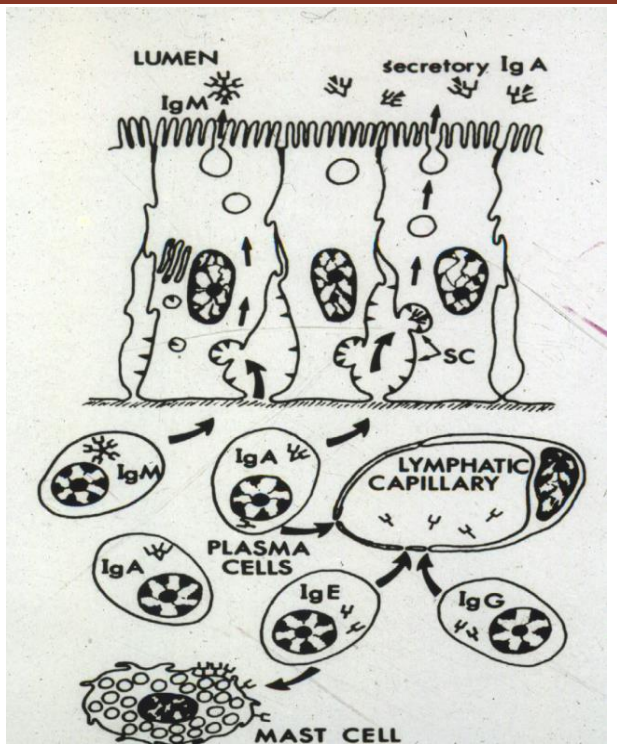


32409 rat intestine




M-Cell
Lymphocytes
Macrophage

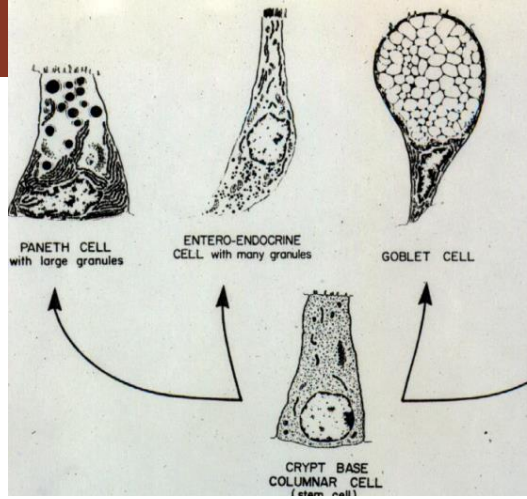




M (microfold) cells are specialized epithelial cells in the mucosa of the ileum overlying the lymphoid follicles of Peyer patches.

M cells selectively endocytose antigens and transport them to the underlying lymphocytes and dendritic cells, which then migrate to lymph nodes for an appropriate immune response.

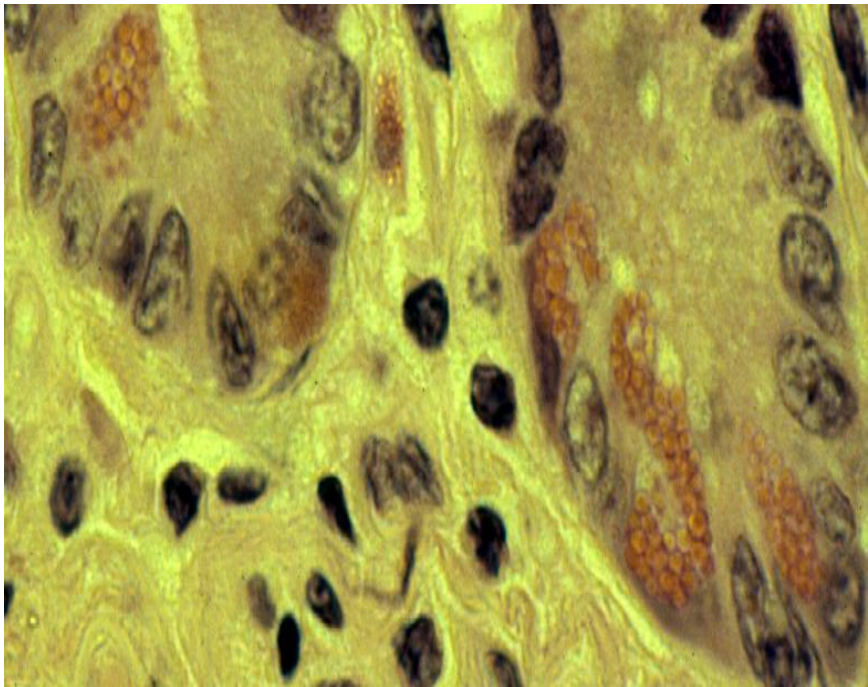
PANETH CELLS

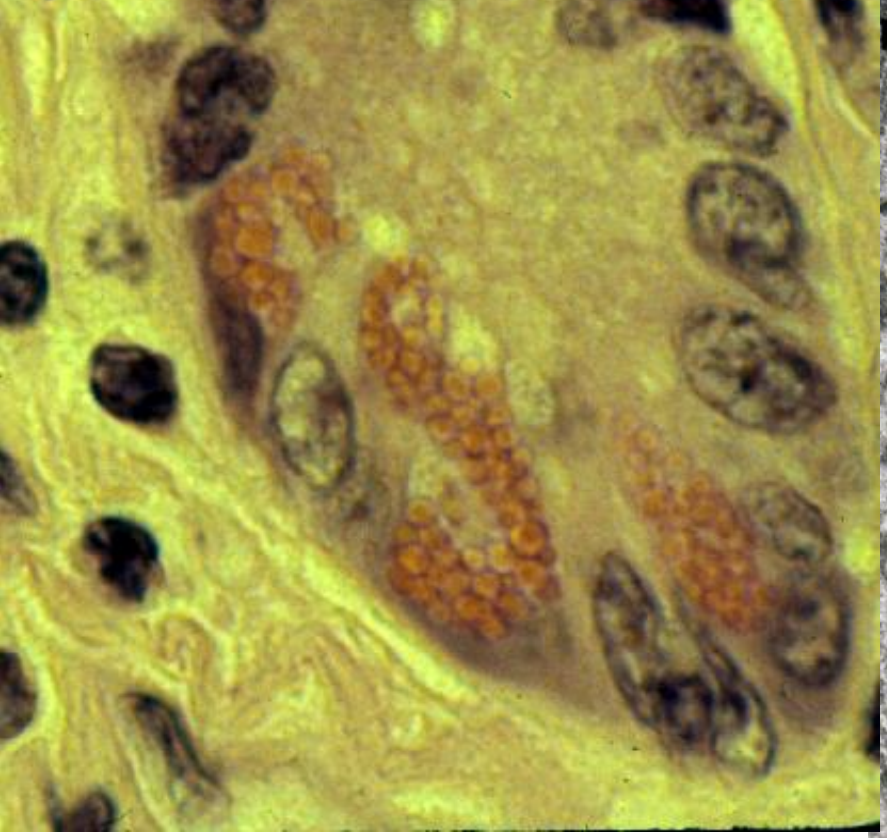


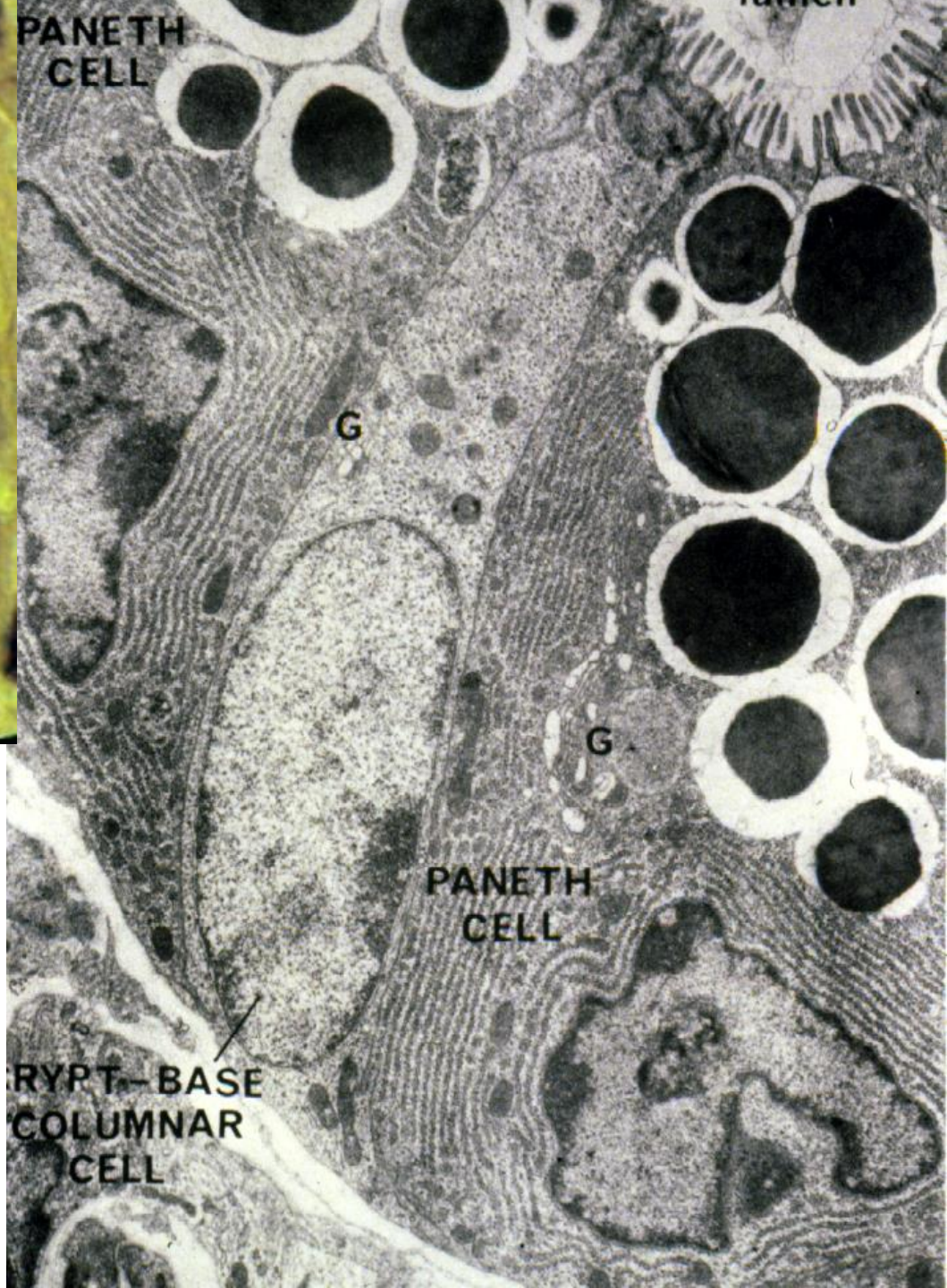
DEPTHS OF CRYPTS OF LIEBERKUHN
STABLE POPULATION
ABUNDANT IN HUMANS, HORSE, & RUMINANTS
- **(ABSENT IN OTHER DOMESTIC SPECIES)**

ORGANELLES INDICATIVE OF PROTEIN SYNTHESIS
LARGE SECRETORY GRANULES
GRANULES
- **ACIDOPHILIC (EOSIN)**
- **LYSOZYME CAPABLE OF LYSING BACTERIA**

CONCENTRATION OF RADIOACTIVE ZINC







Paneth cell granules release lysozyme, phospholipase A2, and hydrophobic peptides called defensins, all of which bind and break down membranes of microorganisms and bacterial cell walls. Paneth cells have an important role in innate immunity and in regulating the microenvironment of the intestinal crypts.

GOBLET CELL

UNICELLULAR GLAND

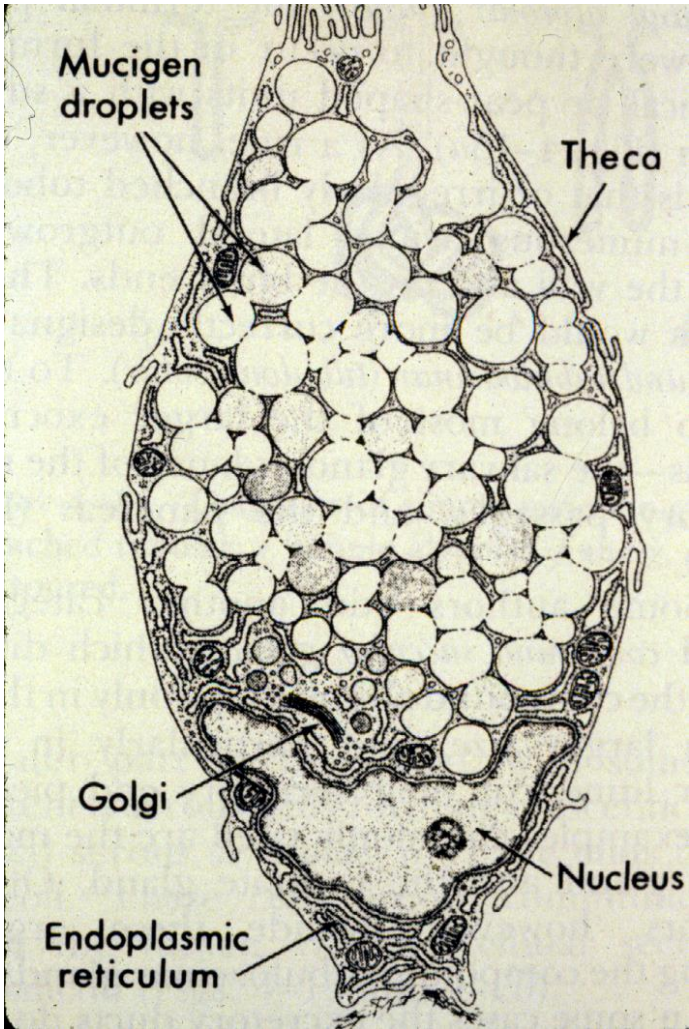
THECA

FLATTENED NUCLEUS

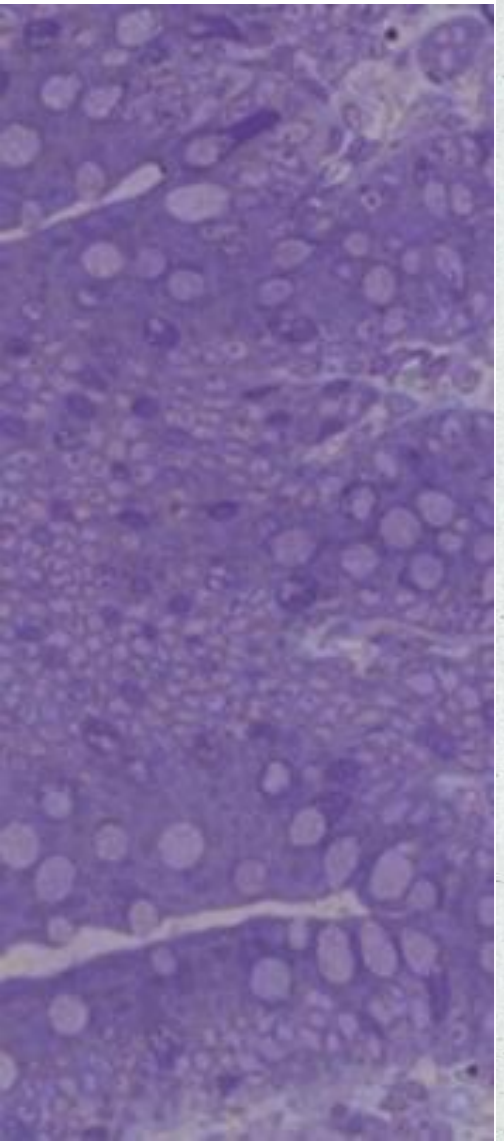
SHORT LIVED - ONE

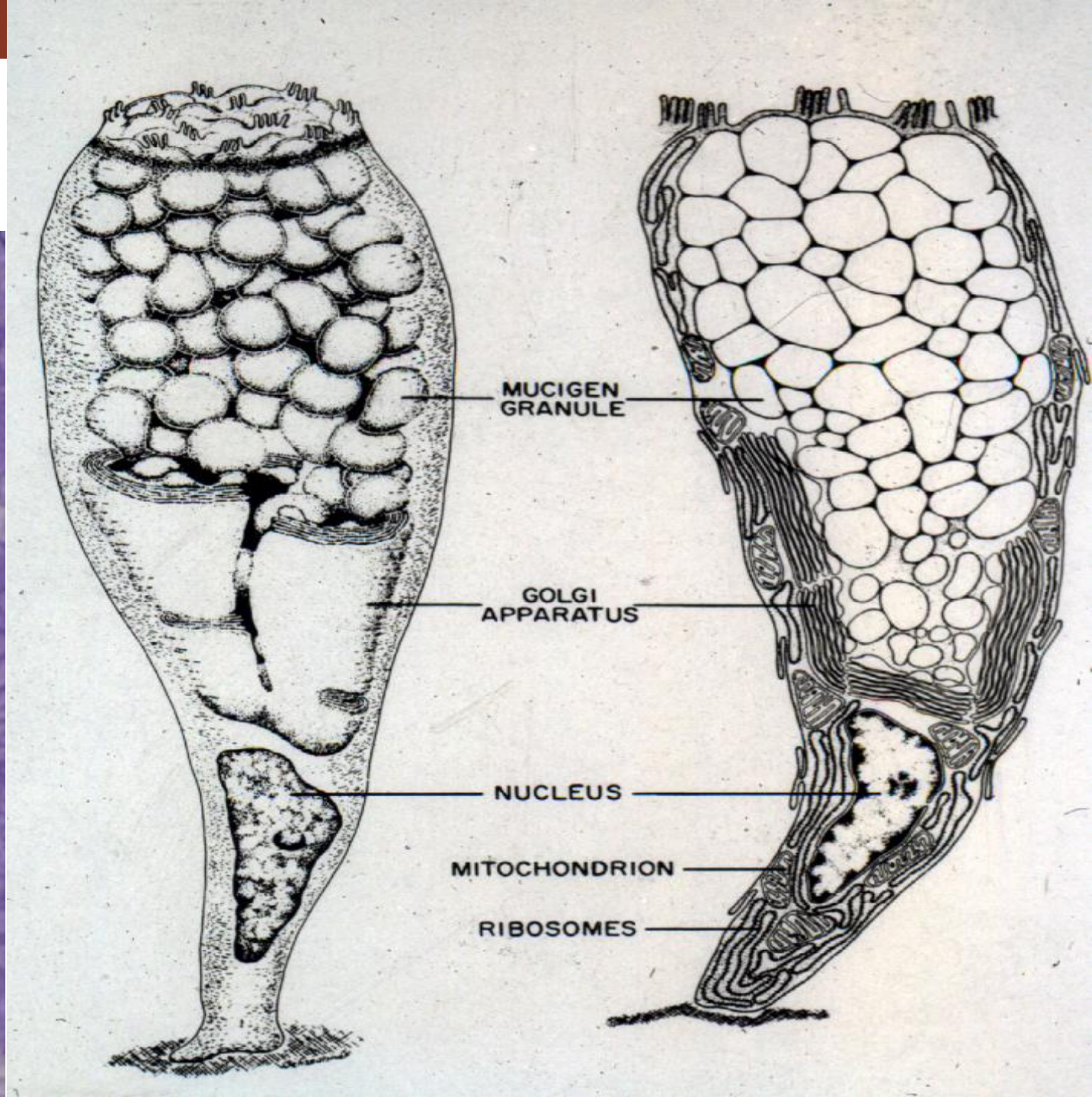
MUCUS

- **RAW EGG WHITE**
- **LUBRICATE AND PROTECT**

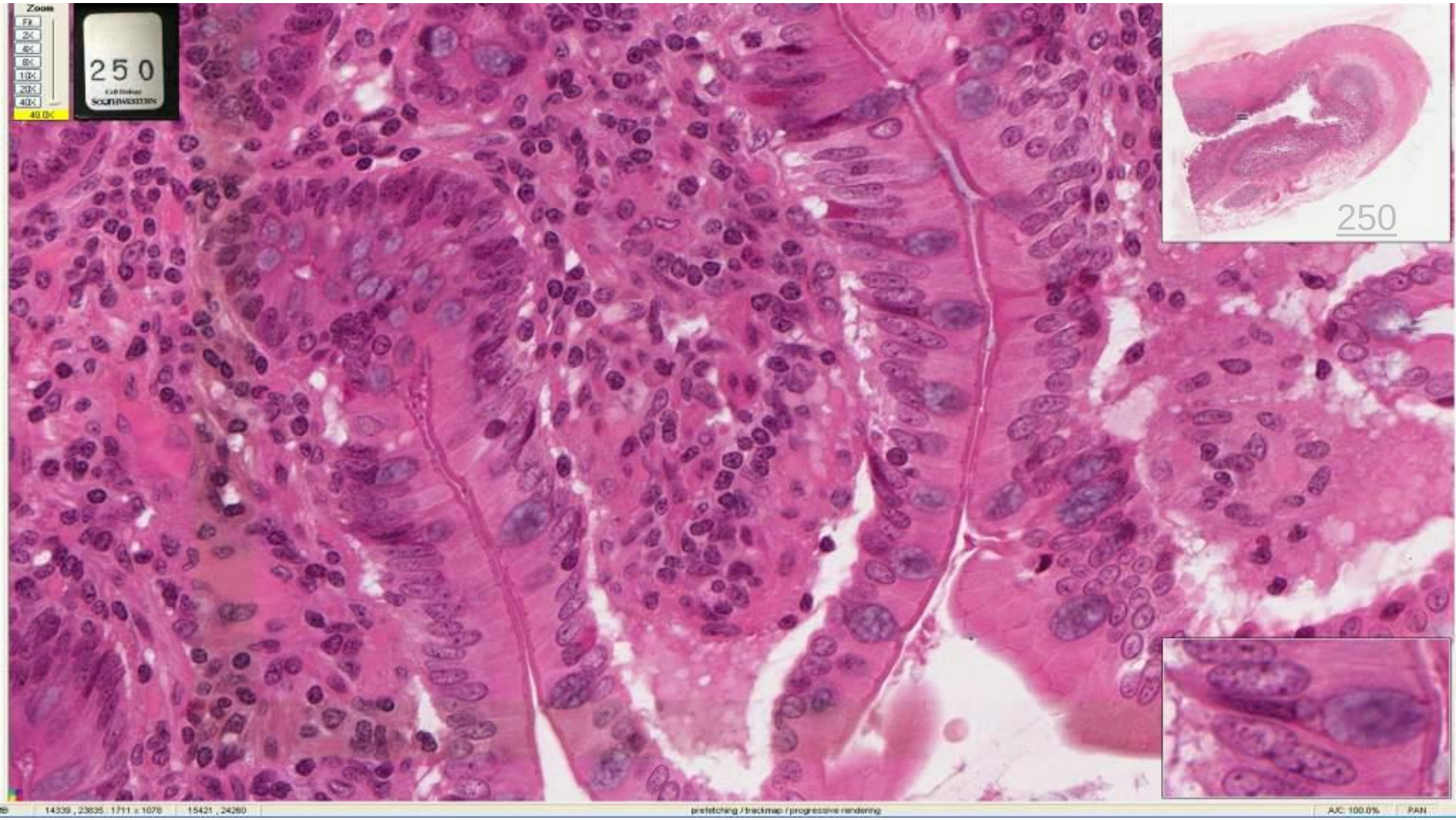


GOBLET CELL

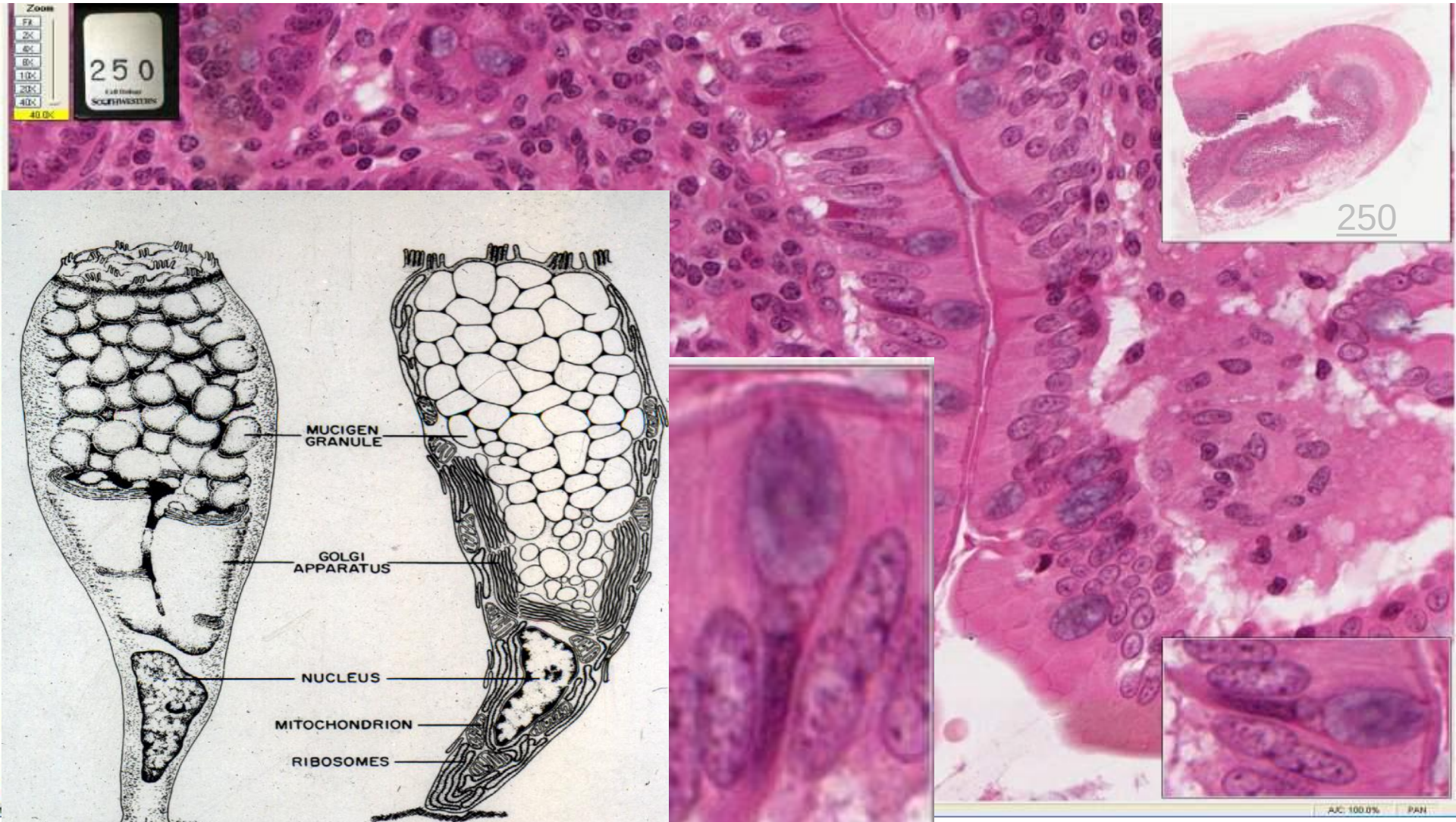



MUCIGEN GRANULE
GOLGI APPARATUS
NUCLEUS
MITOCHONDRION
RIBOSOMES

Goblet cells of ileum, monkey



Goblet cells of ileum, monkey

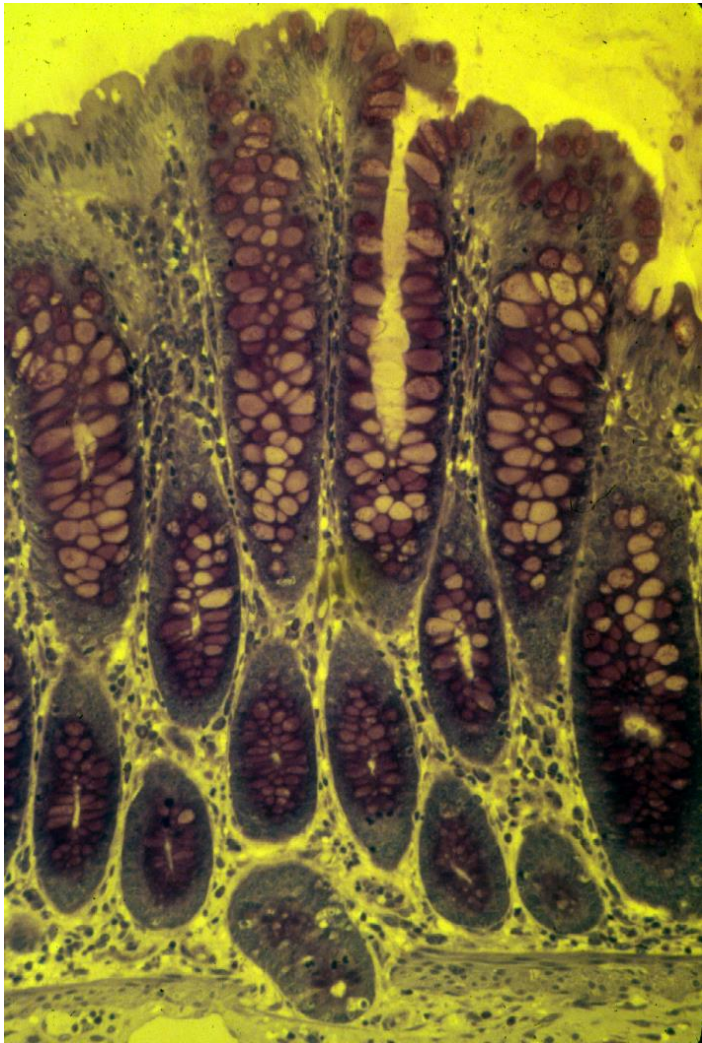


FUNCTION OF MUCUS IN LARGE INTESTINES

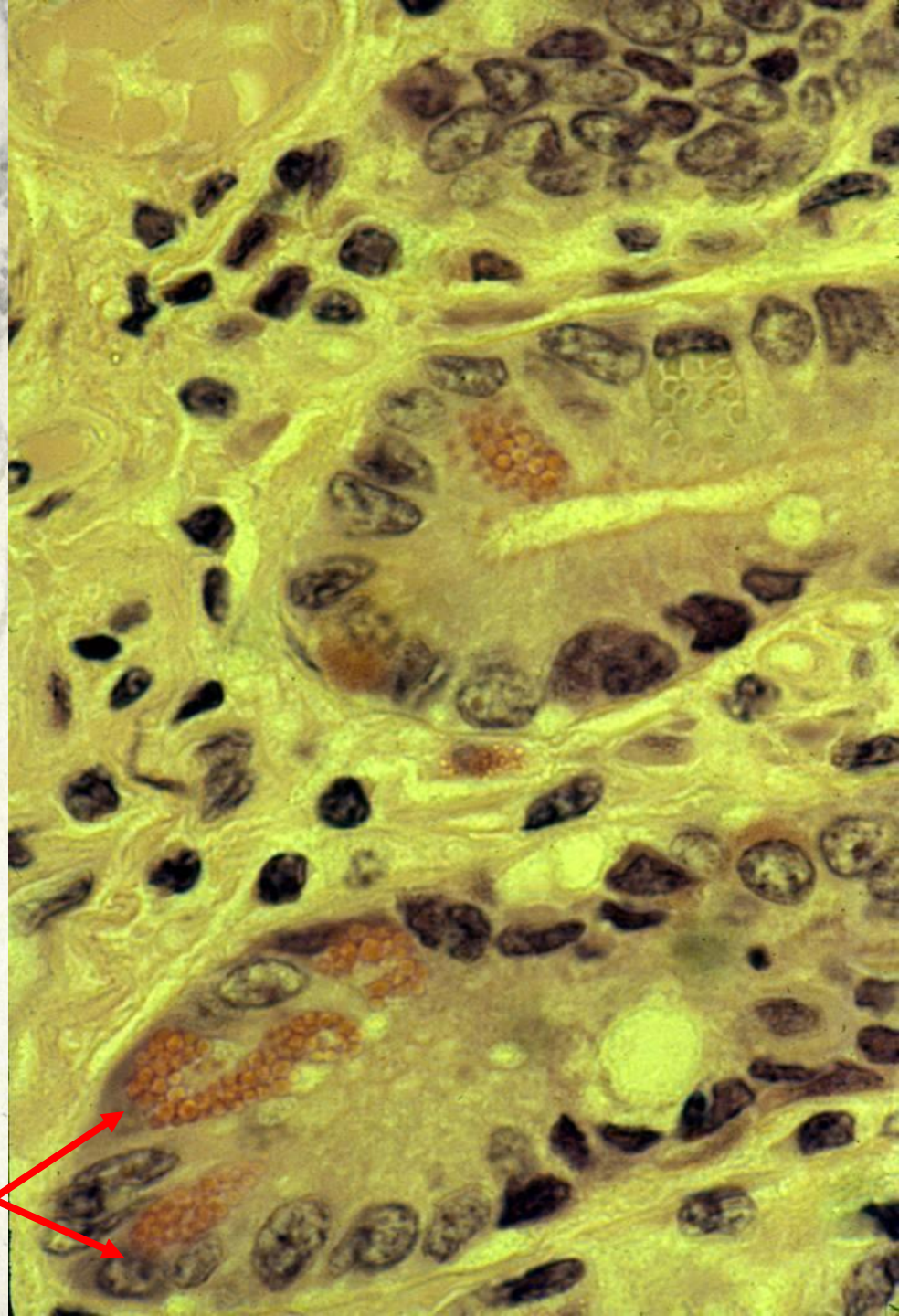
PROTECTS WALL AGAINST EXCORIATION

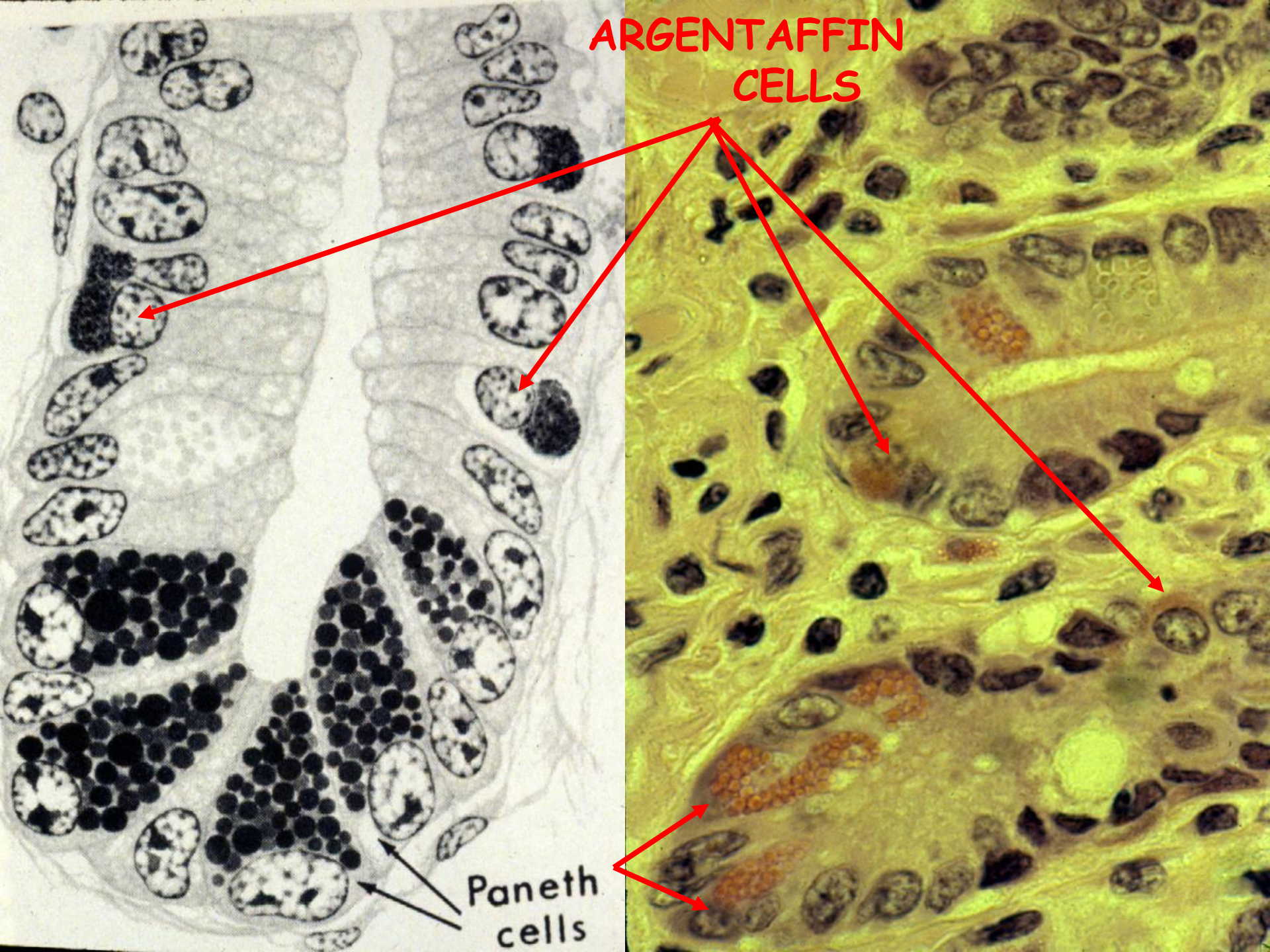
PROVIDES ADHERENT QUALITIES TO FECES

PROTECTS WALL AGAINST BACTERIAL ACTIVITY




Paneth
cells




ARGENTAFFIN
CELLS
Paneth
cells

ARGENTAFFIN (BASAL GRANULAR CELLS)

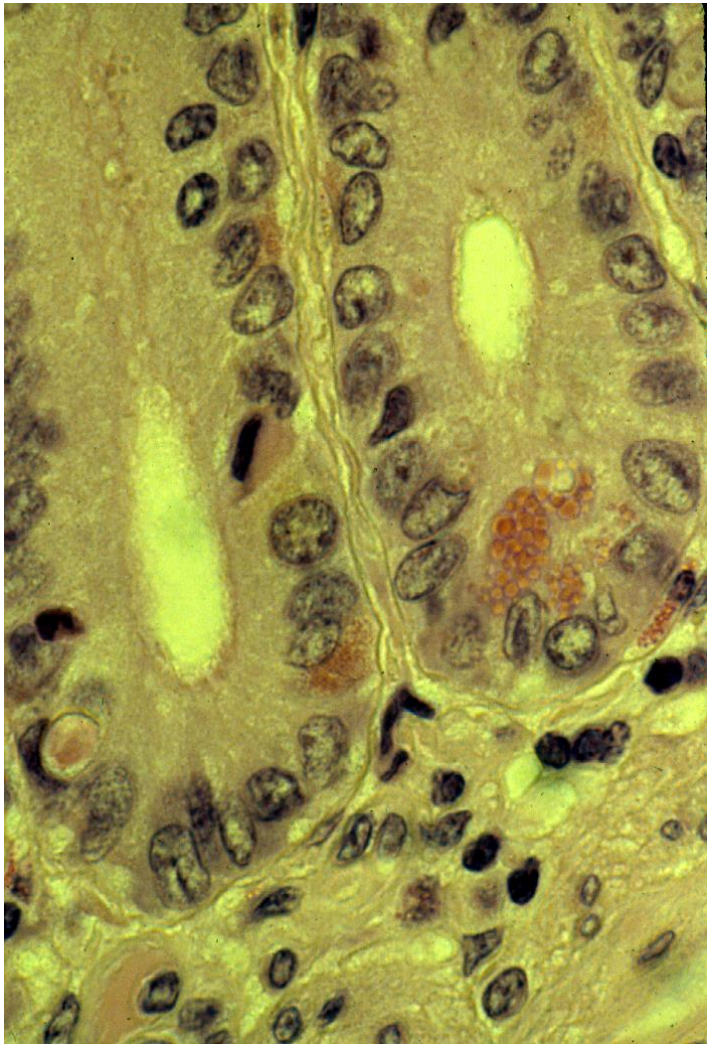
IN CRYPTS AND VILLI

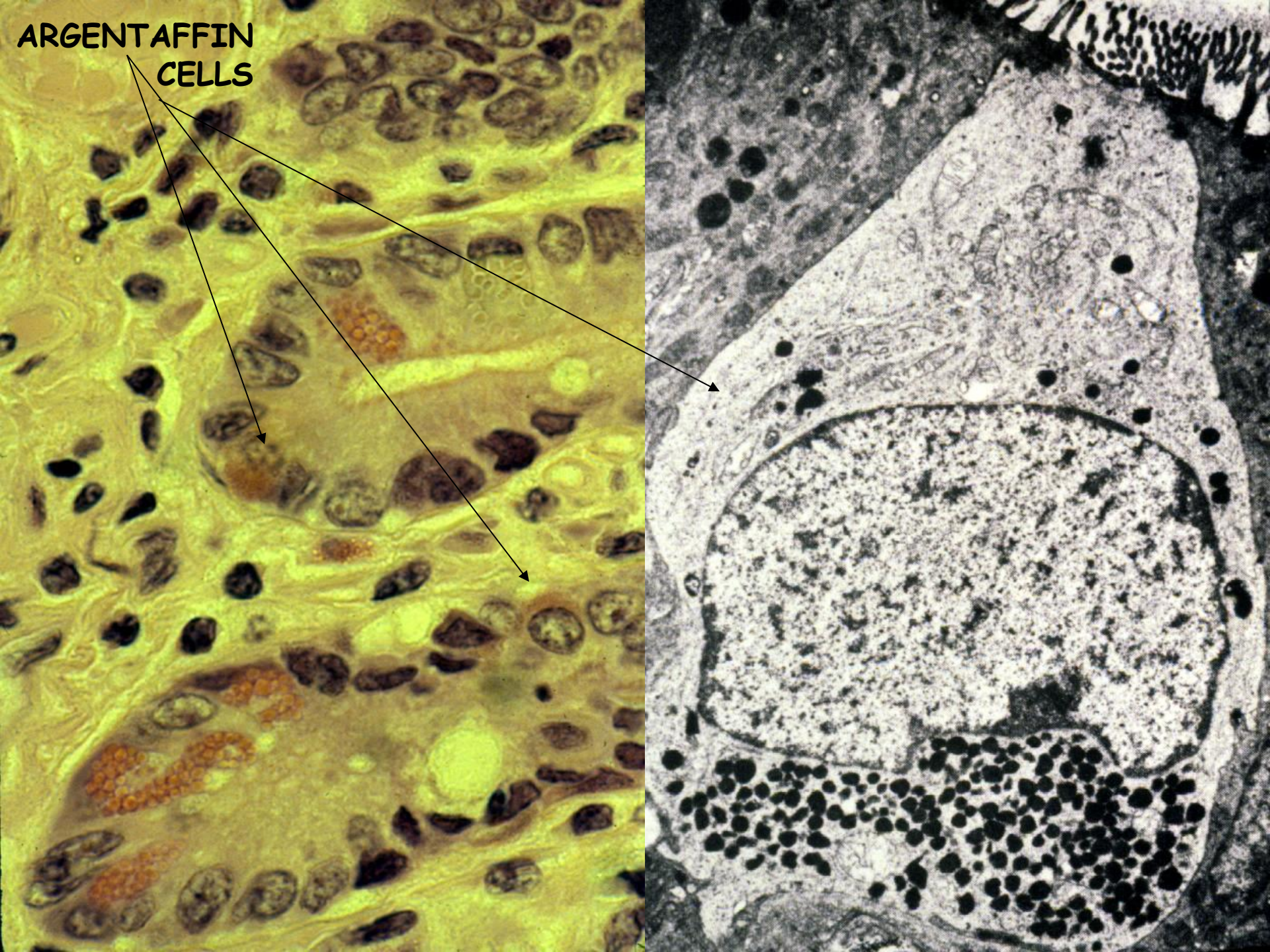
GRANULES AT BASE

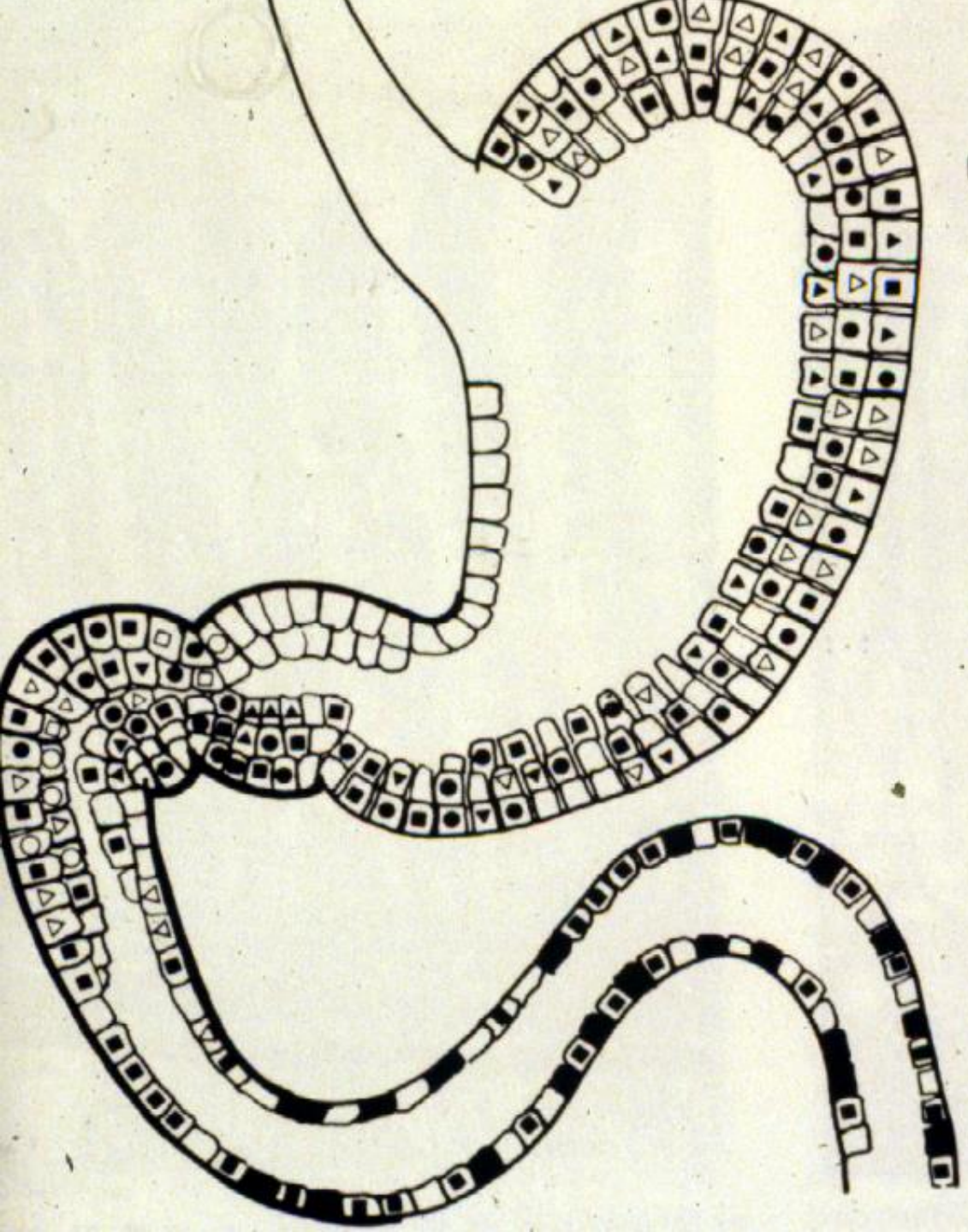
WIDELY SCATTERED THROUGHOUT GI TRACT

SECRETIONS - SEROTONIN

- **VIGOROUS CONTRACTION OF SMOOTH MUSCLE NERVOUS SYSTEM**




ARGENTAFFIN
CELLS



Name of Cells	Product
D_1	Gastric inhibitory polypeptide (GIP)
ECL	Similar to EC
A	Glucagonlike substance
EC	5-Hydroxytryptamine
G	Gastrin
D	Unknown
S	Secretin
I	Unknown

BASAL GRANULAR CELLS (ARGENTAFFIN)

ORGAN	ABUNDANCE
STOMACH	MODERATE
DUODENUM	COMMON
JEJUNUM AND ILEUM	SPARSE
APPENDIX	ABUNDANT

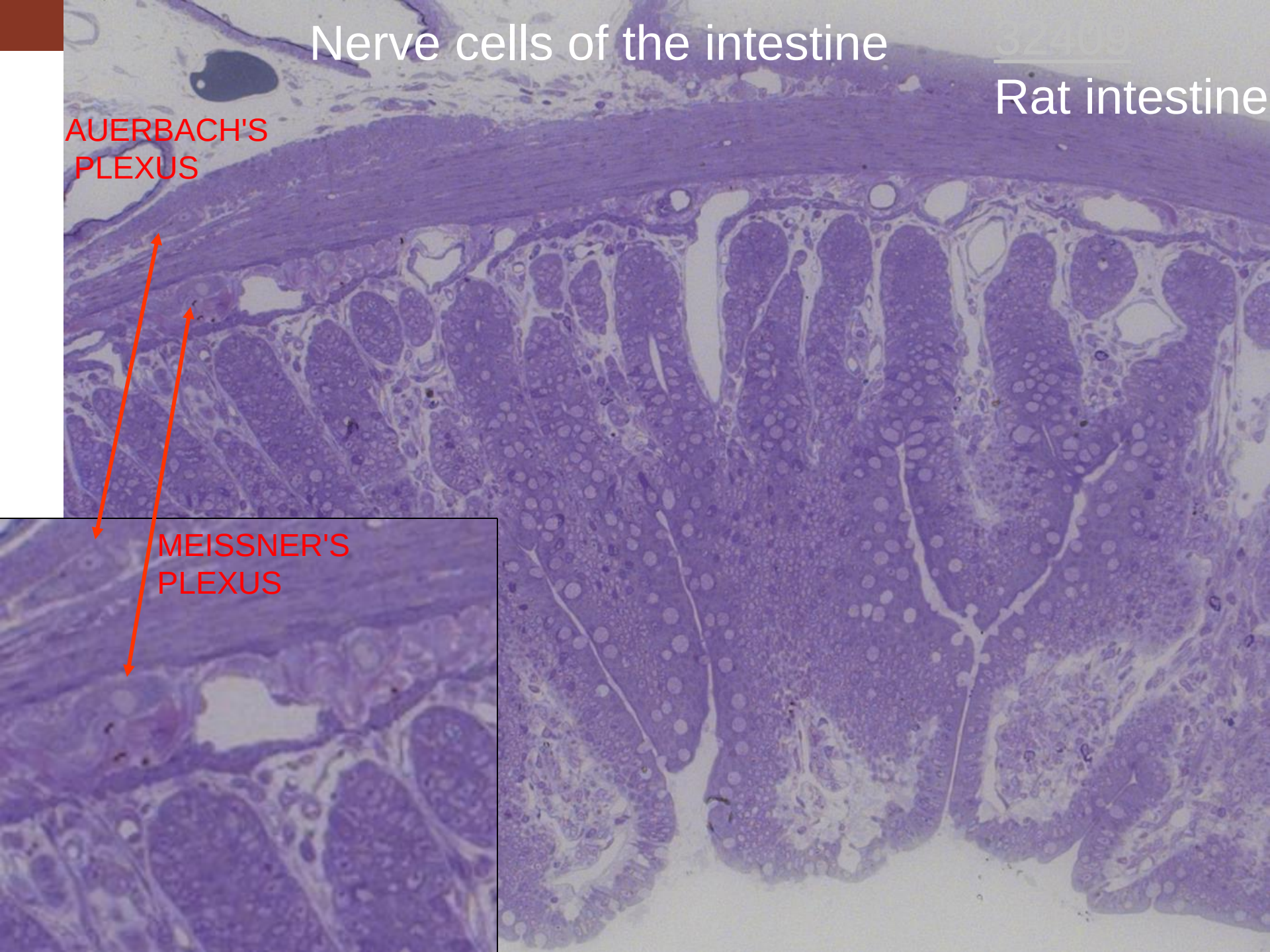
SECRETIONS OF GUT ARGENTAFFIN CELLS

Cell Name	Location	Product	Major Action
A	Stomach	Pancreatic glucagon	Hepatic glycogenolysis
B	Pylorus, duodenum	Somatostatin	Local inhibition of endocrine cells (?)
D	Stomach, intestines	Vasoactive intestinal peptide (VIP)	Ion/water secretion, gut motillity
EC	Stomach, intestine, submucosal glands, appendix, etc.	Serotonin (5-HT), motilin, substance P	Gut motility

SECRETIONS OF GUT
ARGENTAFFIN CELLS

Cell Name	Location	Product	Major Action
G	Pylorus, duodenum	Gastrin	Gastric acid secretion
I	Small intestine	Cholecystokinin	Pancreatic enzyme secretion, gallbladder emptying
K	Small intestine	Gastric inhibitory peptide (GIP)	Inhibition of gastric acid secretion
L	Small intestine, colon	Gut-type glucagon, pancreatic glucagon	Hepatic glycogenolysis
N	Small intestine	Neurotensin	
S	Small intestine	Secretin	Pancreatic and biliary ion/water secretion

Nerve cells of the intestine



Rat intestine

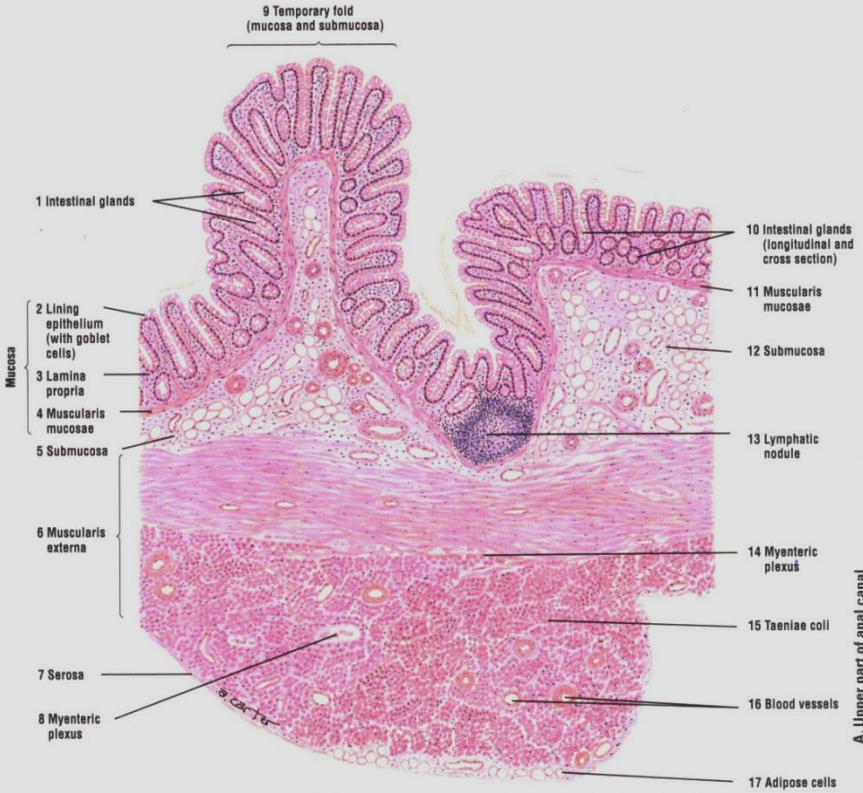


Fig. 12-7 Large Intestine: Colon Wall (transverse section). Stain: hematoxylin-eosin. Medium magnification.

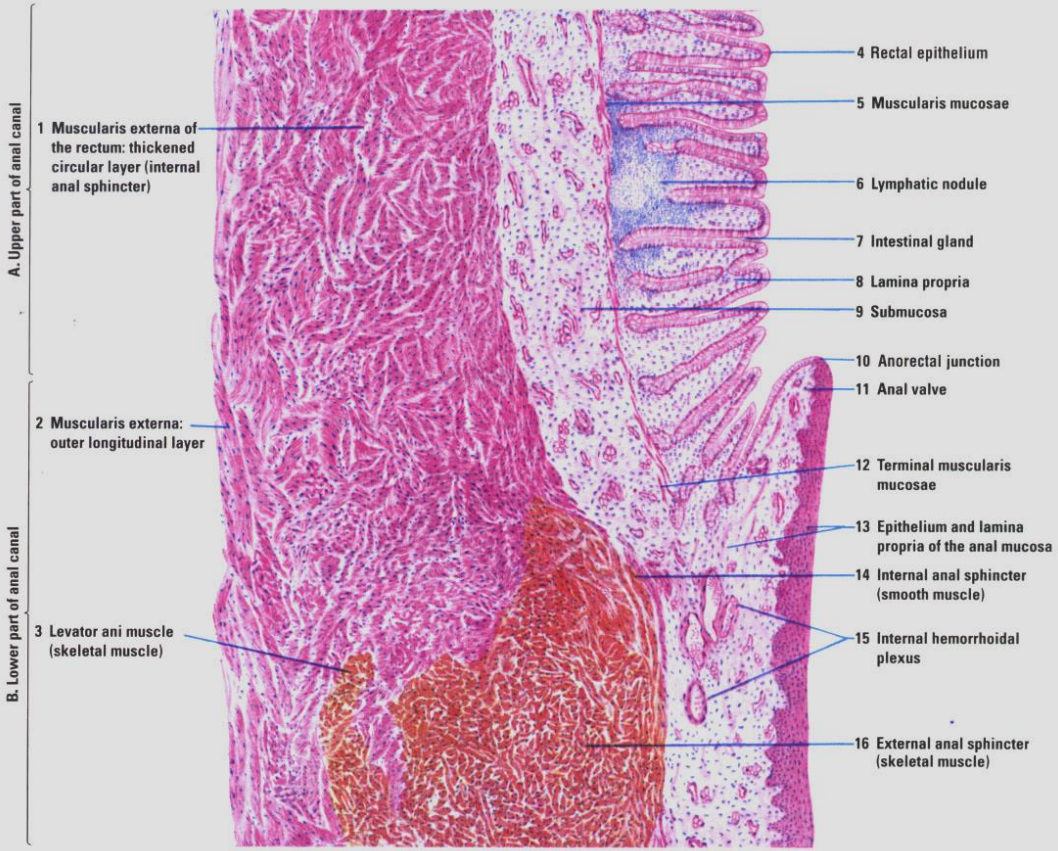


Fig. 12-10 Anal Canal (longitudinal section). Stain: hematoxylin-eosin. Low magnification.

Ninth Edition di Fiore's ATLAS OF HISTOLOGY with FUNCTIONAL CORRELATIONS EROSCHENKO

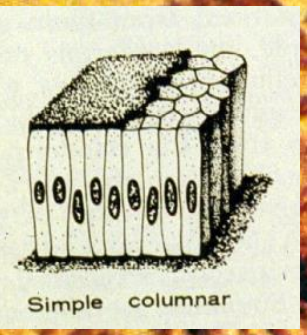
LARGE INTESTINES

ANAL SKIN

LARGE INTESTINES

ANAL SKIN

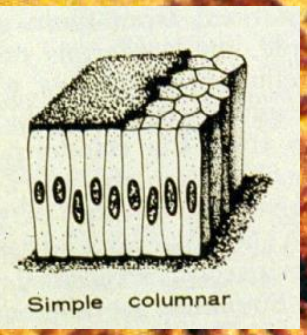
Simple columnar



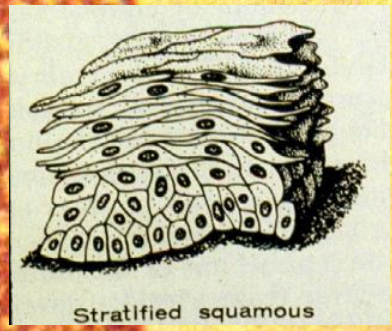
LARGE INTESTINES

ANAL SKIN

Simple columnar



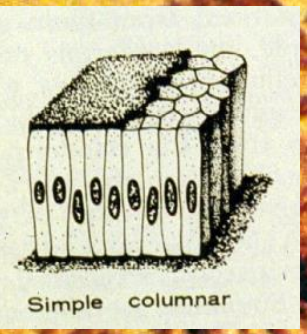
Stratified squamous



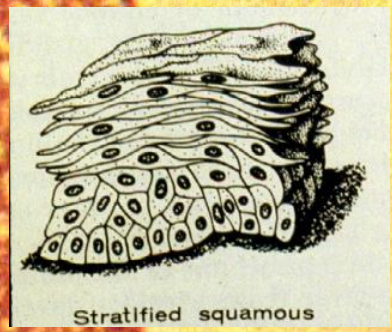
LARGE INTESTINES

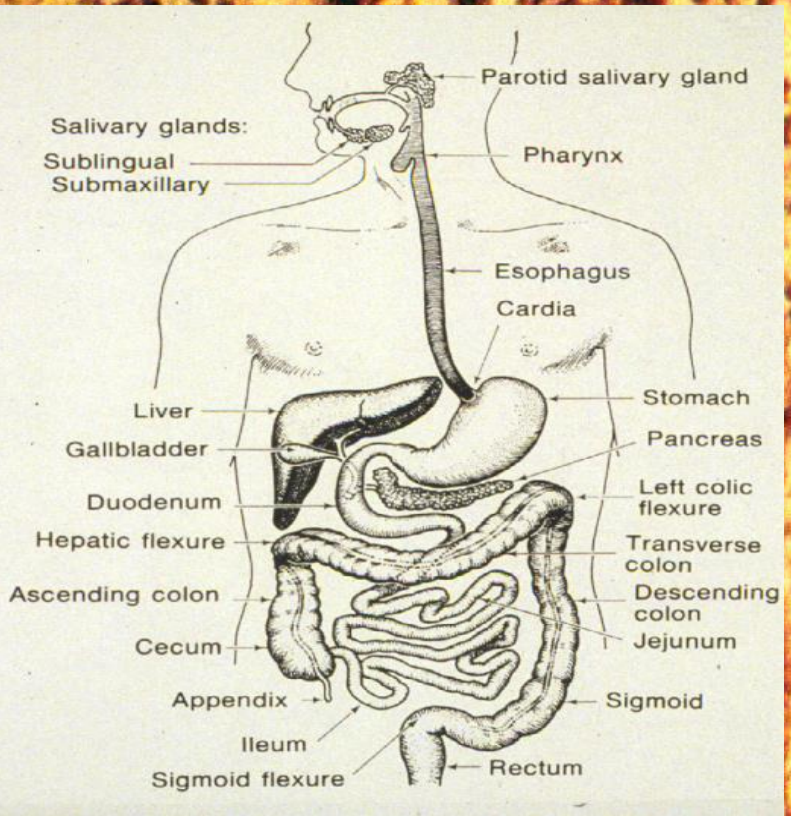
ANAL SKIN

Simple columnar



Stratified squamous





MUCOCUTANEOUS JUNCTIONS

Many illustrations in these VIBS Histology YouTube videos were modified from the following books and sources: Many thanks to original sources!

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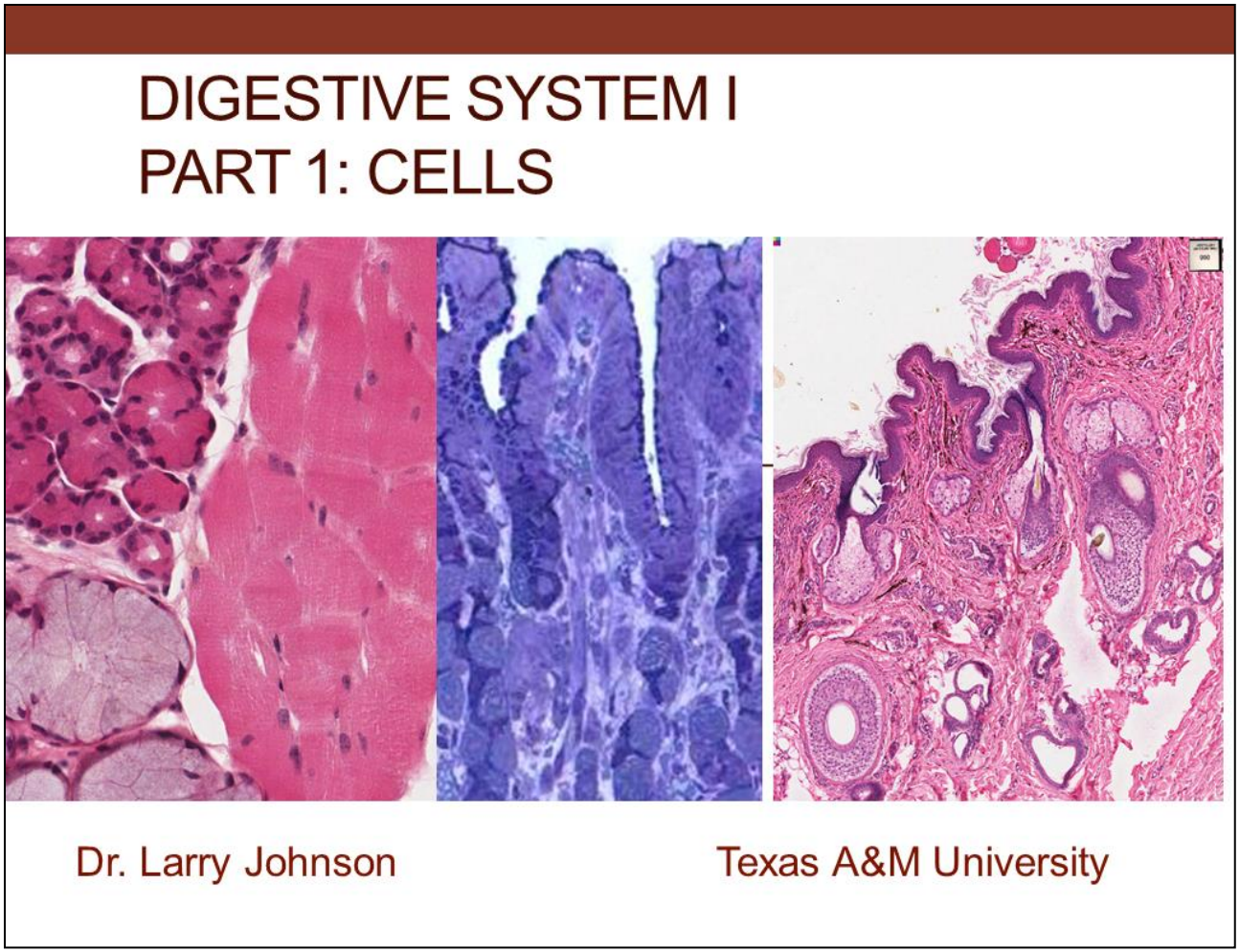
- Douglas P. Dohrman and TAMHSC Faculty 2012 Structure and Function of Human Organ Systems, Histology Laboratory Manual - Slide selections were largely based on this manual for first year medical students at TAMHSC

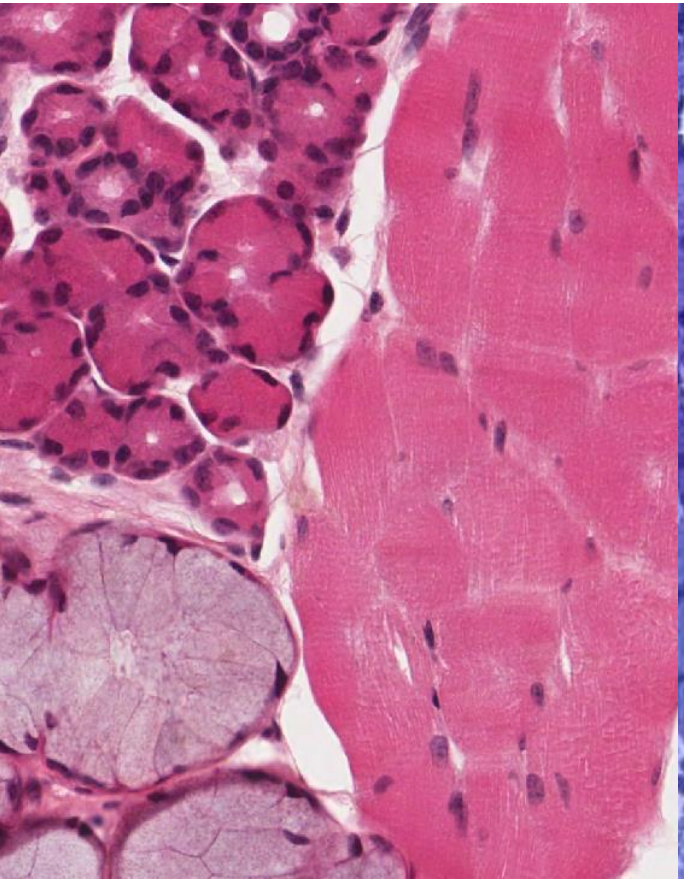
End of

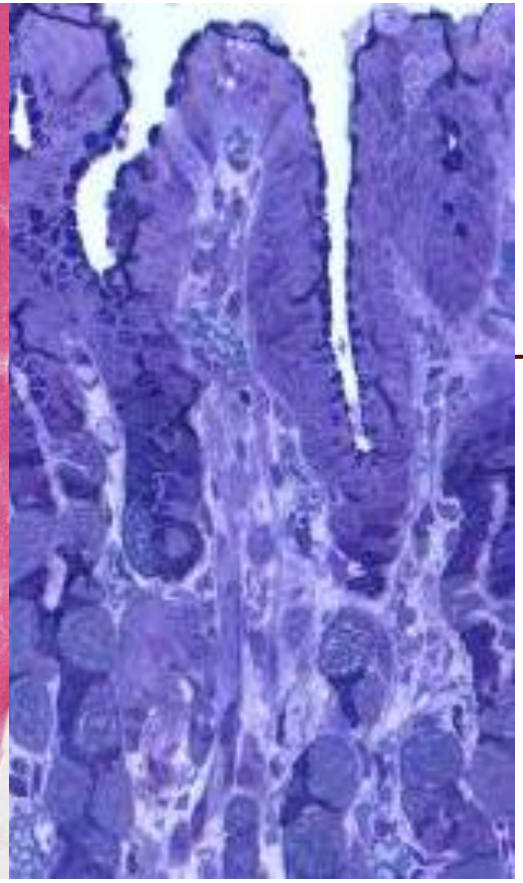


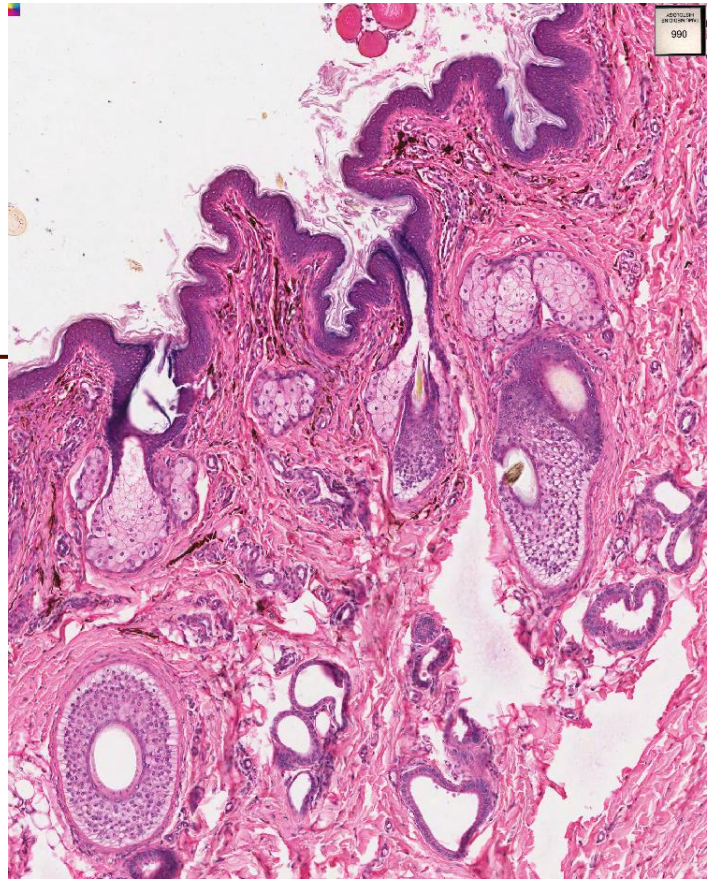
Next

- Digestive System I
  Part 2: Oral cavity to stomach

DIGESTIVE SYSTEM I
PART 2: ORAL CAVITY TO STOMACH







Dr. Larry Johnson

Texas A&M University

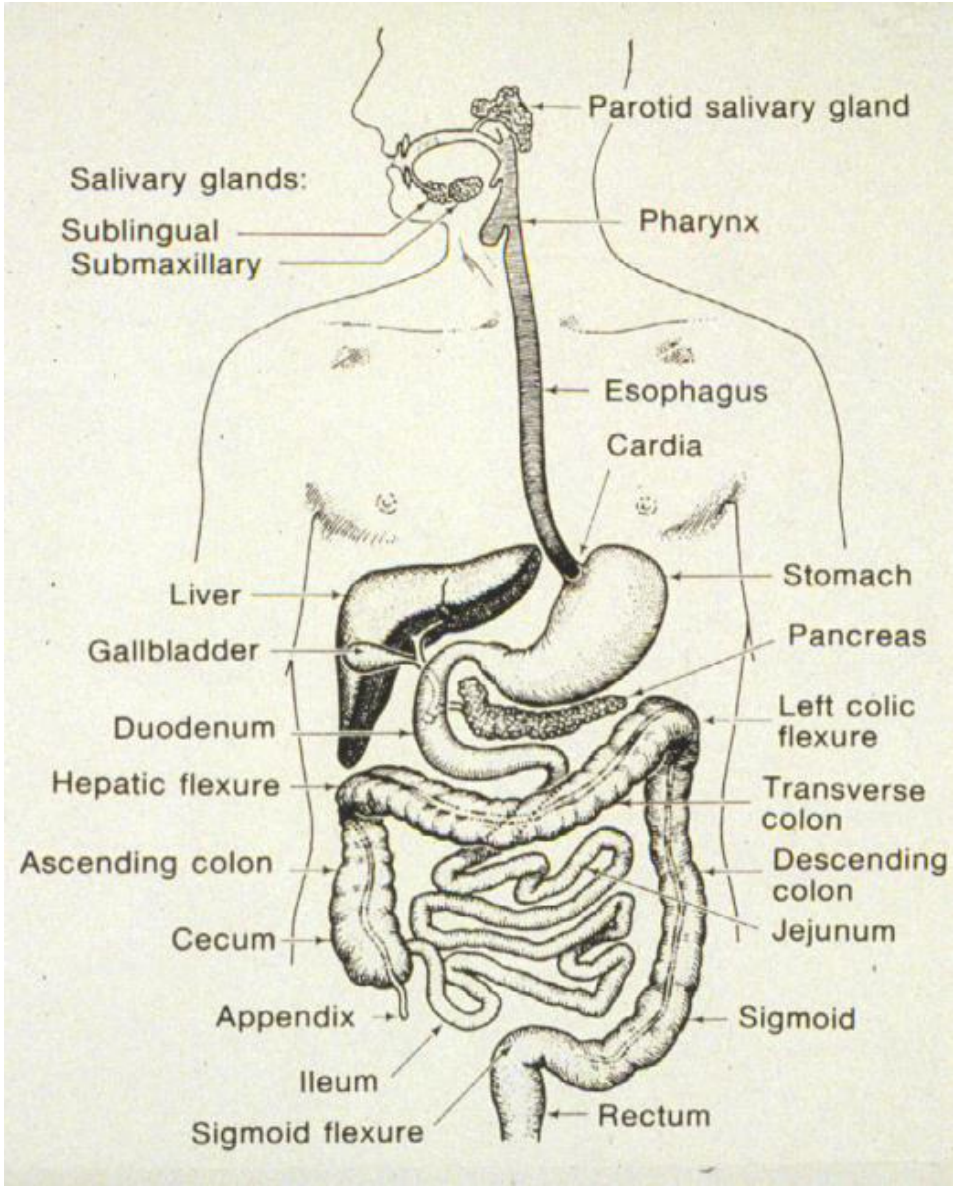
Objectives Digestive System I

- Name the parts of the digestive tract.
- Identify the four layers that form the walls of the tubular organs of the digestive tract and the tissue types found in each layer.
- Identify and know the distinguishing structural features of the various regions of each of the tubular organs of the digestive tract.
- Identify the organ region and cell types present from a slide or photomicrograph of a section of any part of the digestive tract

- Part 1: Cells
- Part 2: Oral cavity to stomach
- Part 3: Small and large intestines

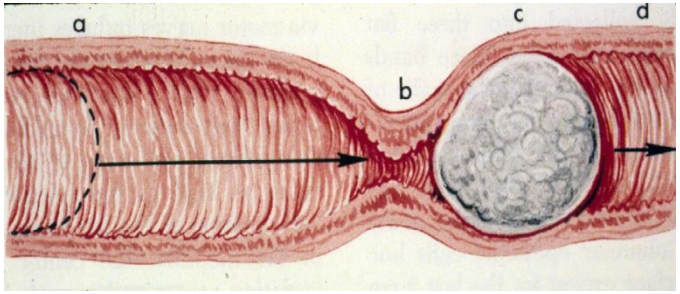
As we the
UNDERSTAND THE GENERAL ORGANIZATION OF ORGANS OF THE DIGESTIVE SYSTEM

We want to see
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



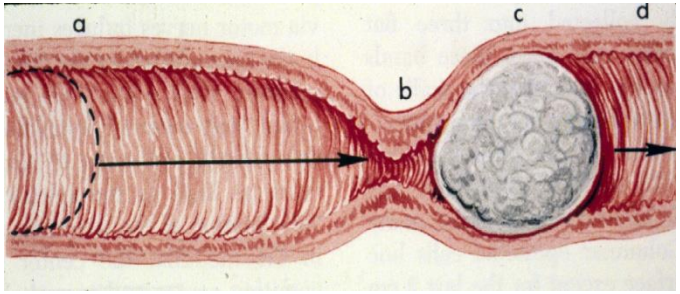
FUNCTION OF the G.I. TRACT

MOVEMENT OF FOOD

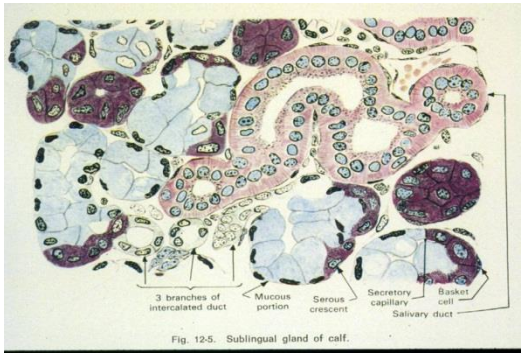


FUNCTION OF the G.I. TRACT

MOVEMENT OF FOOD

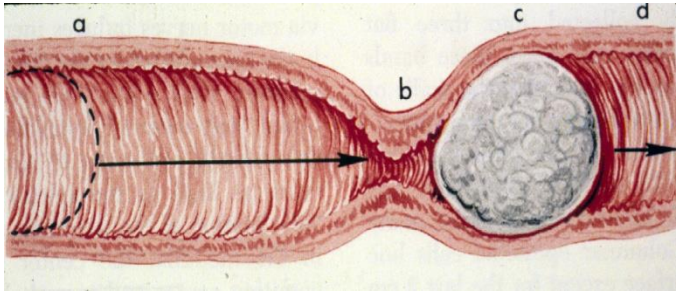


SECRETION OF DIGESTIVE JUICES



FUNCTION OF the G.I. TRACT

MOVEMENT OF FOOD



SECRETION OF DIGESTIVE JUICES

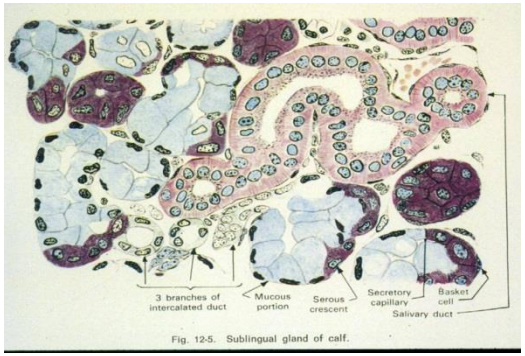
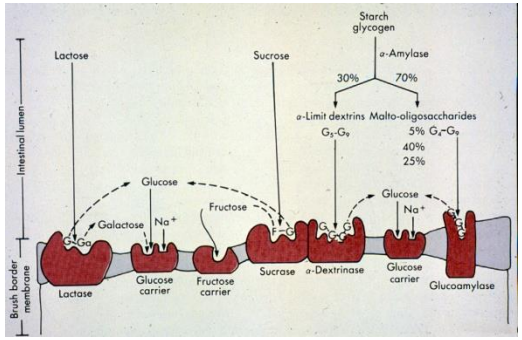


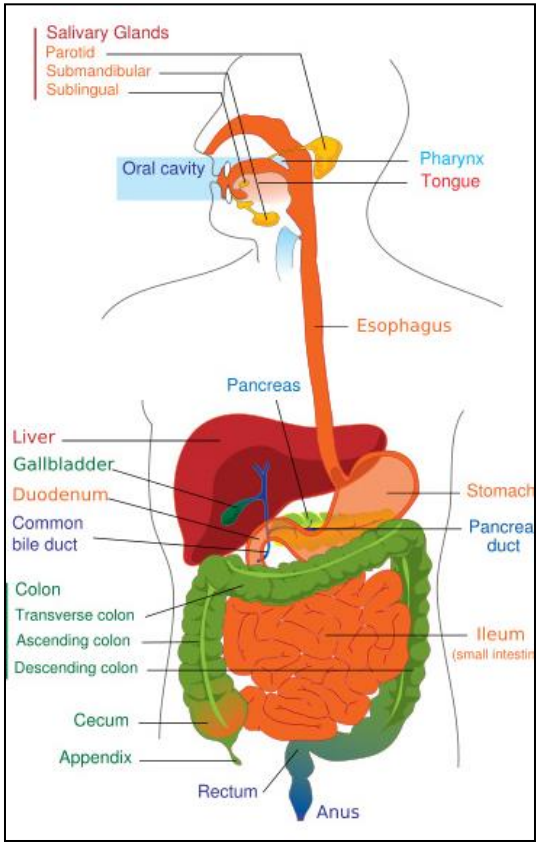
Fig. 12-5. Sublingual gland of calf.

ABSORPTION OF DIGESTED FOODS, WATER, AND ELECTROLYTES

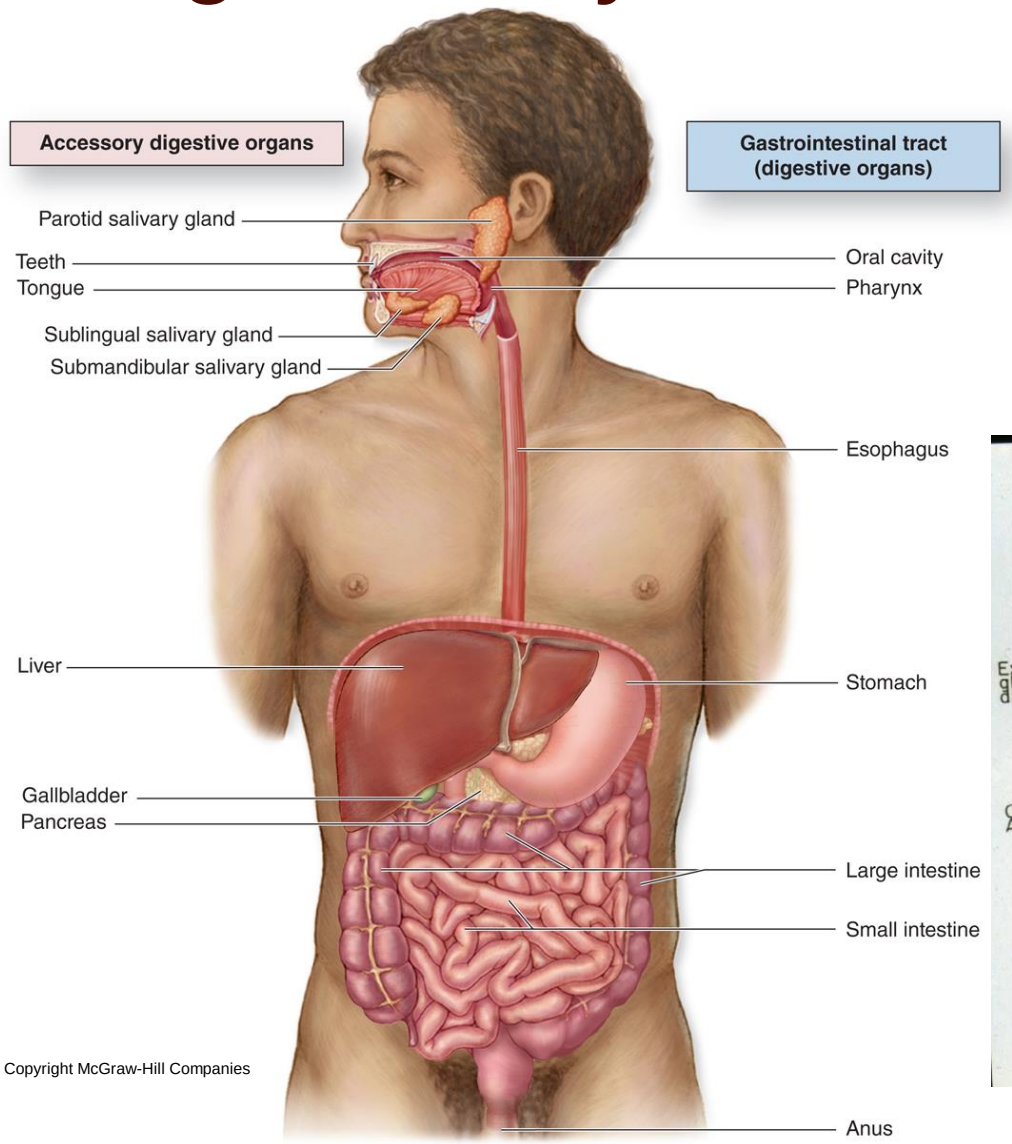


ADAPTATION OF G.I. TRACT FOR SPECIFIC FUNCTION

FUNCTION	ORGAN
SIMPLE PASSAGE FROM ONE PART TO ANOTHER	ESOPHAGUS
STORAGE OF FOOD OR FECES	STOMACH OR DISTAL COLON
DIGESTION	STOMACH, SMALL INTESTINE
ABSORPTION OF END PRODUCTS	SMALL INTESTINE, PROXIMAL COLON



Digestive System



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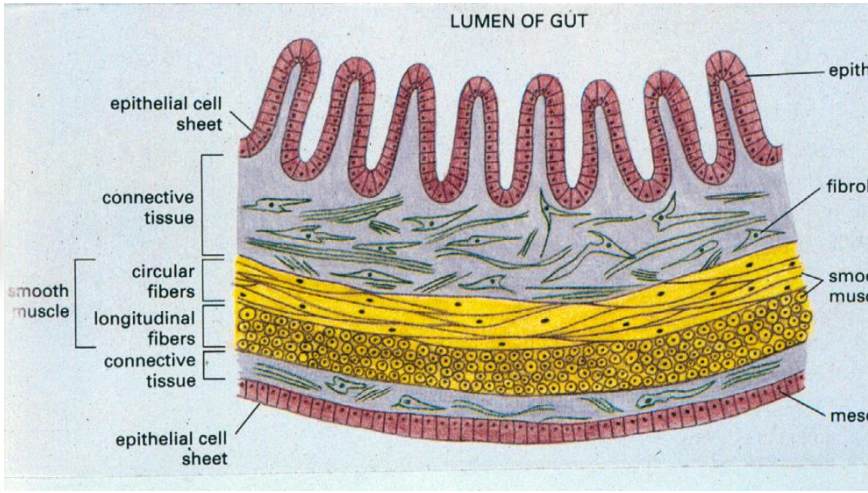
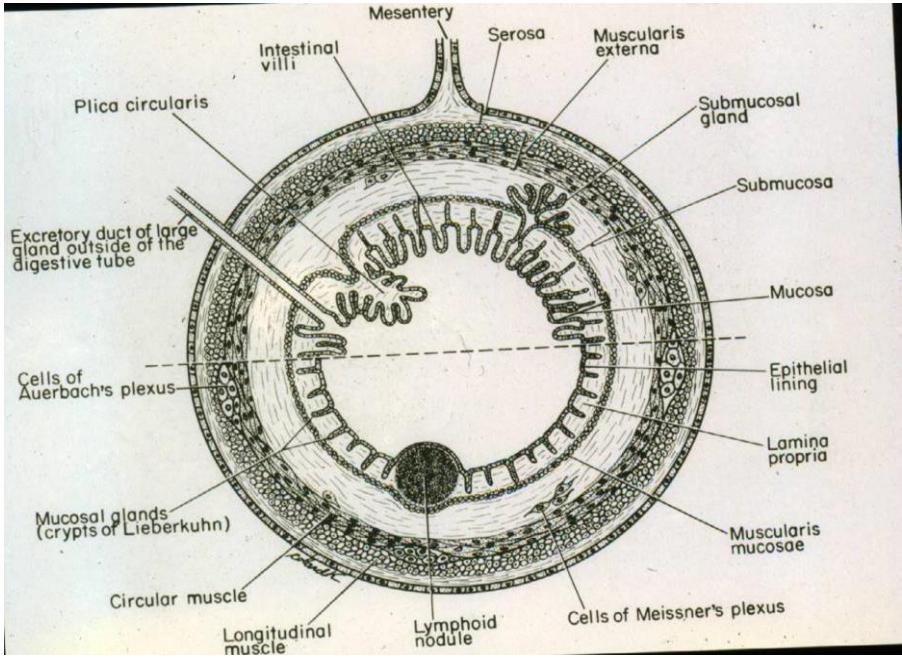
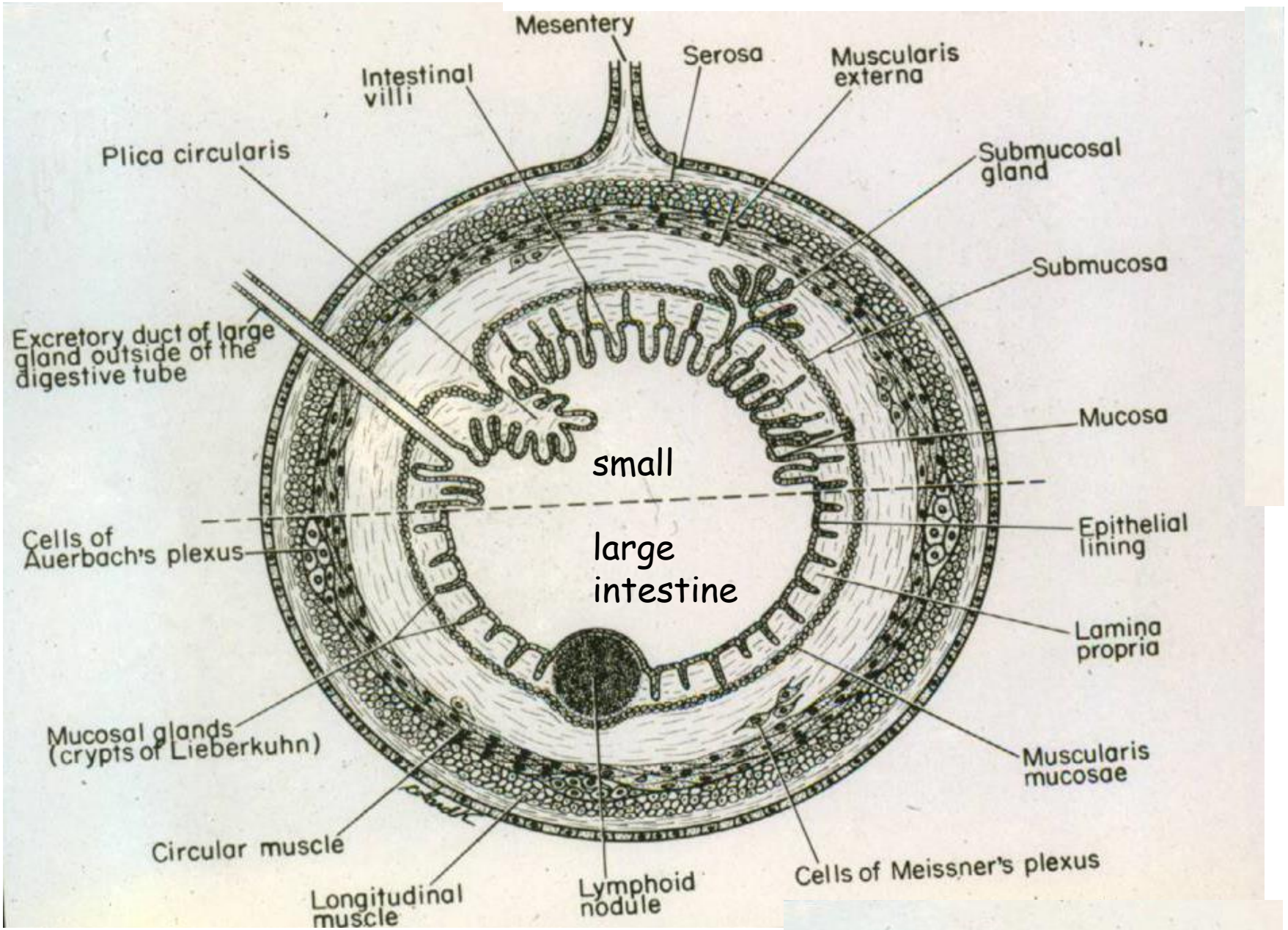
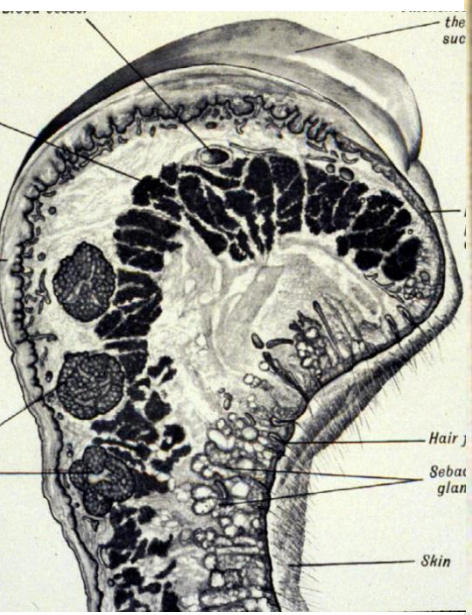




GENERAL STRUCTURE OF THE DIGESTIVE TRACT



MUCOCUTANEOUS JUNCTIONS



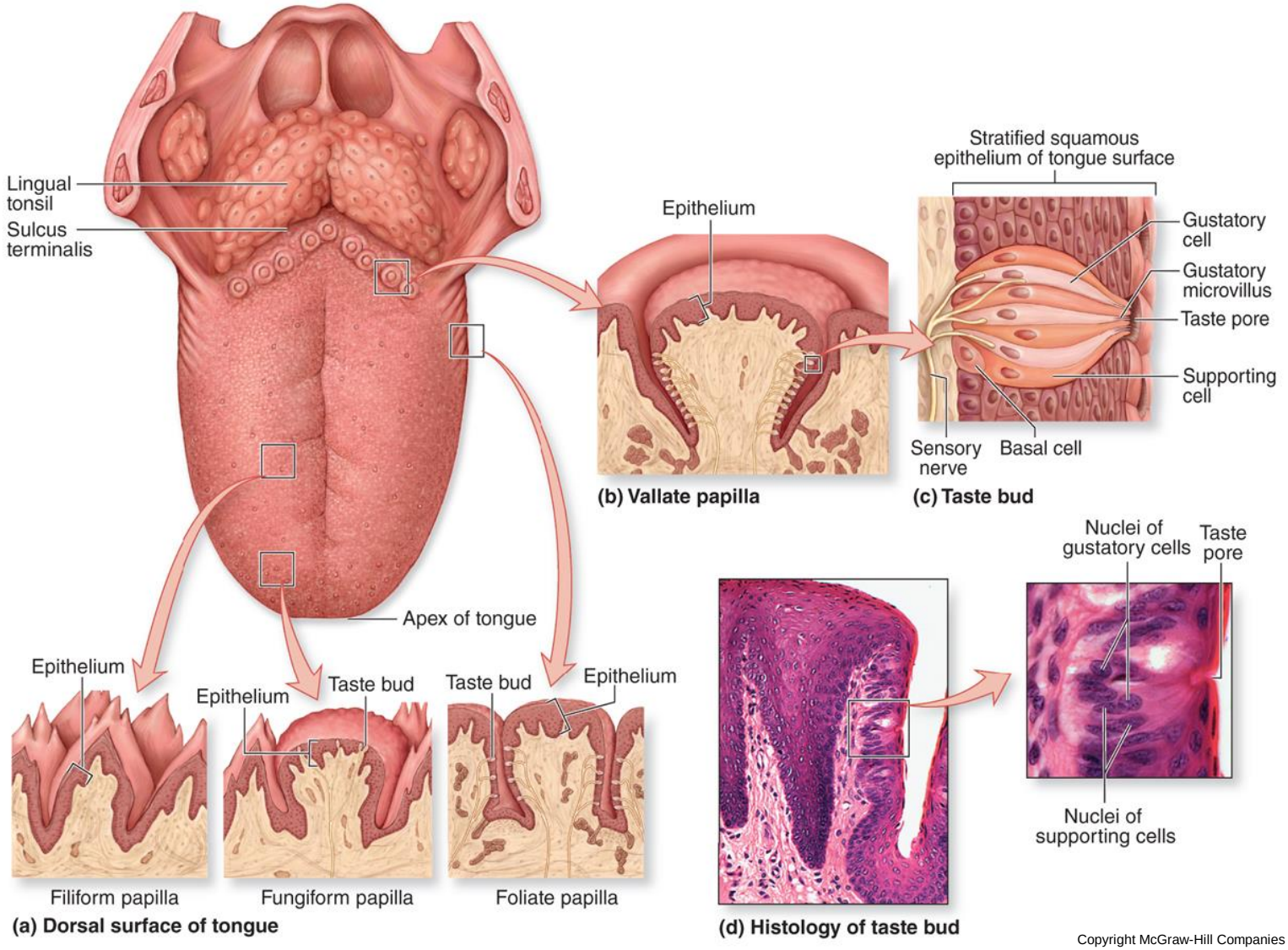
LIP
Oral epithelium

SKIN
Epidermis

Lamina propria

Dermis

Tongue structure



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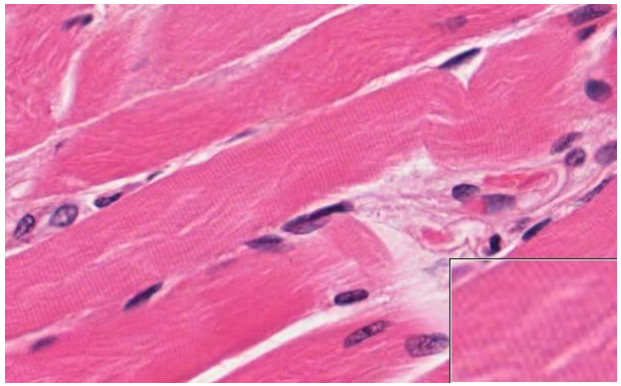
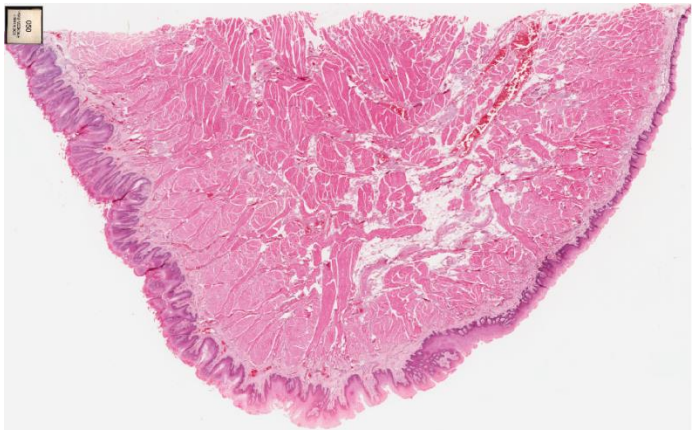
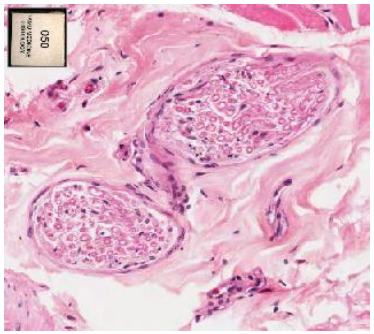
Slide 50: Tongue (sagittal section)



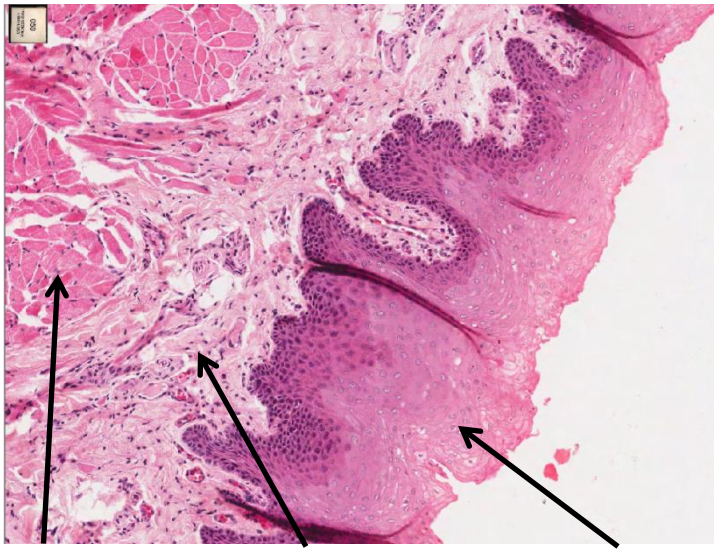
Skeletal muscle



Tongue



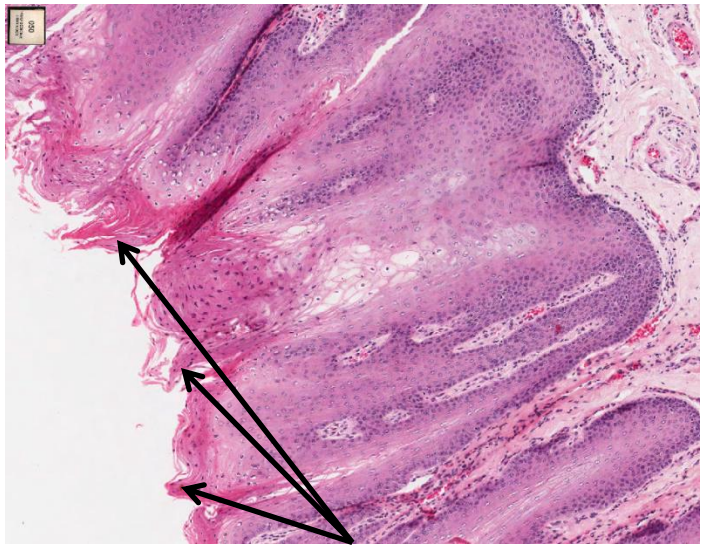
Nerves



Musculature

Lamina propria

Stratified squamous epithelium

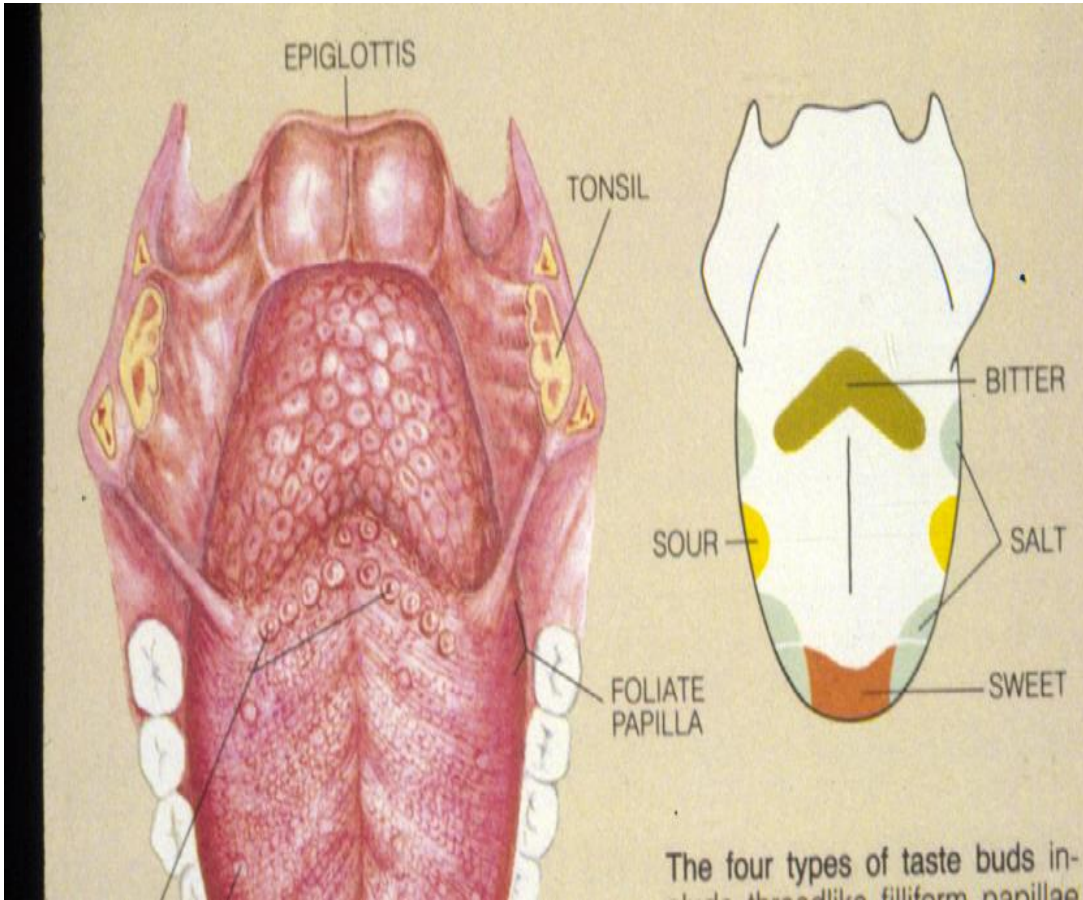


Filiform papillae

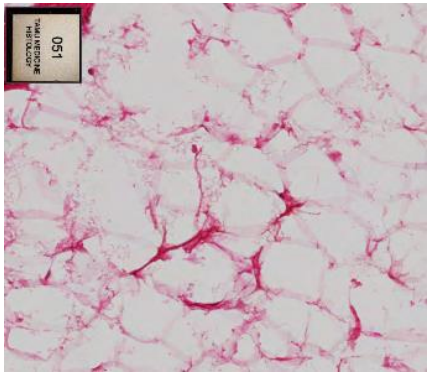
Mucocutaneous interactions

- Oral cavity:
- Epidermis-like epithelium
- Tongue has filiform, fungiform, folate, and circumvallate papillae.

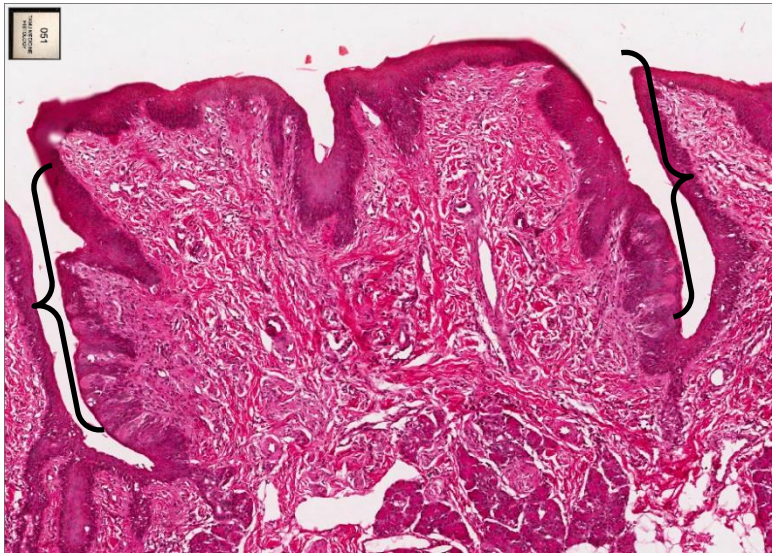
- All tongue papillae have taste buds except the filiform papillae whose function is to move food under the teeth.



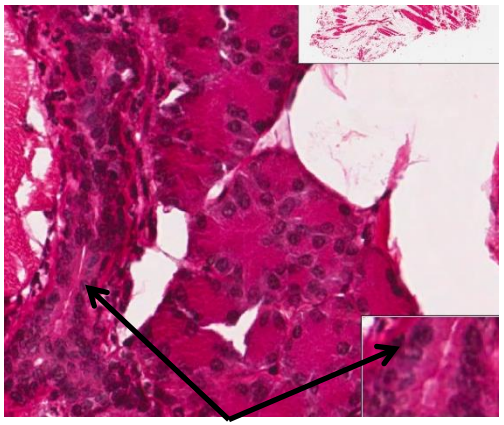
Slide 51: Tongue (cross section)



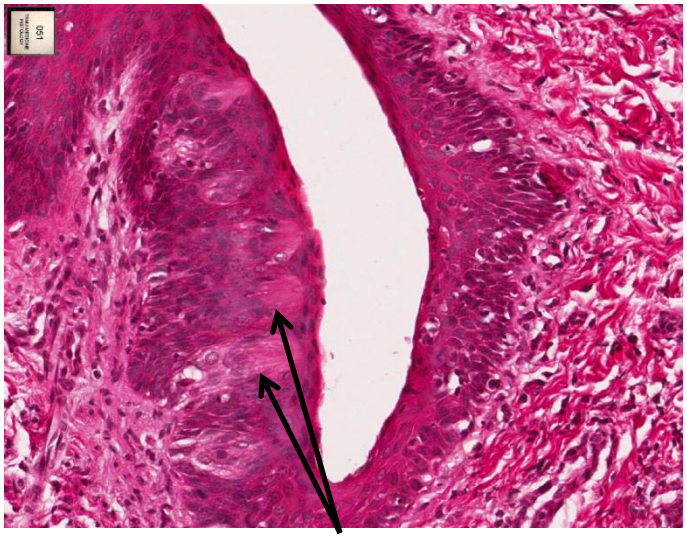
Adipose tissue



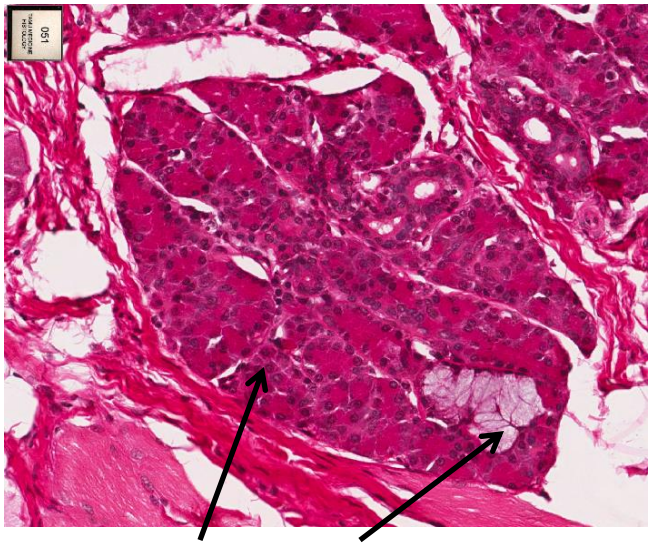
Circumvallate papilla



Gland duct

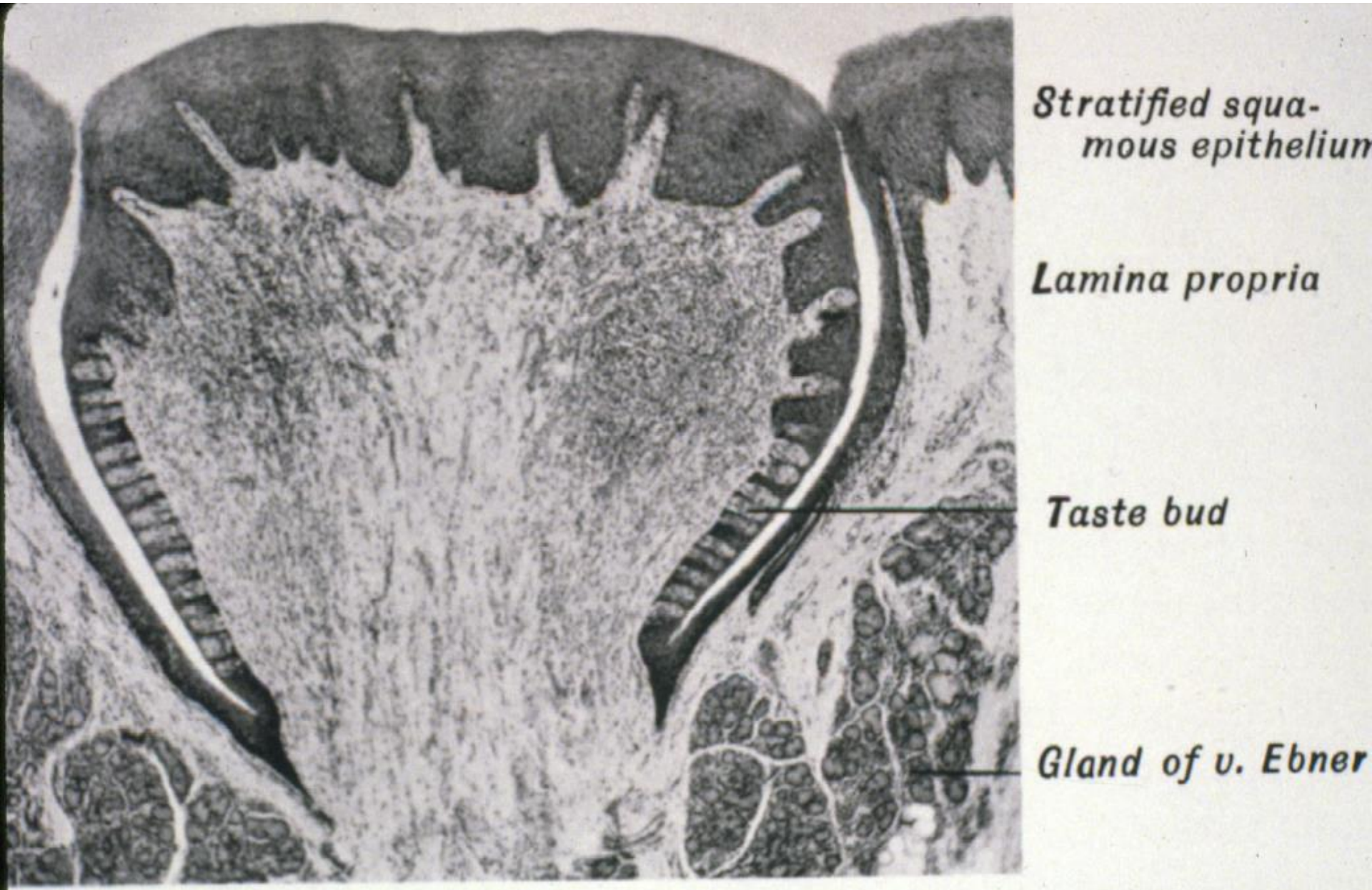


Taste buds

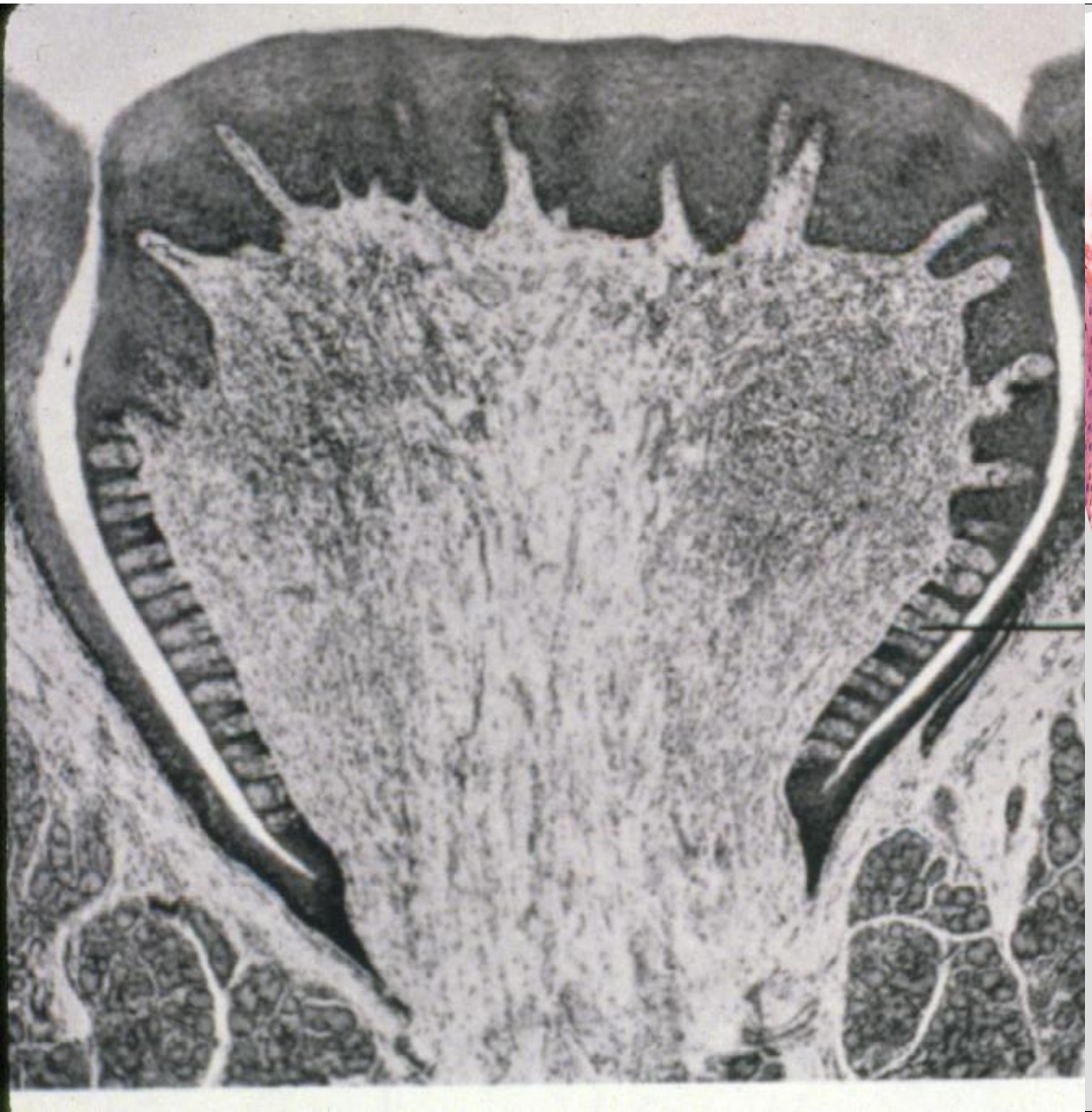


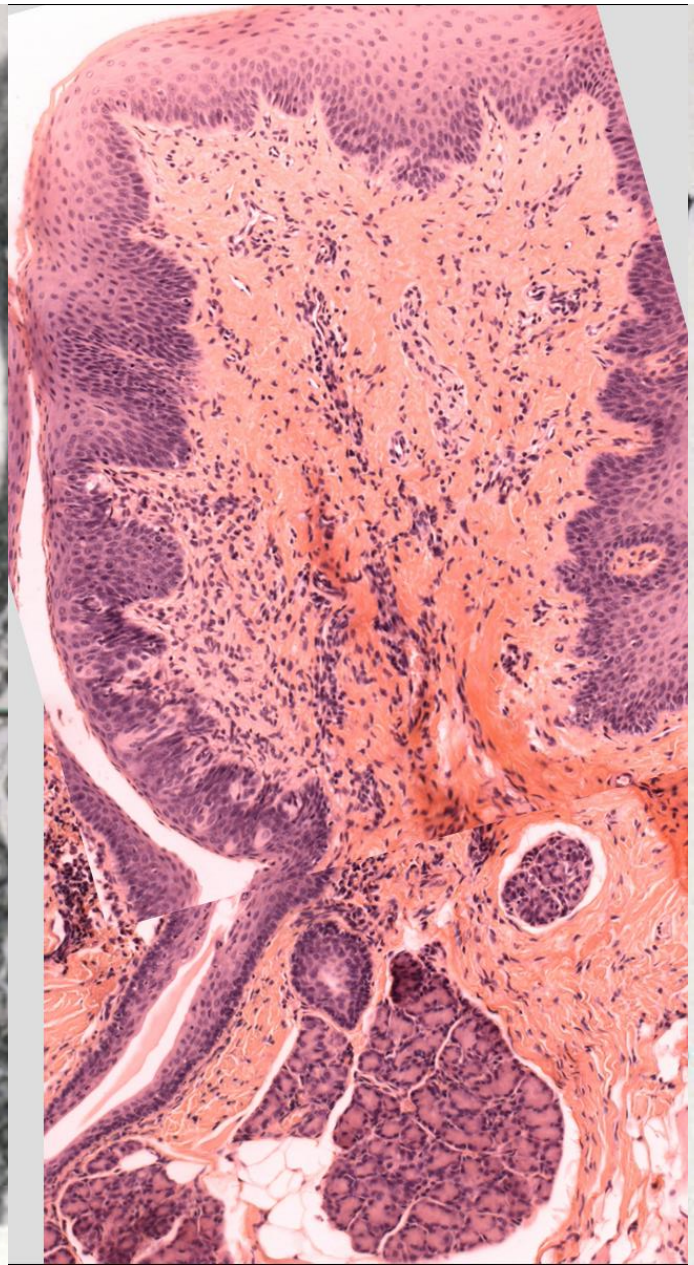
Serous and mucous glands

CIRCUMVALLATE PAPILLAE

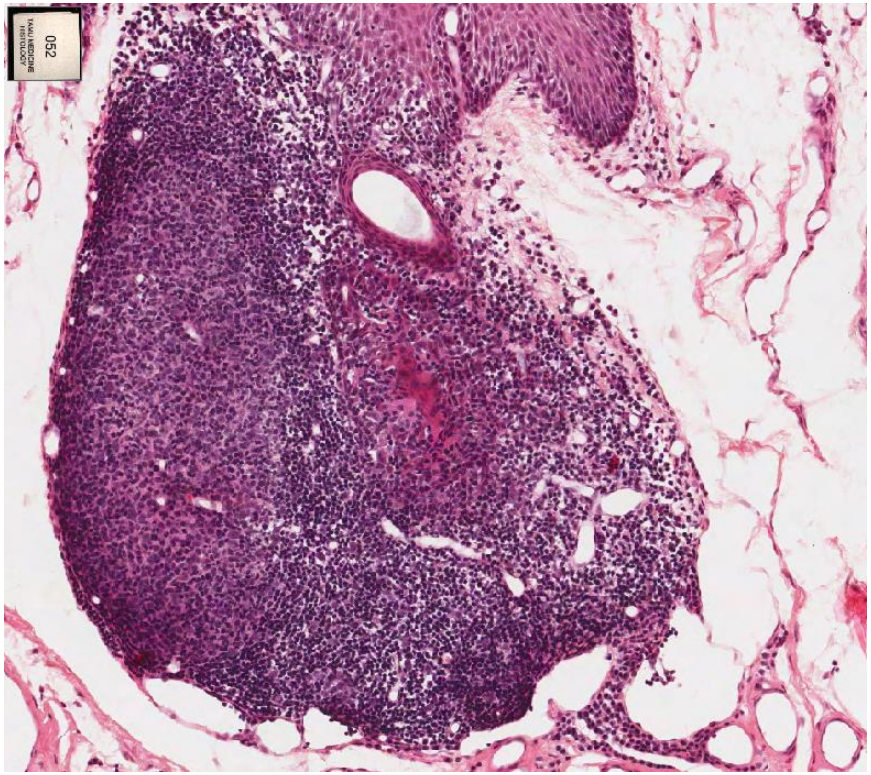


CIRCUMVALLATE PAPILLAE

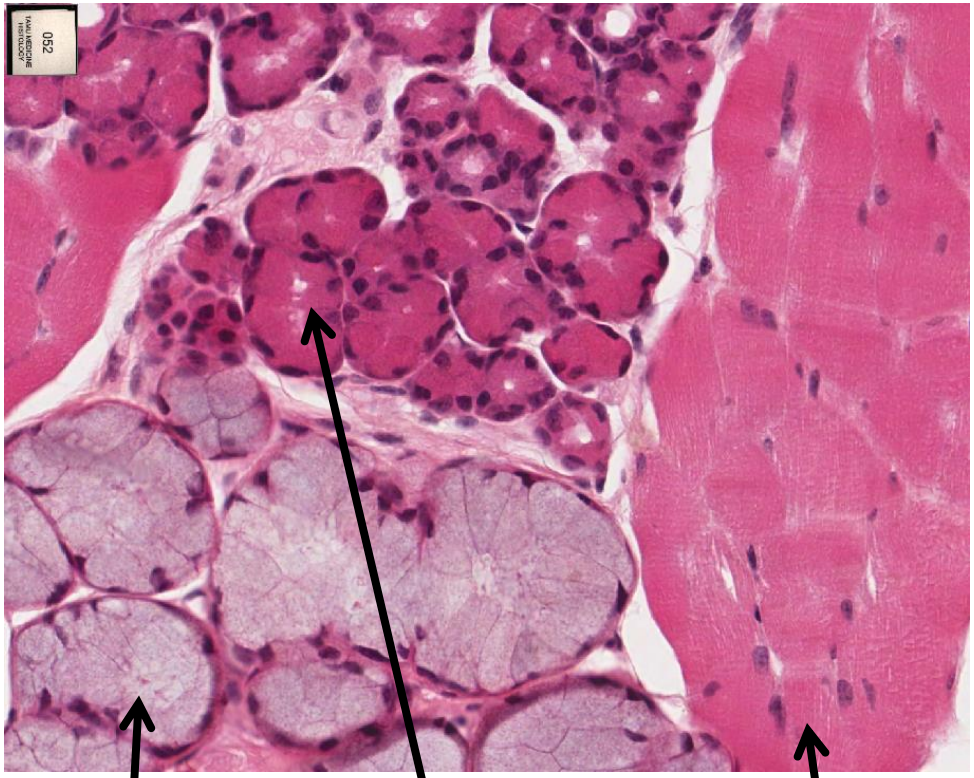




Slide 52: Tongue (cross section, lingual tonsil)



Lymph tissue of lingual tonsil



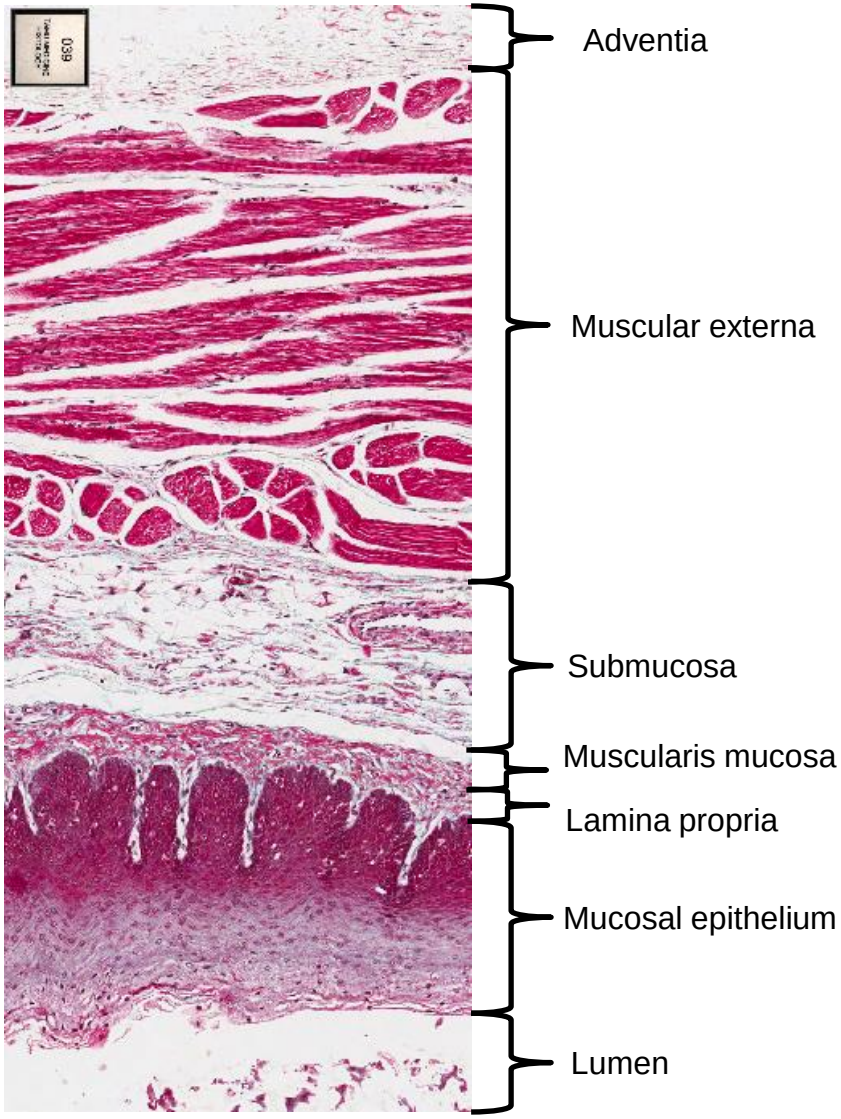
Mucous glands

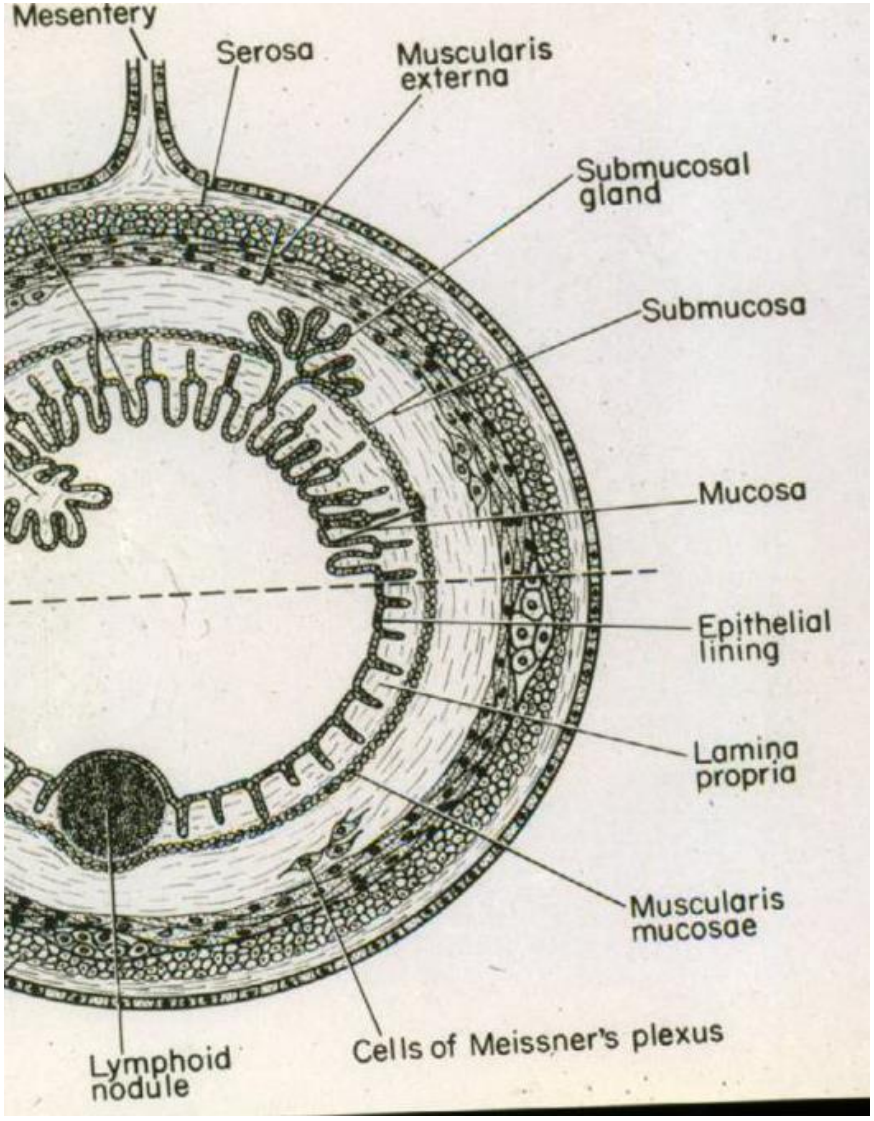
Serous glands

Skeletal muscle

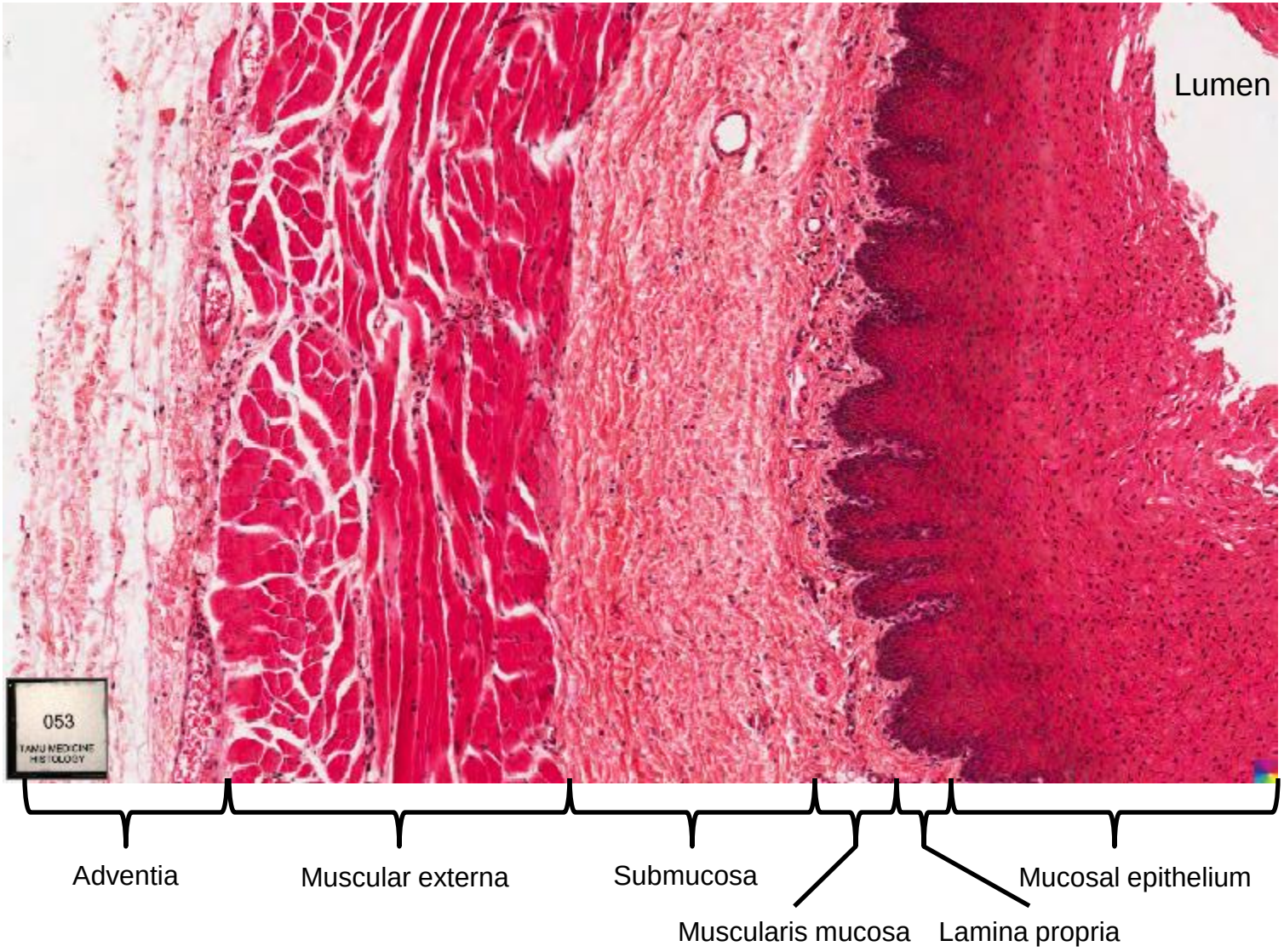
Serous glands secretions contain a lipase that prevents the formation of a hydrophobic film on taste buds that would hinder gustation.

Slide 39: Upper esophagus

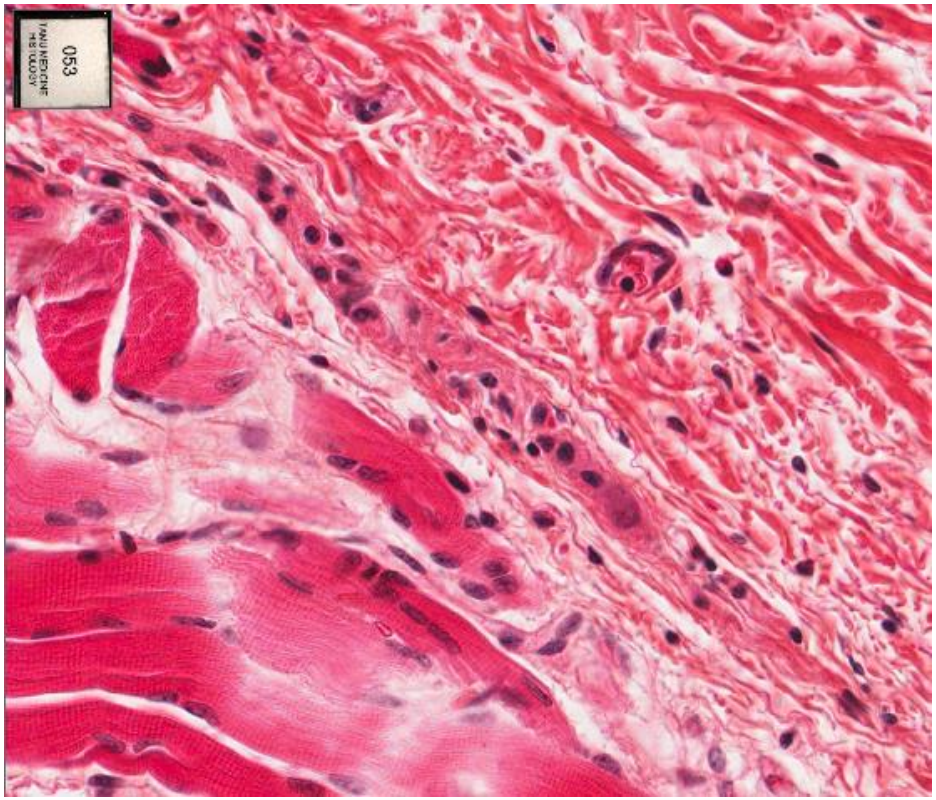




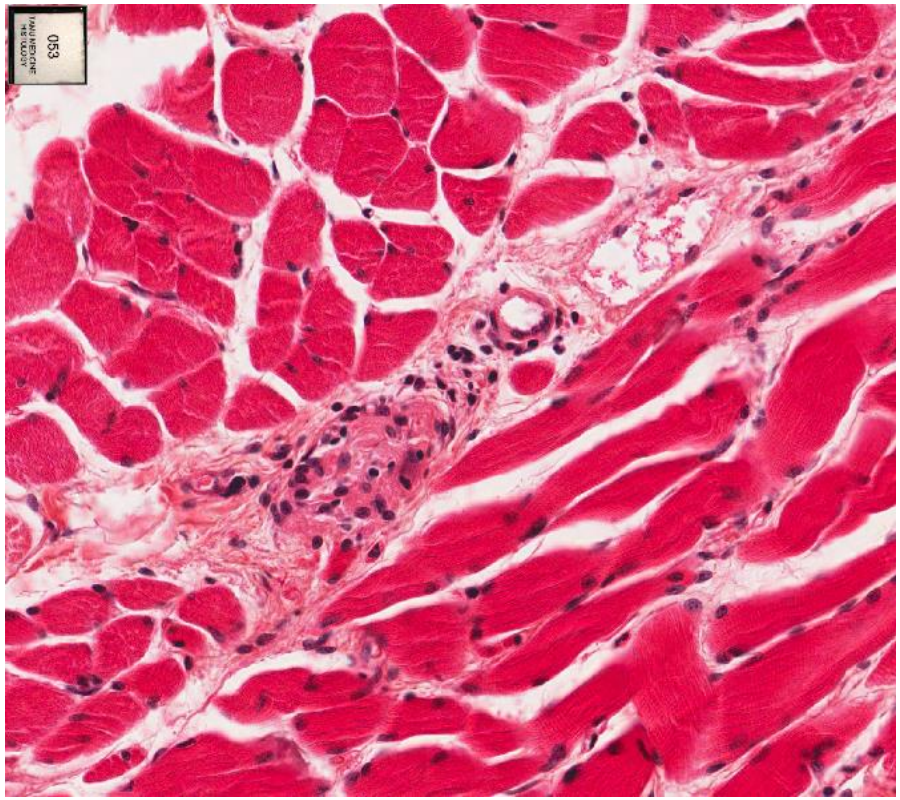
Slide 53: Esophagus (upper portion)



Slide 53 : Esophagus (upper portion)

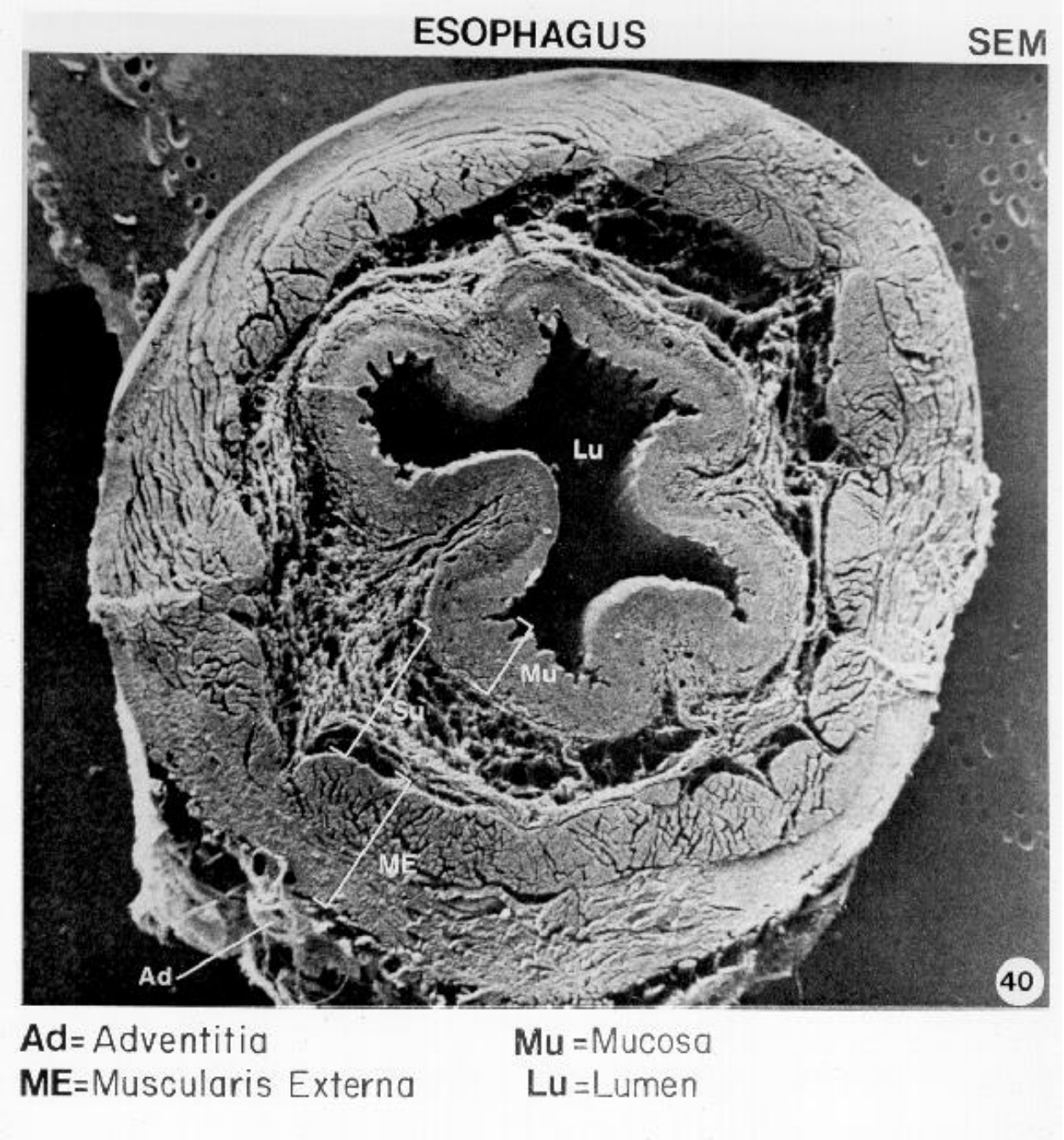


Submucosal plexus
(Meissner's)

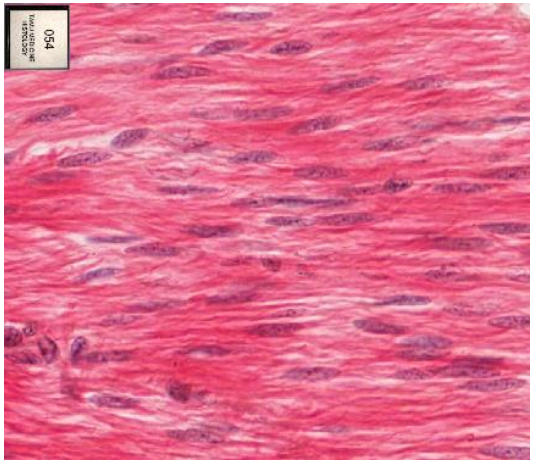


Myenteric plexus
(Auerbach's)

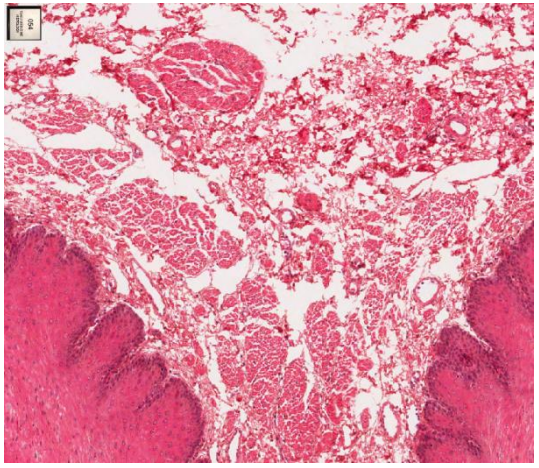
EM 40


ESOPHAGUS
SEM
Lu
Mu
Su
ME
Ad
40
Ad= Adventitia
ME=Muscularis Externa
Mu =Mucosa
Lu =Lumen

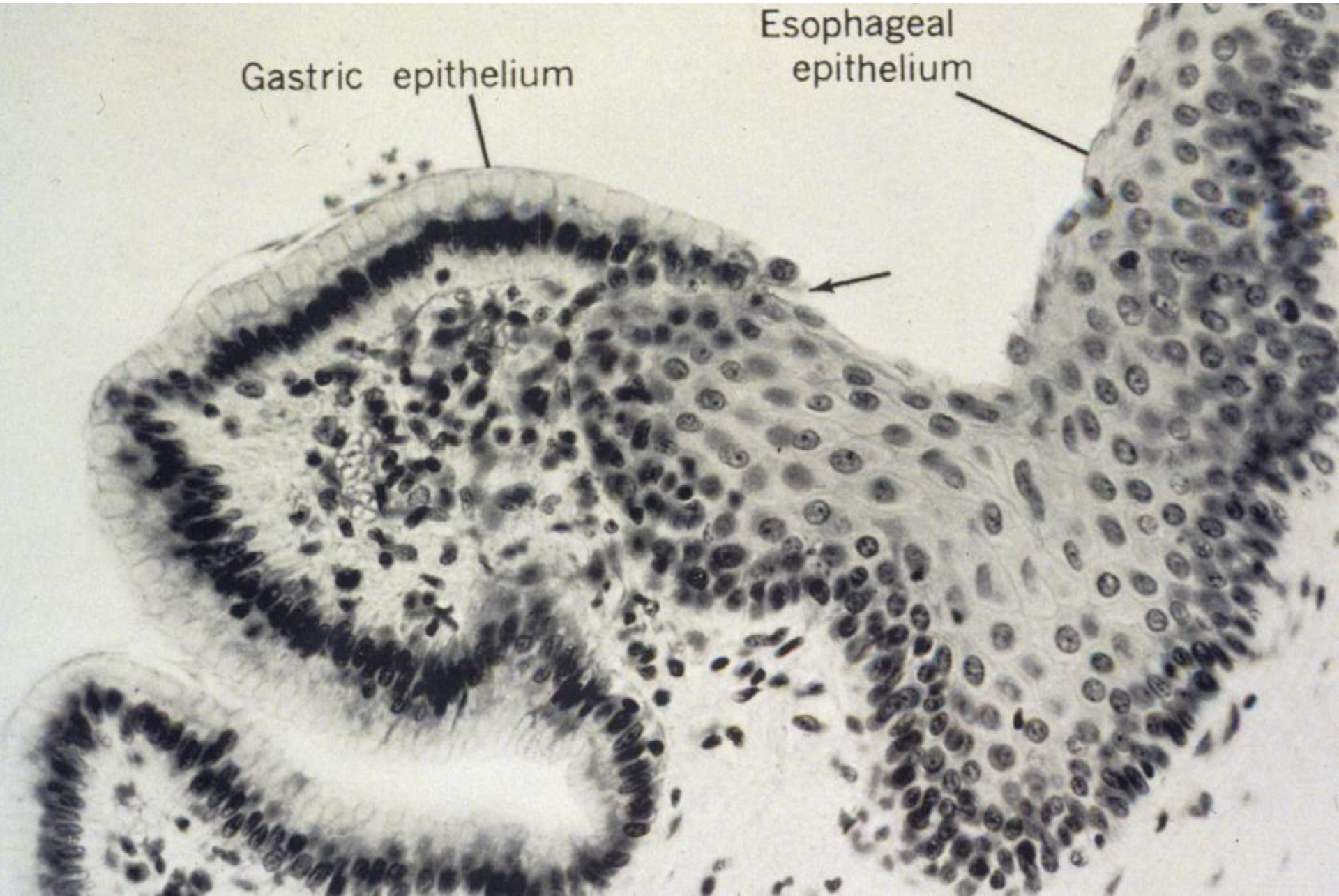
Slide 54: Esophagus (lower portion)



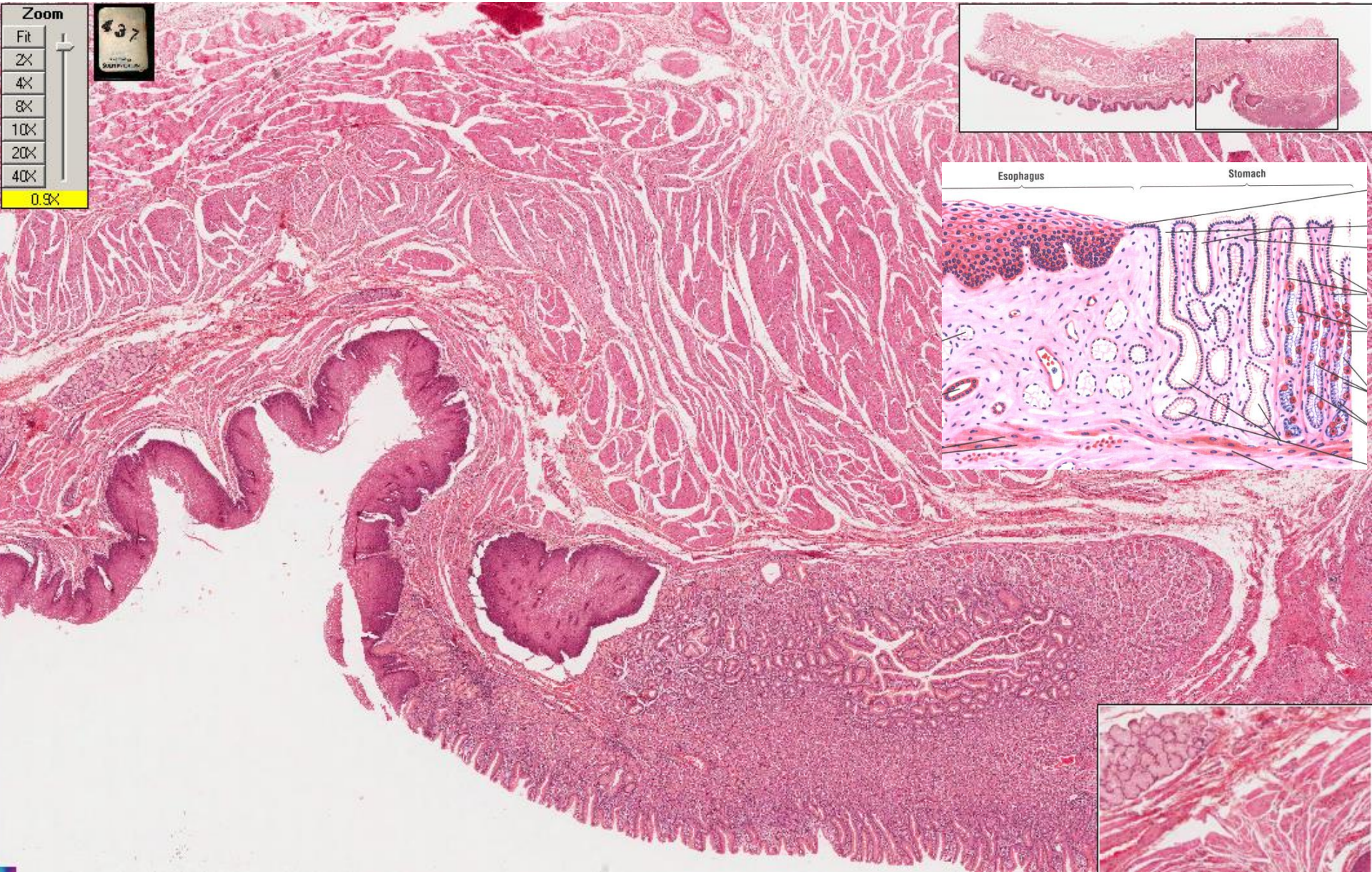
Smooth muscle of
muscularis externa



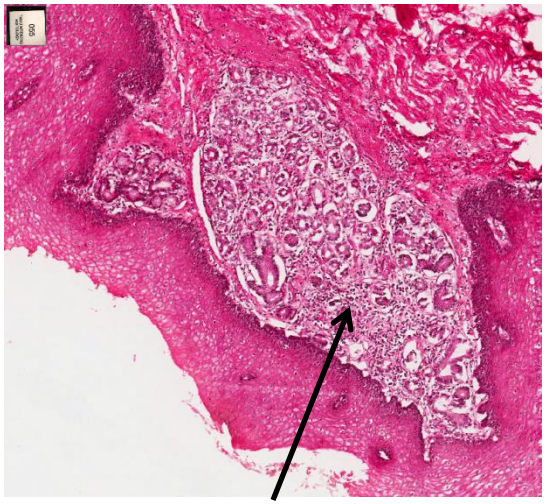
Muscularis mucosa


Gastric epithelium
Esophageal epithelium

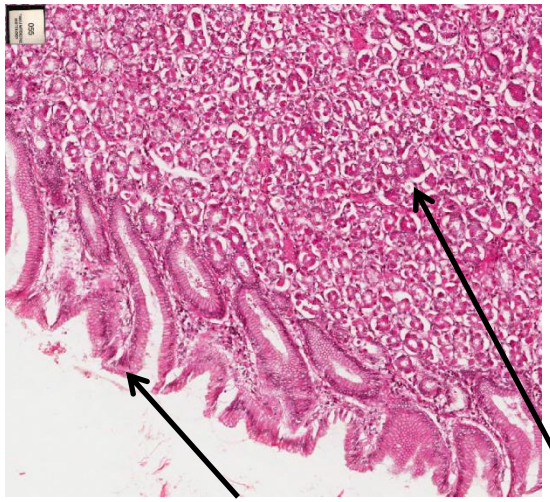
437 cardioesophageal junction



Slide 55: Gastroesophageal junction

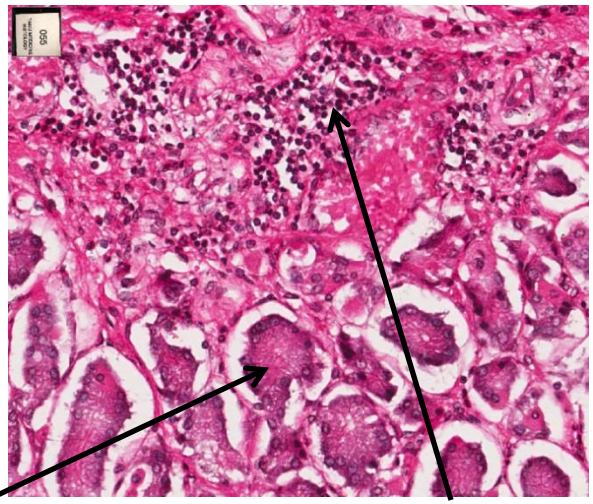


Cardiac gland of the esophagus



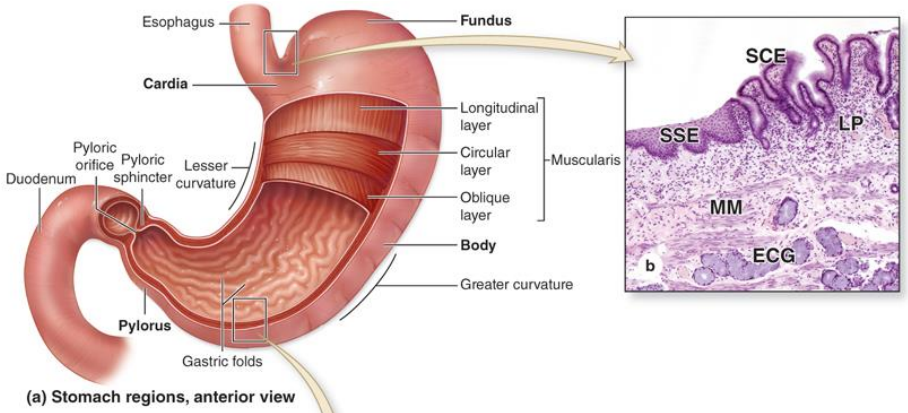
Simple columnar gastric epithelium

Cardiac glands

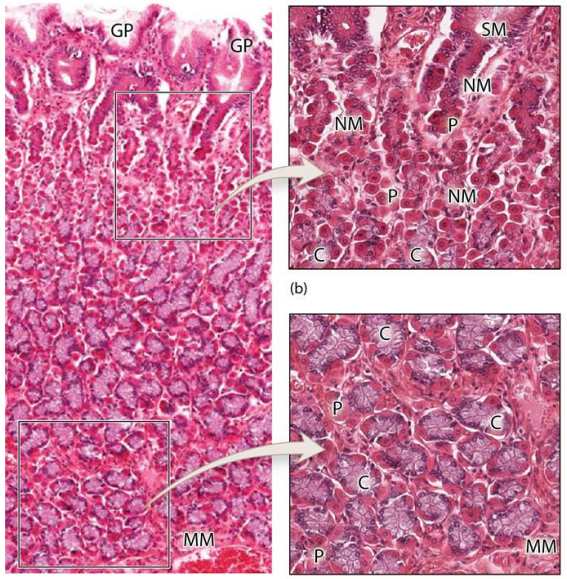


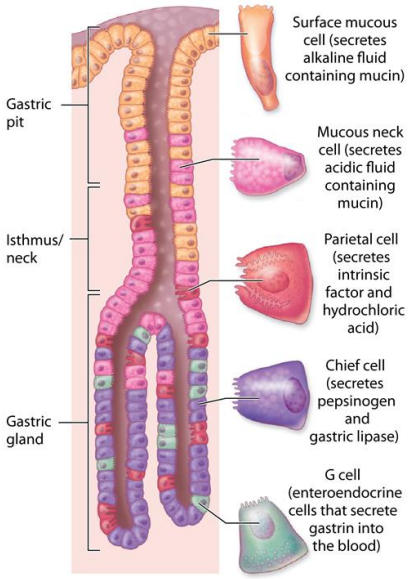
Lymph tissue

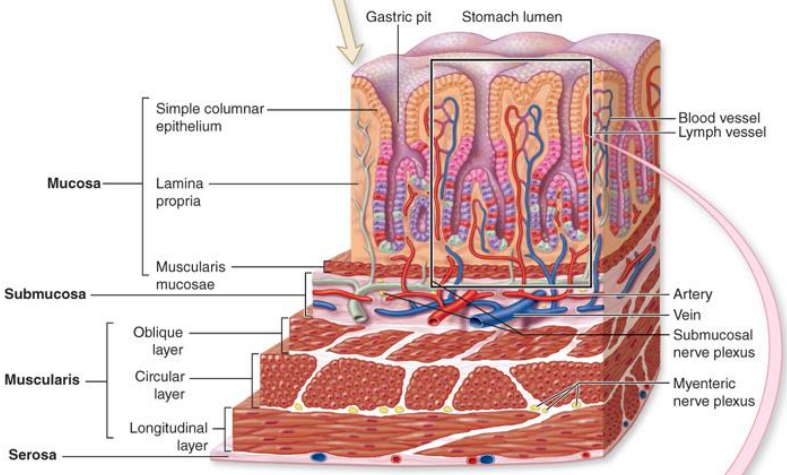
Stomach Structure



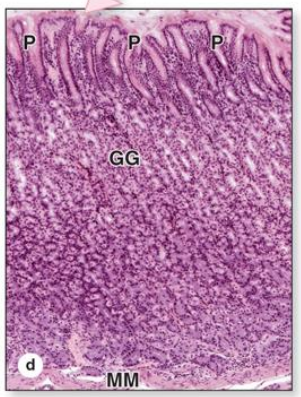
(a) Stomach regions, anterior view







(c) Stomach wall, sectional view



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GENERAL ORGANIZATION OF STOMACH

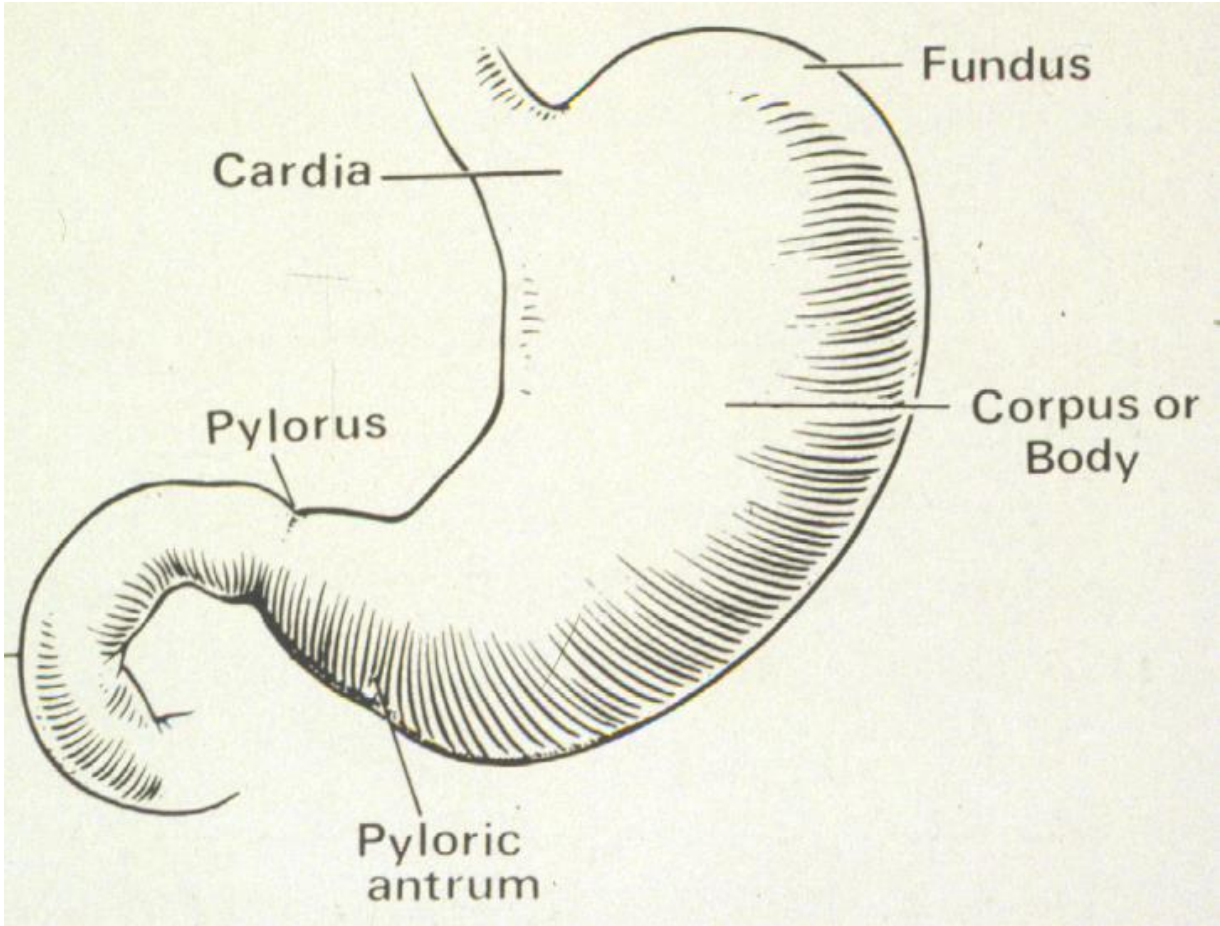
GASTRIC MUCOSA EPITHELIUM

SURFACE EPITHELIUM

CARDIAC GLANDS

GASTRIC GLANDS (OXYNTIC GLANDS)

PYLORIC GLANDS



CARDIAC GLANDS

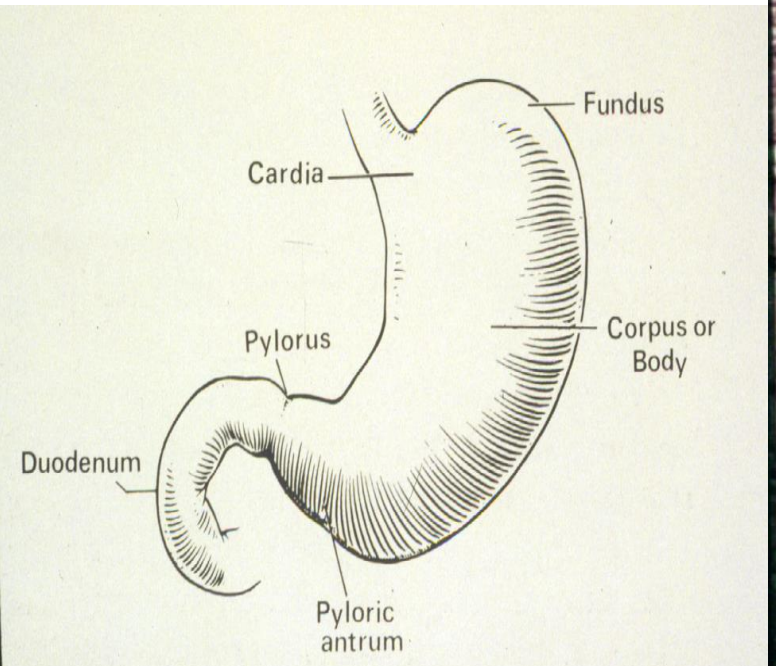
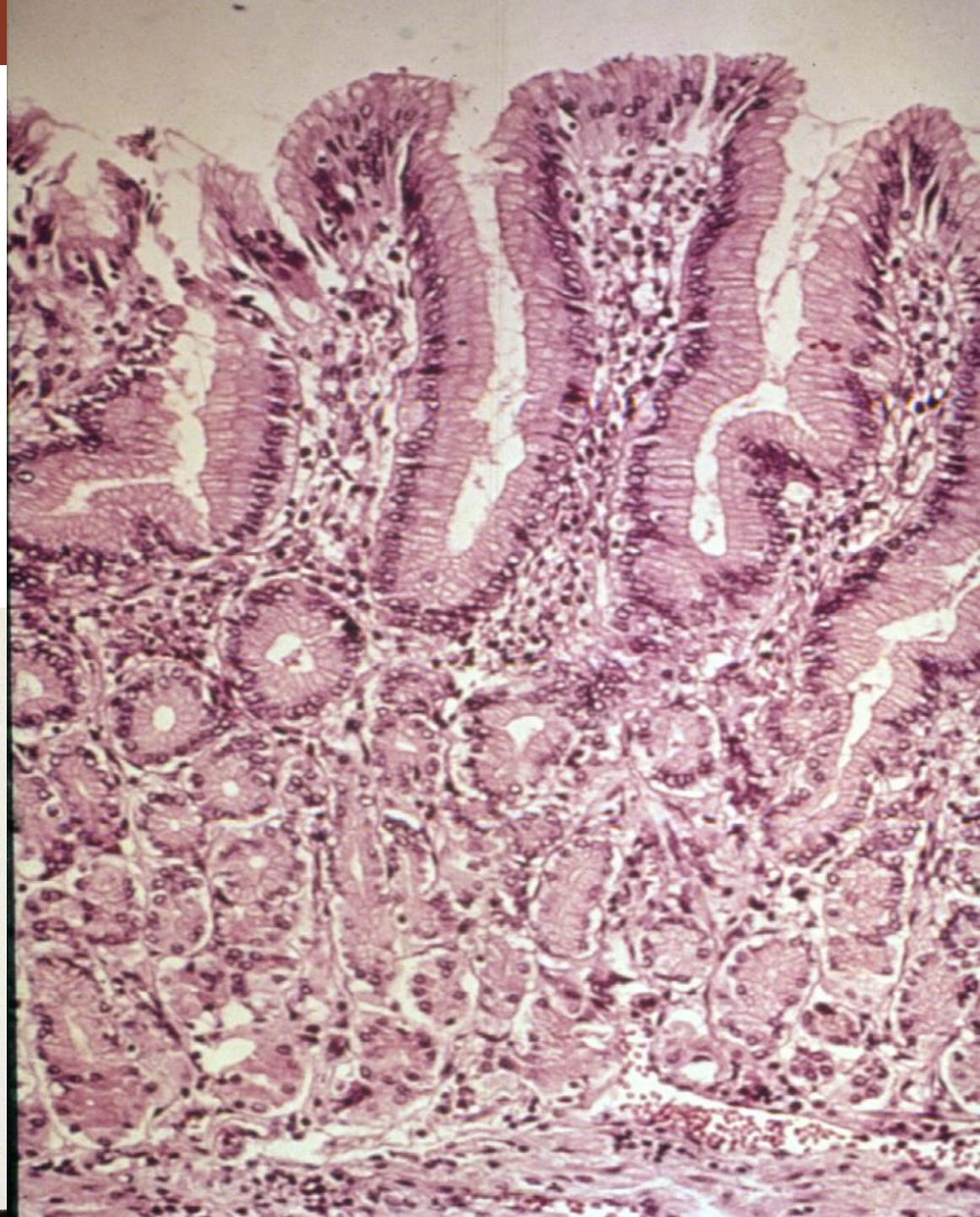


Figure 25–6. Drawing of the human stomach presenting



GLANDULAR EPITHELIAL CELLS OF STOMACH

- SURFACE MUCOUS CELLS
- MUCOUS NECK CELL
- CHIEF CELL (ZYMOGENIC CELL)
- PARIETAL CELL (OXYNTIC CELL)
- ENDOCRINE CELL (ARGENTAFFIN OR ENTROCHROMAFFIN CELL)

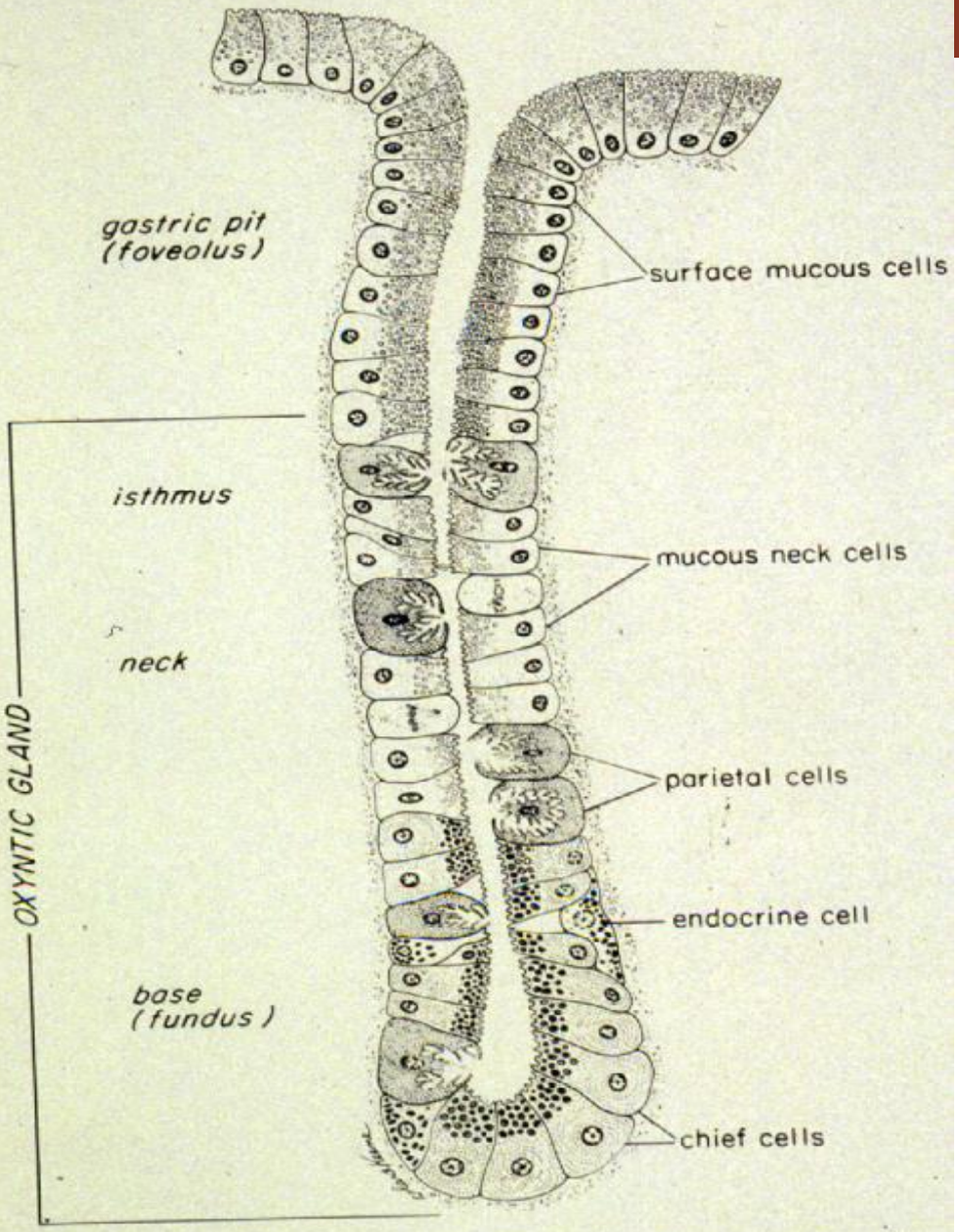


Figure 25–13. Diagram of an oxyntic gland from th corpus of a mammalian stomach. (From Ito, S. *In* Johnso L. R., ed.: Physiology of the Gastrointestinal Tract. Ne York, Raven Press, 1981.)

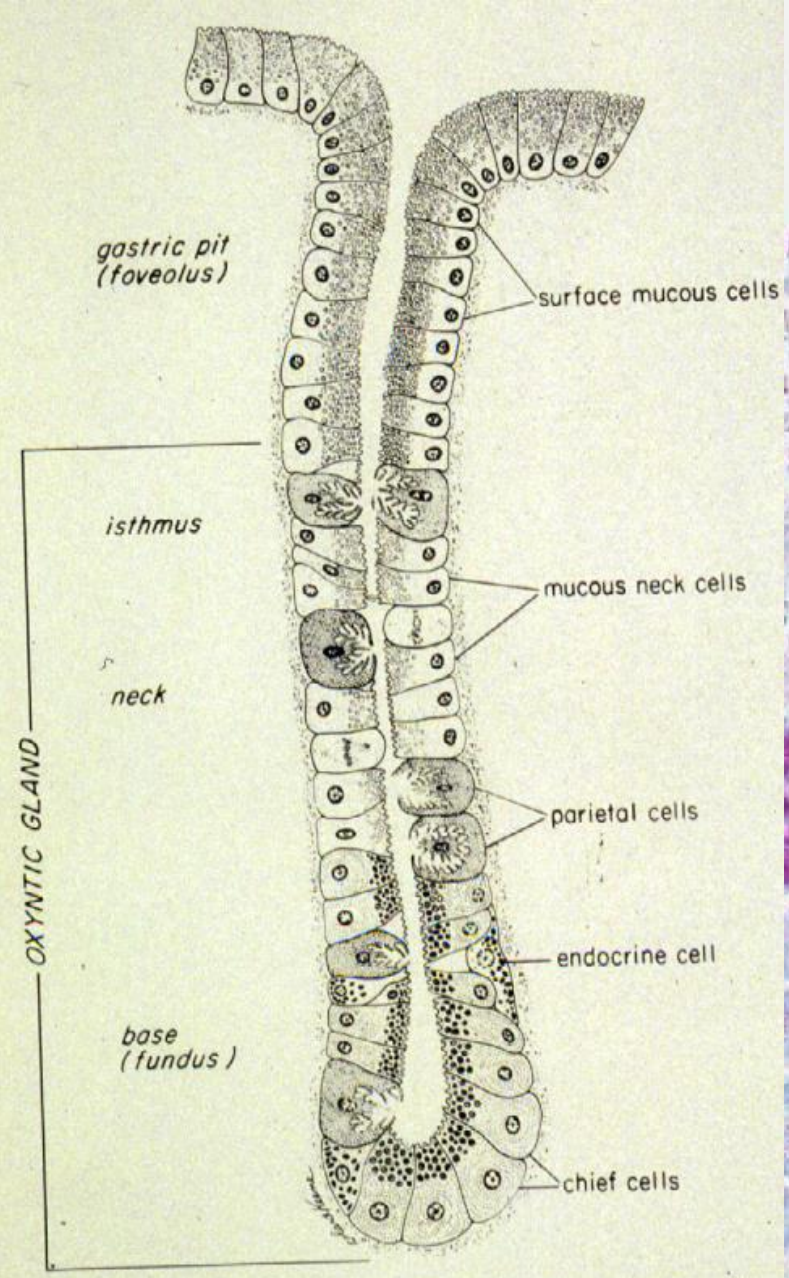
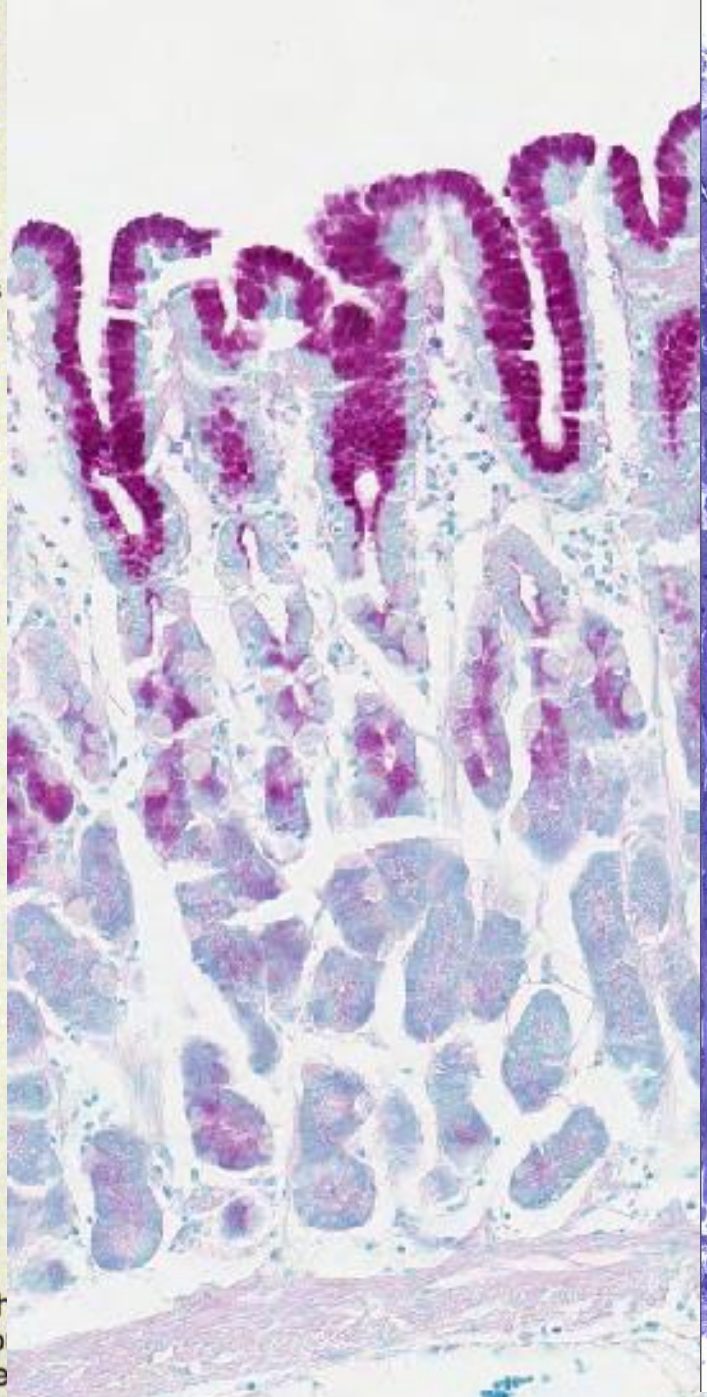
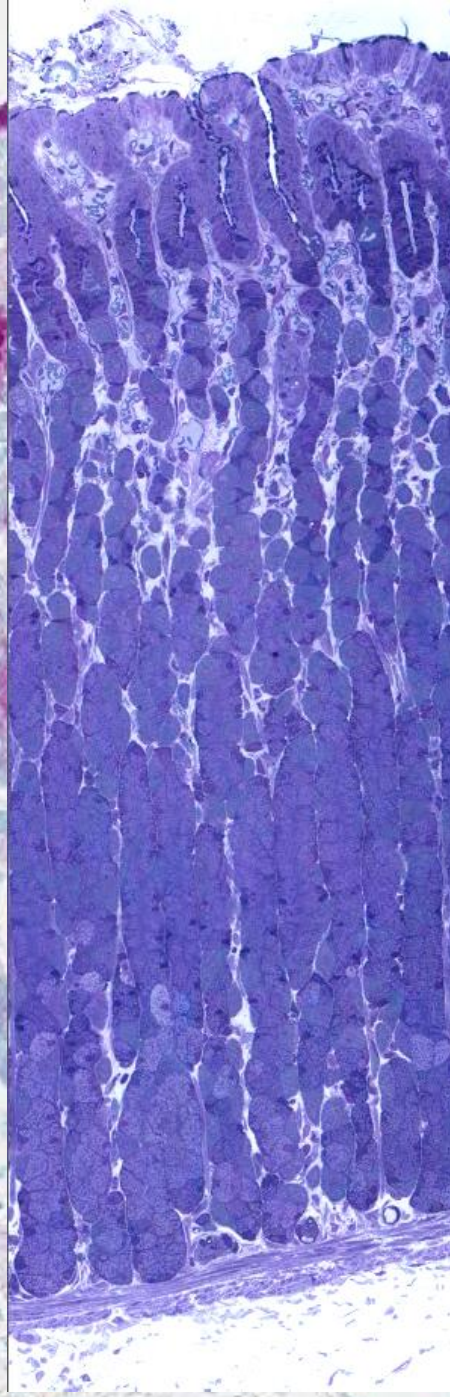


Figure 25–13. Diagram of an oxyntic gland from th corpus of a mammalian stomach. (From Ito, S. *In* Johnso L. R., ed.: Physiology of the Gastrointestinal Tract. Ne York, Raven Press, 1981.)





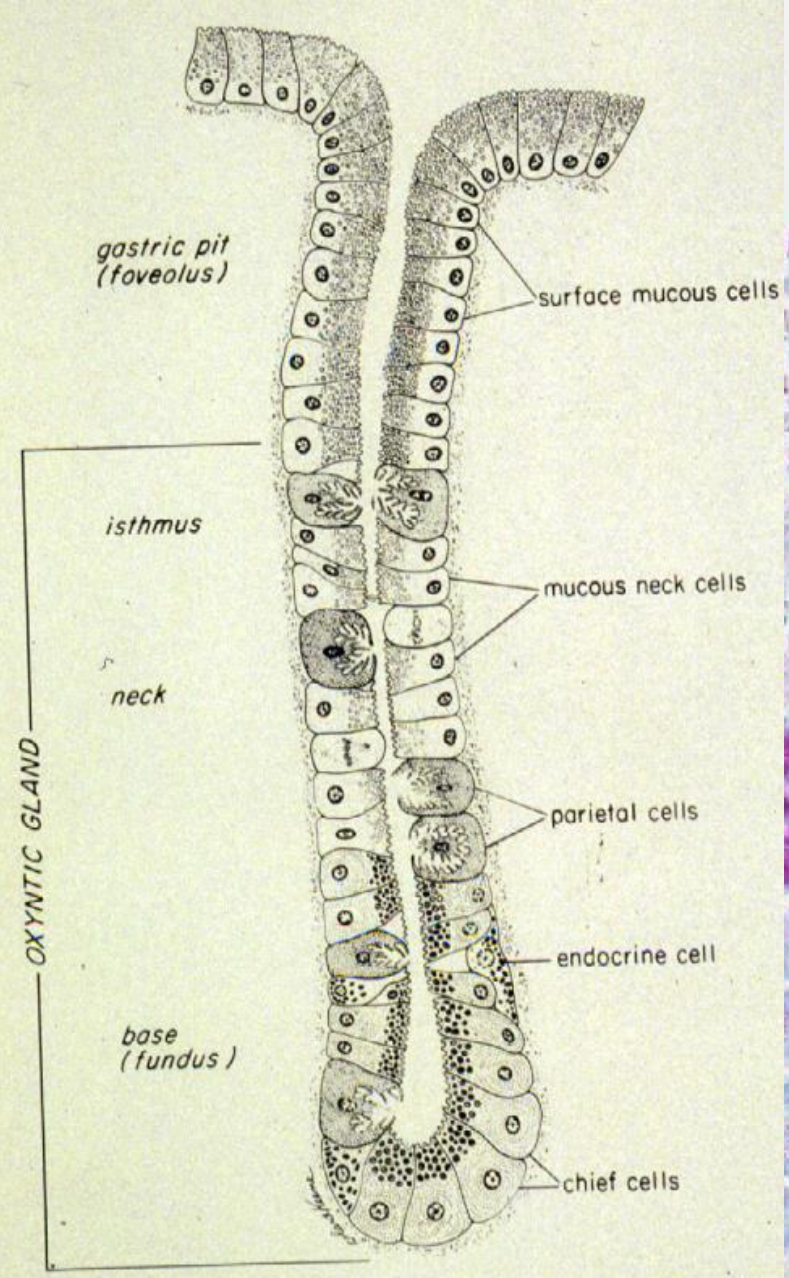
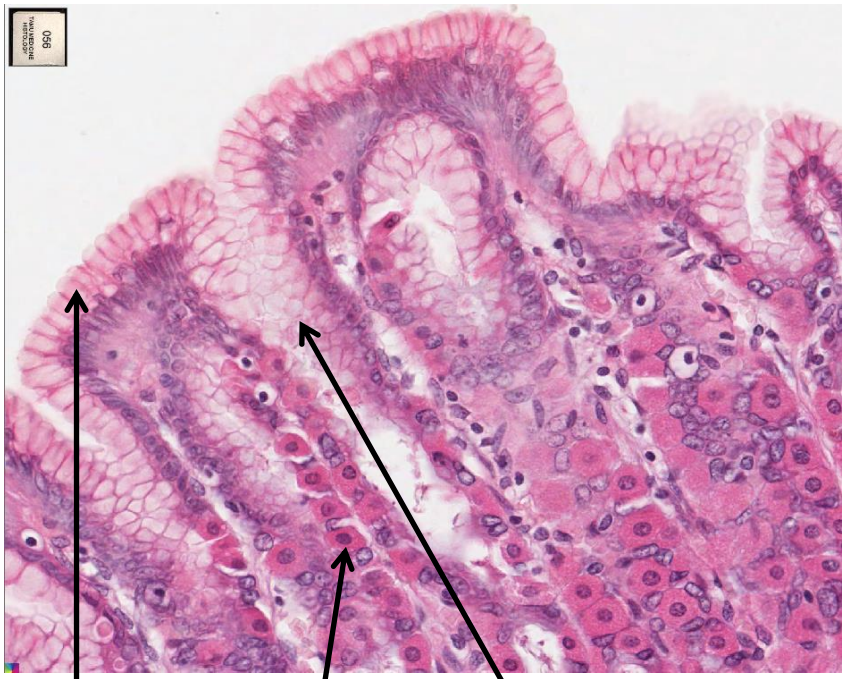


Figure 25–13. Diagram of an oxyntic gland from th corpus of a mammalian stomach. (From Ito, S. *In* Johnso L. R., ed.: Physiology of the Gastrointestinal Tract. Ne York, Raven Press, 1981.)

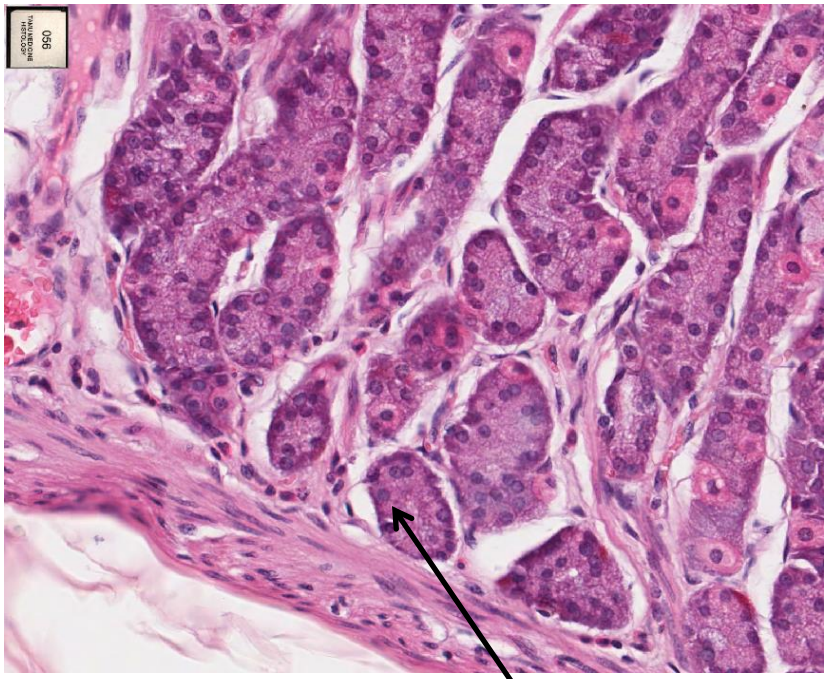
Slide 56: Fundic stomach



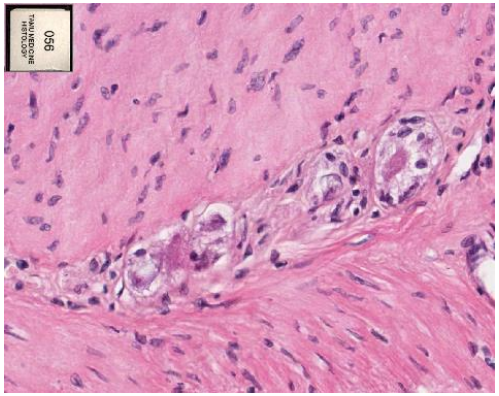
Mucous surface cells

Parietal cells

Mucous neck cells

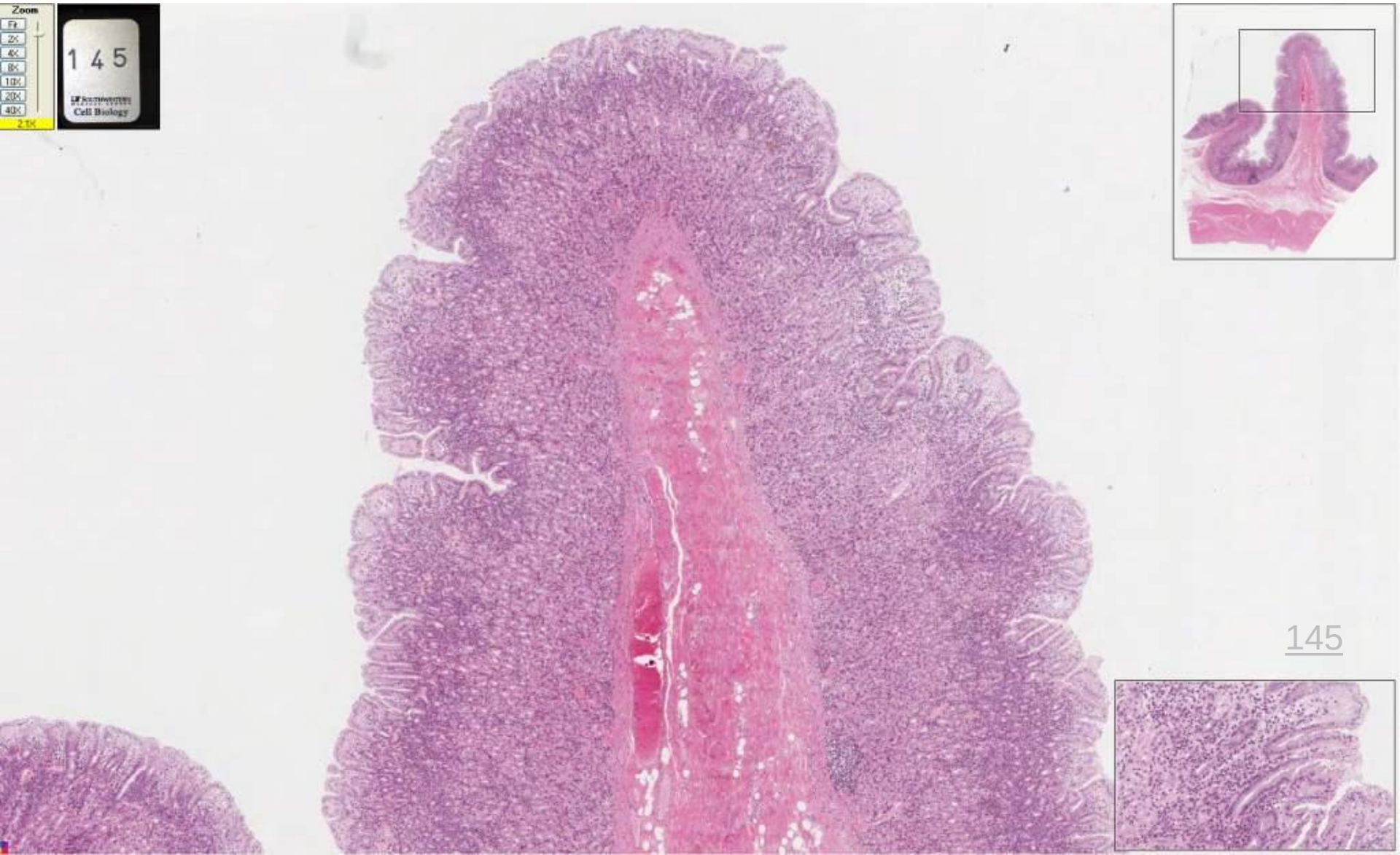


Chief cells



Myenteric plexuses in muscularis externa

Fundic stomach



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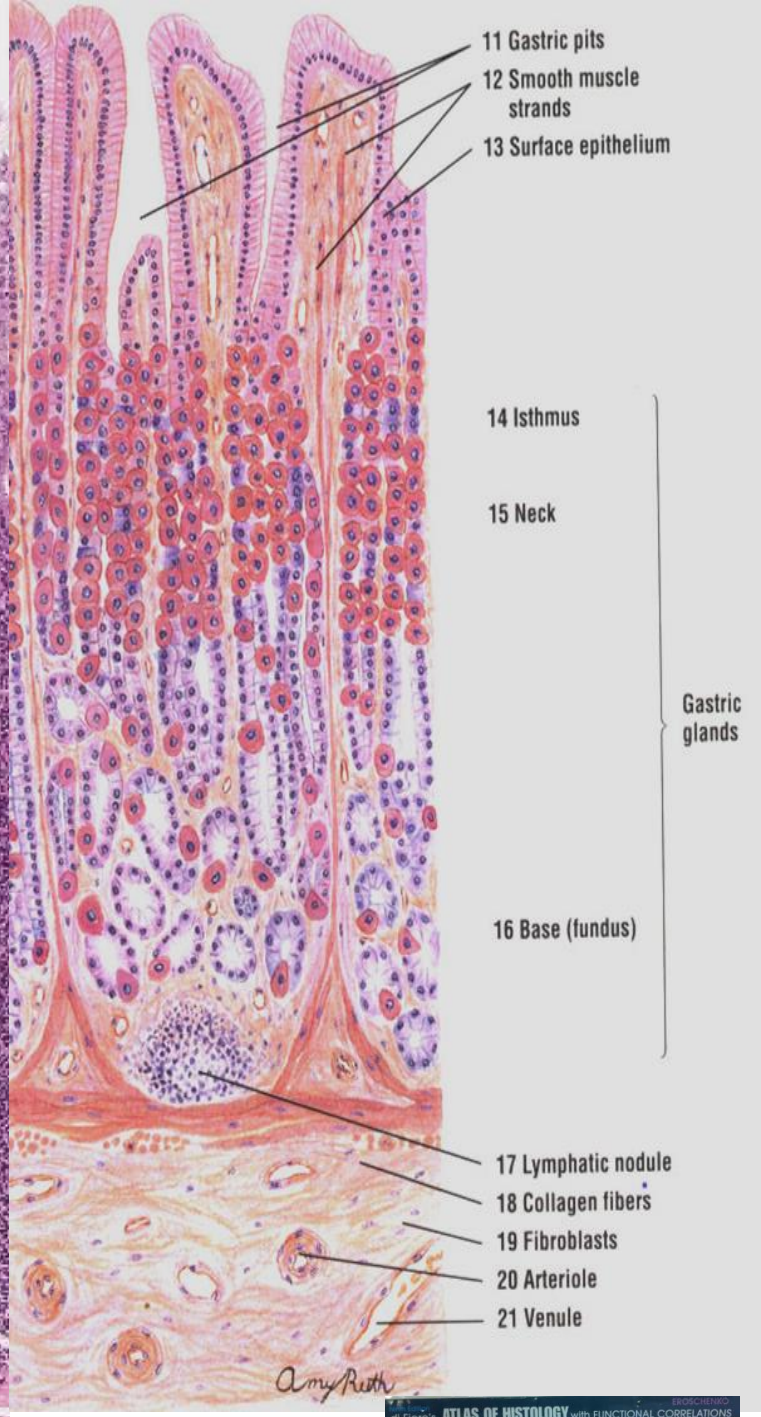
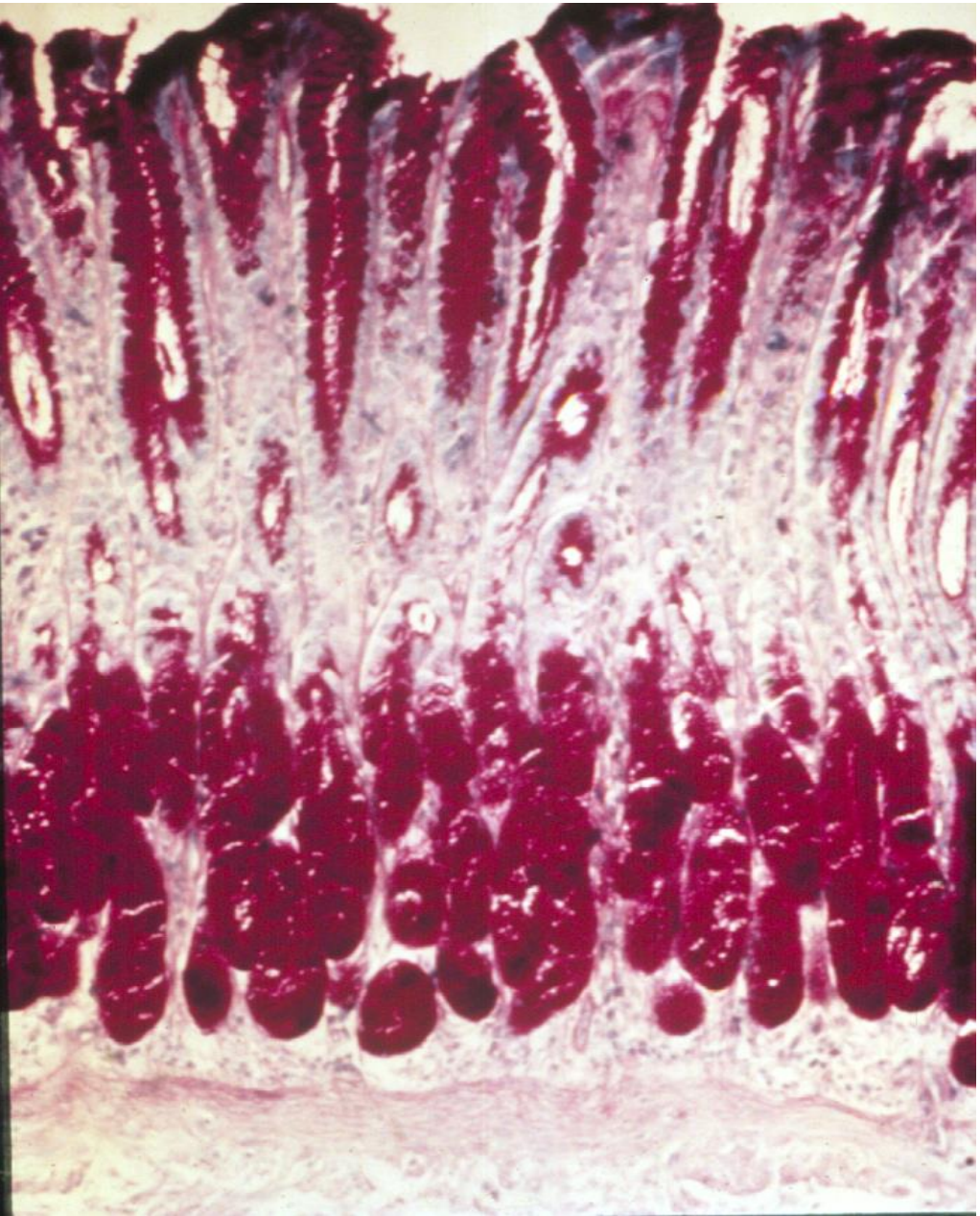
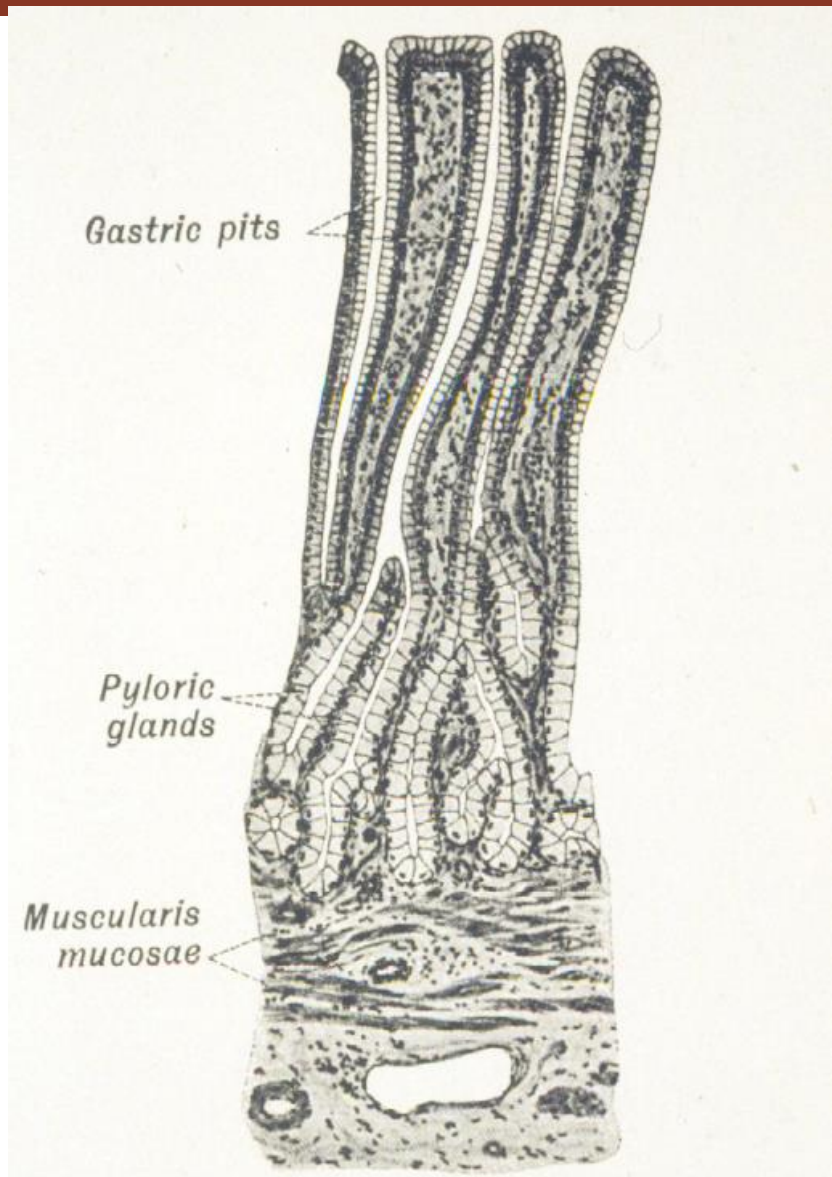


di Fiore's ATLAS OF HISTOLOGY with FUNCTIONAL CORRELATIONS

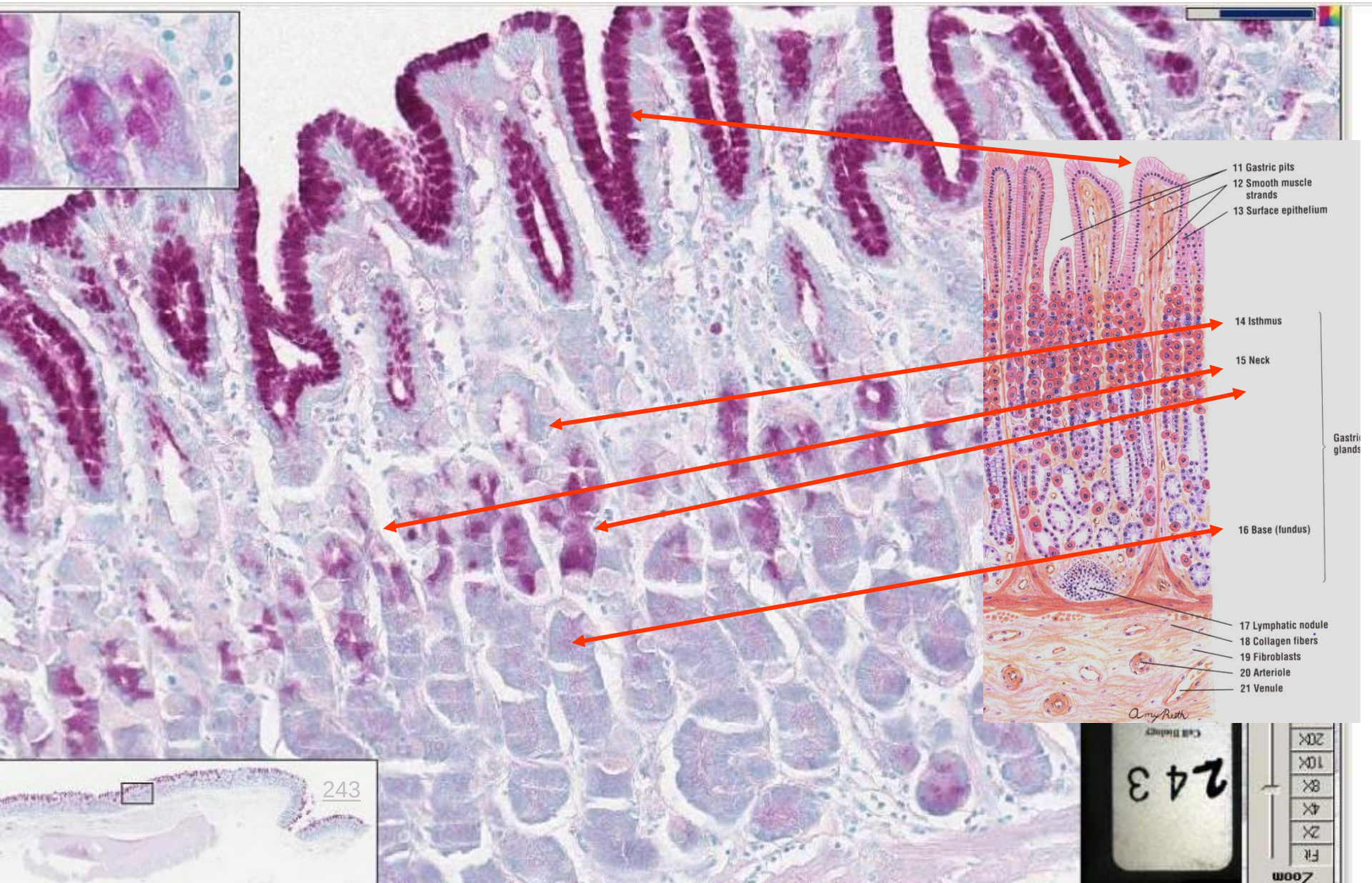
PYLORIC GLANDS



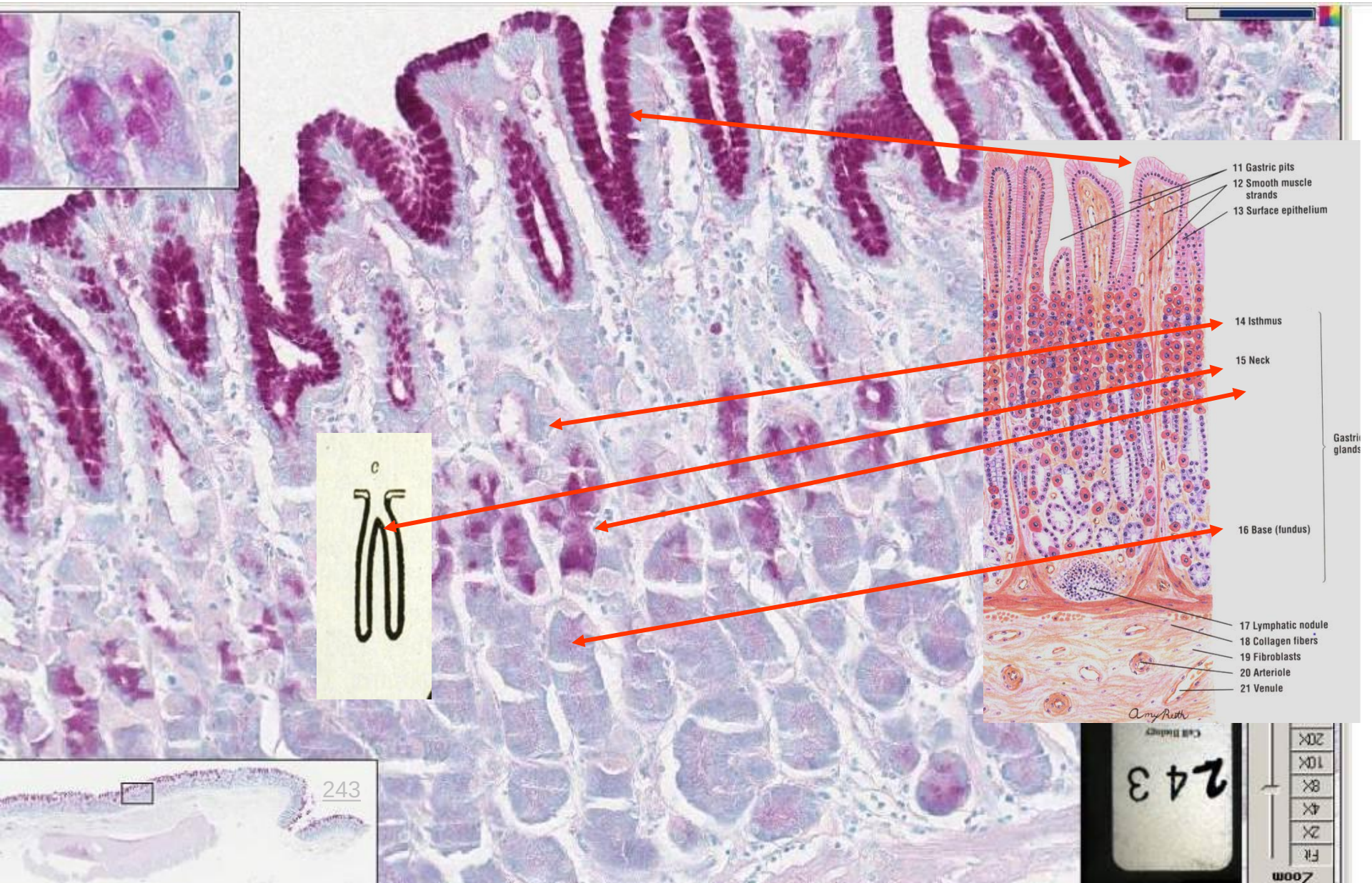


25–20. Pyloric glands from human stomach. Diagrammatic. × 75. (After Braus.)

Fundic stomach, monkey (PAS)



Fundic stomach, monkey (PAS)



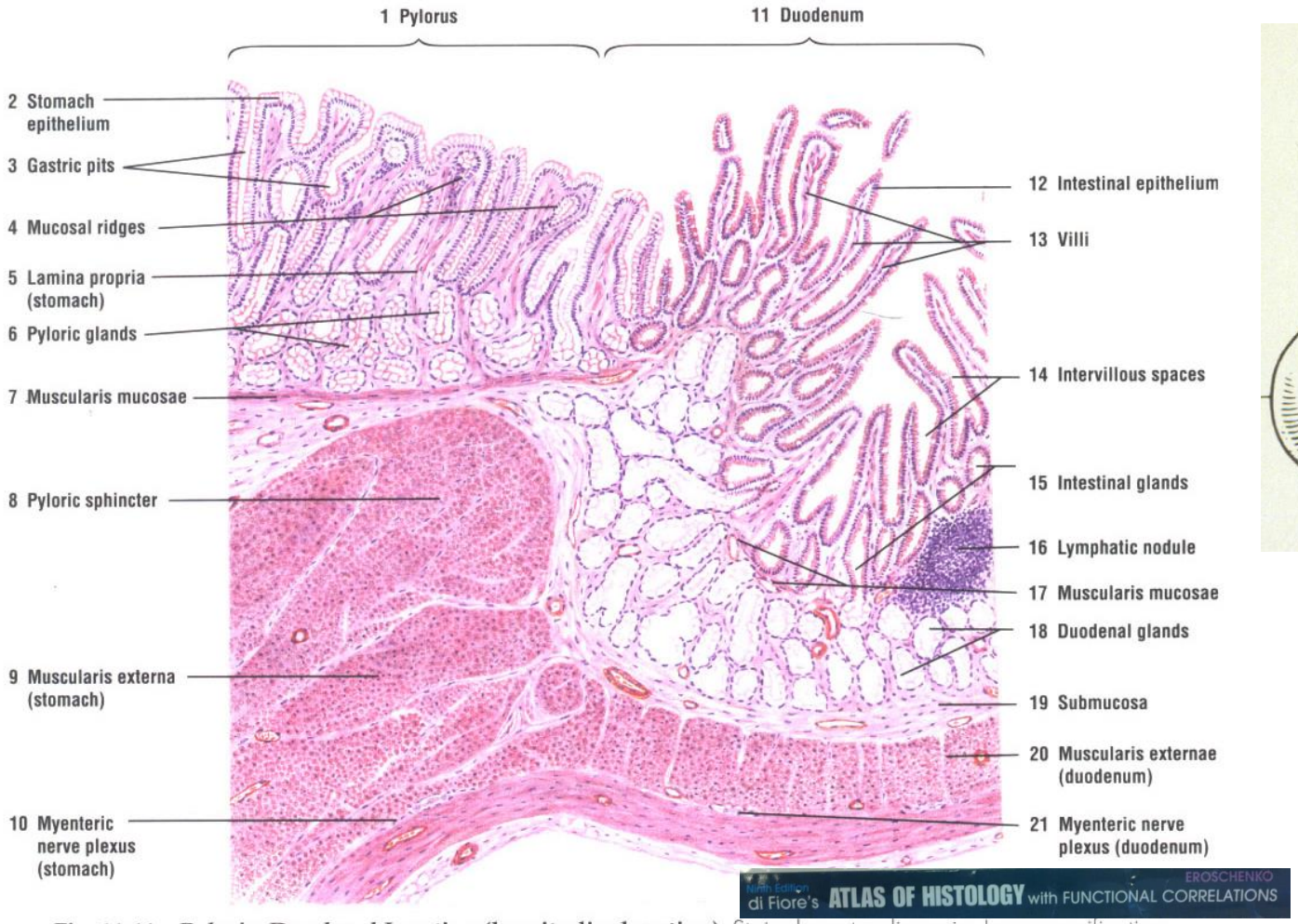
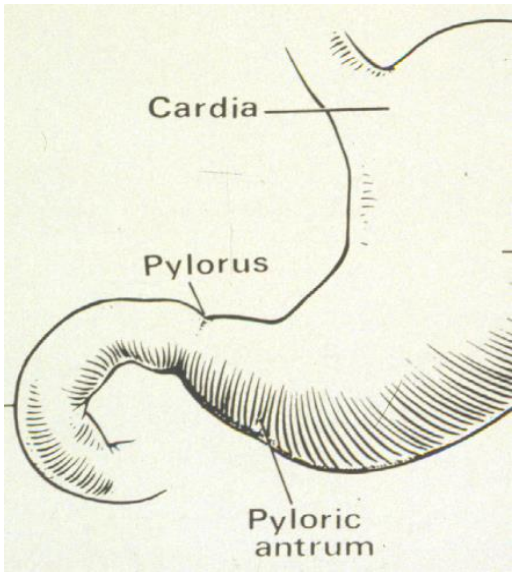


Fig. 11-11 **Pyloric–Duodenal Junction (longitudinal section).** Stain: hematoxylin-eosin. Low magnification.



Characteristics of the epithelium in the stomach and intestine:

Stomach: Simple columnar, mucous secreting, glands within lamina propria

Intestine: Simple columnar with microvilli, goblet cells, glands within submucosa

Many illustrations in these VIBS Histology YouTube videos were modified from the following books and sources: Many thanks to original sources!

- Bruce Alberts, et al. 1983. Molecular Biology of the Cell. Garland Publishing, Inc., New York, NY.
- Bruce Alberts, et al. 1994. Molecular Biology of the Cell. Garland Publishing, Inc., New York, NY.
- William J. Banks, 1981. Applied Veterinary Histology. Williams and Wilkins, Los Angeles, CA.
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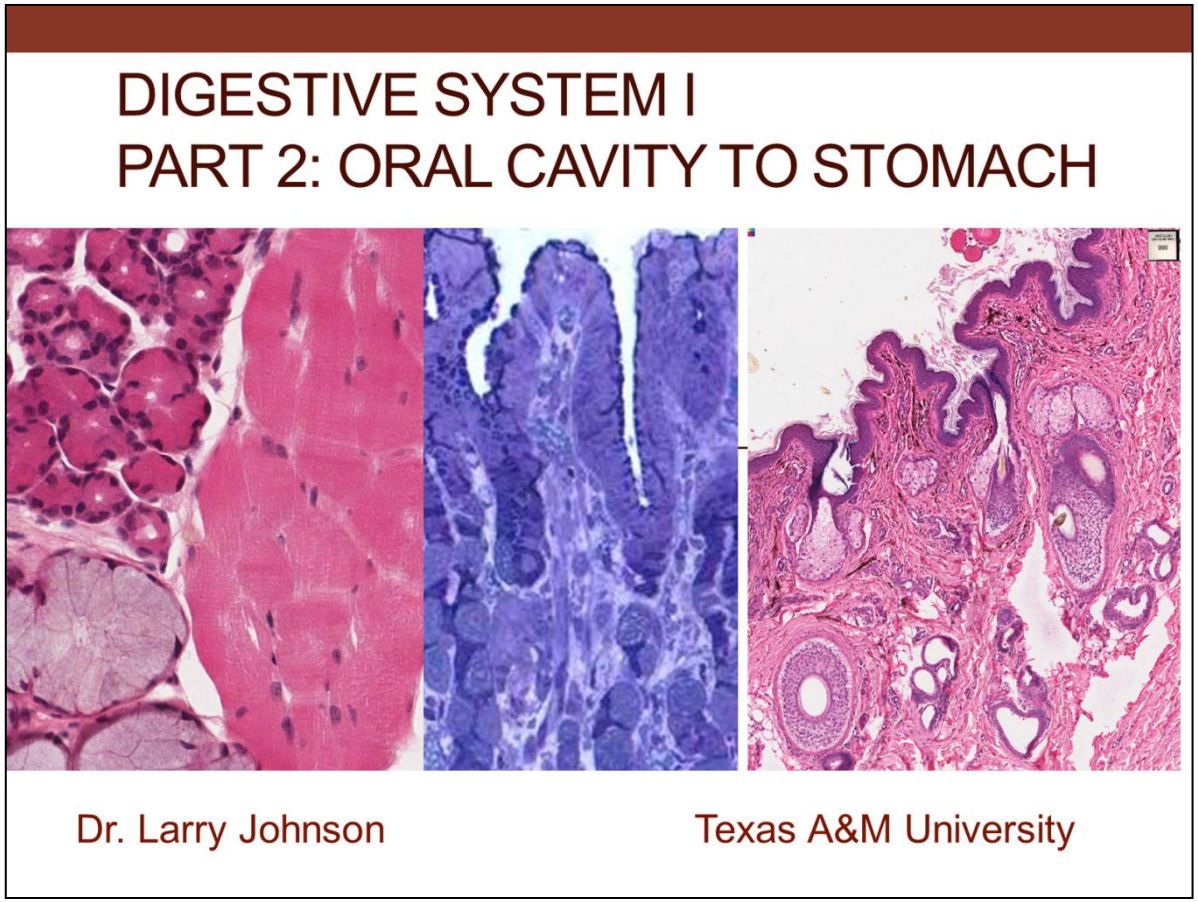
- Leon Weiss and Roy O. Greep. 1977. Histology. McGraw-Hill Book Company, New York, NY.
- Nature (http://www.nature.com), Vol. 414:88,2001.
- A.L. Mescher 2013 Junqueira's Basis Histology text and atlas, 13th ed. McGraw
- Douglas P. Dohrman and TAMHSC Faculty 2012 Structure and Function of Human Organ Systems, Histology Laboratory Manual - Slide selections were largely based on this manual for first year medical students at TAMHSC

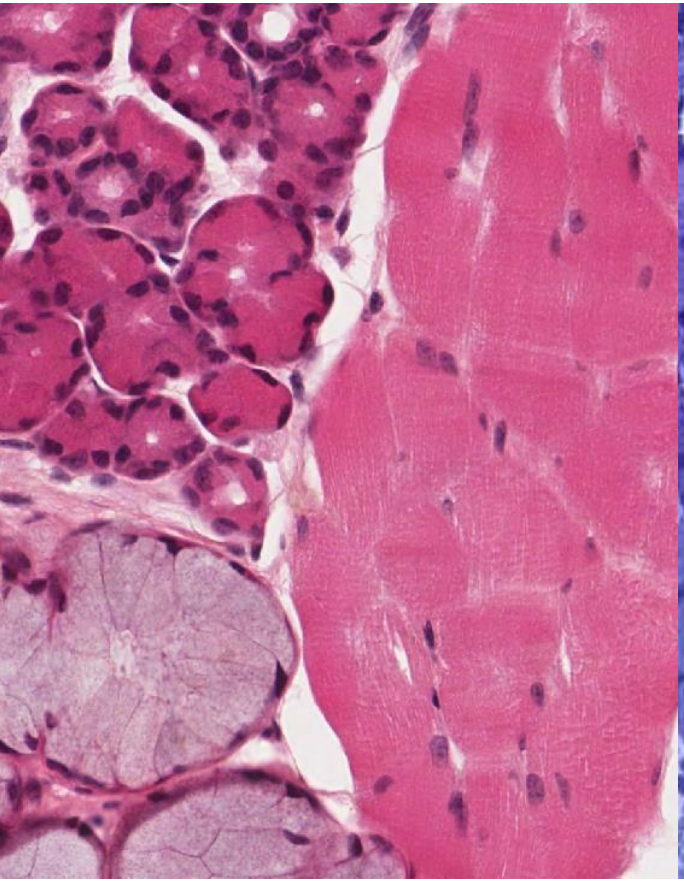
End of

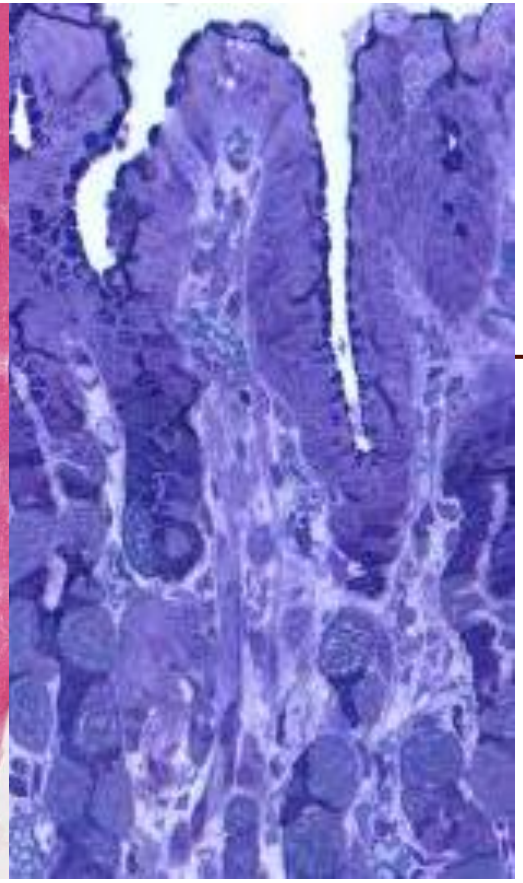


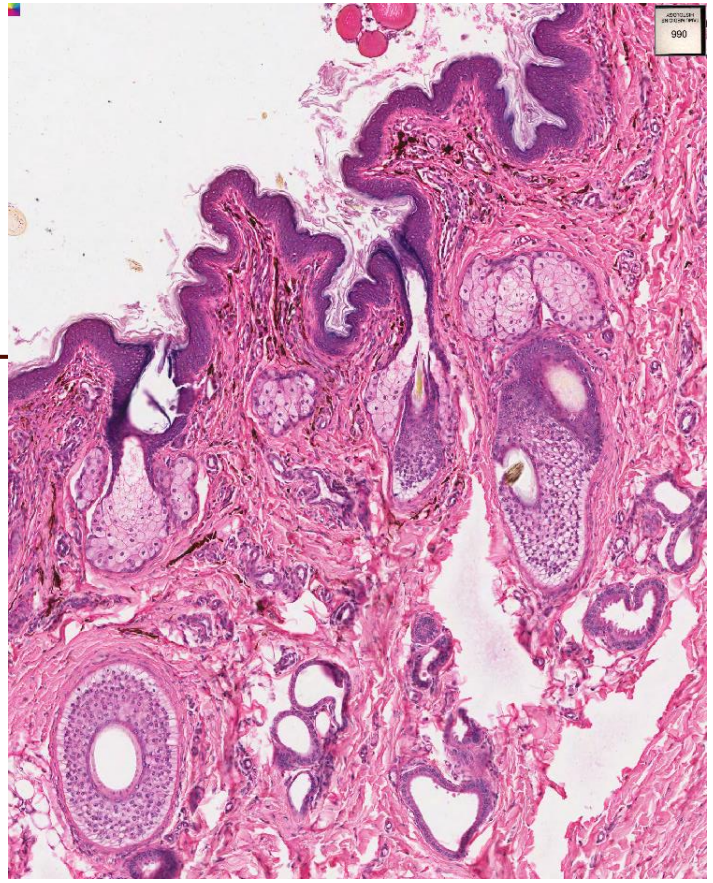
Next

- Digestive System I
  Part 3: Small and large intestines

DIGESTIVE SYSTEM I
PART 3: SMALL AND LARGE INTESTINES







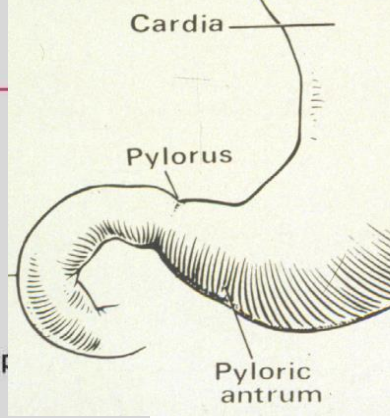
Dr. Larry Johnson

Texas A&M University

Objectives Digestive System I

- Name the parts of the digestive tract.
- Identify the four layers that form the walls of the tubular organs of the digestive tract and the tissue types found in each layer.
- Identify and know the distinguishing structural features of the various regions of each of the tubular organs of the digestive tract.
- Identify the organ region and cell types present from a slide or photomicrograph of a section of any part of the digestive tract

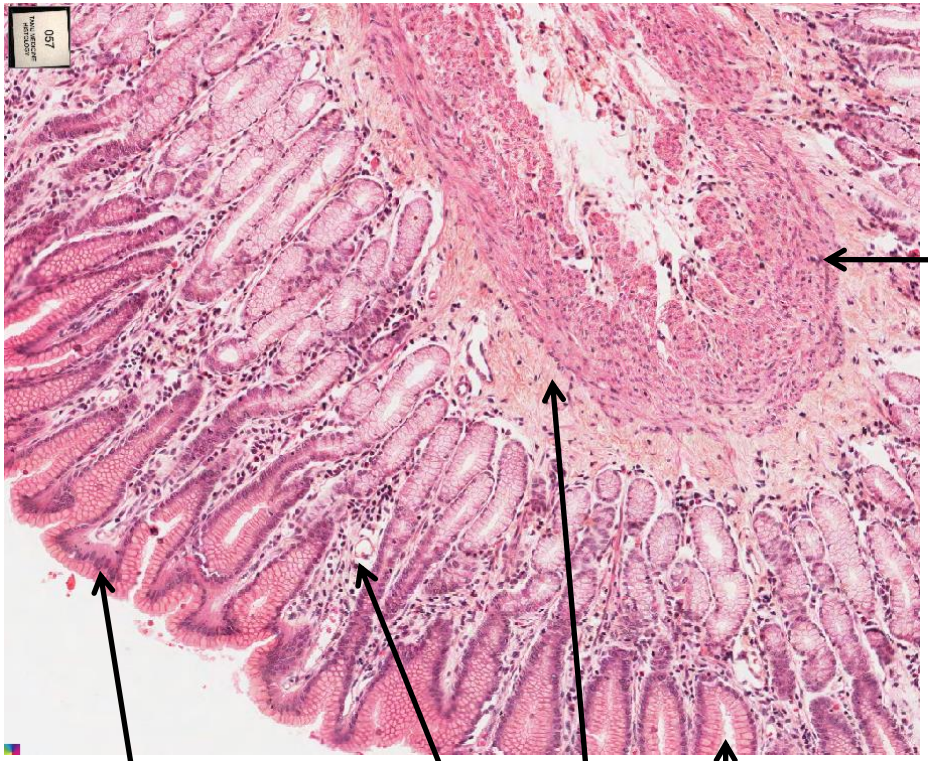
- Part 1: Cells
- Part 2: Oral cavity to stomach
- Part 3: Small and large intestines



1 Pylorus
11 Duodenum
2 Stomach epithelium
3 Gastric pits
4 Mucosal ridges
5 Lamina propria (stomach)
6 Pyloric glands
7 Muscularis mucosae
8 Pyloric sphincter
9 Muscularis externa (stomach)
10 Myenteric nerve plexus (stomach)
12 Intestinal ep
13 Villi
14 Intervillous spaces
15 Intestinal glands
16 Lymphatic nodule
17 Muscularis mucosae
18 Duodenal glands
19 Submucosa
20 Muscularis externae (duodenum)
21 Myenteric nerve plexus (duodenum)

Fig. 11-11 Pyloric–Duodenal Junction (longitudinal section). Stain: hematoxylin-eosin. Low magnification.

Slide 57: Pyloric stomach

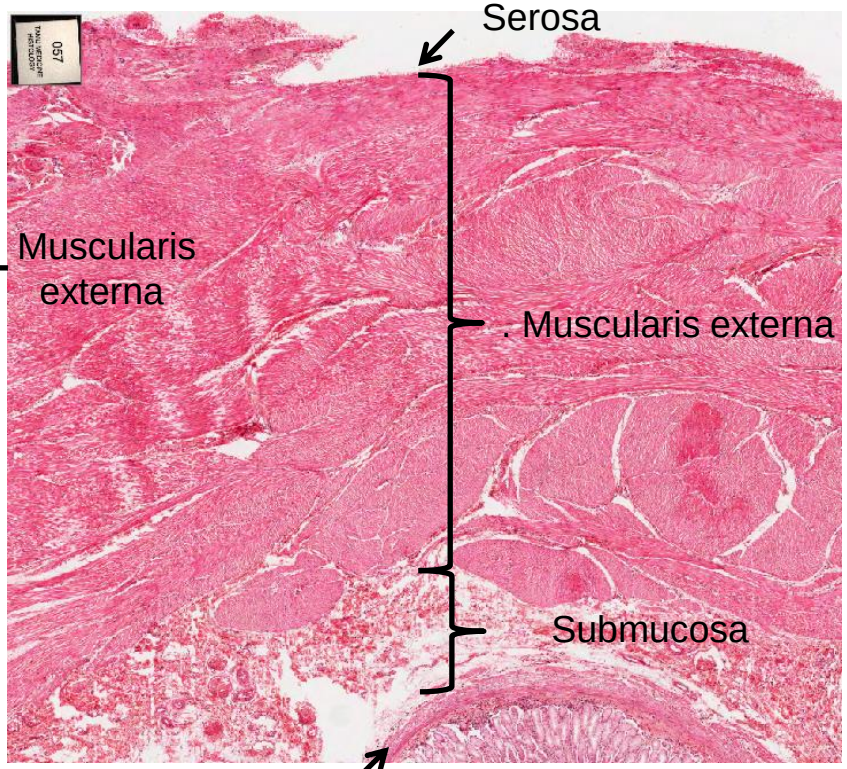


Mucosal epithelium

Lamina propria

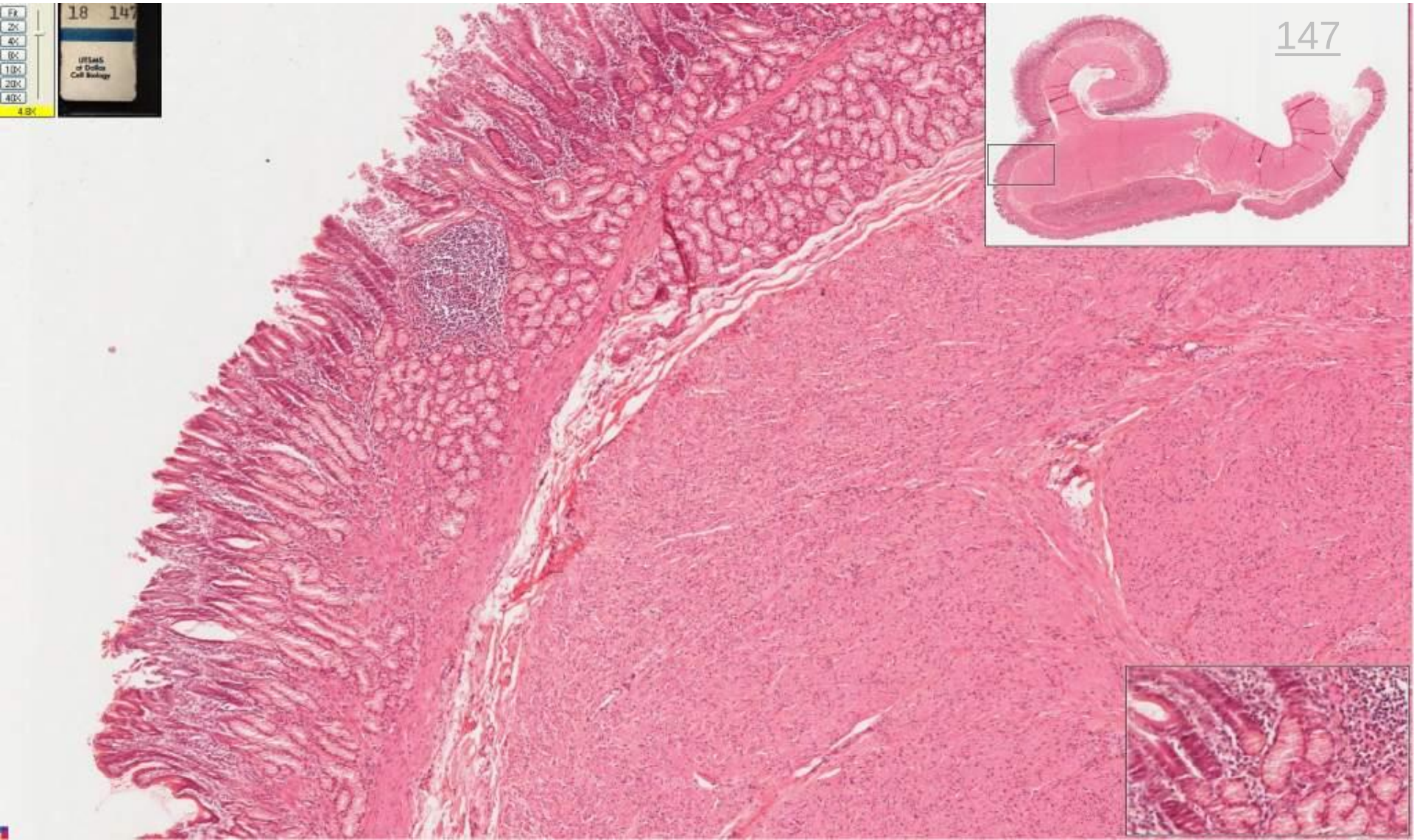
Submucosa

Gastric pits



Muscularis mucosa

Pyloroduodenal junction, baboon



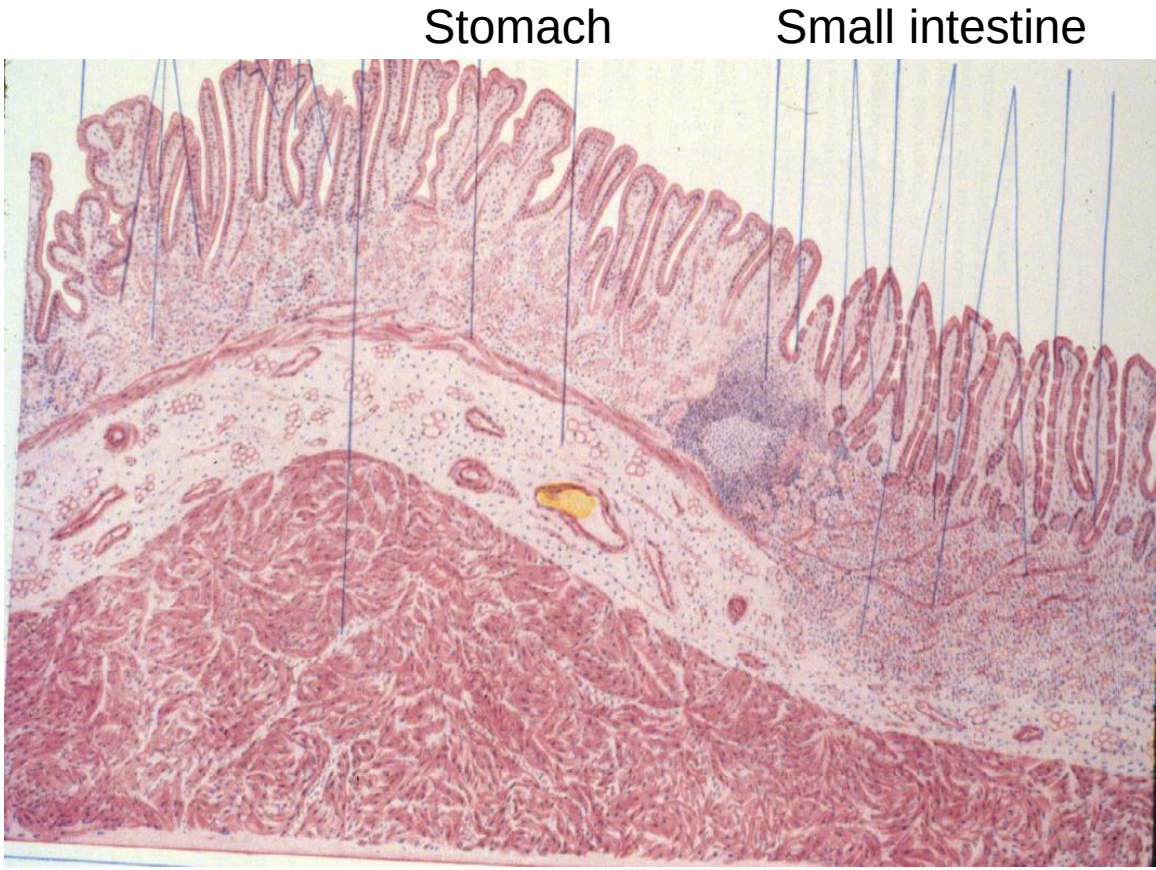
SMALL INTESTINE

GENERAL ORGANIZATION

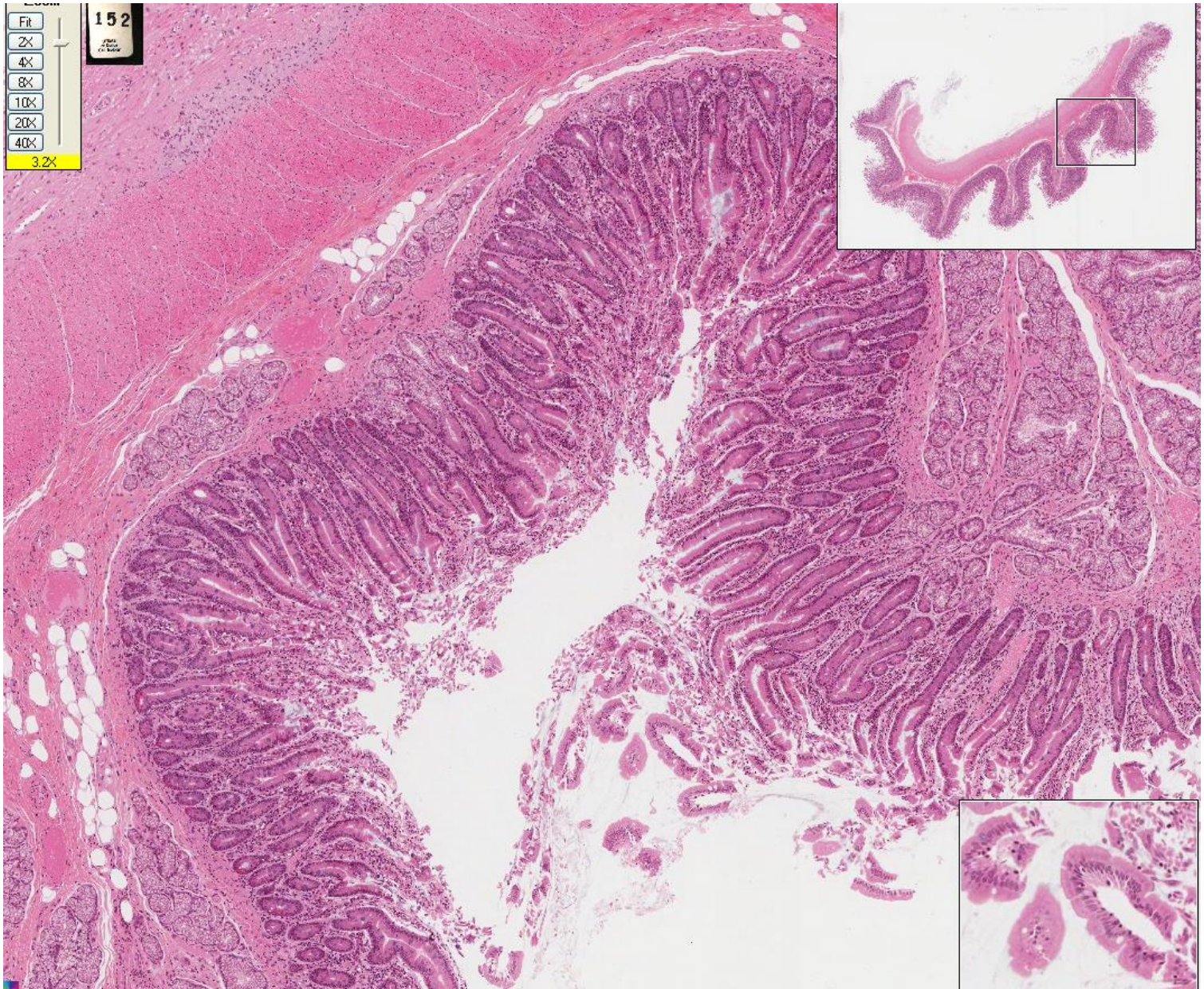
CRYPTS OF LIEBERKUHN

INTESTINAL EPITHELIUM

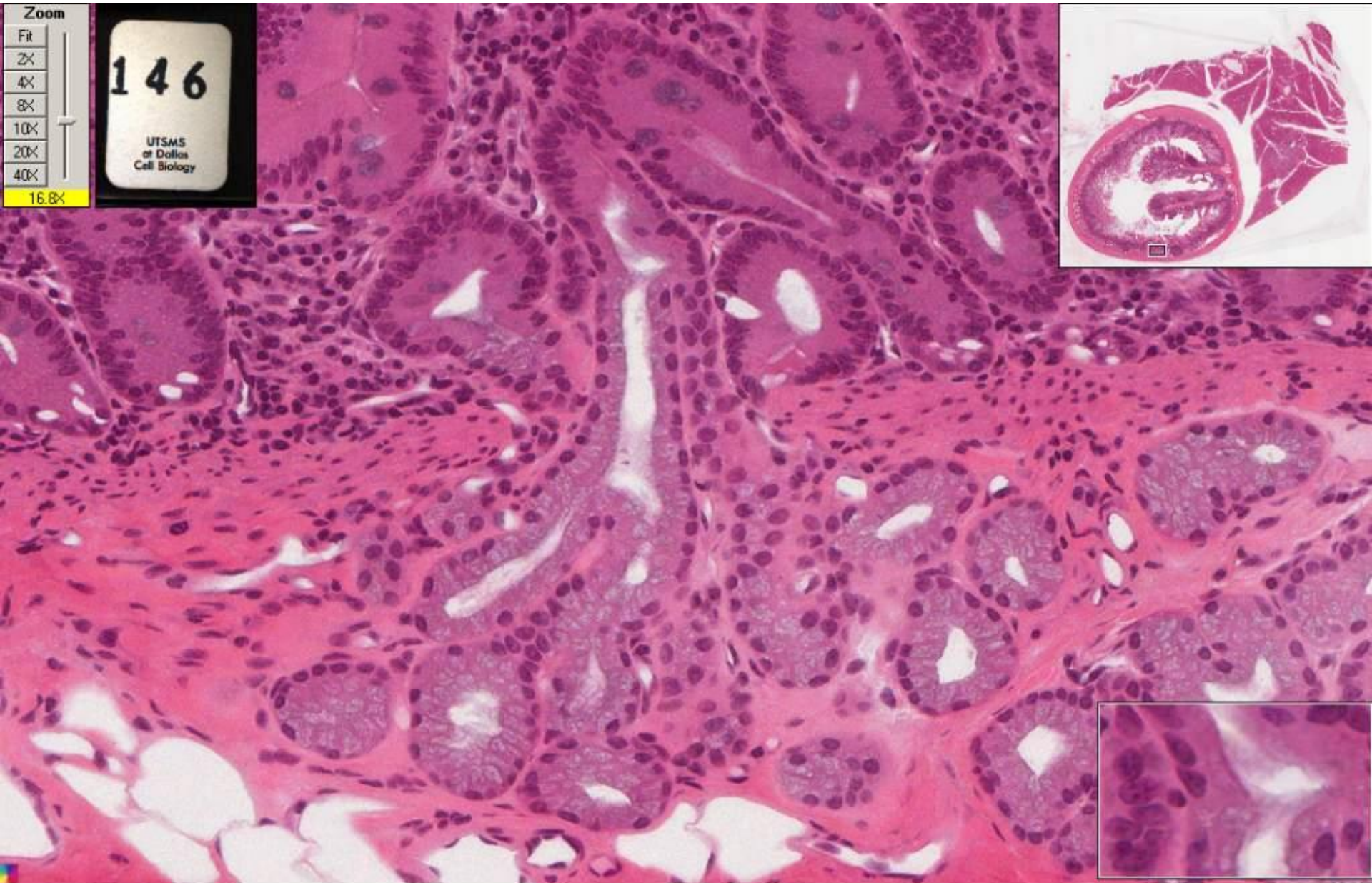
- ABSORPTIVE CELLS
- ENTEROENDOCRINE CELLS
- PANETH CELLS
- GOBLET CELL



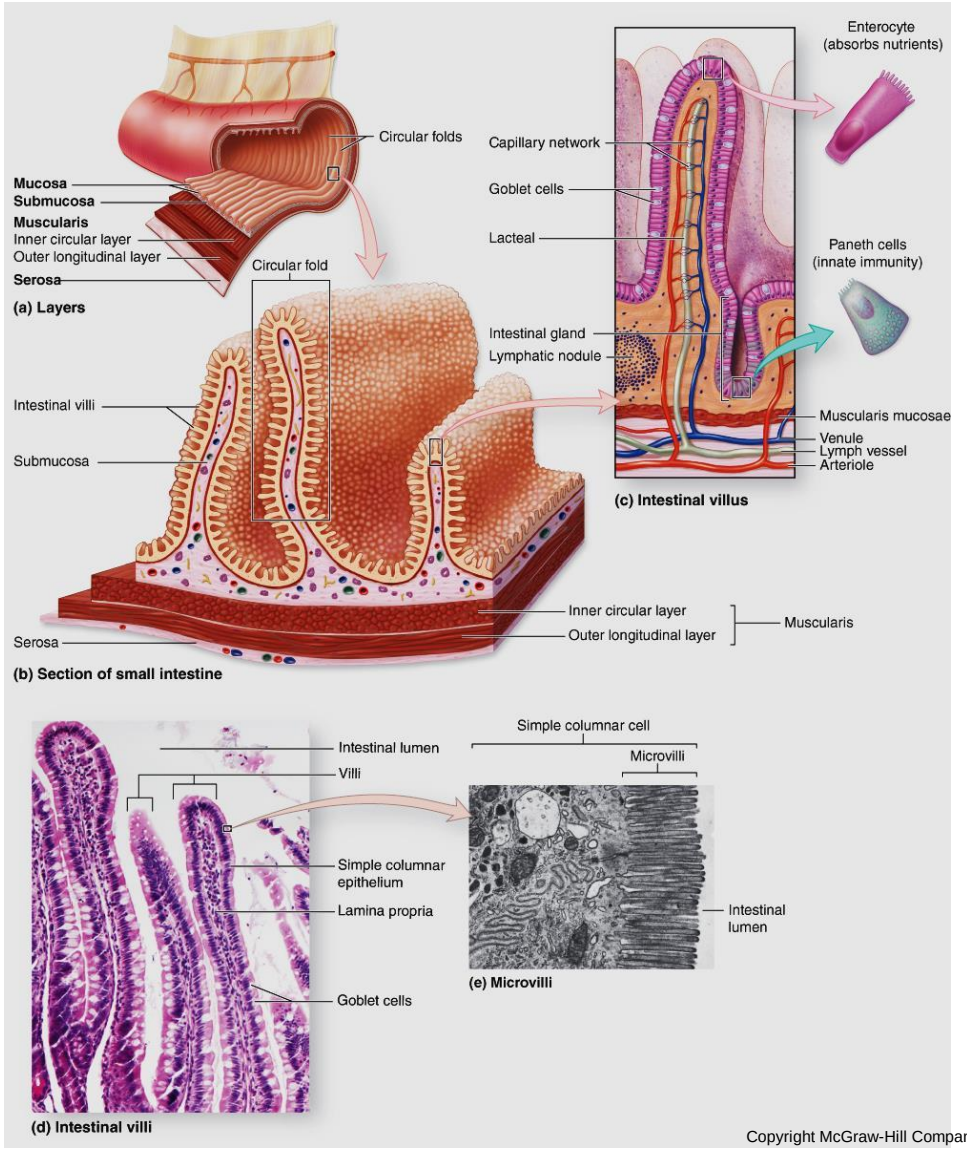
Duodenum



Duodenum, monkey



Small intestine



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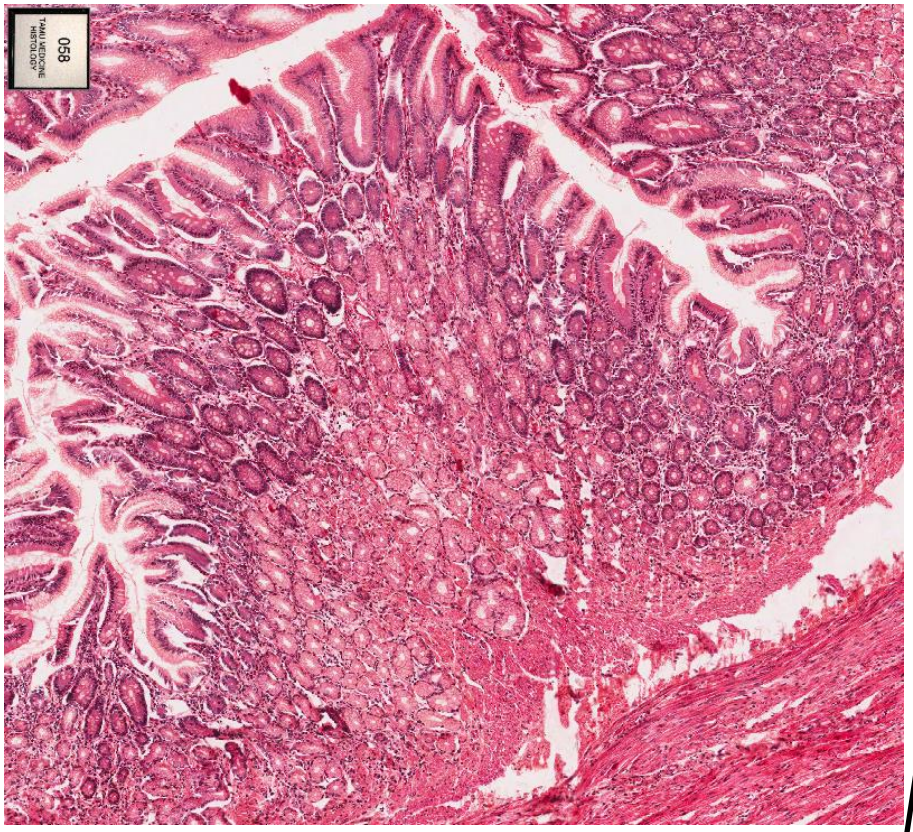
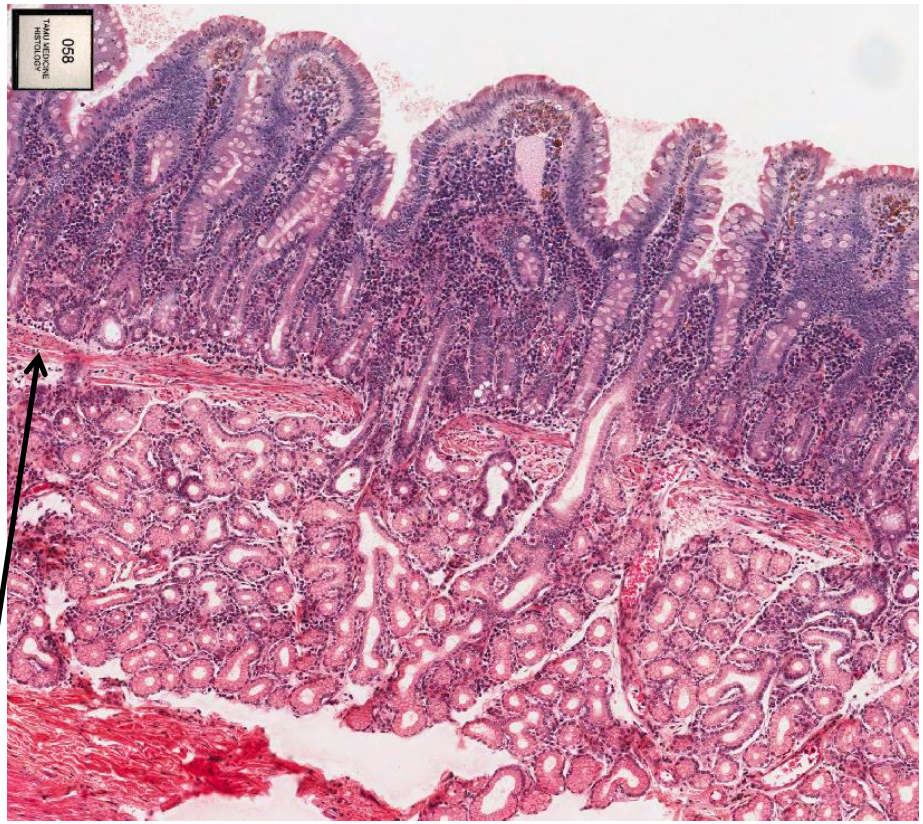
Slide 58: Pyloric stomach and duodenum



Pyloric stomach

- Note that the glands lie within the lamina propria

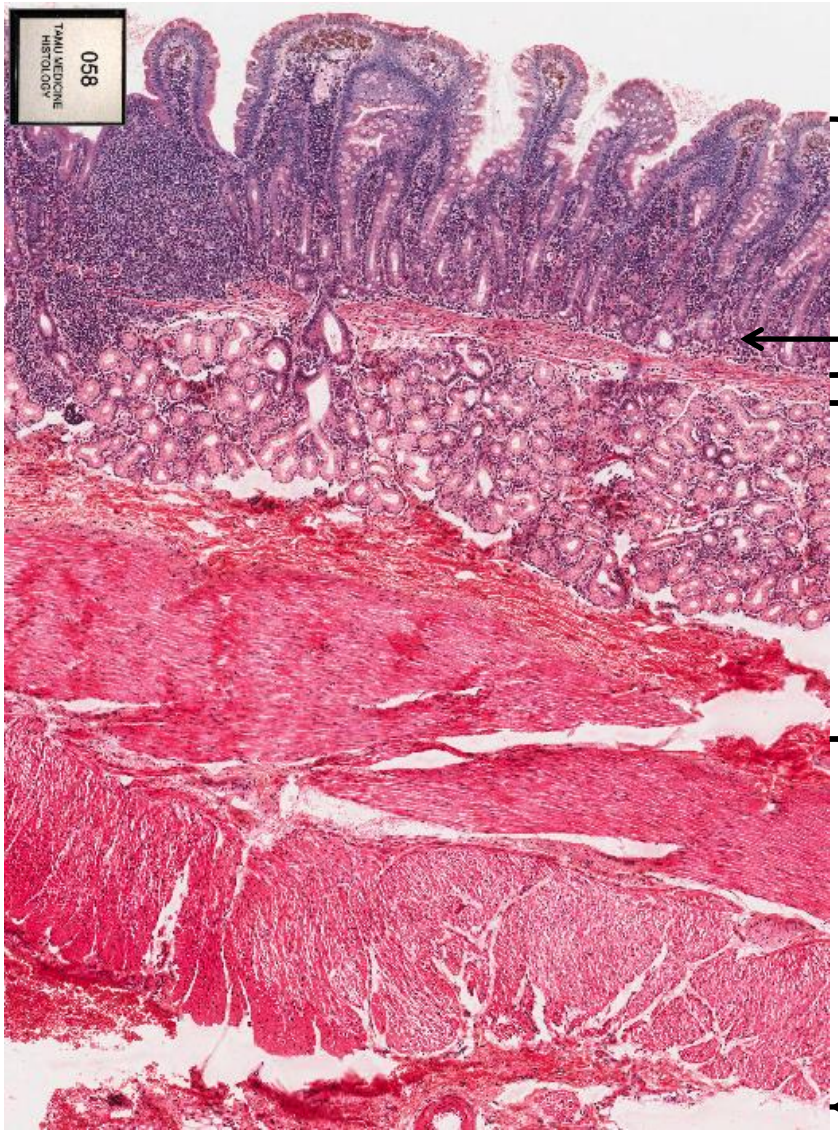
Muscularis mucosa



Duodenum

- Note that the glands lie within the submucosa

Slide 58 : Duodenum



Mucosal epithelium

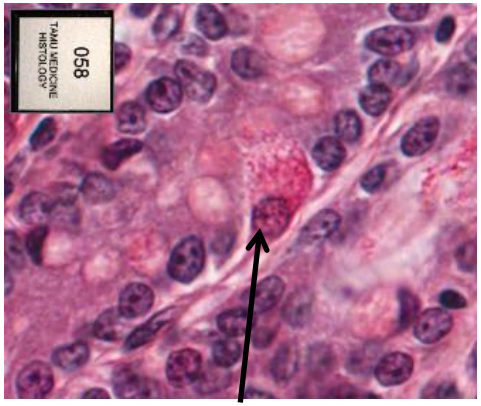
Lamina propria

Muscularis mucosa

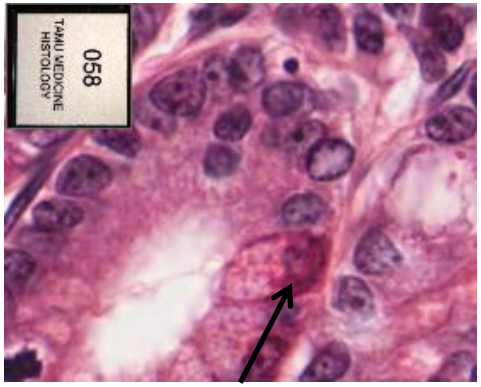
Submucosa

Muscularis externa

Serosa

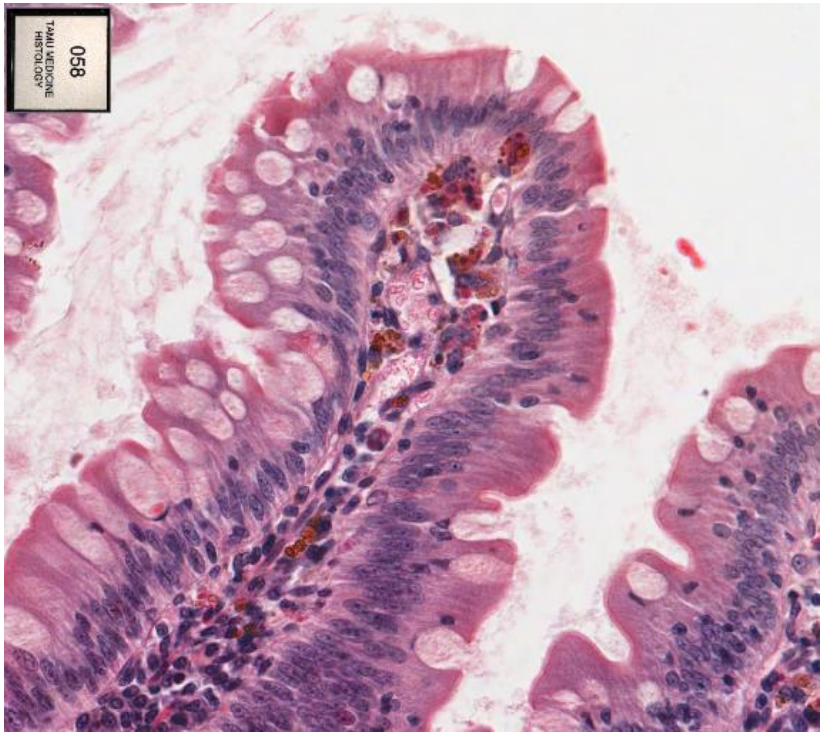


Paneth cell

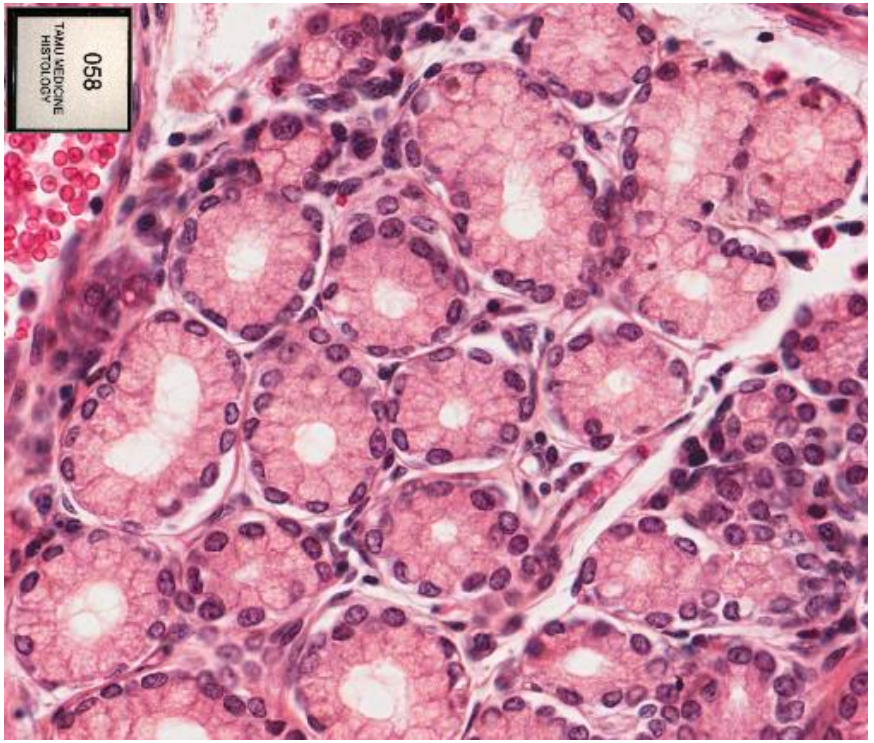


Enteroendocrine cell

Slide 58 : Duodenum

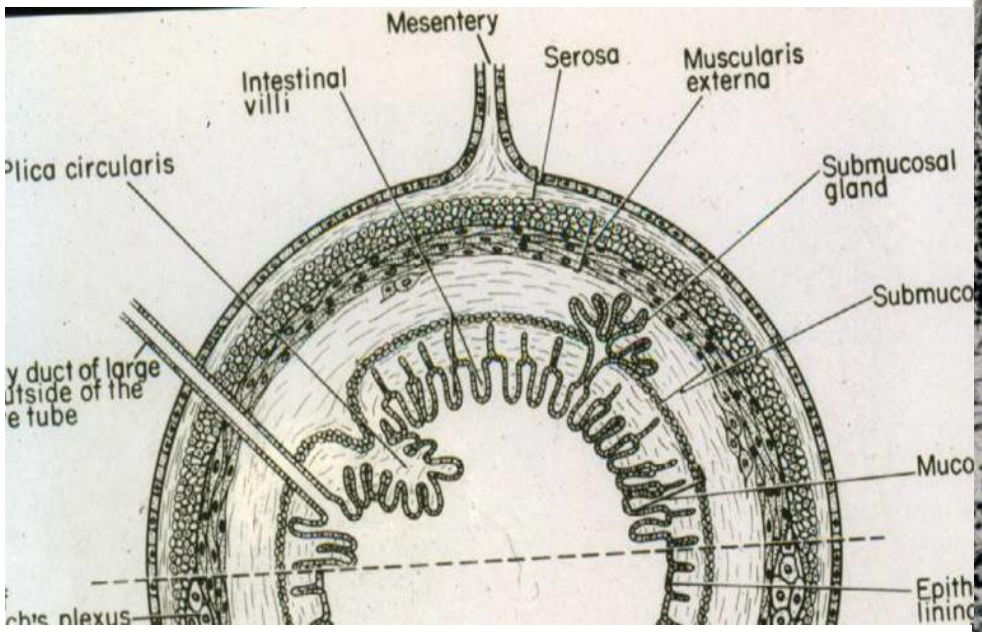


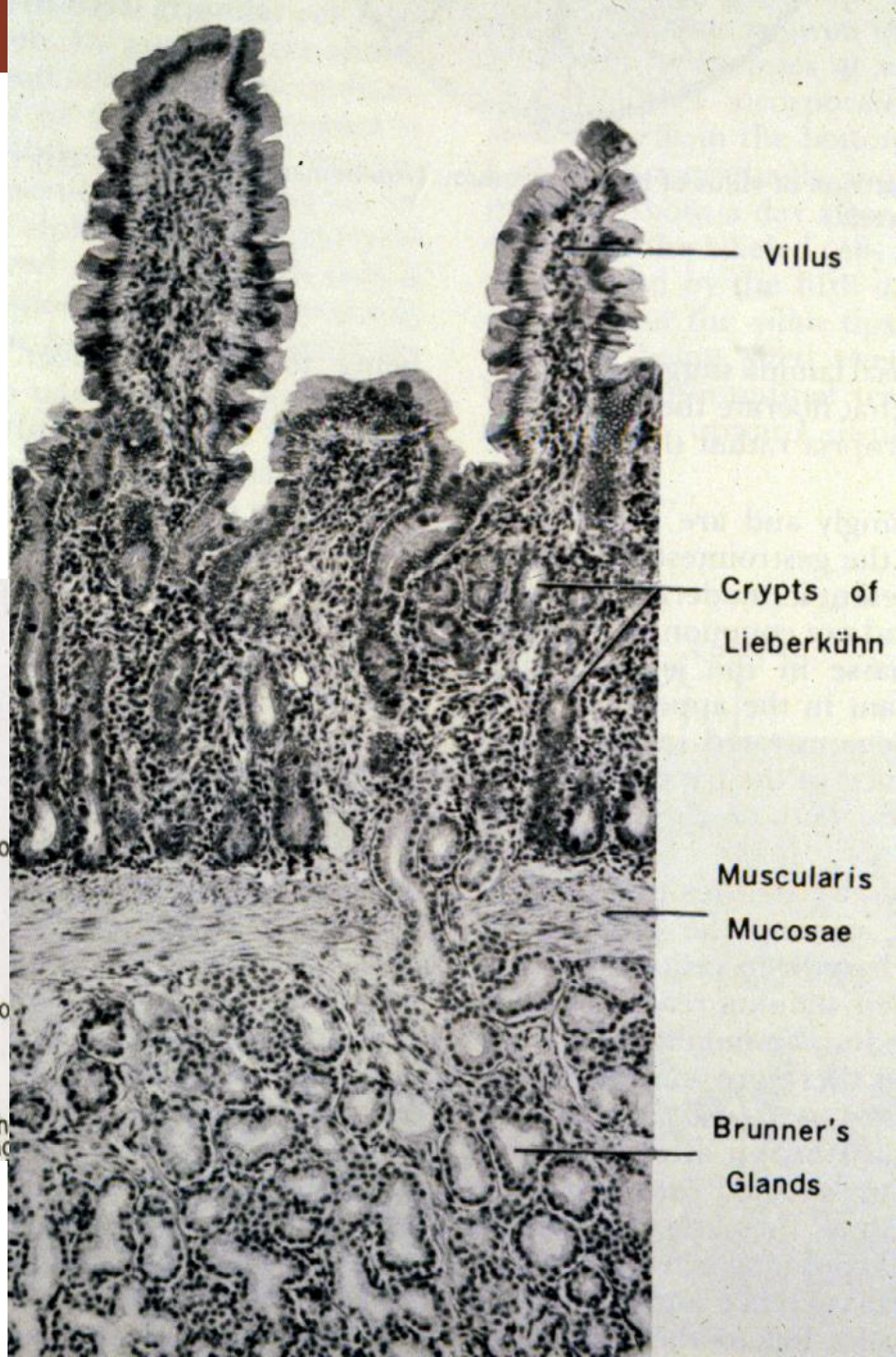
Simple columnar epithelium with goblet cells



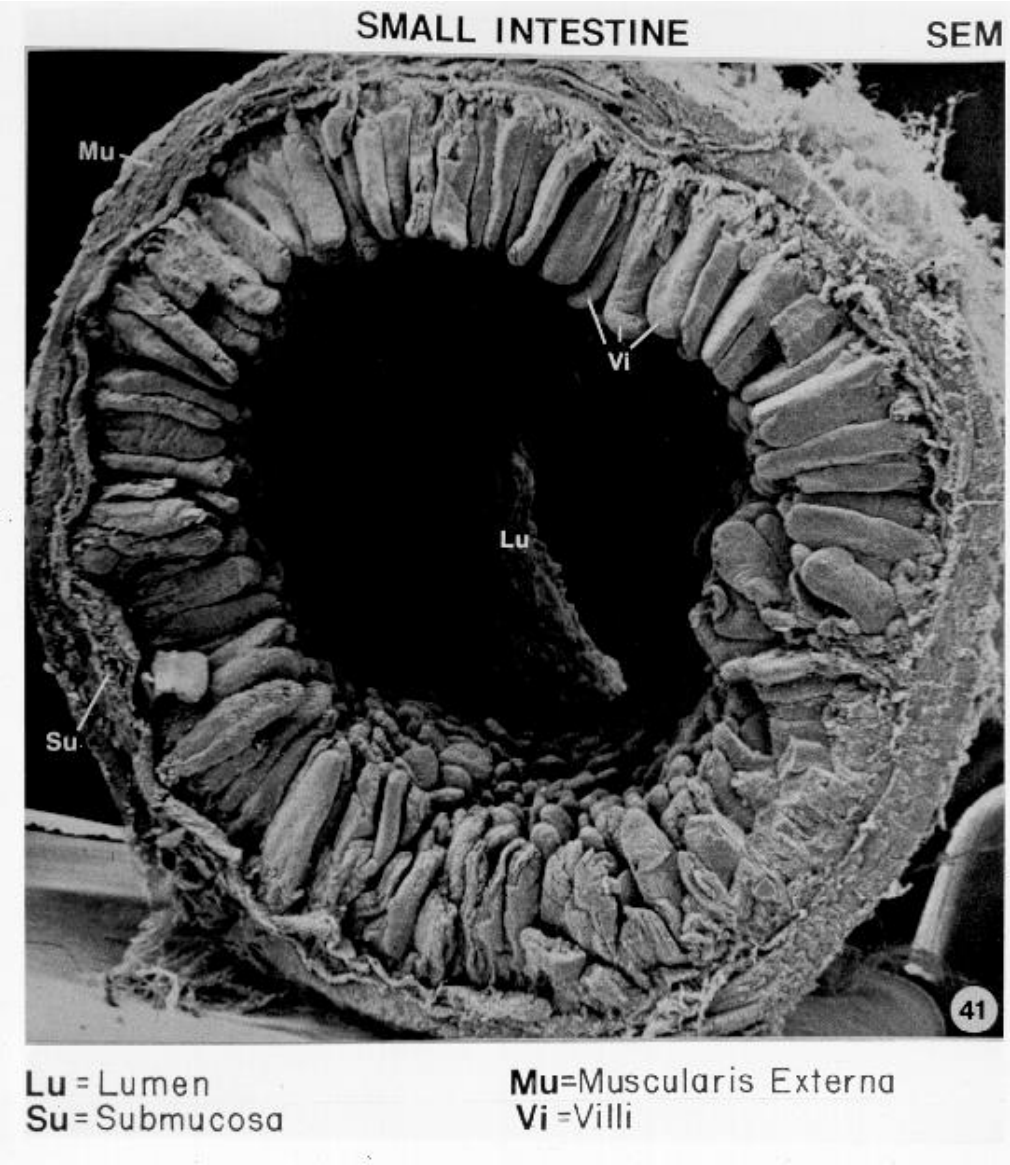
Submucosal Brunner’s glands

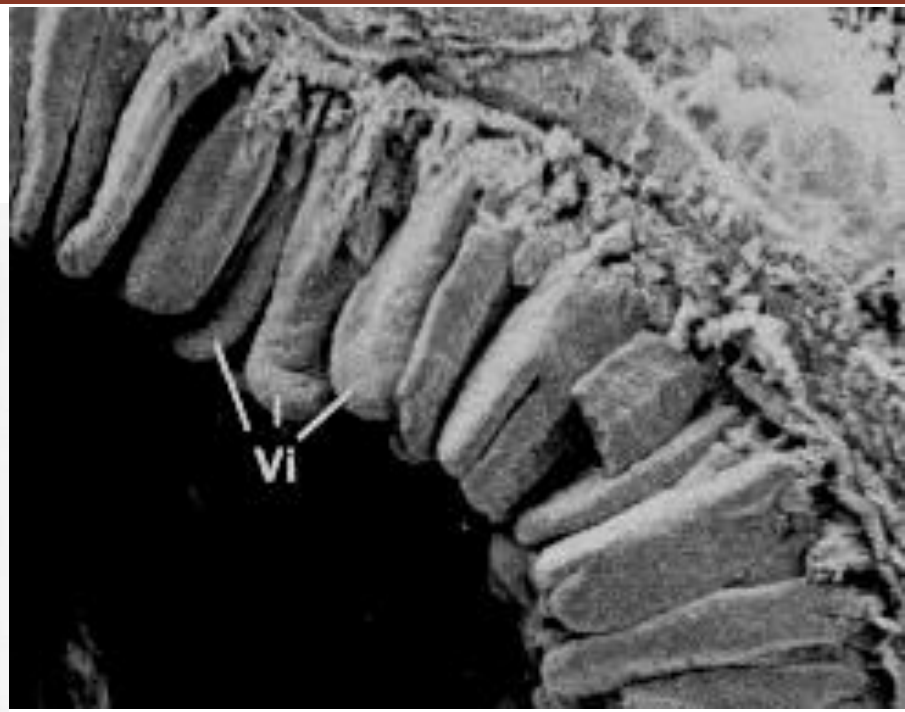
LAMINA PROPRIA
SUBMUCOSA
(GLANDS OF BRUNNER)

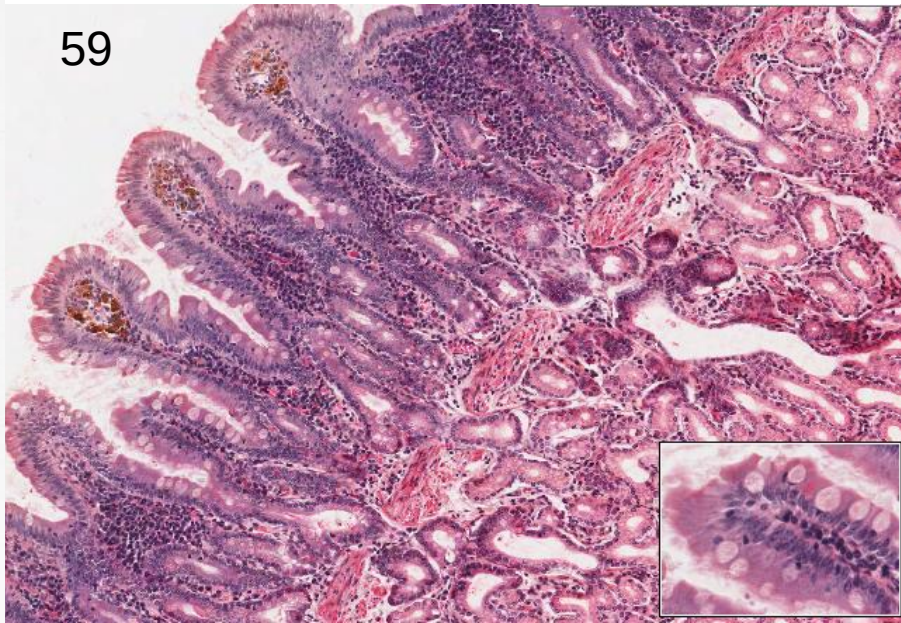




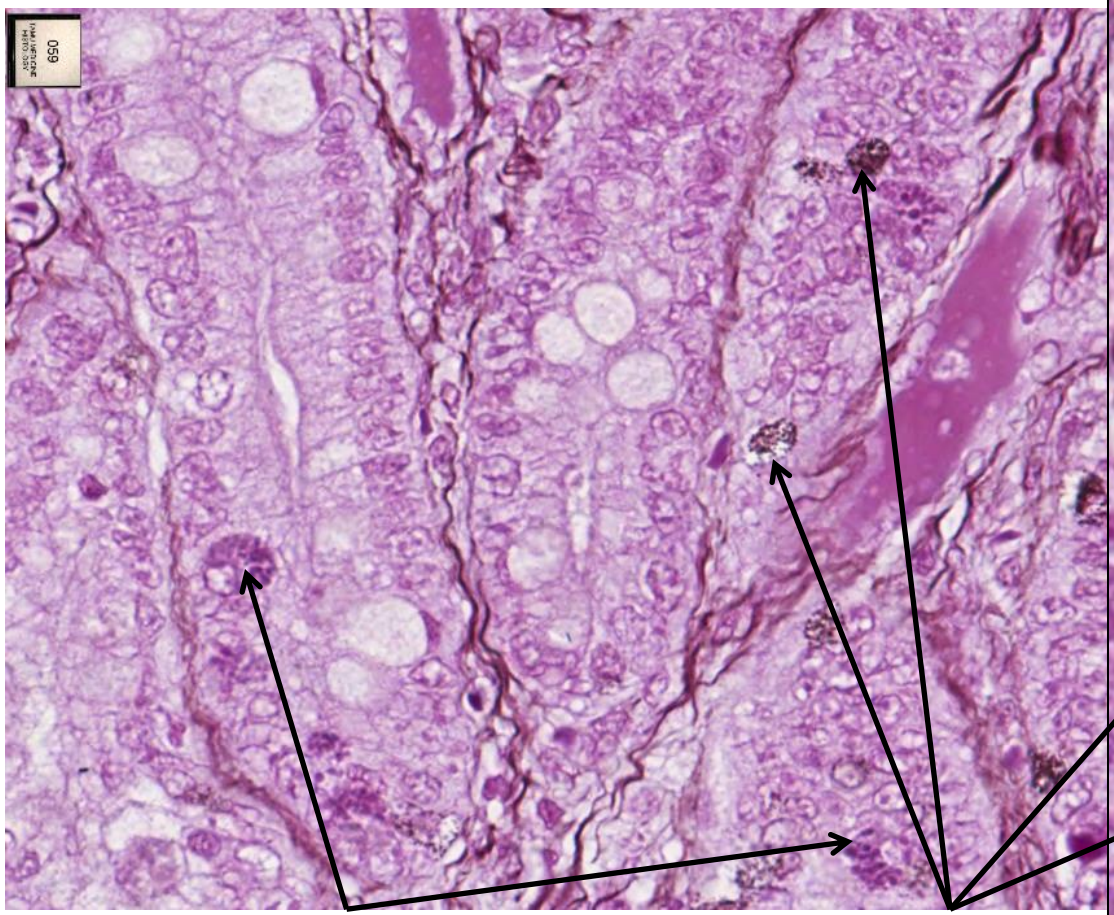
EM 41: Duodenum





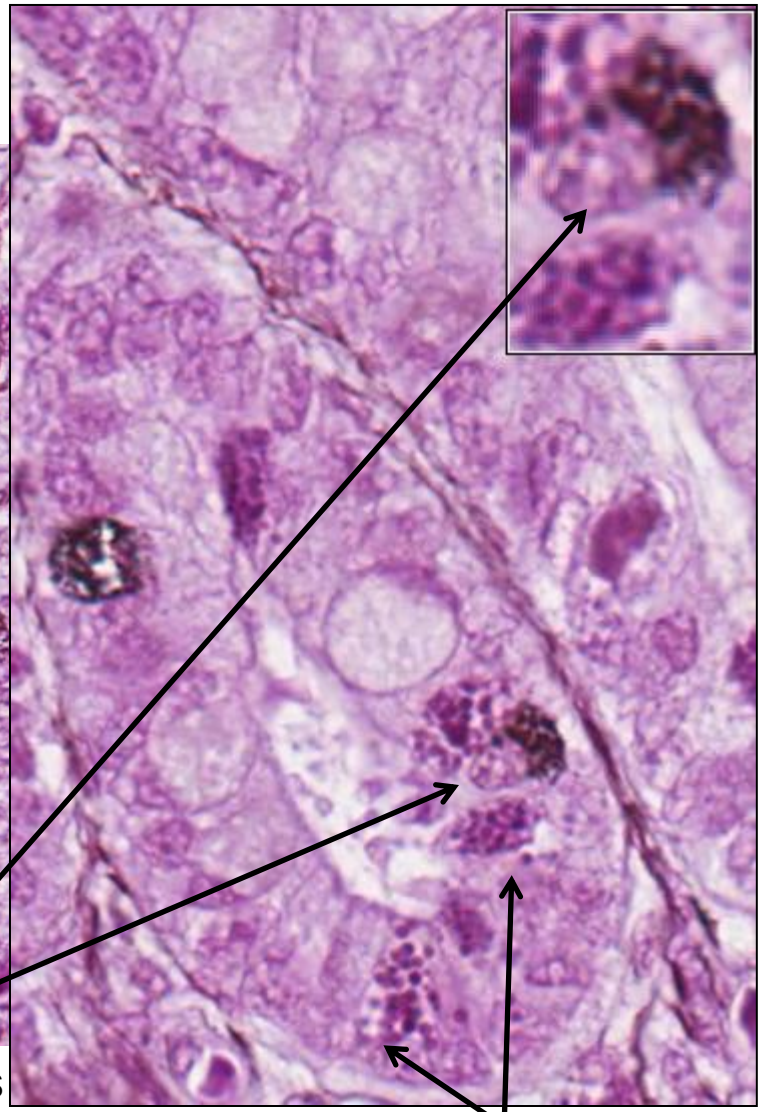


Slide 59: Duodenum (Argentaffin cells; Fontanna-Masson stain)



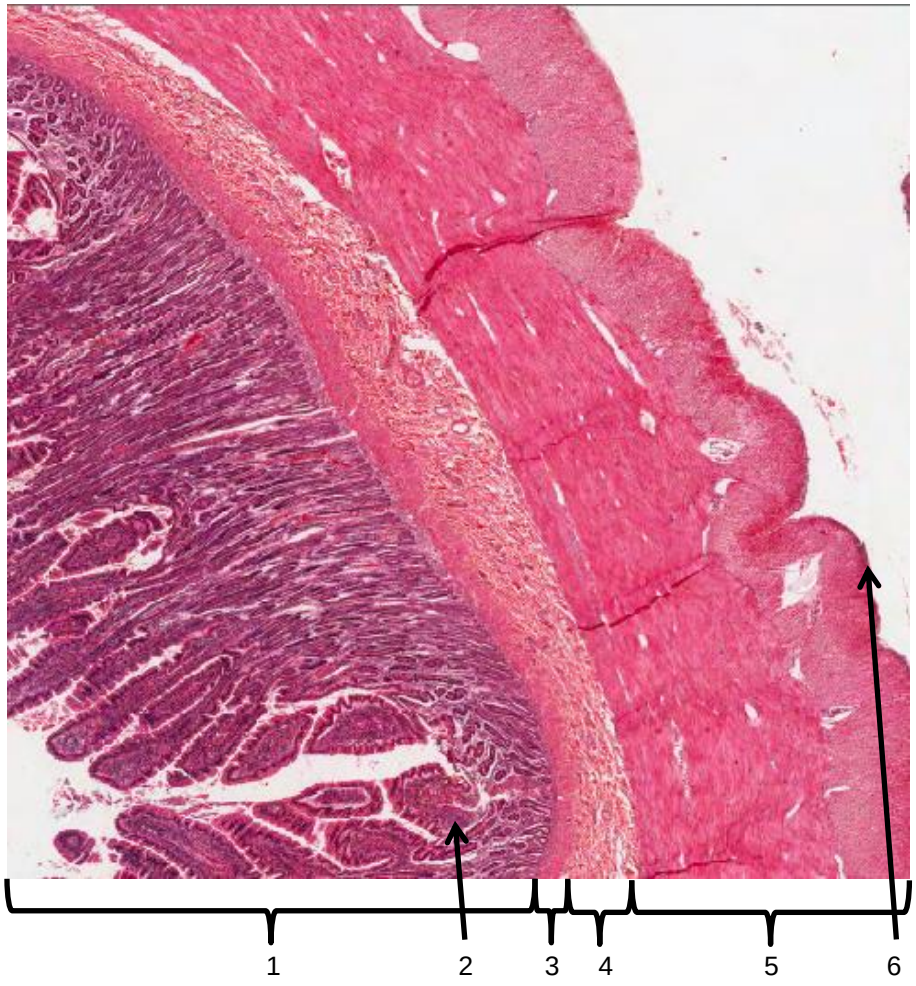
Paneth cells

Argentaffin cells

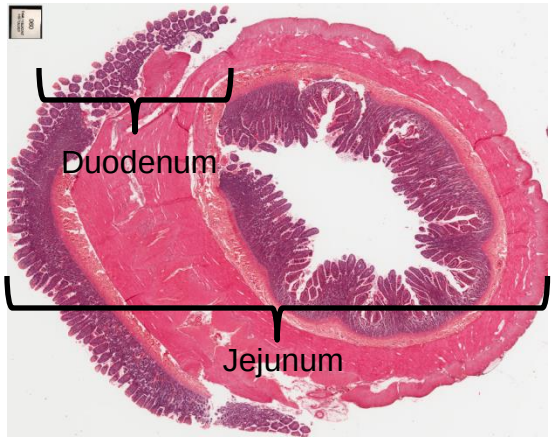


Paneth cells

Slide 60: Small intestines (jejunum)



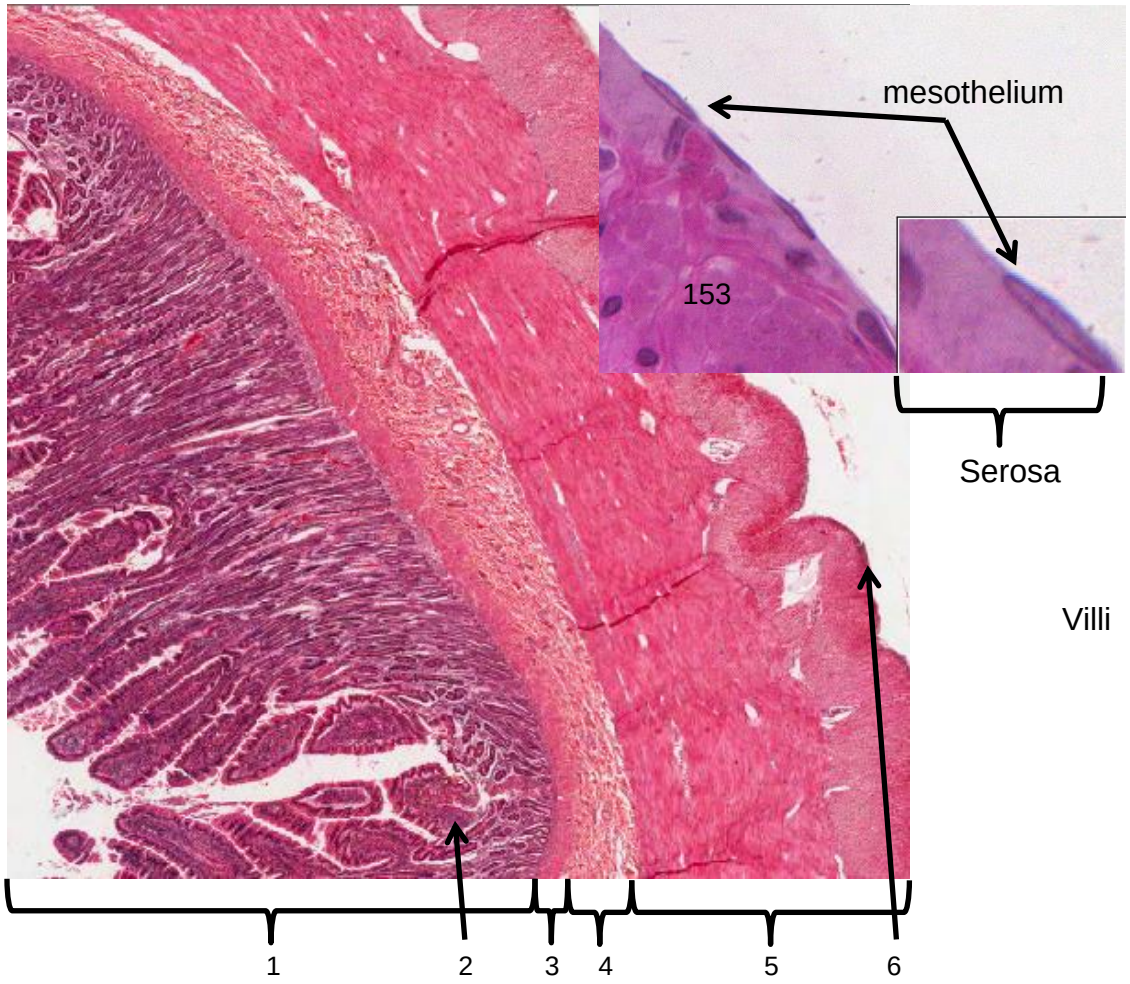
1. Mucosal epithelium
2. Lamina propria
3. Muscularis mucosa
4. Submucosa
5. Muscularis externa
6. Serosa



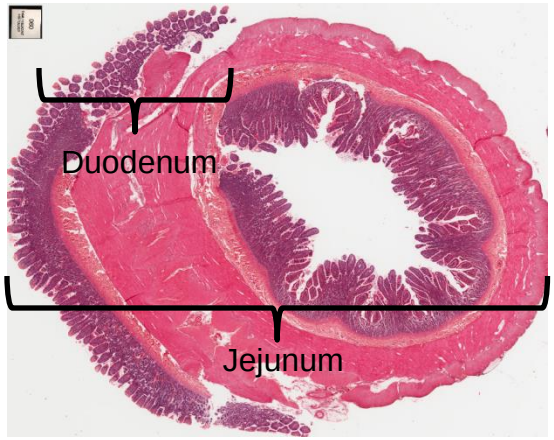
Plicae circulares

Villi

Slide 60 : Small intestines (jejunum)



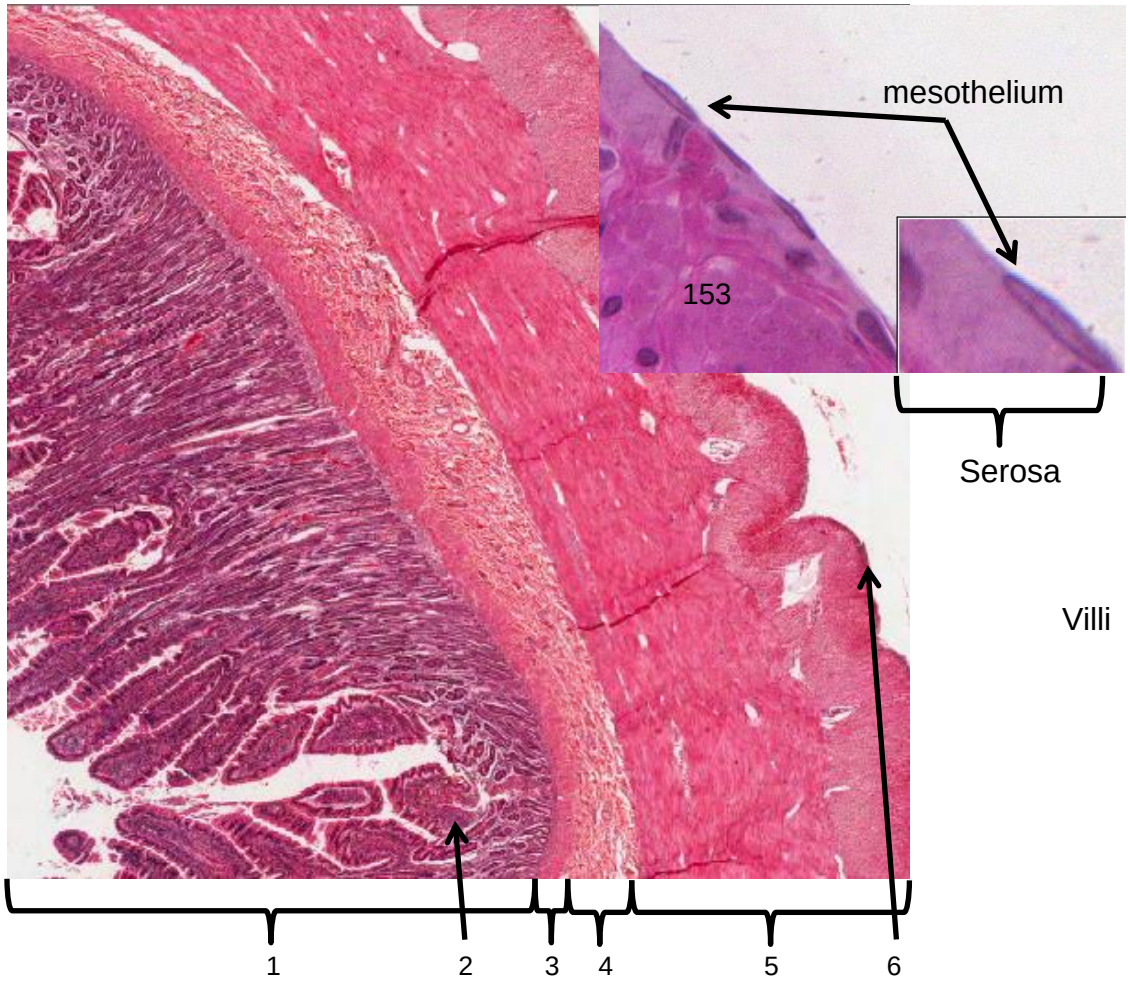
1. Mucosal epithelium
2. Lamina propria
3. Muscularis mucosa
4. Submucosa
5. Muscularis externa
6. Serosa



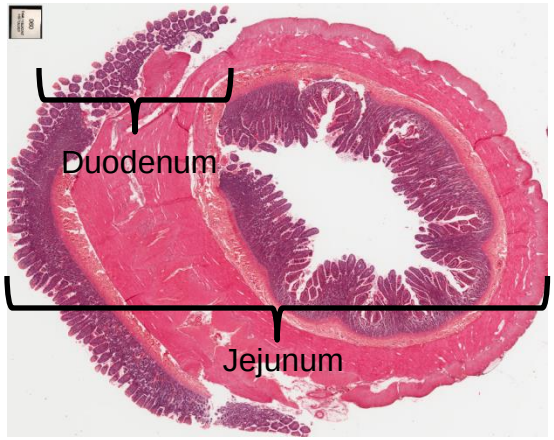
Plicae circulares

Villi

Slide 60 : Small intestines (jejunum)

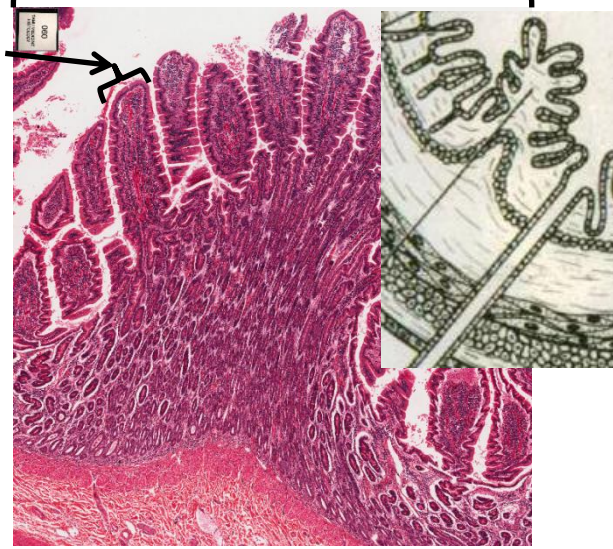


1. Mucosal epithelium
2. Lamina propria
3. Muscularis mucosa
4. Submucosa
5. Muscularis externa
6. Serosa

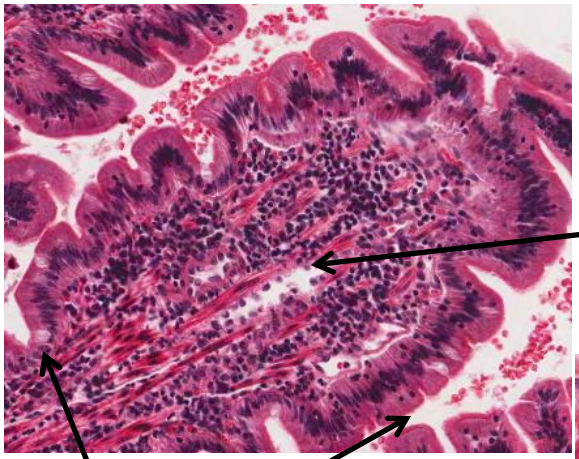


Plicae circulares

Villi



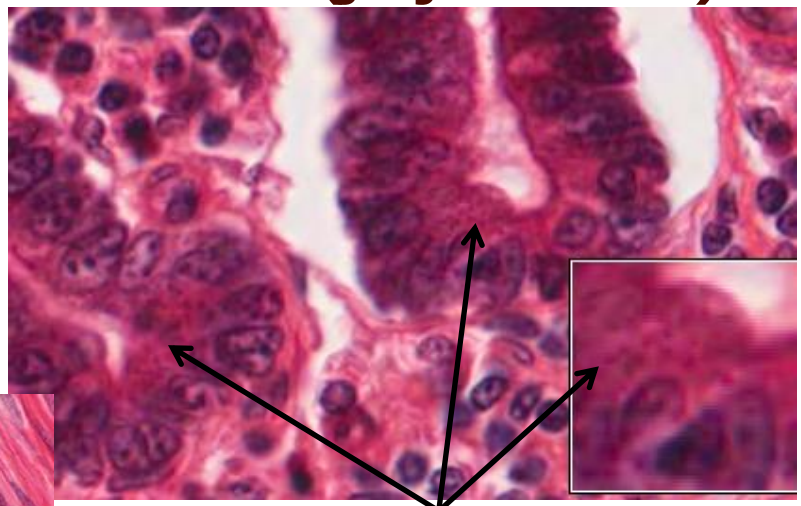
Slide 60 : Small intestines (jejunum)



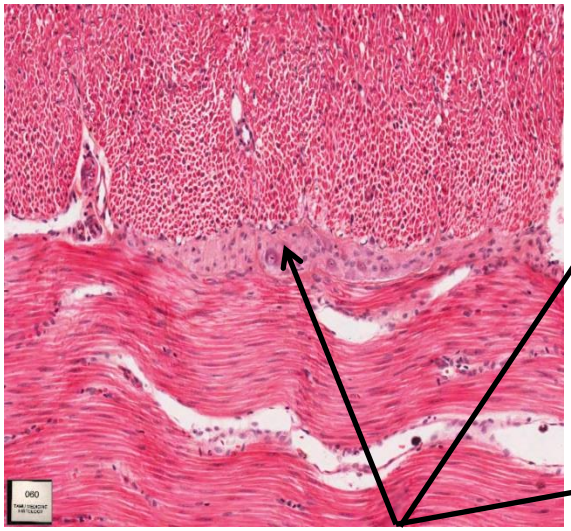
Central lacteal

Goblet cells

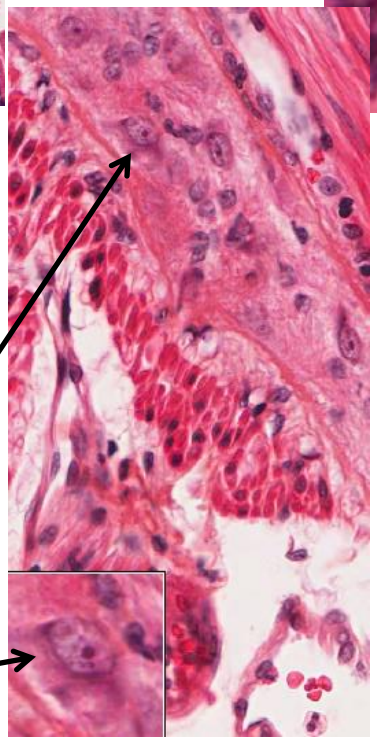
Brush border

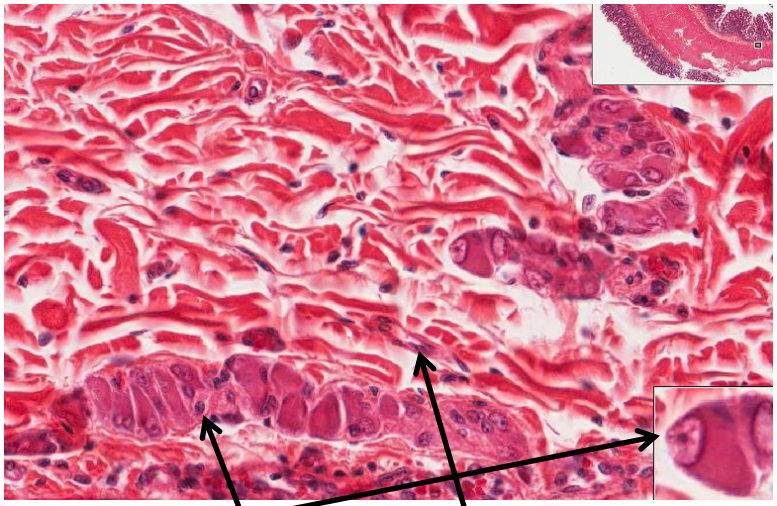


Paneth cell



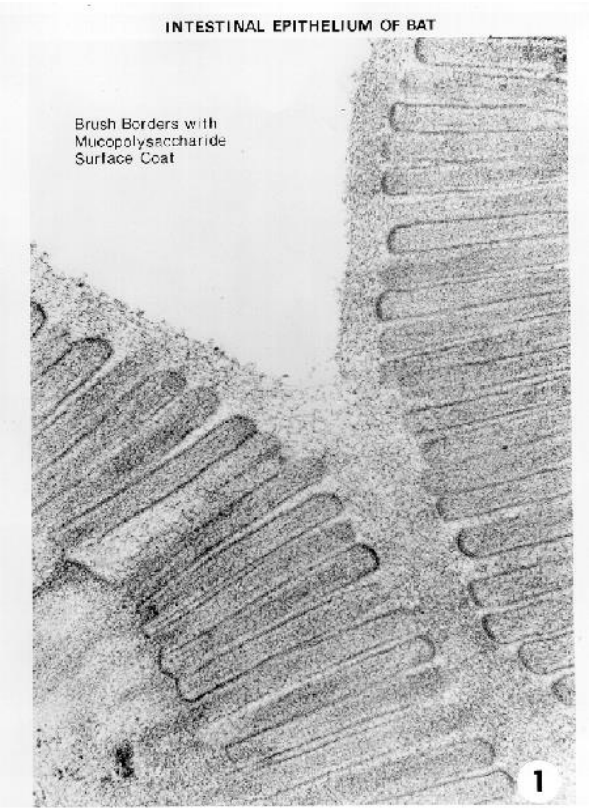
Myenteric plexus

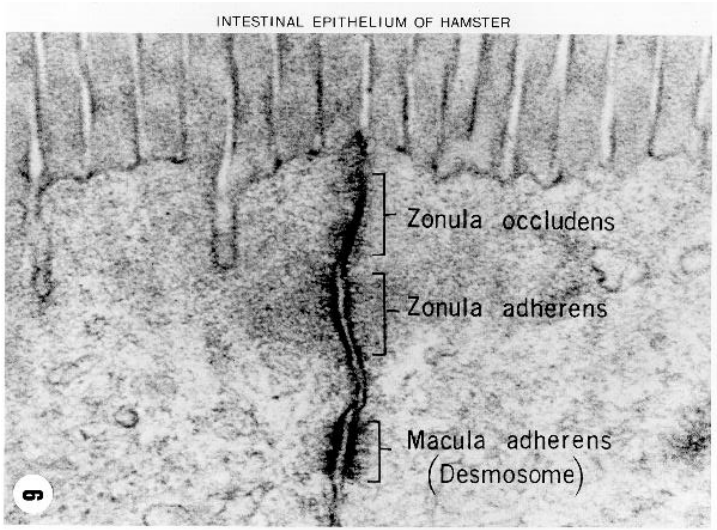


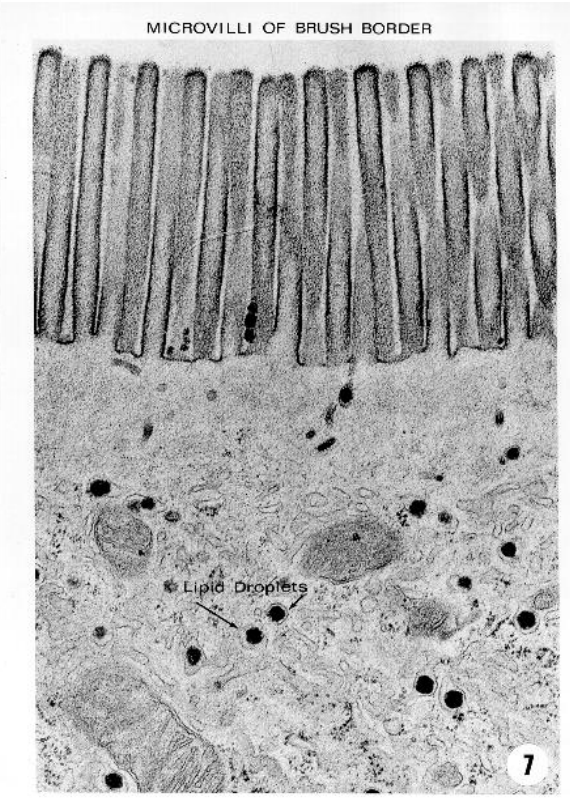


Submucosal plexus and vasculature

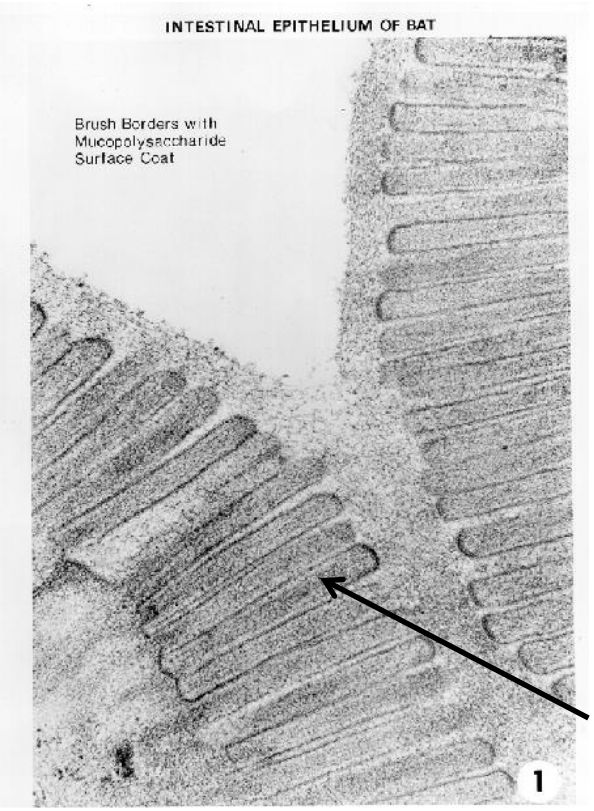
EM 1, 7, and 9: Small intestine

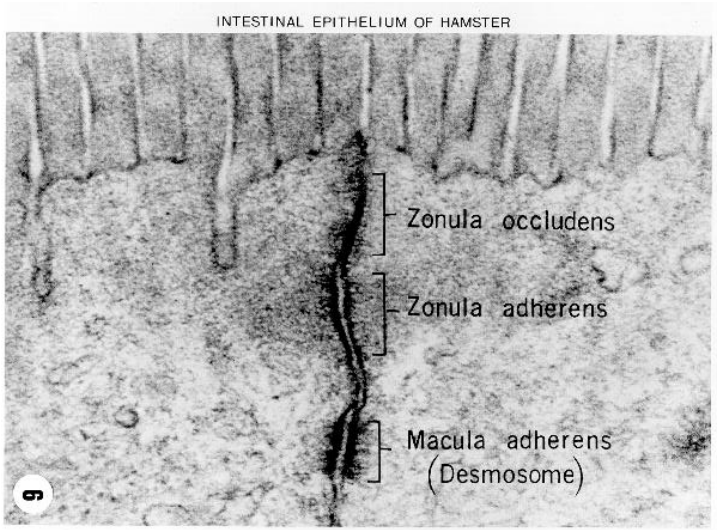


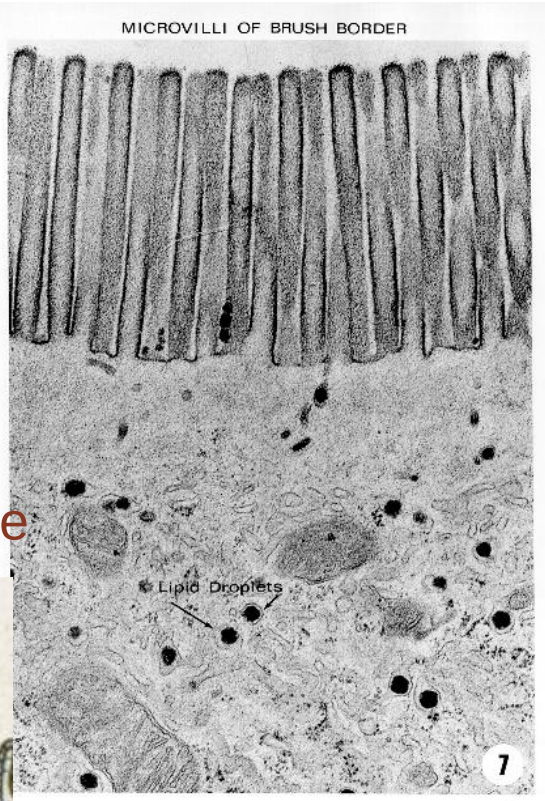




EM 1, 7, and 9: Small intestine

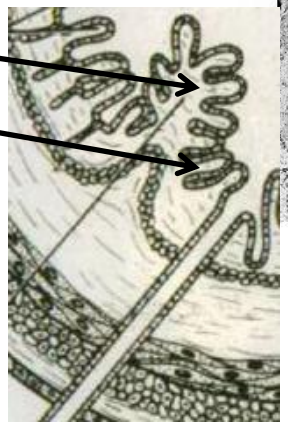






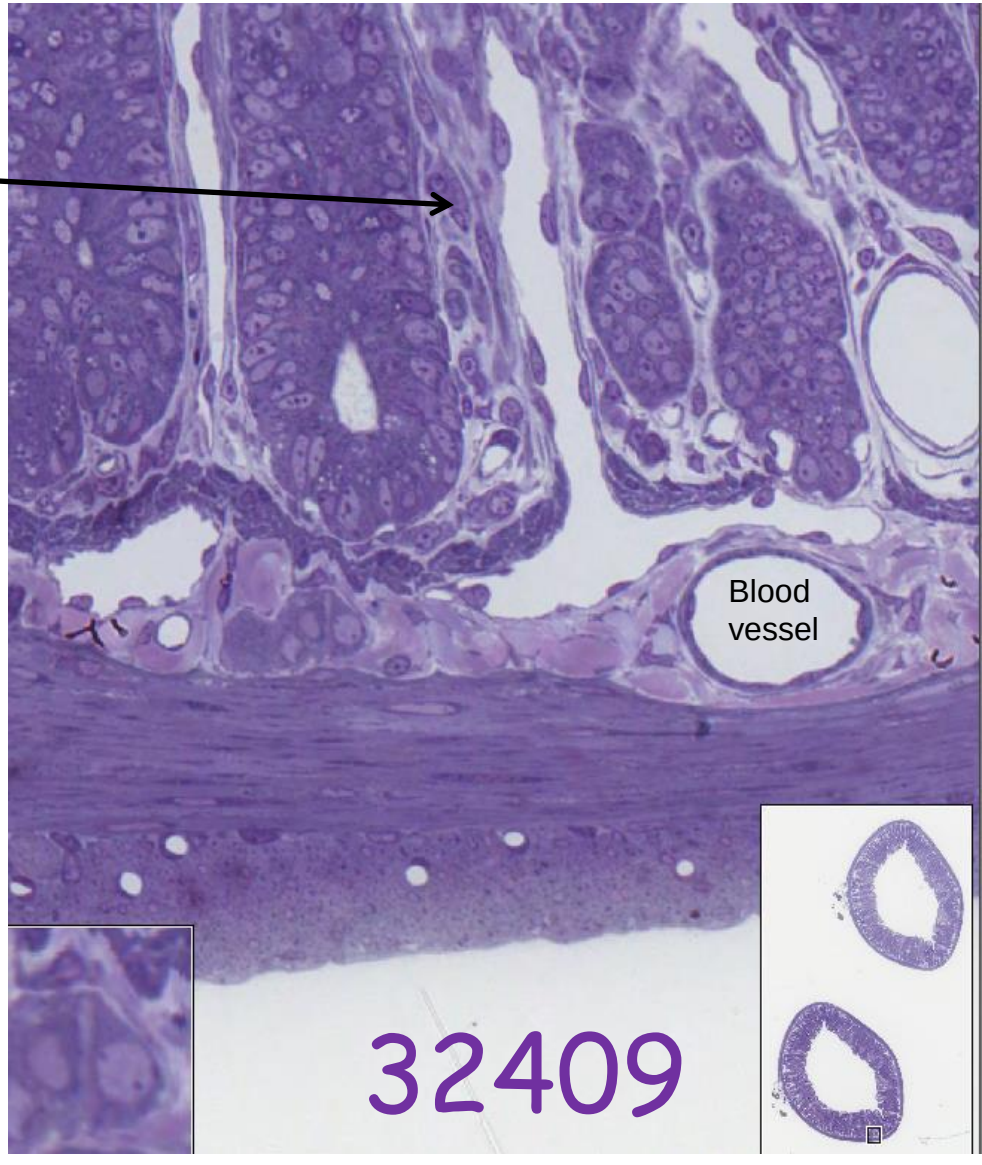
Three structures increase the surface area of the small intestine

1. Plicae (3x)
2. Villi (10x)
3. Microvilli (20x)



LAMINA PROPRIA

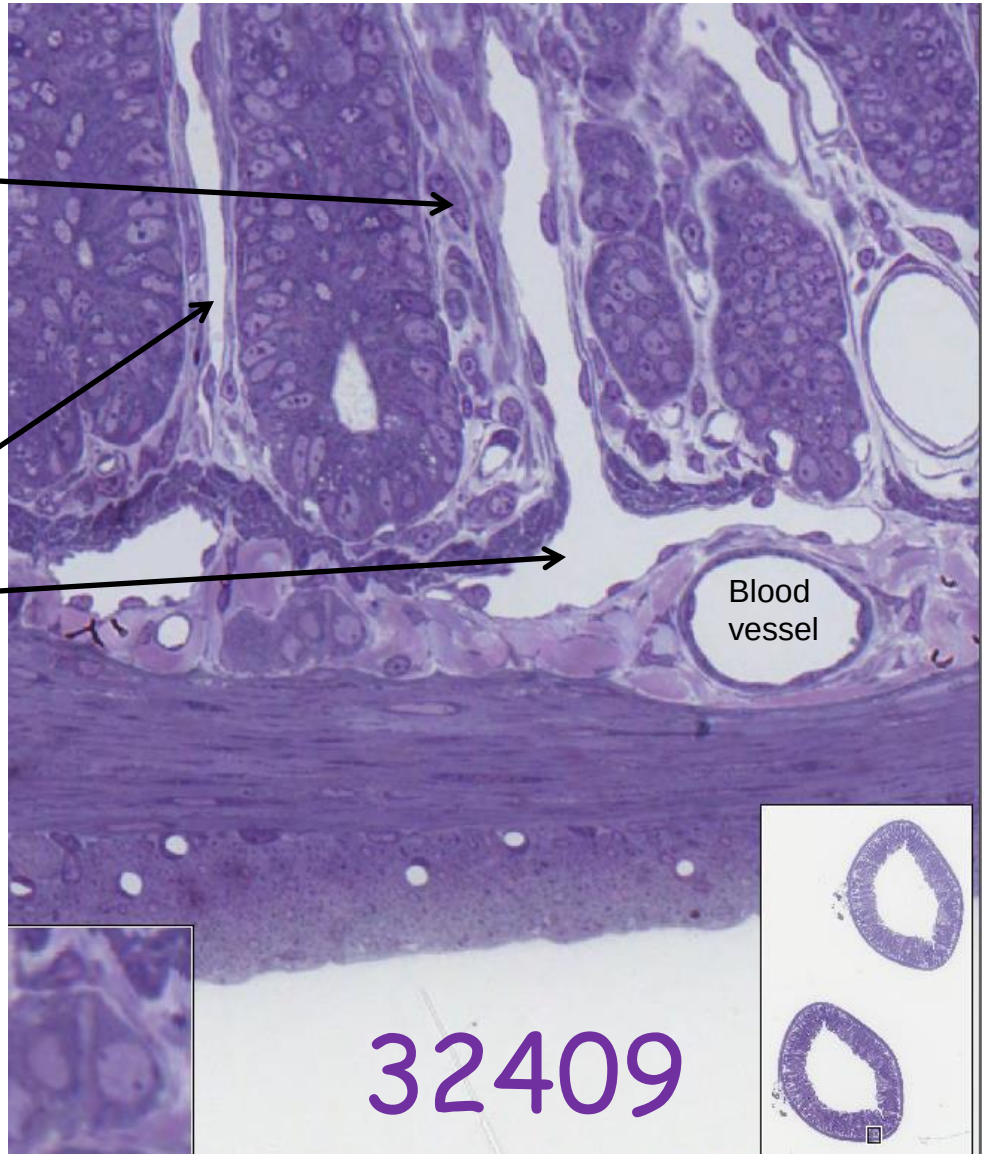
CONNECTIVE TISSUE BETWEEN INTESTINAL GLANDS AND FORMS CORES OF INTESTINAL VILLI



LAMINA PROPRIA

CONNECTIVE TISSUE BETWEEN INTESTINAL GLANDS AND FORMS CORES OF INTESTINAL VILLI

CENTRAL LACTEAL

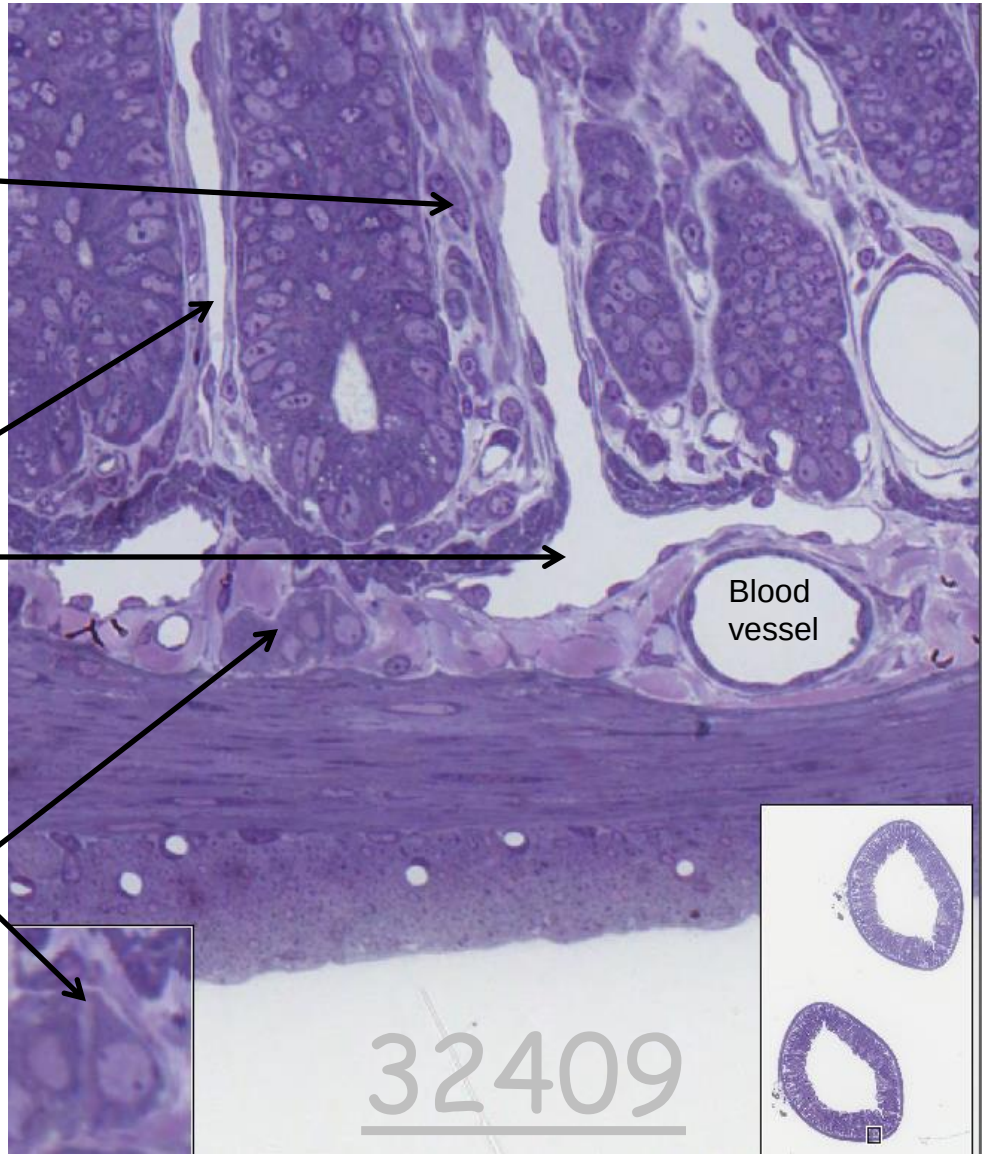


LAMINA PROPRIA

CONNECTIVE TISSUE BETWEEN INTESTINAL GLANDS AND FORMS CORES OF INTESTINAL VILLI

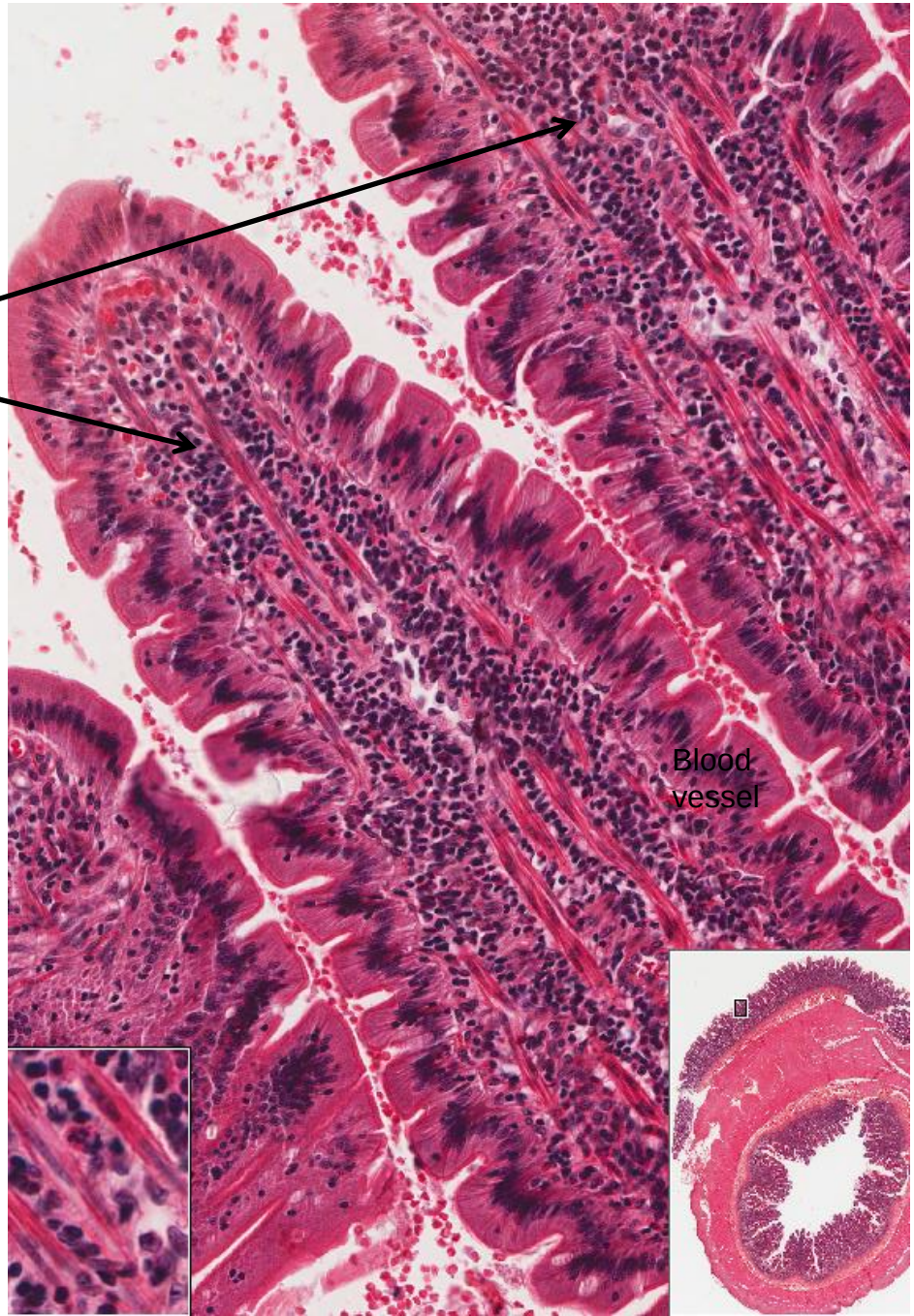
CENTRAL LACTEAL

SMOOTH MUSCLE INNERVATED BY MEISSNER'S PLEXES in submucosa



LAMINA PROPRIA

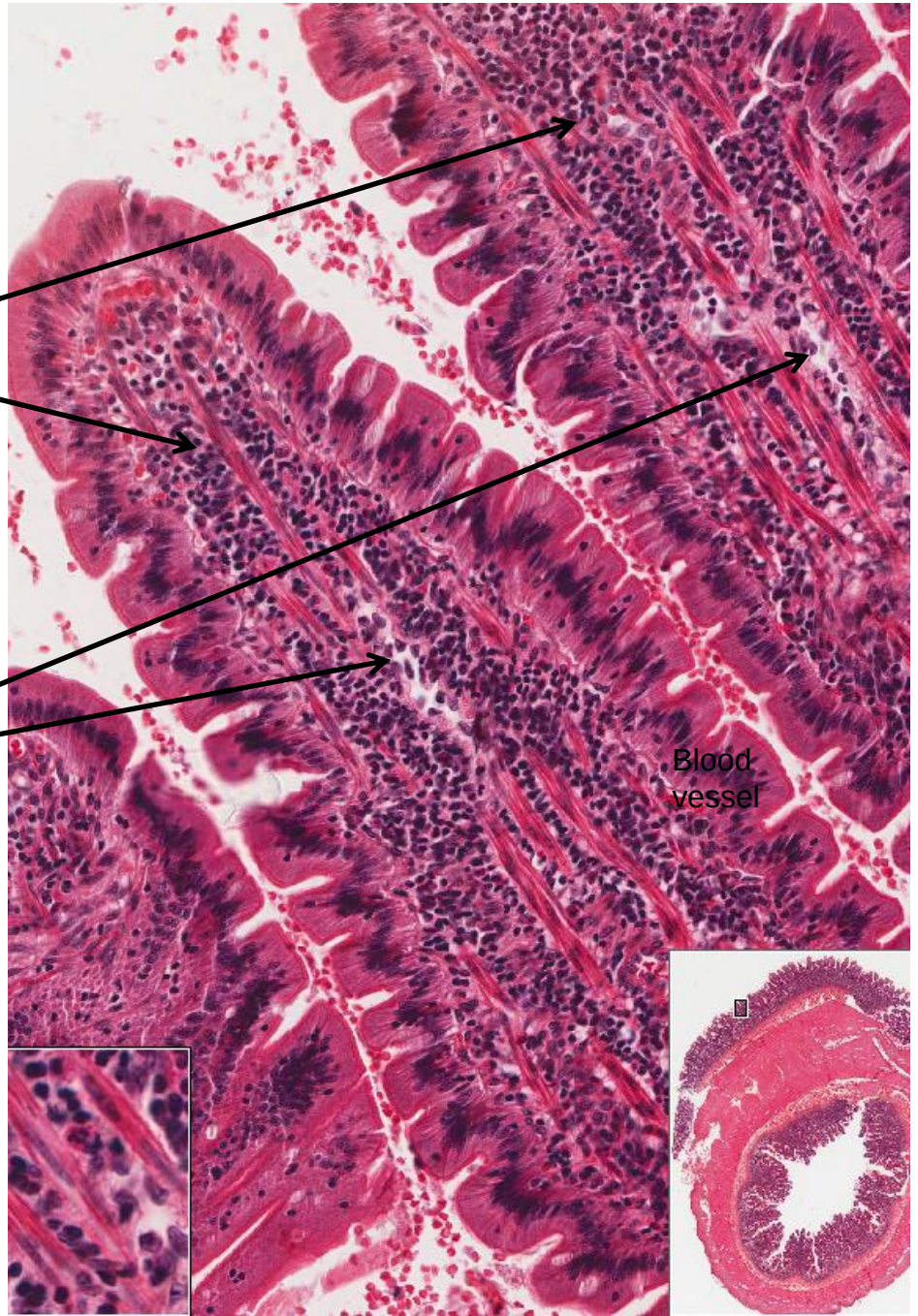
CONNECTIVE TISSUE BETWEEN INTESTINAL GLANDS AND FORMS CORES OF INTESTINAL VILLI



LAMINA PROPRIA

CONNECTIVE TISSUE BETWEEN INTESTINAL GLANDS AND FORMS CORES OF INTESTINAL VILLI

CENTRAL LACTEAL

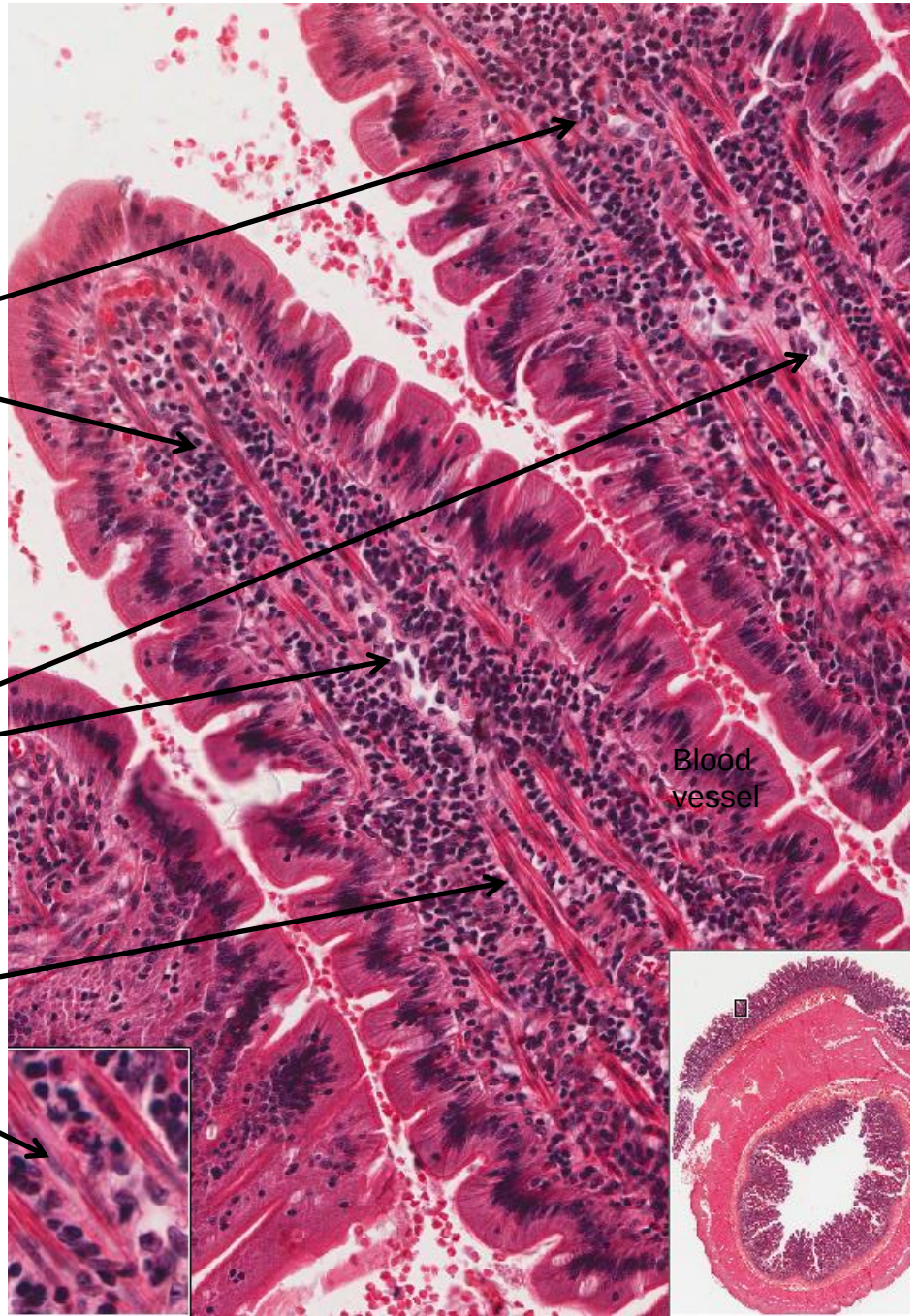


LAMINA PROPRIA

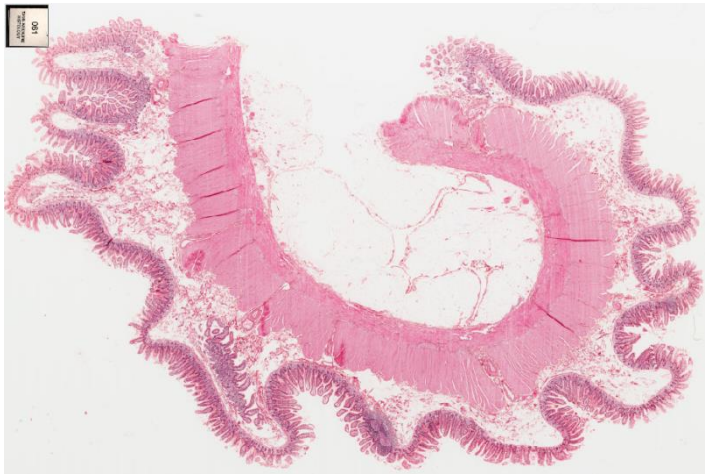
CONNECTIVE TISSUE BETWEEN INTESTINAL GLANDS AND FORMS CORES OF INTESTINAL VILLI

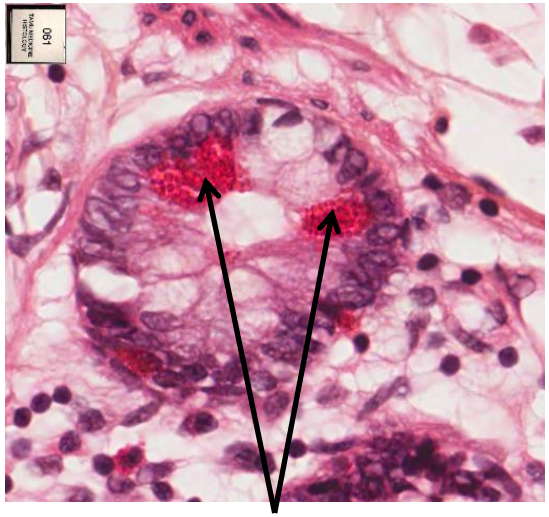
CENTRAL LACTEAL

SMOOTH MUSCLE in lamina propria



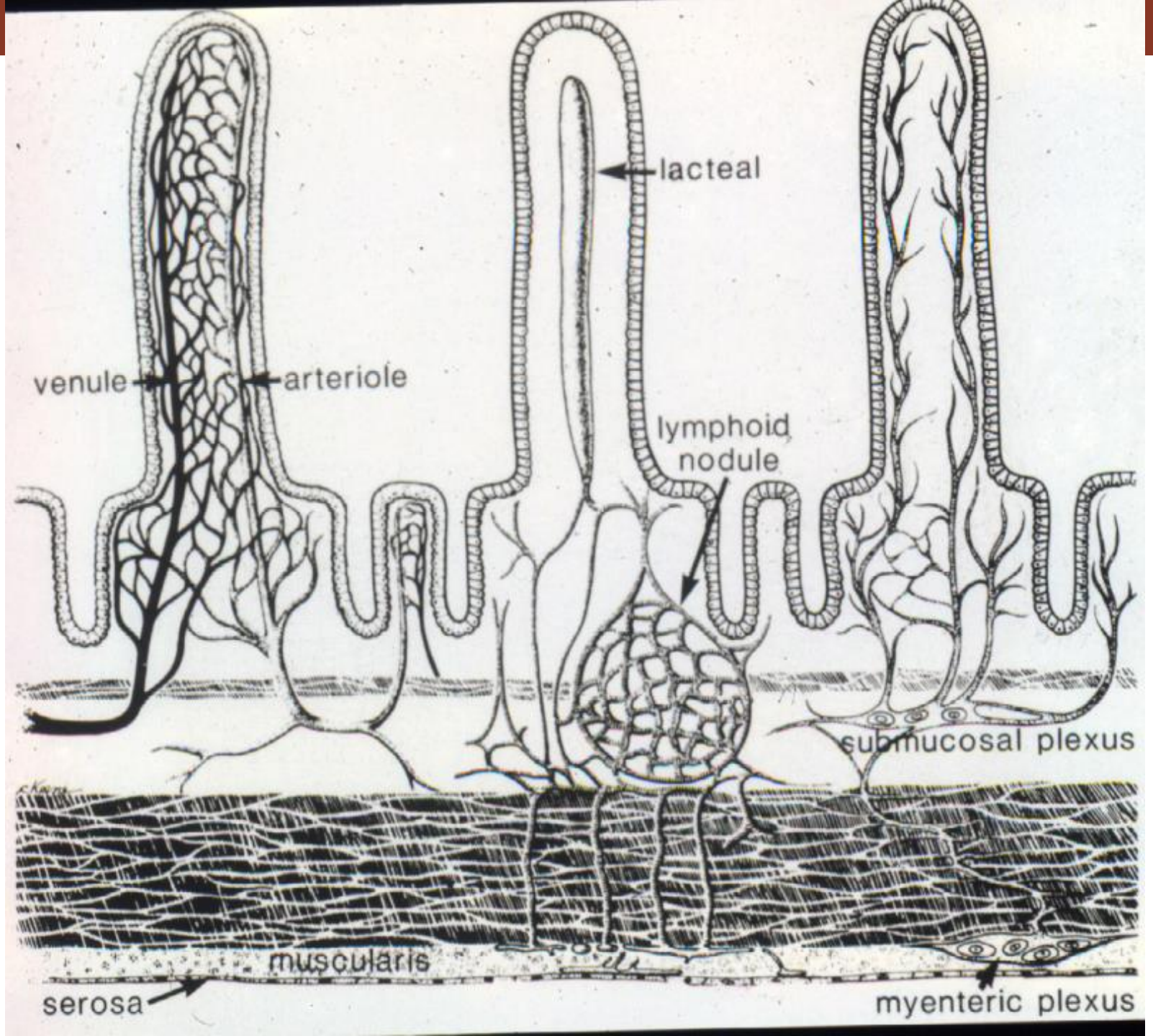
Slide 61: Terminal ileum





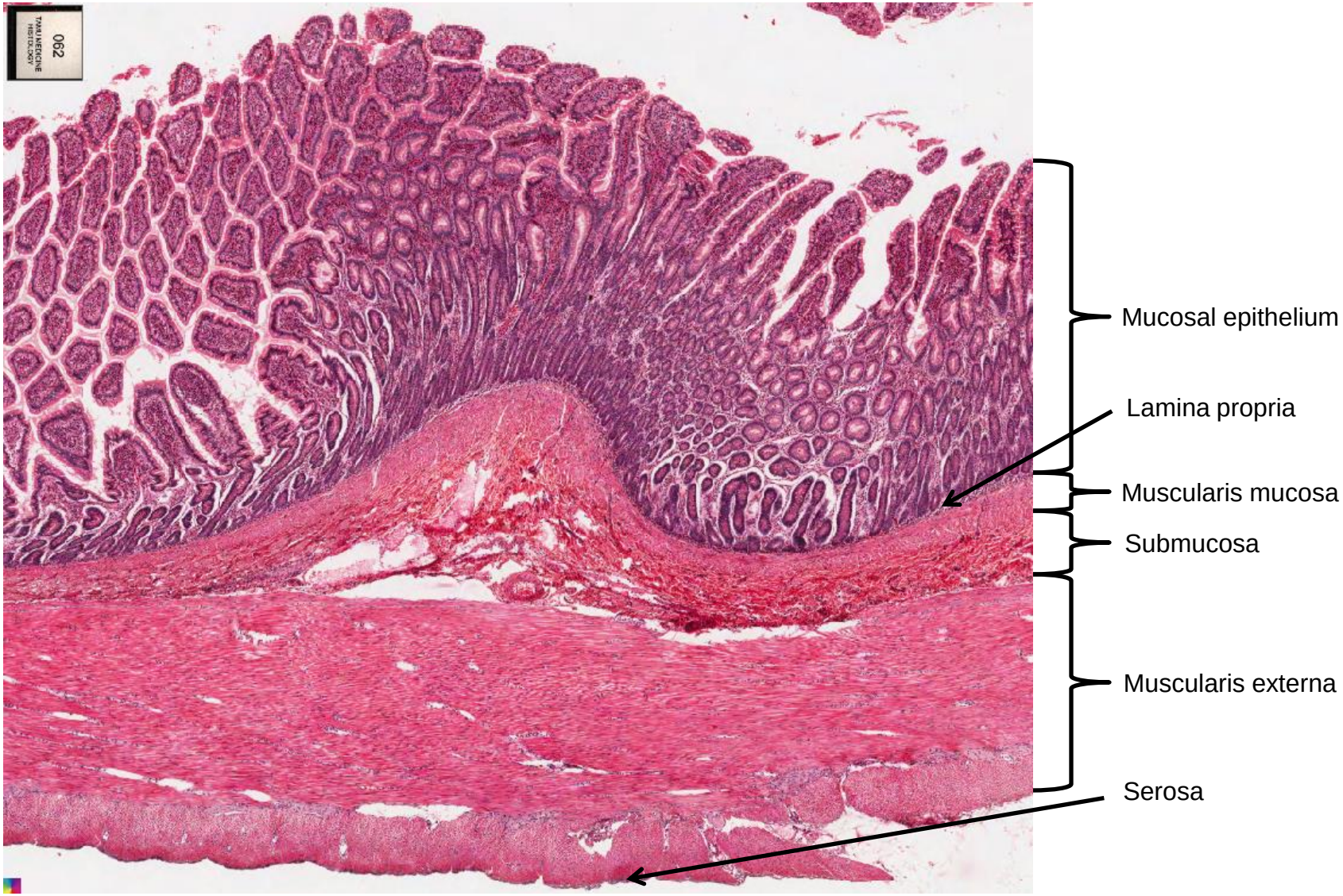
Paneth cells

Paneth cells


lacteal
venule
arteriole
lymphoid nodule
submucosal plexus
muscularis
serosa
myenteric plexus

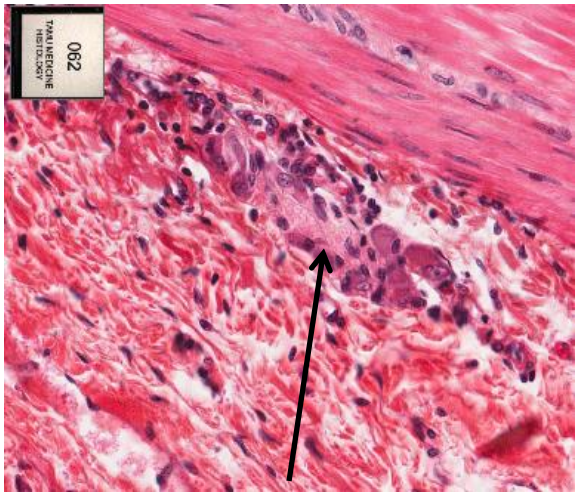
Ileum

Slide 62: Terminal ileum

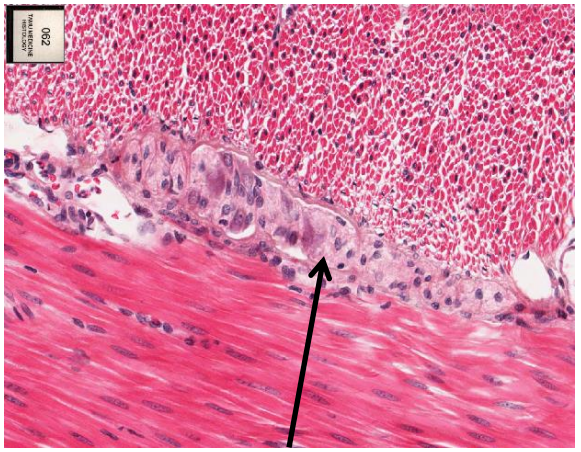


Slide 62 : Terminal ileum

Peyer's patches

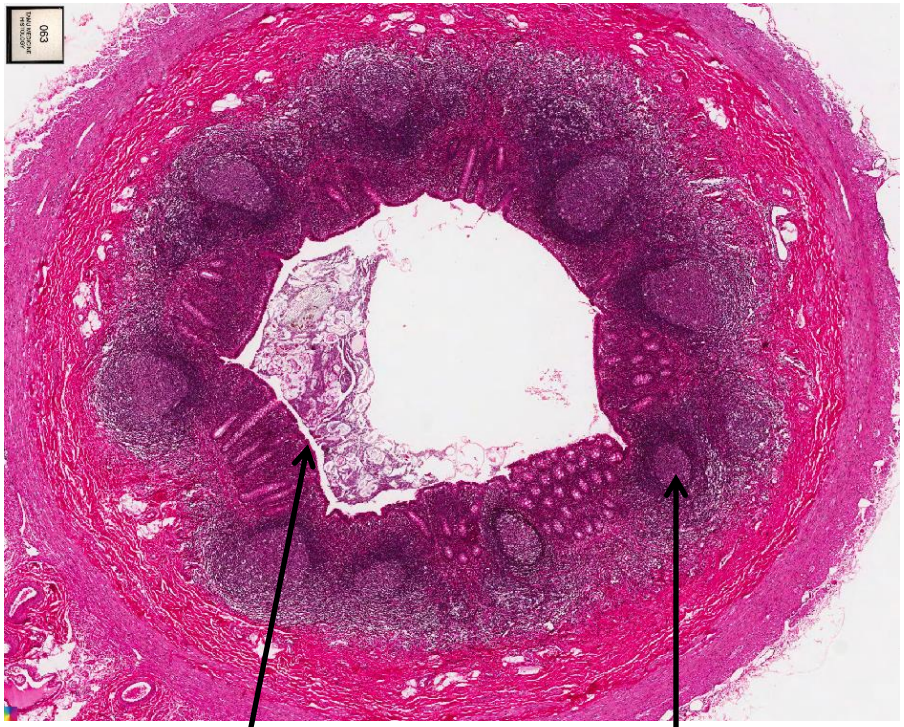


Submucosal plexus



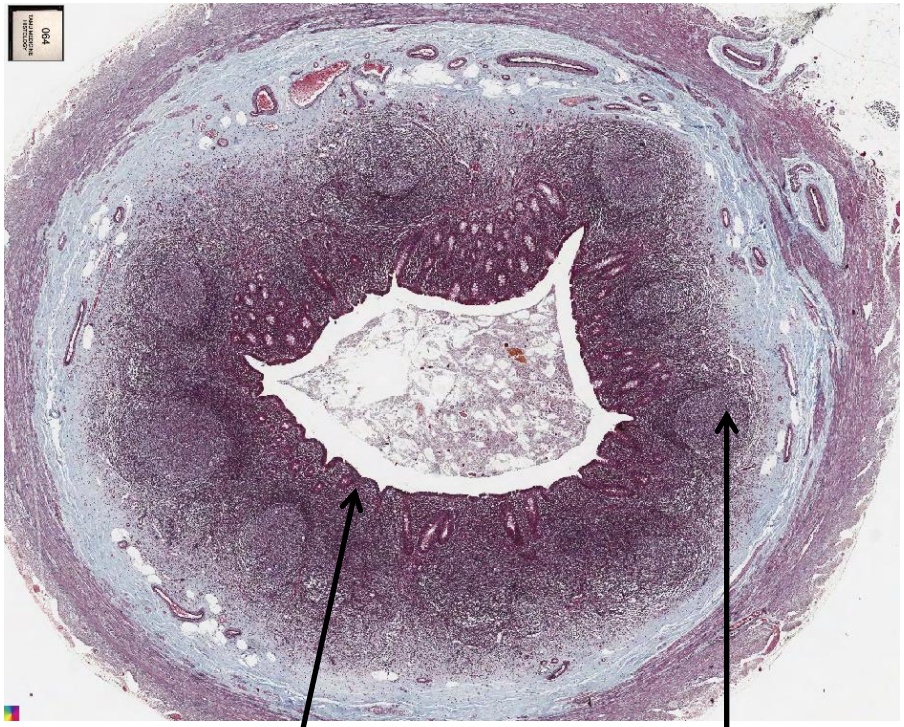
Myenteric plexus

Slide 63: Appendix (cross section)



Smooth luminal surface

Lymph nodules



Smooth luminal surface

Lymph nodules

THE APPENDIX

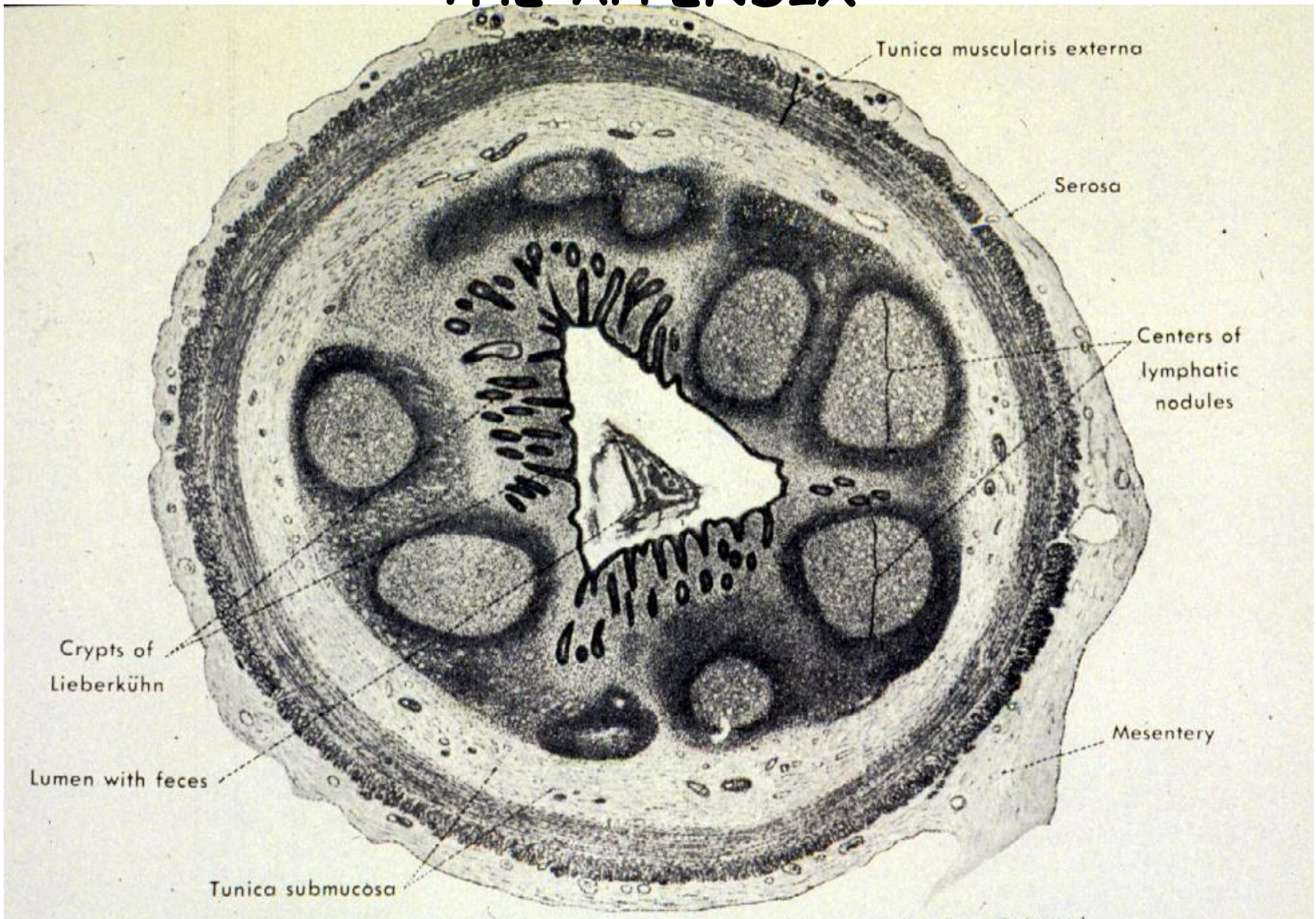
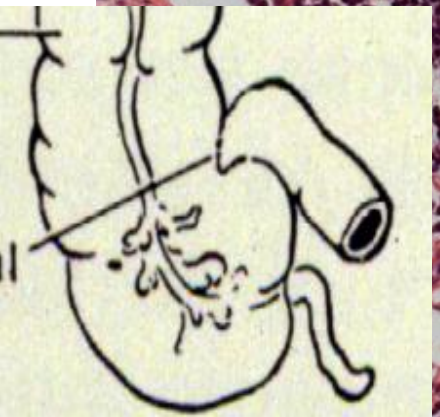
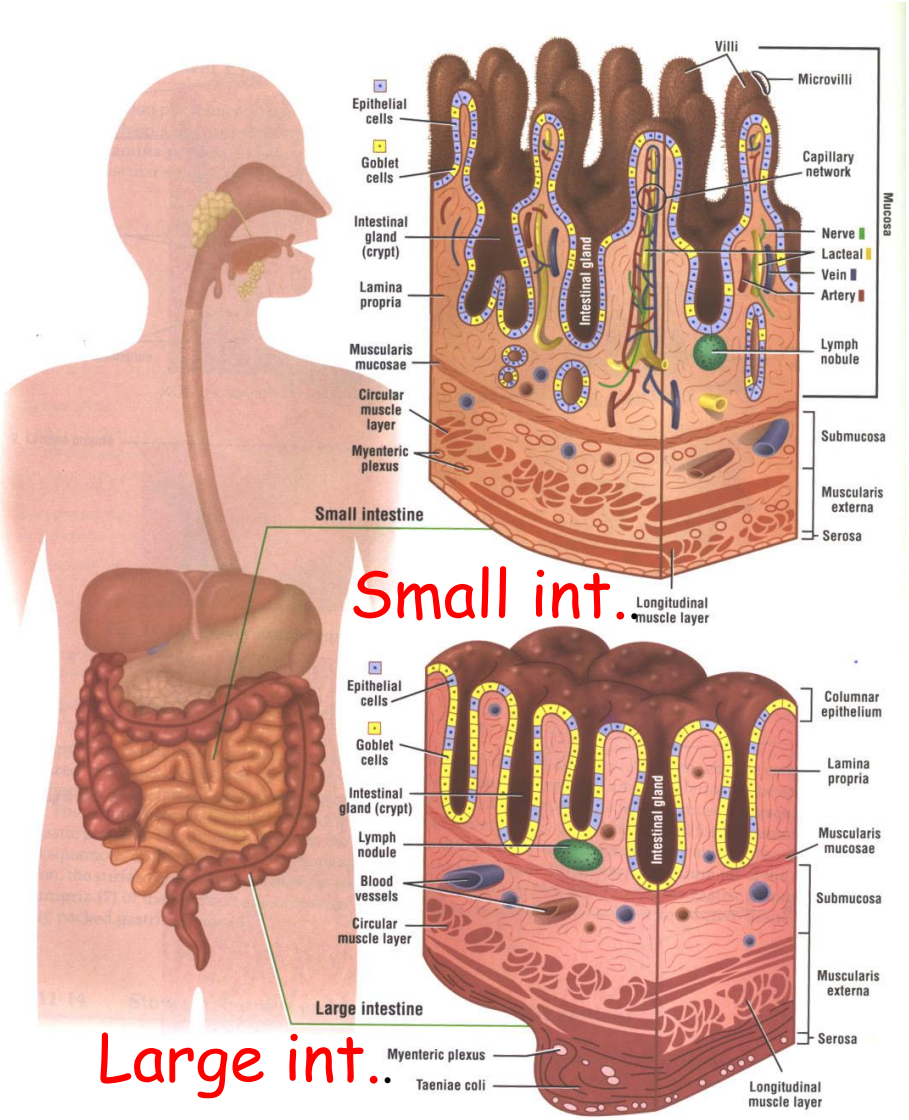


Figure 26–20. Cross section of appendix from a 23-year-old man. × 22. (After Sobotta.)

Human appendix

204





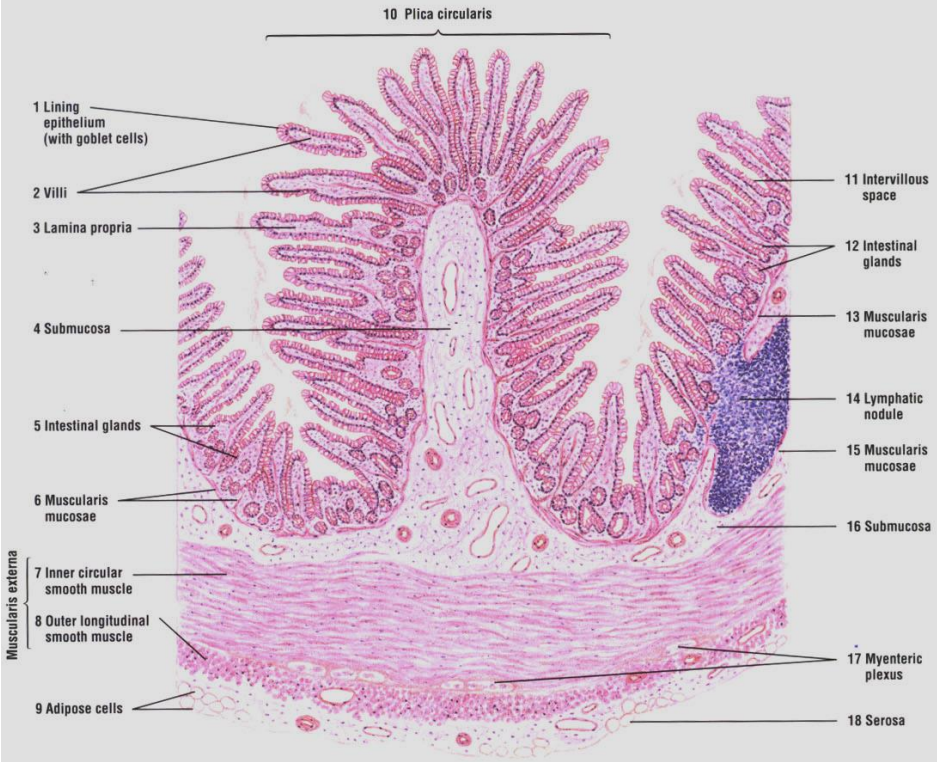


Fig. 12-2 Small Intestine: Jejunum–Ileum (transverse section). Stain: hematoxylin-eosin. Low magnification.

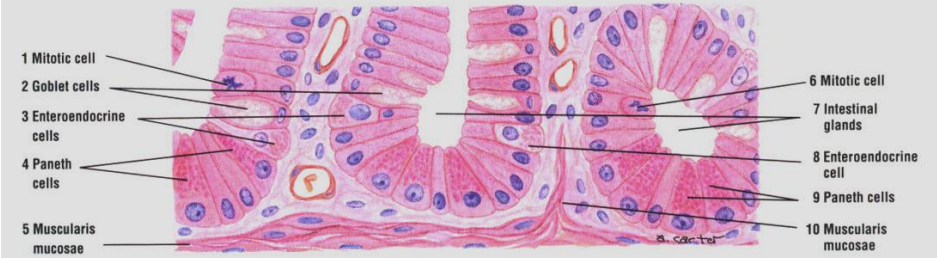
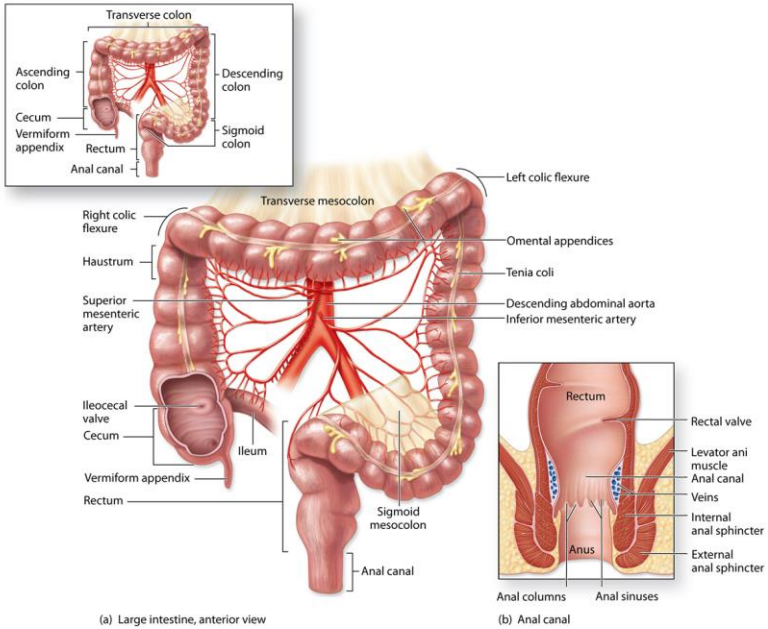
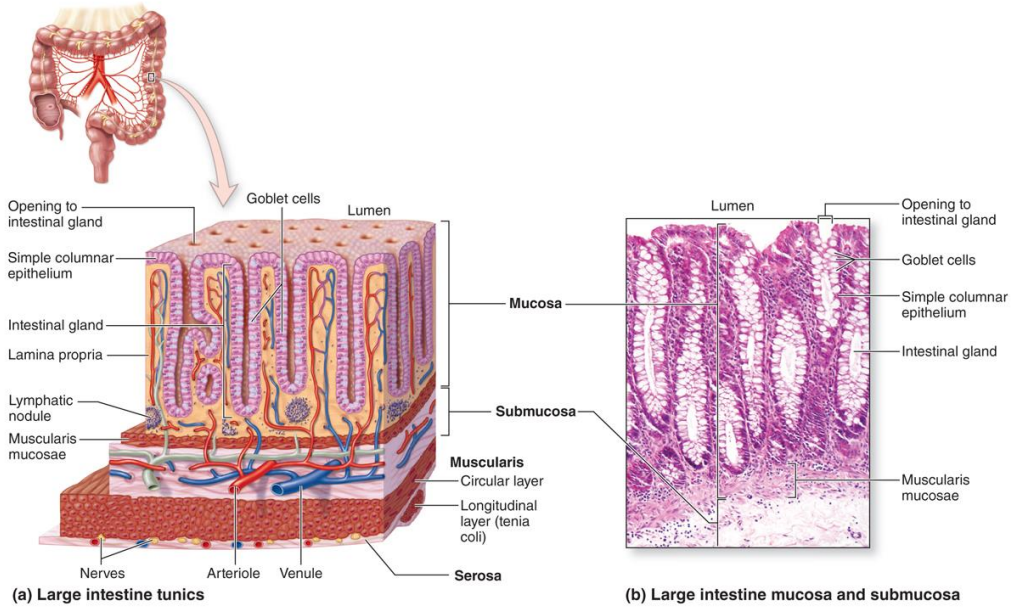


Fig. 12-3 Intestinal Glands With Paneth Cells and Enteroendocrine Cells. Stain: hematoxylin-eosin, plastic section. High magnification.

Large intestine





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NERVOUS STIMULATION

PARASYMPATHETIC - ACTIVATES AUERBACH'S PLEXUS

SYMPATHETIC - INHIBITORY TO GI TRACT MOVEMENTS

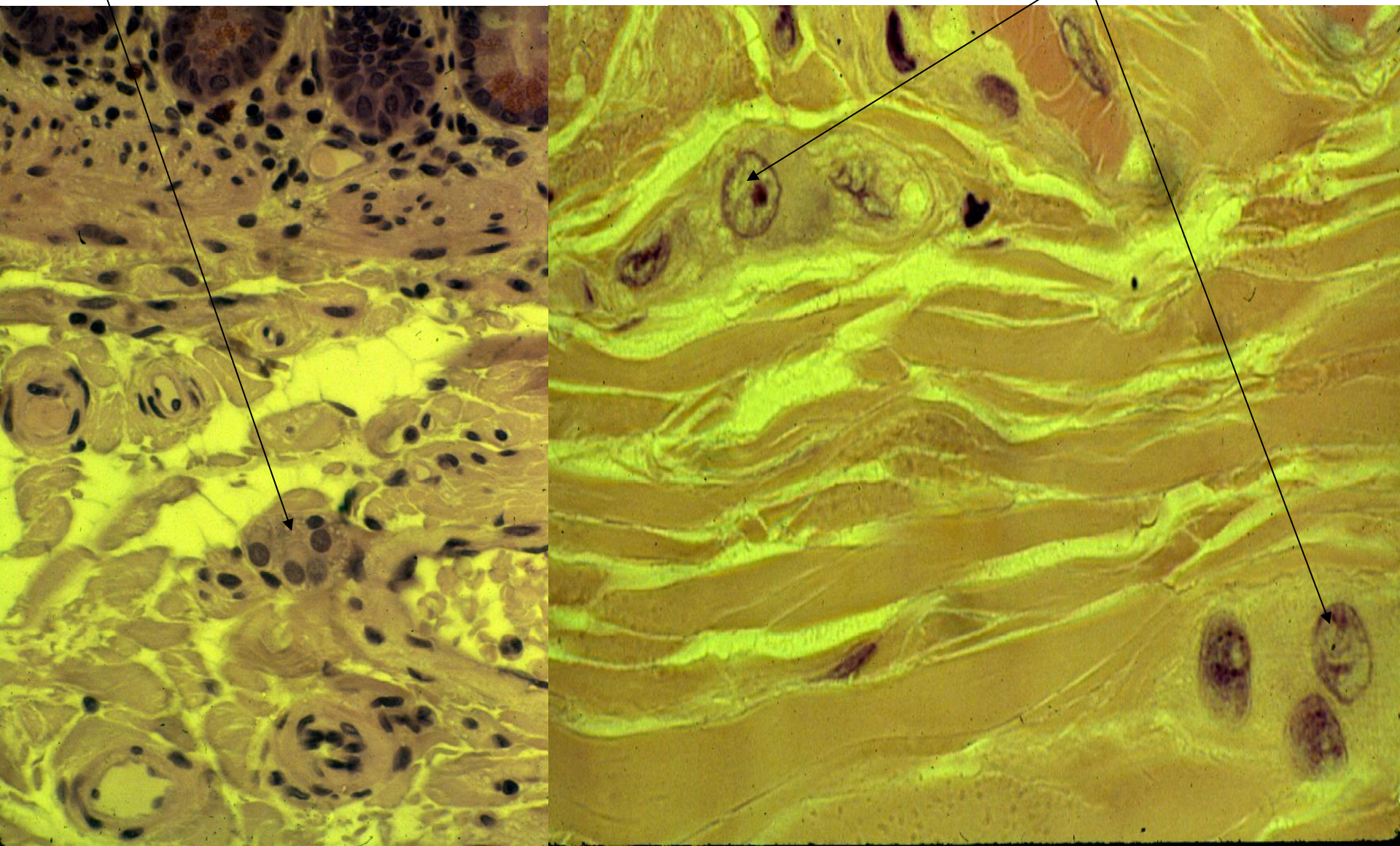
- EXCITES ILEOCECAL SPHINCTER
- INTERNAL ANAL SPHINCTER

MEISSNER'S PLEXUS

submucosal nerve plexus

AUERBACH'S PLEXUS

myenteric plexus

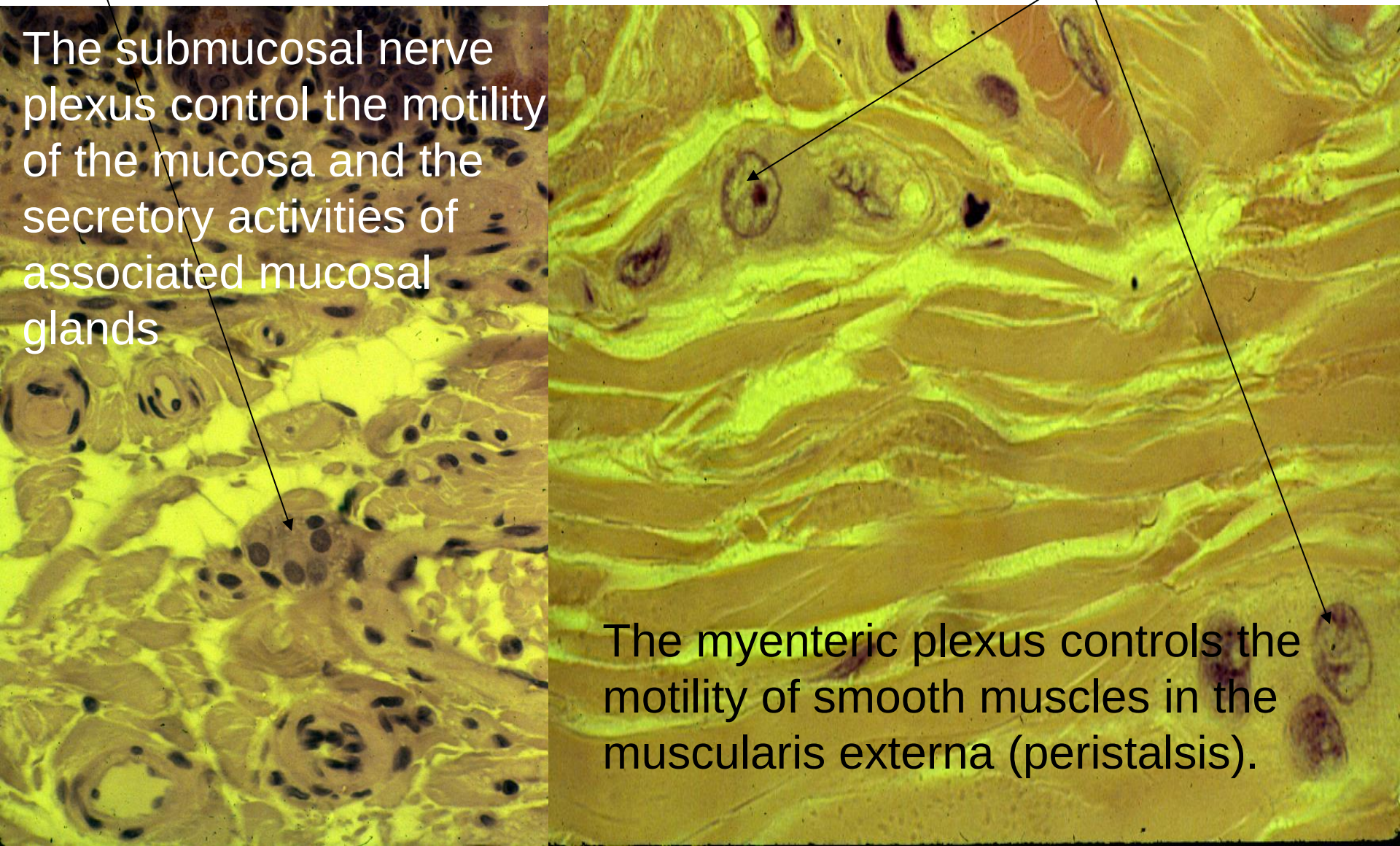


MEISSNER'S PLEXUS

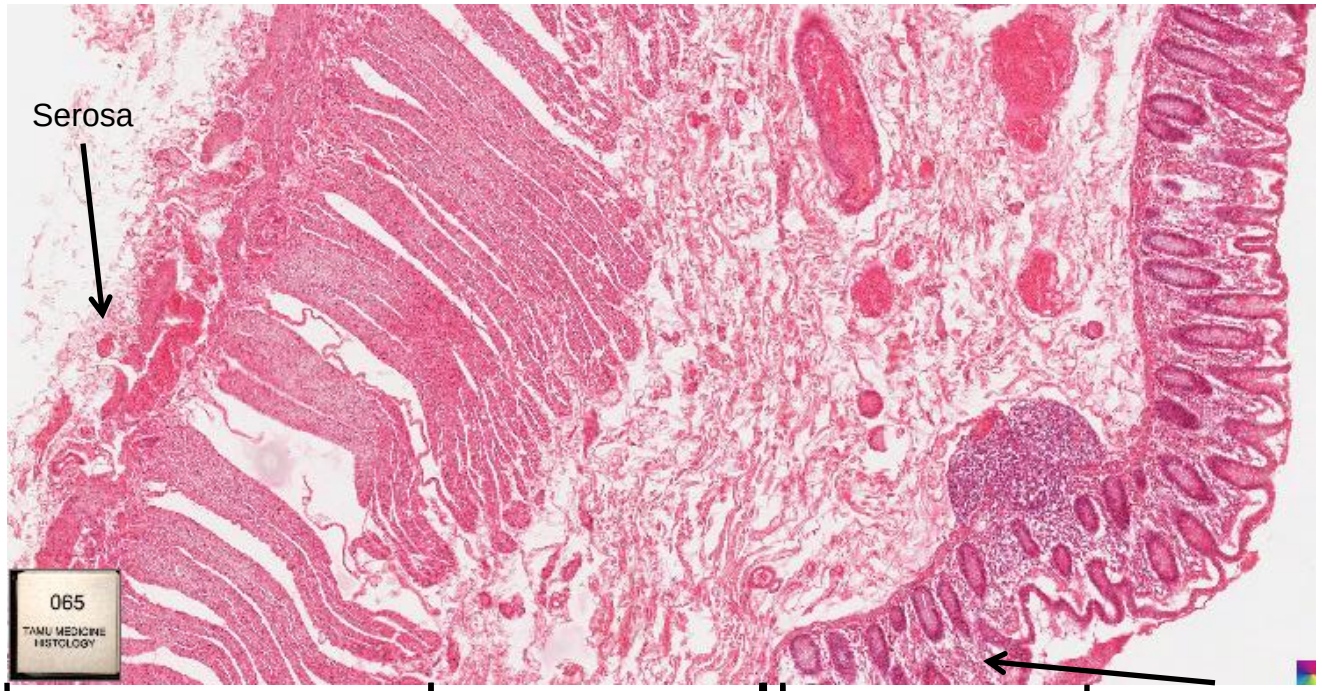
submucosal nerve plexus

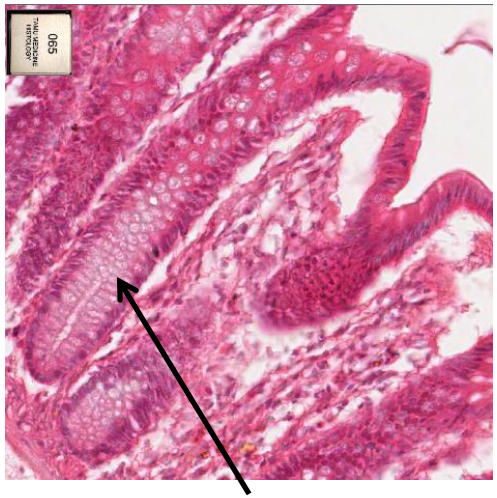
AUERBACH'S PLEXUS

myenteric plexus

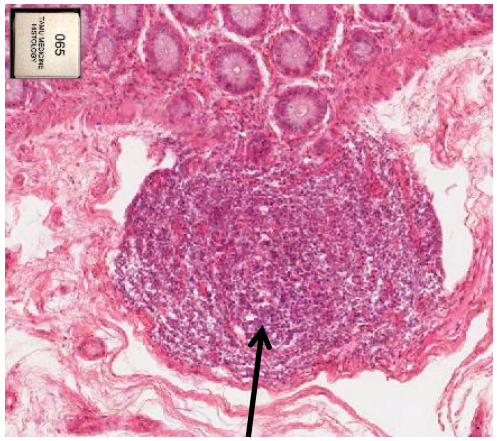


Slide 65: Transverse colon (longitudinal section)

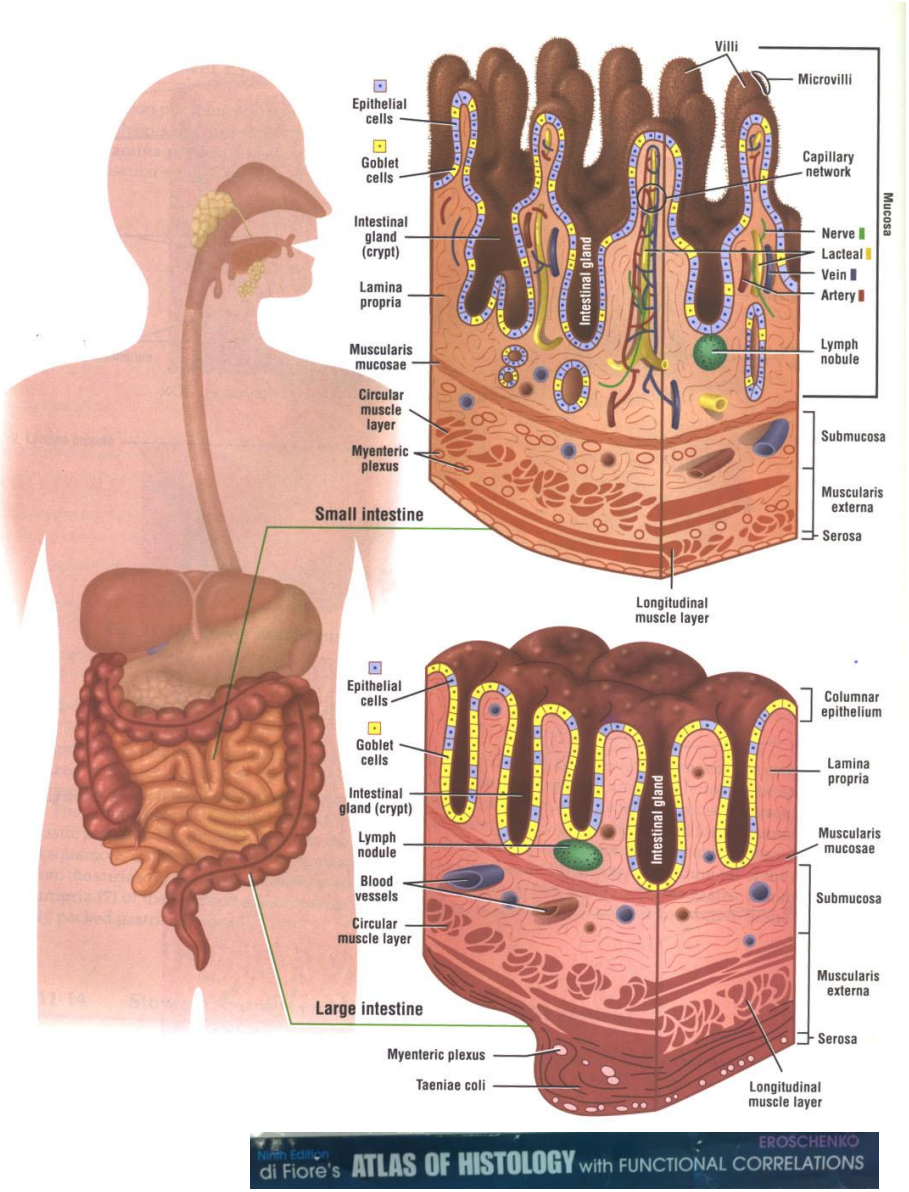




Goblet cells



Lymphoid nodule



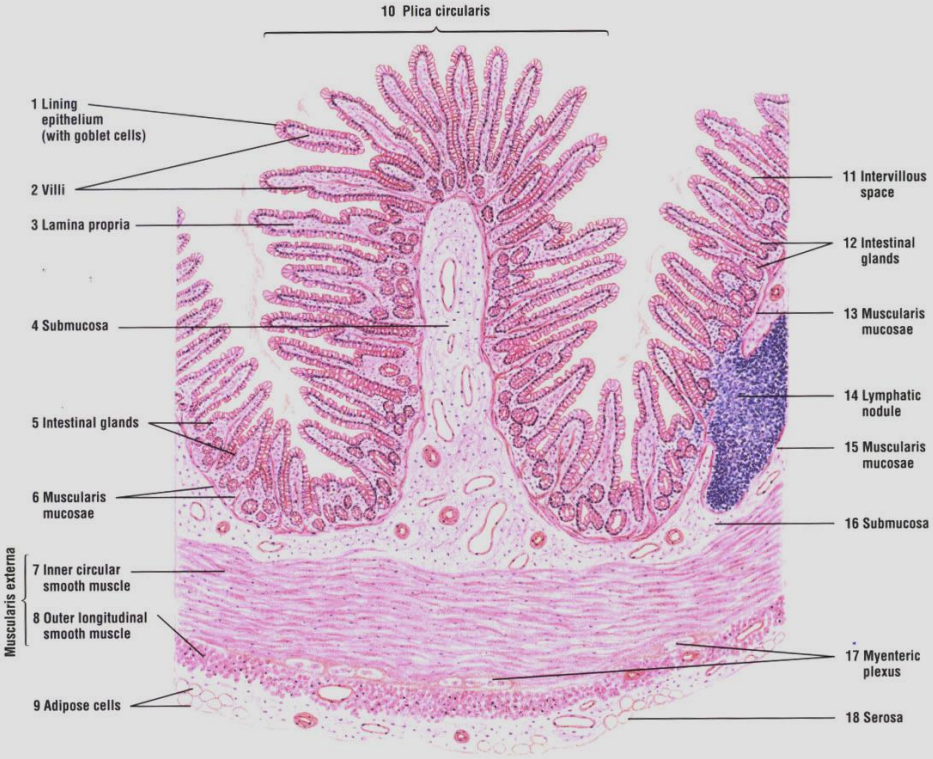
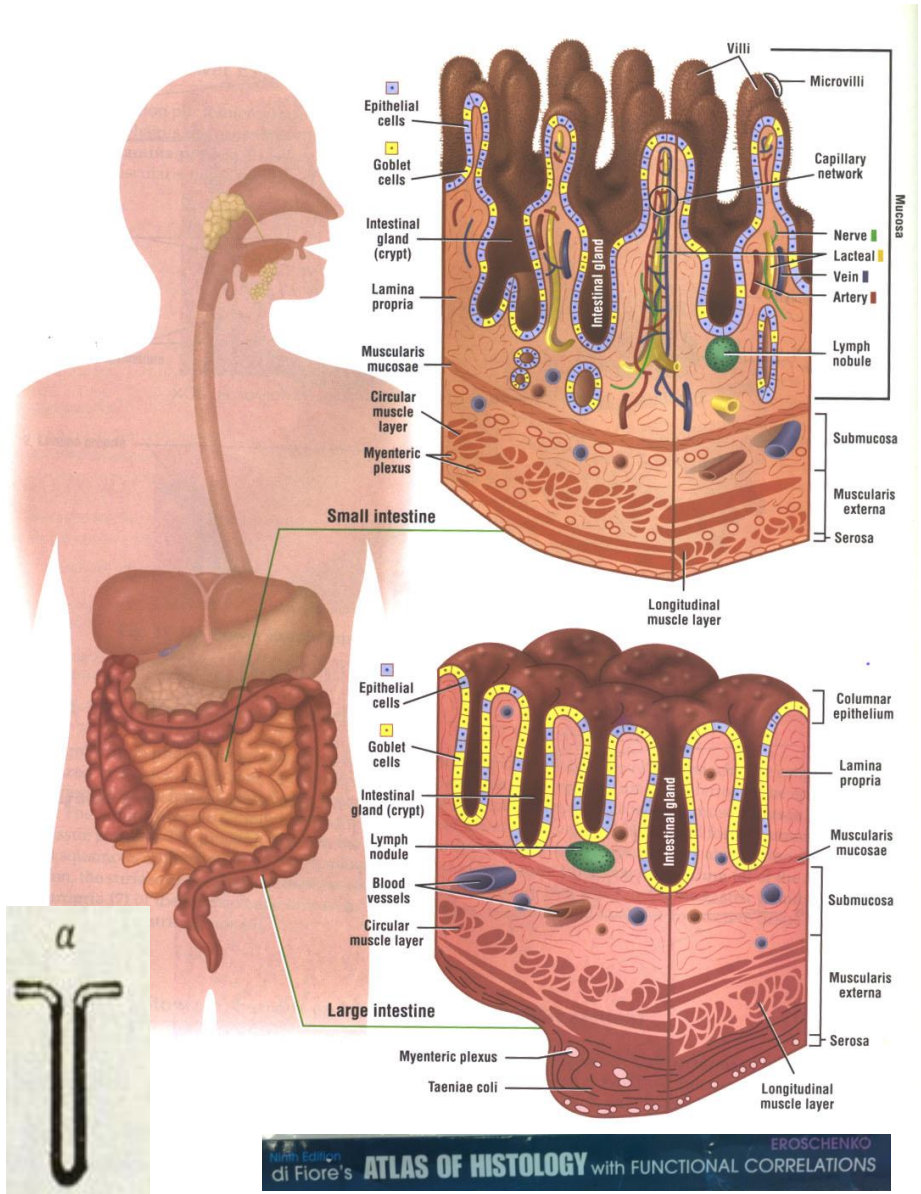


Fig. 12-2 Small Intestine: Jejunum–Ileum (transverse section). Stain: hematoxylin-eosin. Low magnification.

Fig. 12-3 Intestinal Glands With Paneth Cells and Enteroendocrine Cells. Stain: hematoxylin-eosin, plastic section. High magnification.



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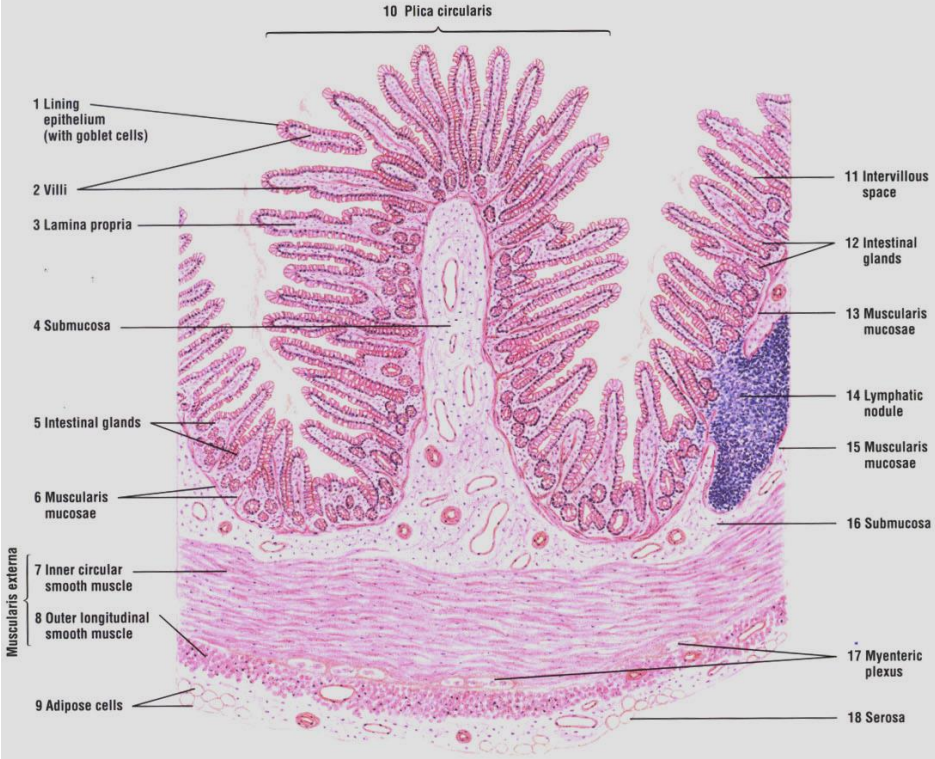


Fig. 12-2 Small Intestine: Jejunum–Ileum (transverse section). Stain: hematoxylin-eosin. Low magnification.

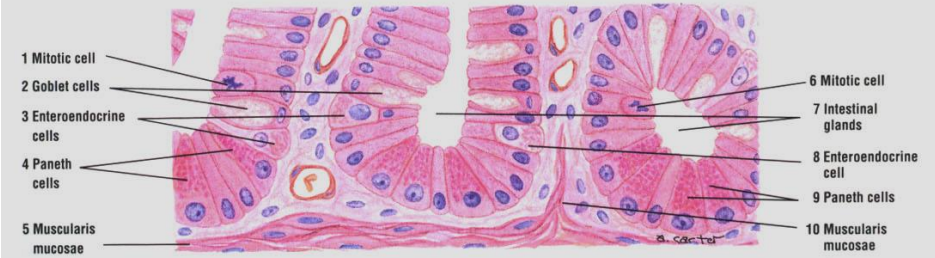
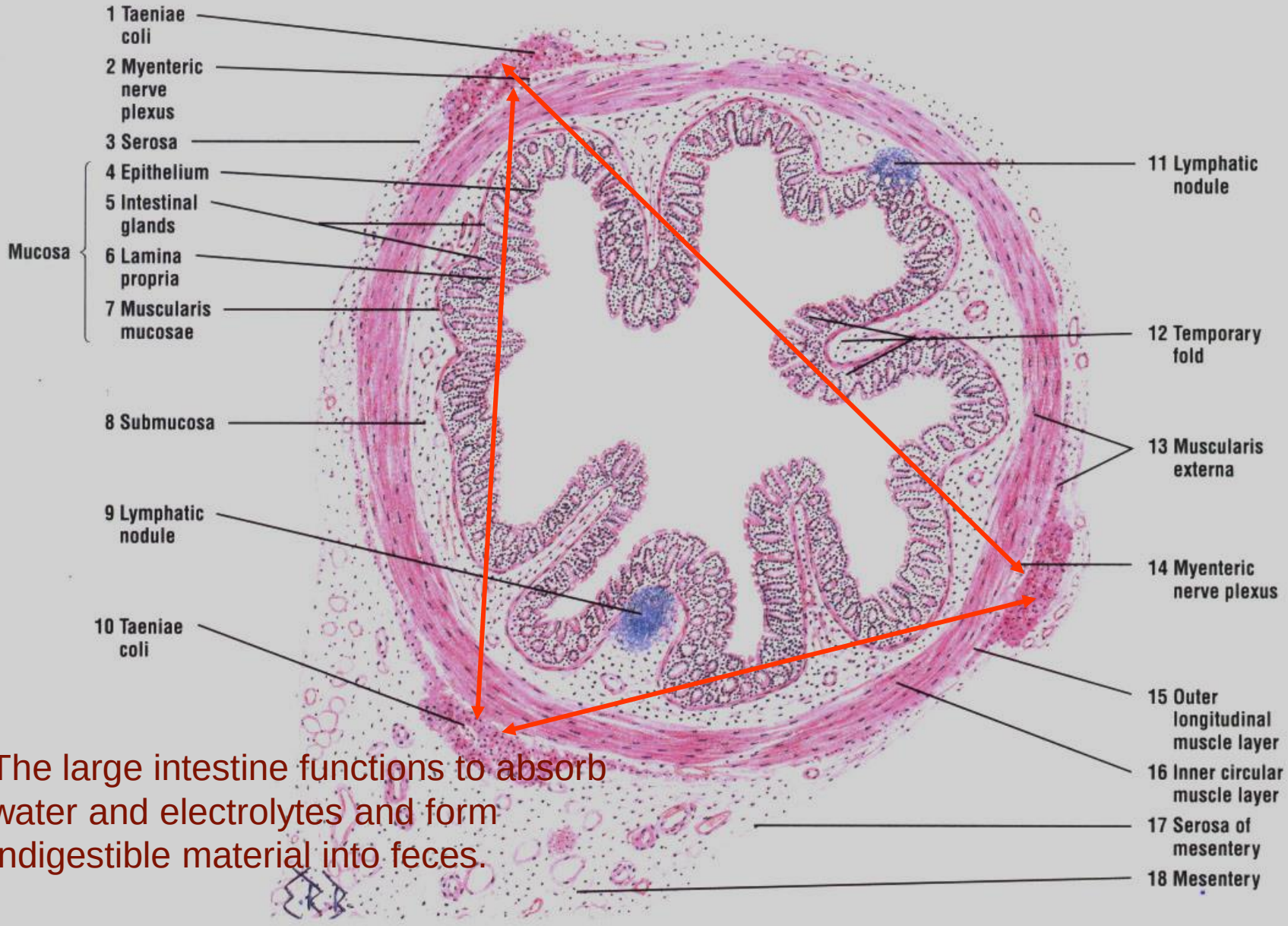


Fig. 12-3 Intestinal Glands With Paneth Cells and Enteroendocrine Cells. Stain: hematoxylin-eosin, plastic section. High magnification.



The large intestine functions to absorb water and electrolytes and form indigestible material into feces.

Fig. 12-6 Large Intestine: Colon and Mesentery (panoramic view, transverse section). Stain: hematoxylin-eosin. Low magnification.

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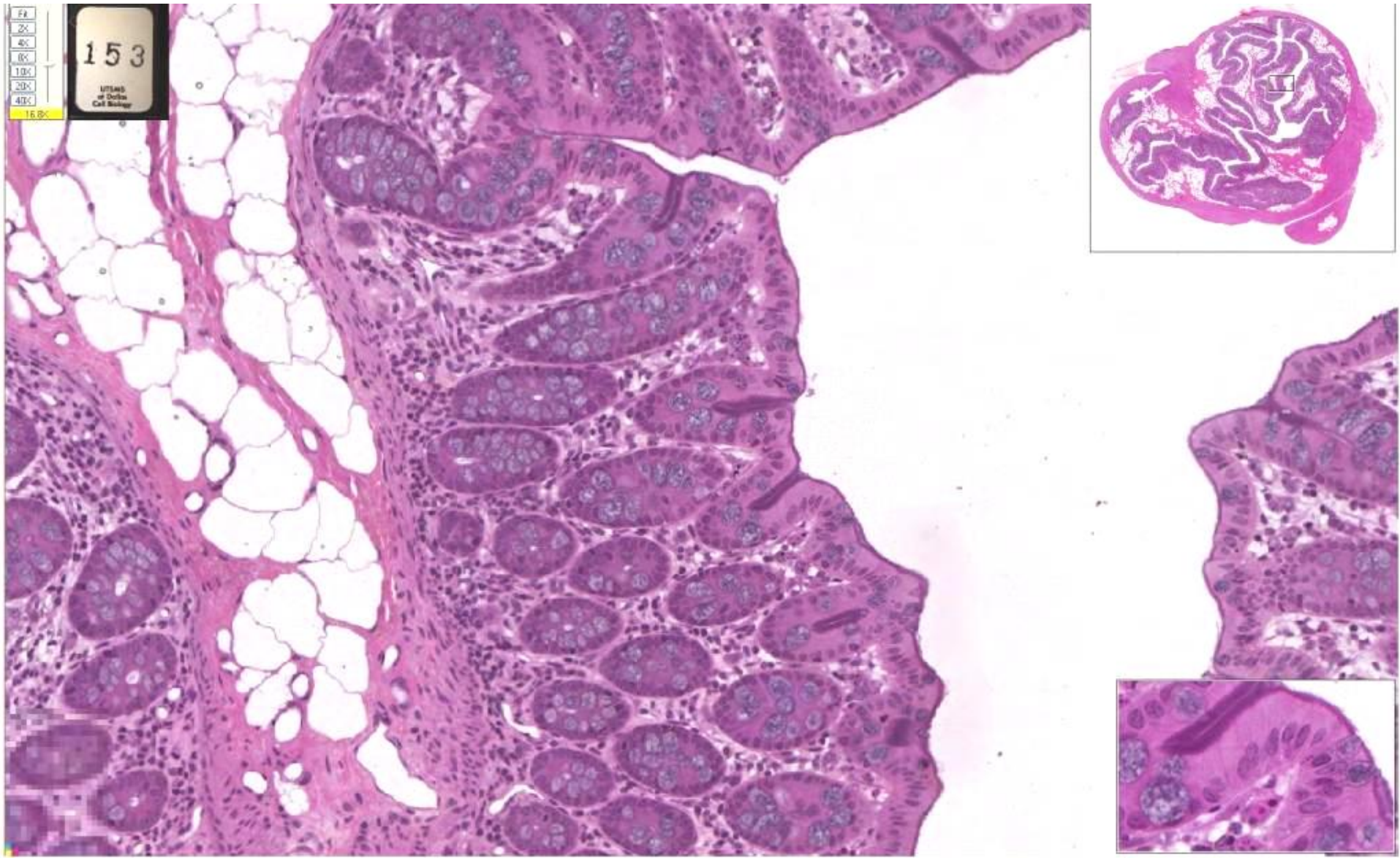
Large intestine or Colon, monkey



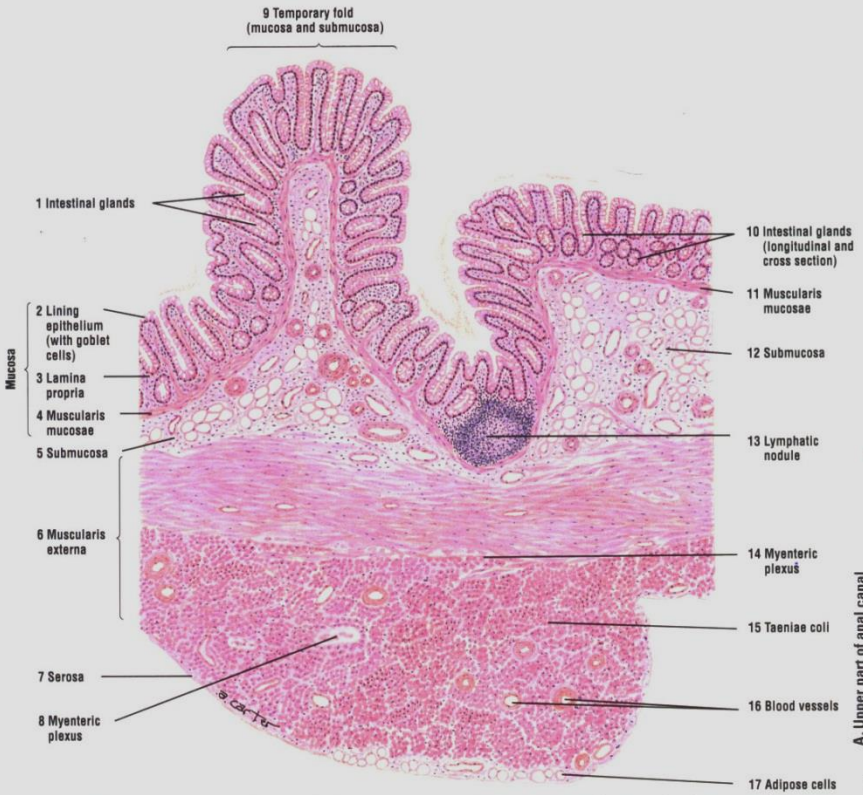
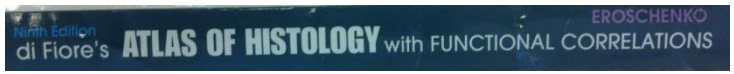


Fig. 12-7 Large Intestine: Colon Wall (transverse section). Stain: hematoxylin-eosin. Medium magnification.



MUCOCUTANEOUS JUNCTIONS

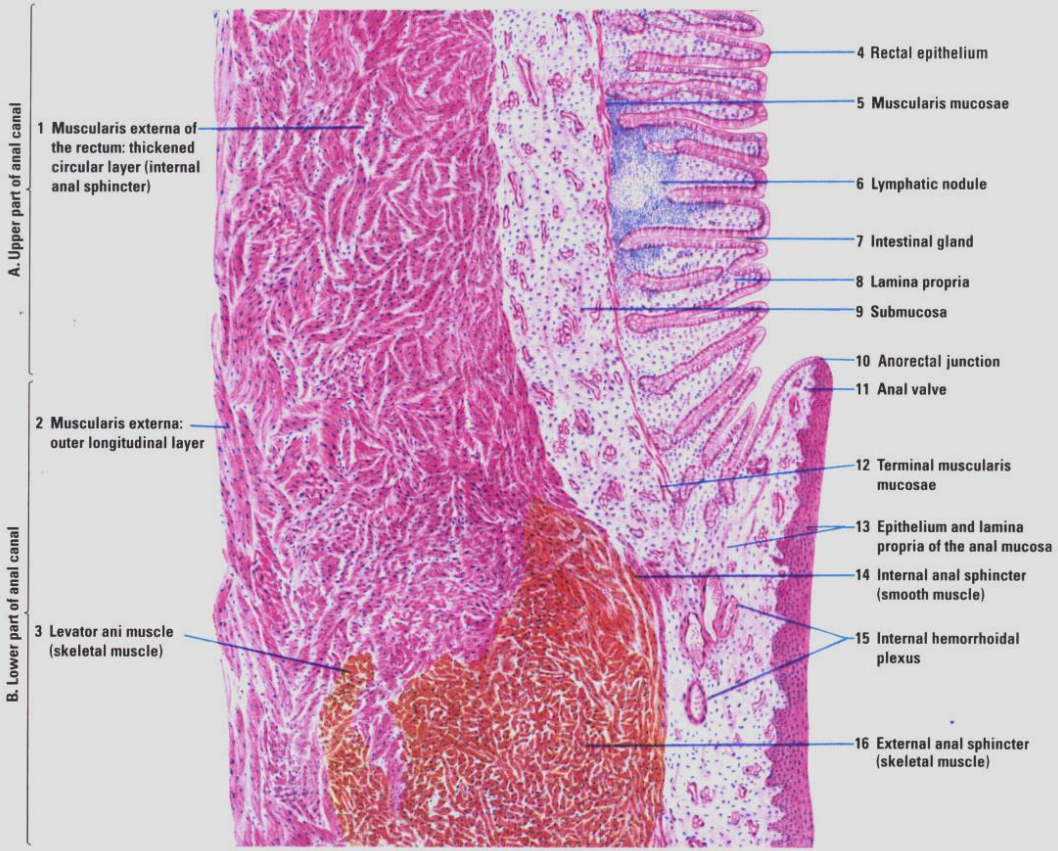
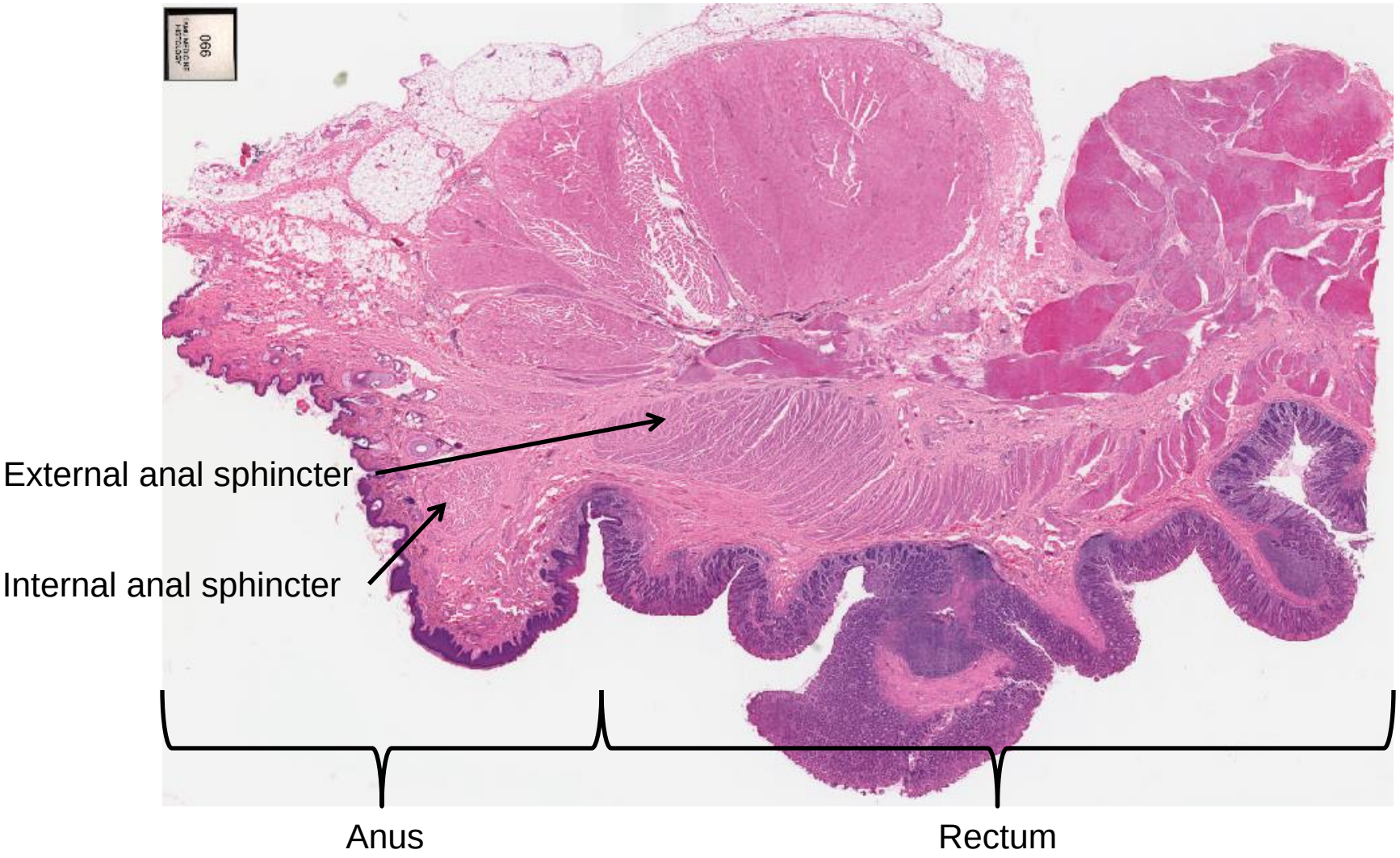
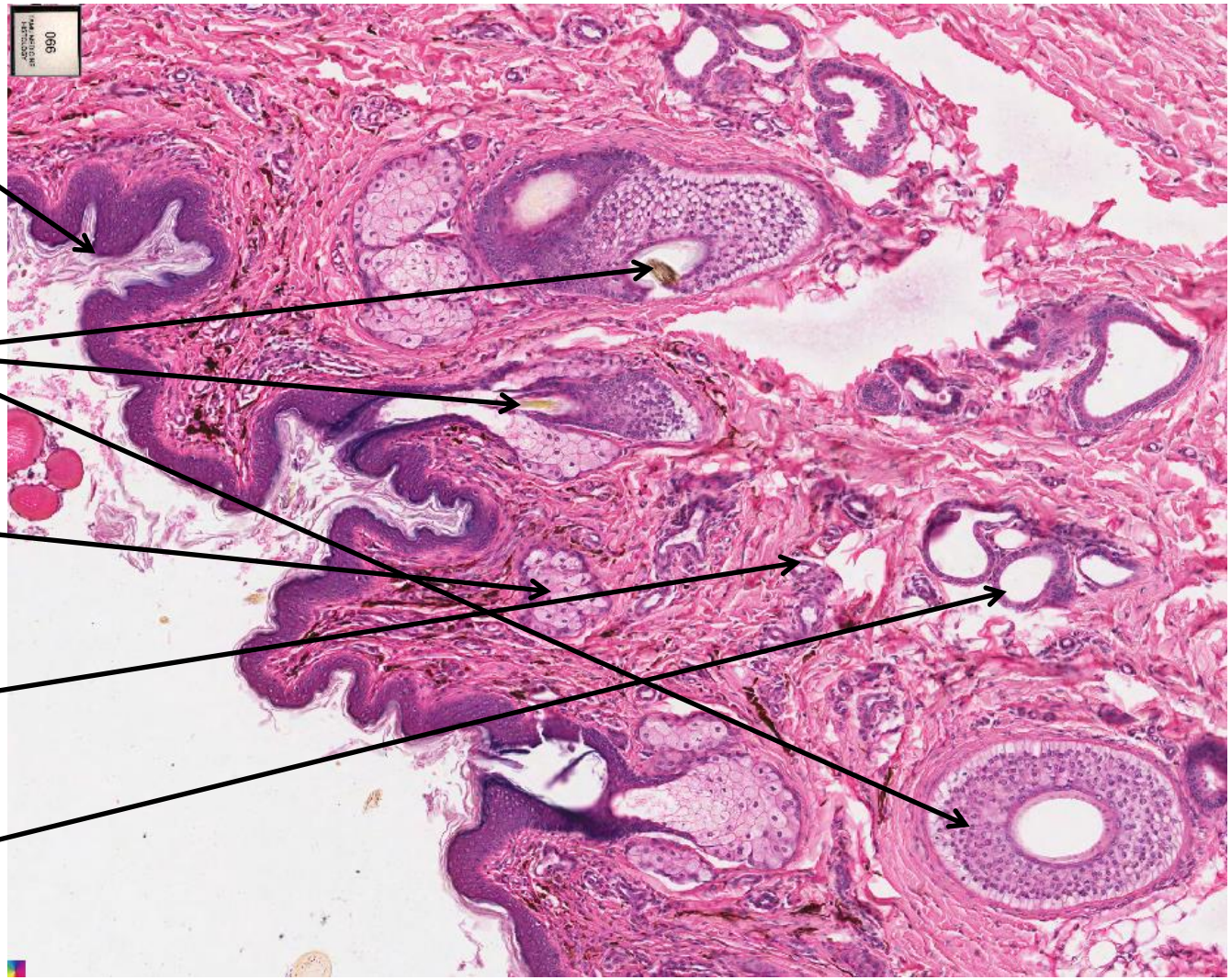


Fig. 12-10 Anal Canal (longitudinal section). Stain: hematoxylin-eosin. Low magnification.

Slide 66: Recto-anal junction



Slide 66 : Recto-anal junction



Anus

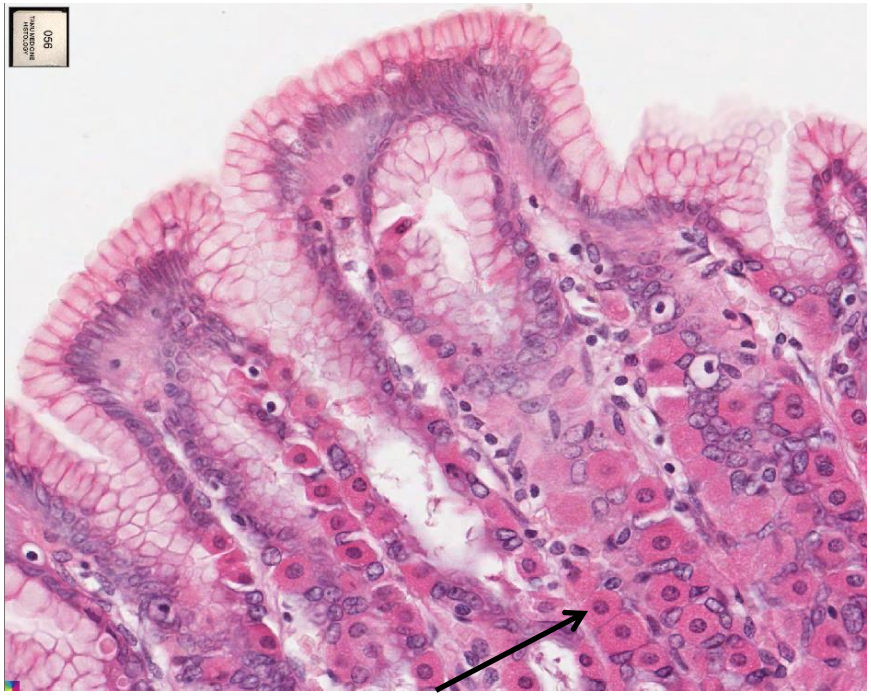
Digestive tract distinguishing features summary

	Mucosa (epithelium, lamina propria, muscularis mucosa)	Submucosa (with submucosal plexuses)	Muscularis (Inner circular and outer longitudinal layers, with myenteric plexuses between them)	Adventitia/ Serosa
Esophagus (upper, middle, lower)	Nonkeratinized stratified squamous epithelium; cardiac glands at lower end	Small esophageal glands (mainly mucous)	Both layers striated muscle in upper region; both layers smooth muscle in lower region; smooth and striated muscle fascicles mingled in middle region	Adventitia, except at lower end with serosa
Stomach (cardia, fundus, body, pylorus)	Surface mucous cells, and gastric pits leading to gastric glands with parietal and chief cells, (in the fundus and body) or to mucous cardiac glands and pyloric glands	No distinguishing features	Three indistinct layers of smooth muscle (inner oblique, middle circular, and outer longitudinal)	Serosa
Small intestine (duodenum, jejunum, ileum)	Plicae circulares; villi, with enterocytes and goblet cells, and crypts/glands with Paneth cells and stem cells; Peyer patches in ileum	Duodenal (Brunner) glands (entirely mucous); possible extensions of Peyer patches in ileum	No distinguishing features	Mainly serosa
Large intestine (cecum, colon, rectum)	Intestinal glands with goblet cells and absorptive cells	No distinguishing features	Outer longitudinal layer separated into three bands, the teniae colo	Mainly serosa, with adventitia at rectum
Anal canal	Stratified squamous epithelium; longitudinal anal columns	Venous sinuses	Inner circular layer thickened as internal sphincter	Adventitia

Clinical Correlation

A 73 year old patient presents with a several week history of fatigue and mild weight loss. The patient is found to have gastric atrophy which has resulted in pernicious anemia.

Why might a disease affecting the GI system result in anemia?



Parietal cells

Gastric atrophy > deterioration of gastric mucosa > decreased parietal cells > decreased intrinsic factor > decreased vitamin B12 absorption > decrease erythroblast proliferation > decreased red blood cells > **pernicious anemia**

Many illustrations in these VIBS Histology YouTube videos were modified from the following books and sources: Many thanks to original sources!

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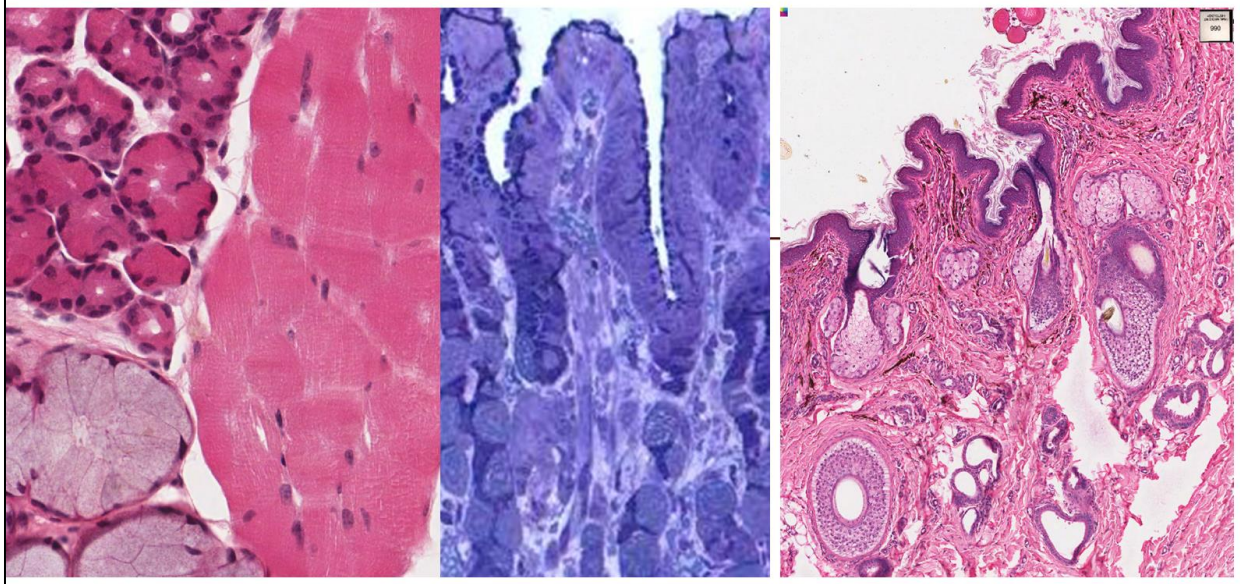
- A.L. Mescher 2013 Junqueira's Basis Histology text and atlas, 13th ed. McGraw
- Douglas P. Dohrman and TAMHSC Faculty 2012 Structure and Function of Human Organ Systems, Histology Laboratory Manual - Slide selections were largely based on this manual for first year medical students at TAMHSC

End of

DIGESTIVE SYSTEM I
PART 3: SMALL AND LARGE INTESTINES



Dr. Larry Johnson

Texas A&M University

Next

- Digestive System II

The End!