

組織學實驗：消化系統 I

Histology laboratory : Digestive system I

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Please study these slides before coming to the class!

Sources of the Pictures & Text

Wheater's Functional Histology (4th ed)

B. Young & J. W. Heath

Histology: A Text and Atlas (4th ed)

M.H. Ross & W. Pawlina

Photomicrograph Taken by

Department of anatomy,

Kaohsiung Medical University

Learning Objective

Microscopic structure of digestive system

93W6748 Esophagus, Middle portion, human

(cs) H&E

93W6746 Esophagus, Upper portion, human

(cs) H&E

93W4875 Trachea and Esophagus (cs) H&E

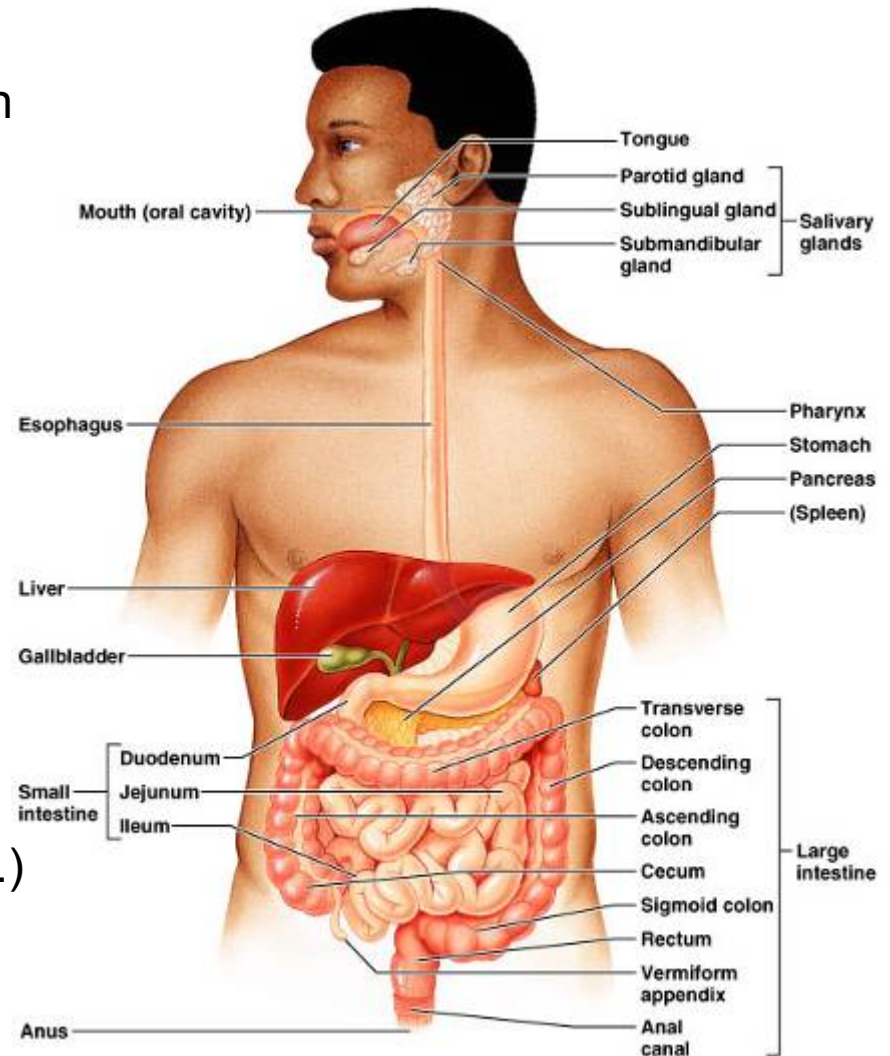
93W4506 Esophagus and stomach (ls) H&E

93W4508 Stomach, composite (sec.) H&E

93W4522 Stomach and Duodenum (ls) H&E

93W4523 Digestive system, Composite (sec.)

H&E



Wheater's Functional Histology

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Learning Objective

- To understand the basic structural organization of the wall of alimentary tube.
- Identify the esophagus, the stomach and the small intestine.
- Identify the upper, middle, and lower portion of the esophagus.
- Identify the duodenum, jejunum, and ileum of the small intestine.



Fig 1. 93W6748
Esophagus, middle
portion, human, H&E

M: Mucosa
S: Submucosa
ME: Muscularis externa
A: Adventitia
V: Vessels

Fig 1. 93W6748 Esophagus, middle portion, human, H&E.

The portion of the alimentary canal that extends from the proximal part of the esophagus to the distal part of the anal canal is a hollow tube of varying diameter. This tube has the same basic structural organization throughout its length. Its wall is formed by four distinctive layers. From the lumen outward, they are **mucosa (M)**, **submucosa (S)**, **muscularis externa (ME)** and **adventitia (or serosa)**. Adventitia or serosa constitutes the outermost layer of the alimentary canal. The adventitia (A) consists of loose connective tissue containing the major vessels (V) and nerves. However, the serosa is a serous membrane consisting of a layer of simple squamous epithelium, called the mesothelium, and a small amount of underlying connective tissue.

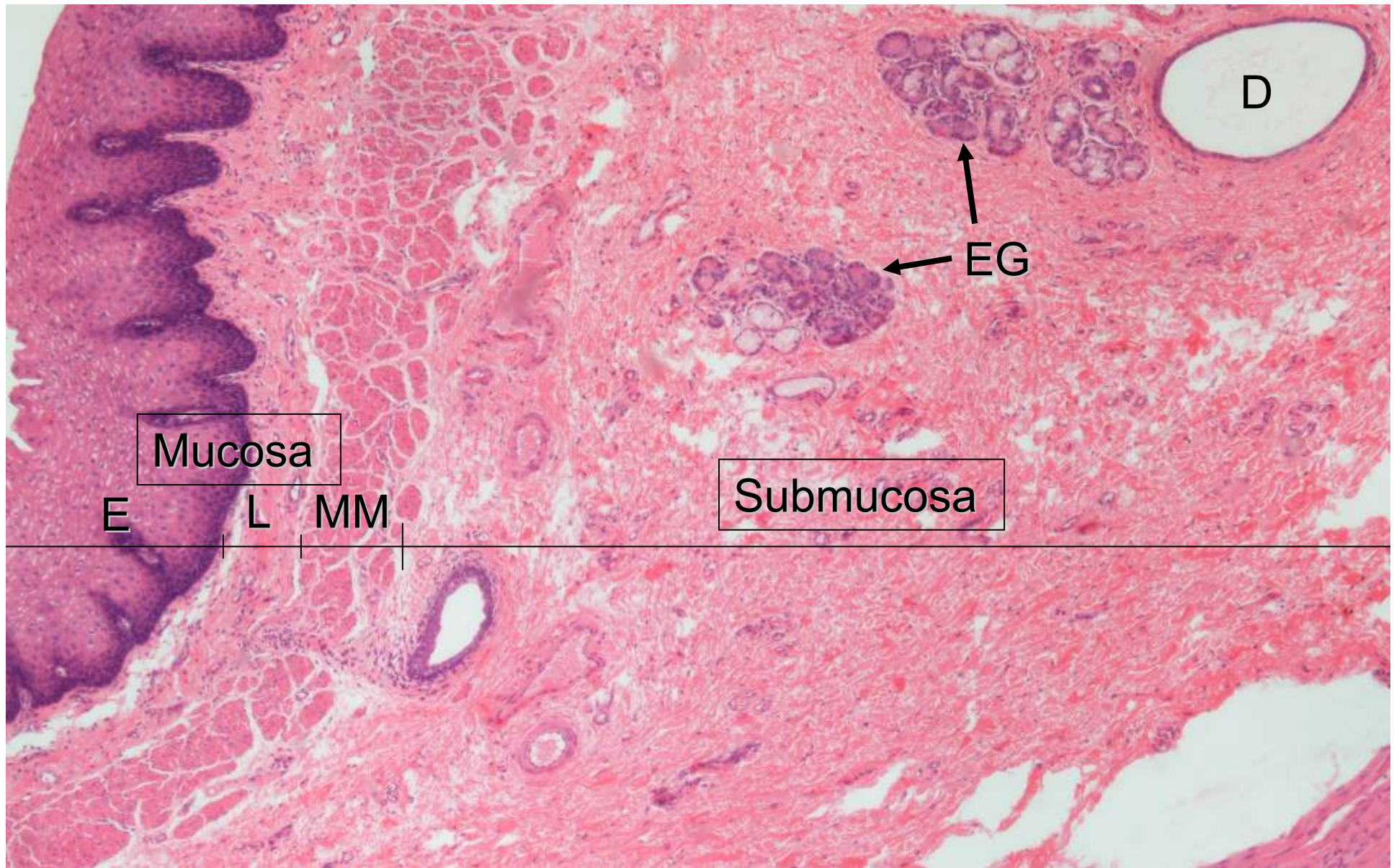


Fig 2. **93W6748** Esophagus,
middle portion, human, H&E

E: Epithelium
MM: Muscularis mucosa
EG: Esophageal gland

L: Lamina propria
D: Duct

Fig 2. 93W6748 The microscopic structure of the esophagus.

The mucosa is made up of three components: a lining epithelium (E), an underlying connective tissue called lamina propria (L), and a thin smooth muscle layer, muscularis mucosa (MM). The epithelium of the esophagus is stratified squamous epithelium. The lamina propria consists of loose supporting tissue with diffuse lymphocytes. The muscularis mucosa is composed of longitudinally organized smooth muscle. The submucosa of the esophagus consists of dense irregular connective tissue that contains the larger blood and lymphatic vessels, nerve plexus, and esophageal glands (EG). There is an excretory duct (D) of esophageal glands adjacent to the gland.

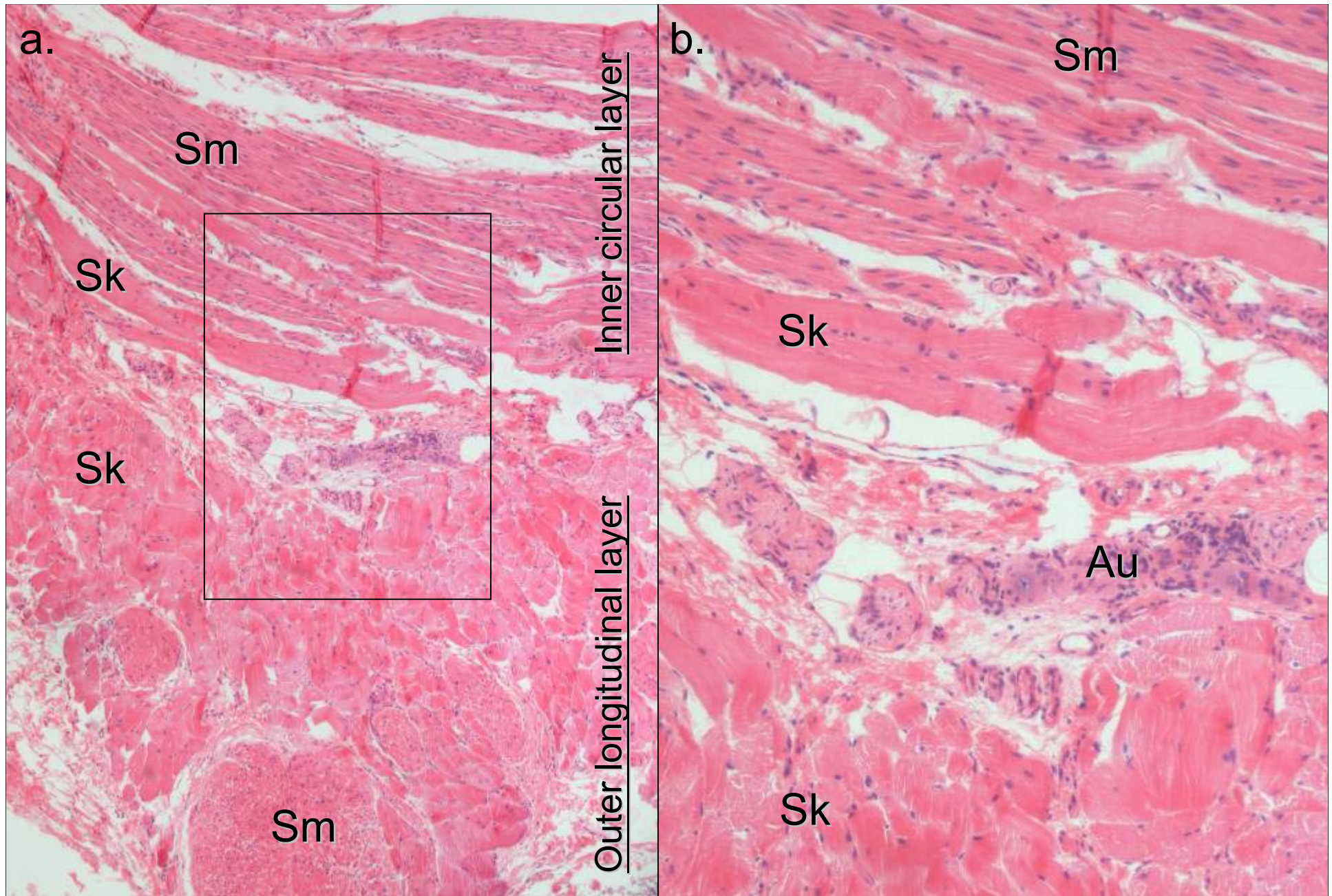


Fig 3. **93W6748** Esophagus, middle portion, human, H&E

Sm: Smooth muscle Sk: Skeletal muscle
Au: Auerbach's plexus

Fig 3. The microscopic structure of the muscularis externa of the esophagus.

The muscularis externa consists of two muscle layers, an inner circular layer and an outer longitudinal layer. The esophagus is divided histologically into three regions on the basis of the type of muscle which muscularis externa contains. At the middle third of the esophagus, skeletal muscle (Sk) and smooth muscle (Sm) bundles are mixed and interwoven in the muscularis externa. Located between the two muscle layers is a thin connective tissue layer. Within this connective tissue lies the Auerbach's plexus (Au) containing nerve cell bodies of postganglionic parasympathetic neurons and neurons of the enteric nervous system, as well as blood vessels and lymphatic vessels. The rectangle of Fig 3a is examined at higher magnification in Fig 3b.

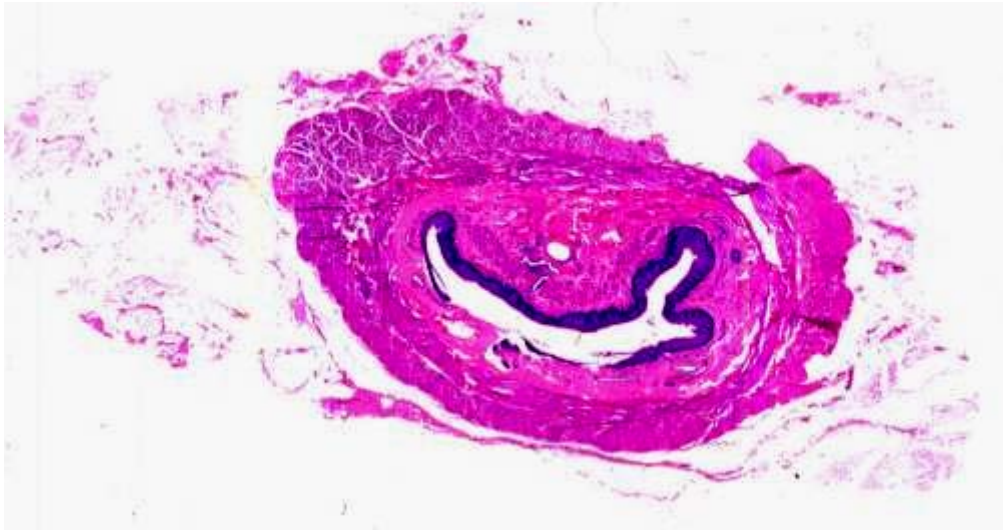


Fig 4a. **93W6746**
Esophagus, Upper portion,
human, H&E

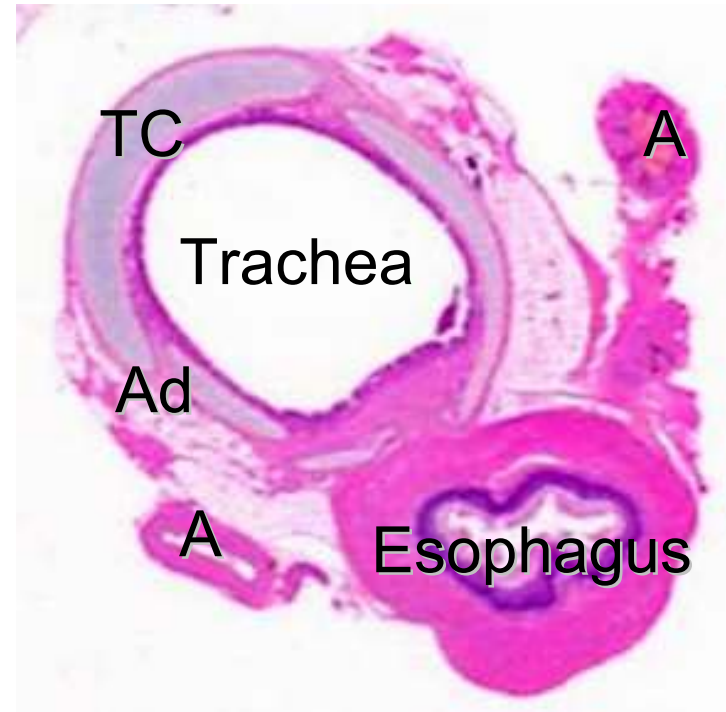


Fig 4b. **93W4875**
Trachea and **esophagus**,
H&E

TC: Tracheal cartilage
Ad: Adipose tissue
A: Artery

Fig 4a. 93W6746 Esophagus, upper portion, human (cs) H&E.

Fig 4b. 93W4875 Trachea and esophagus (cs) H&E.

Both slides are taken from the upper portion of the esophagus. (Fig 4b shows the relationship between the trachea and the esophagus at the base of the neck.) All histological features of the upper portion of the esophagus are similar to its middle portion except the muscularis externa of the upper one third is composed of striated muscle. Please find similar structures in 93W6748.

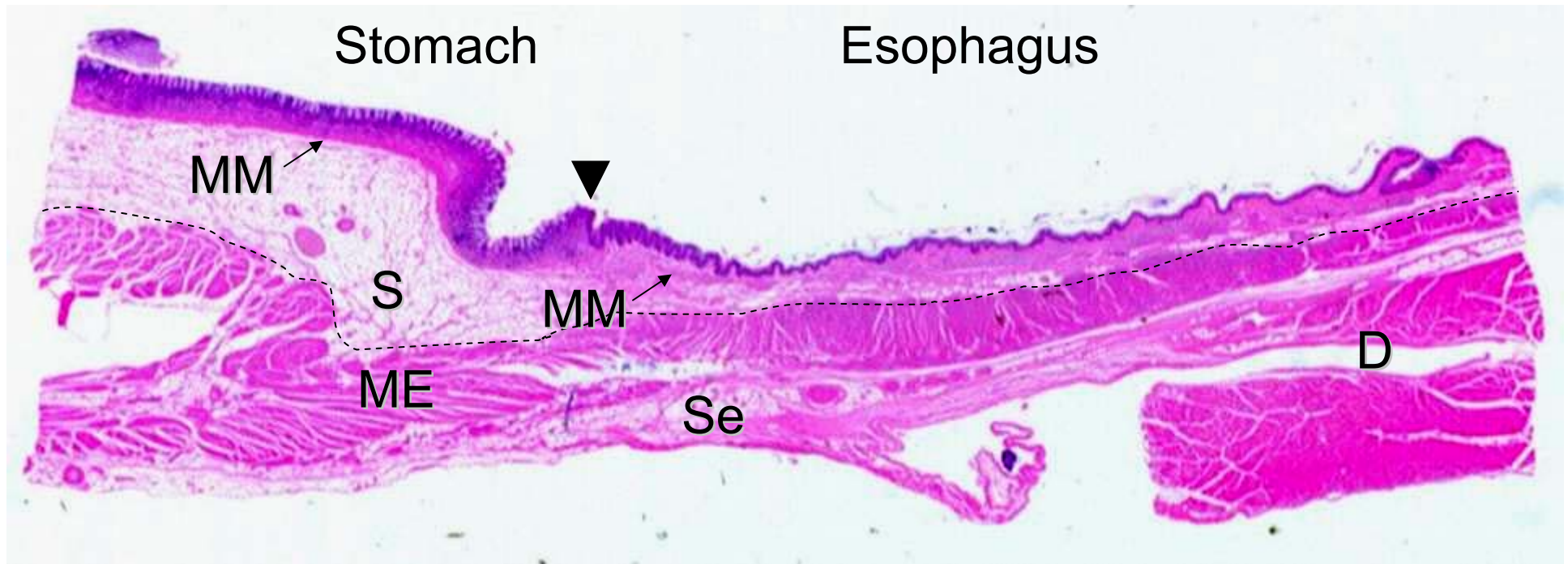


Fig 5. **93W4506** Esophagus and stomach, H&E

MM: Muscularis mucosa
ME: Muscularis externa
D: Diaphragm

S: Submucosa
Se: Serosa

Fig 5. 93W4506 Esophagus and stomach, H&E.

The junction between the esophagus and stomach is shown here. The esophagus is on the right, and the cardiac region of the stomach is on the left. The arrowhead shows the junction of them. The arrows point out the muscularis mucosa (MM) which is continuous across the junction. The dashed line demonstrates the boundary of the submucosa (S) and the muscularis externa (ME). The muscularis externa of the distal third esophagus consists only of smooth muscle. [The skeletal muscle adjacent to the esophagus is the diaphragm (D).] Beneath the muscularis externa is the serous membrane, serosa (Se), containing vessels and nerve fiber bundles.

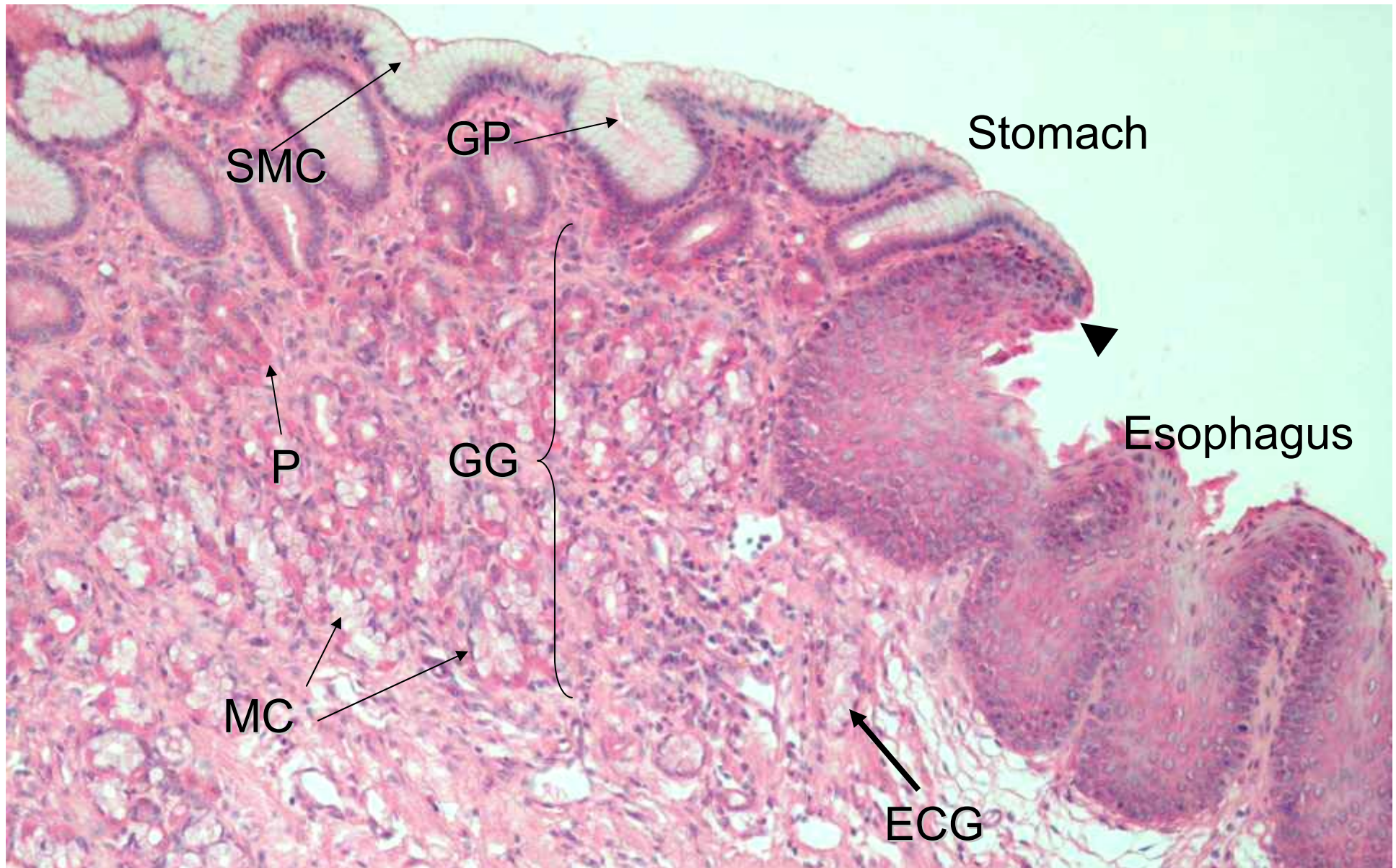


Fig 6. **93W4506**
Esophagus and
stomach, H&E

GP: Gastric pit
SMC: Surface mucous cell
ECG: Esophageal cardiac gland

GG: Gastric gland
MC: Mucous cell
PC: Parietal cell

Fig 6. 93W4506 Esophagus-stomach junction.

At the junction of the esophagus with the stomach, the stratified squamous epithelium of the esophagus ends abruptly, and the simple columnar epithelium of the stomach mucosa begins. The arrowhead shows the junction of them. The surface of the stomach contains pale-stained surface mucous cells (SMC). The surface of the stomach also contains numerous and relatively deep depressions called gastric pits (GP) that are formed by surface mucous cells. Esophageal cardiac glands (ECG) are named for their similarity to the cardiac glands of the stomach. They are present in the terminal part of the esophagus and occur in the lamina propria of the mucosa. This slide is taken from a mammal but not human, hence the histological features of its gastric glands are somewhat unlike human's. The gastric glands (GG) of this species contains abundant mucous cells (MC) and parietal cells (PC).

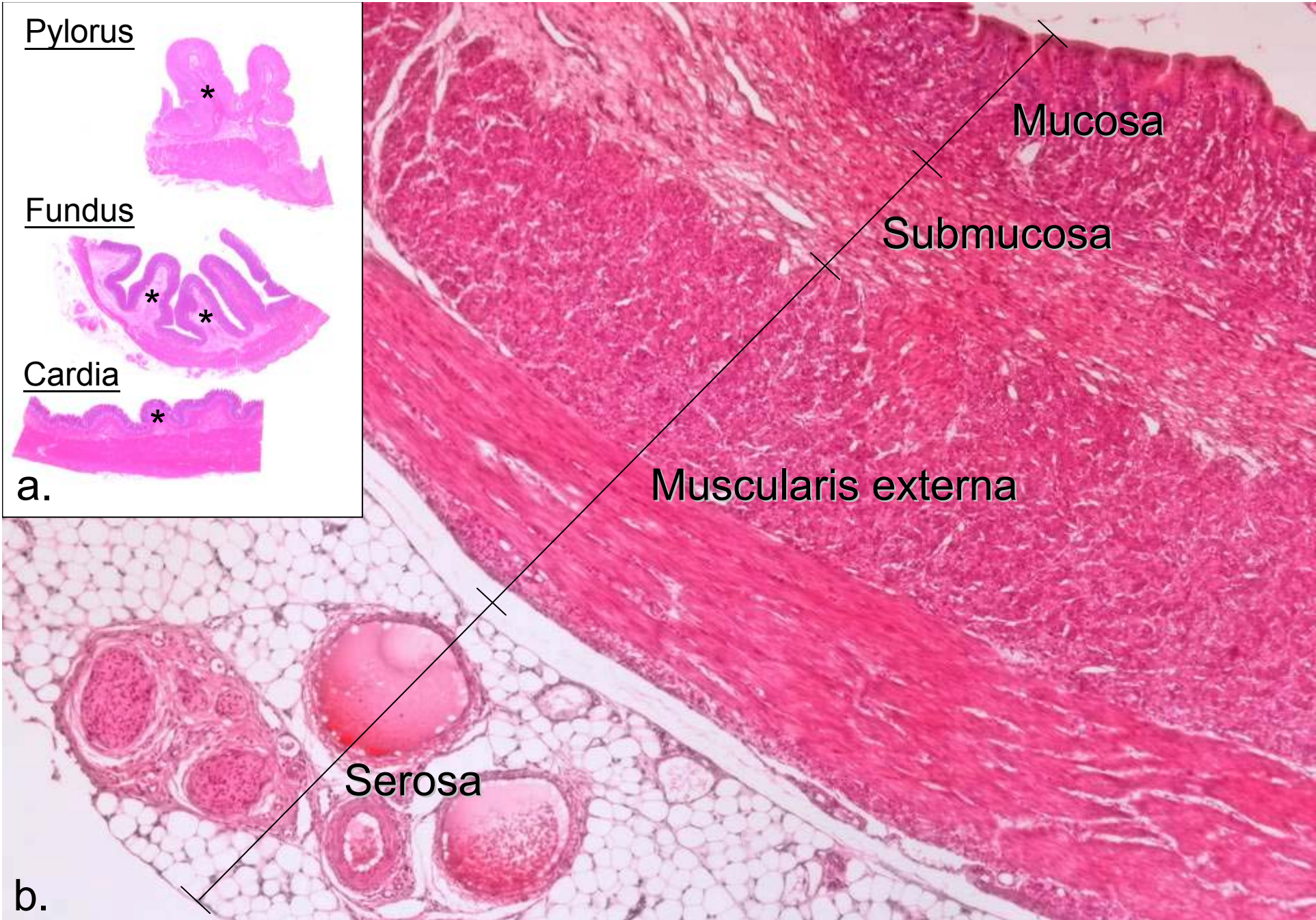


Fig 7. **93W4508** Stomach, composite (sec.) H&E * : Rugae

Fig 7. 93W4508 Stomach, composite (sec.) H&E.

Three regions of the stomach are shown in this slide: upper, pylorus; middle, fundus; lower, cardia (as shown in Fig 7a).

As with other parts of the gastrointestinal tract, the wall of the stomach consists of four layers: a mucosa, a submucosa, a muscularis externa, and a serosa. The inner surface of the empty stomach is thrown into long folds referred to as rugae (*). Several such cross-sectioned folds are shown in Fig 7a. They consist of mucosa and submucosa. The rugae are not permanent folds; they disappear when the stomach wall is stretched, as in the distended stomach.

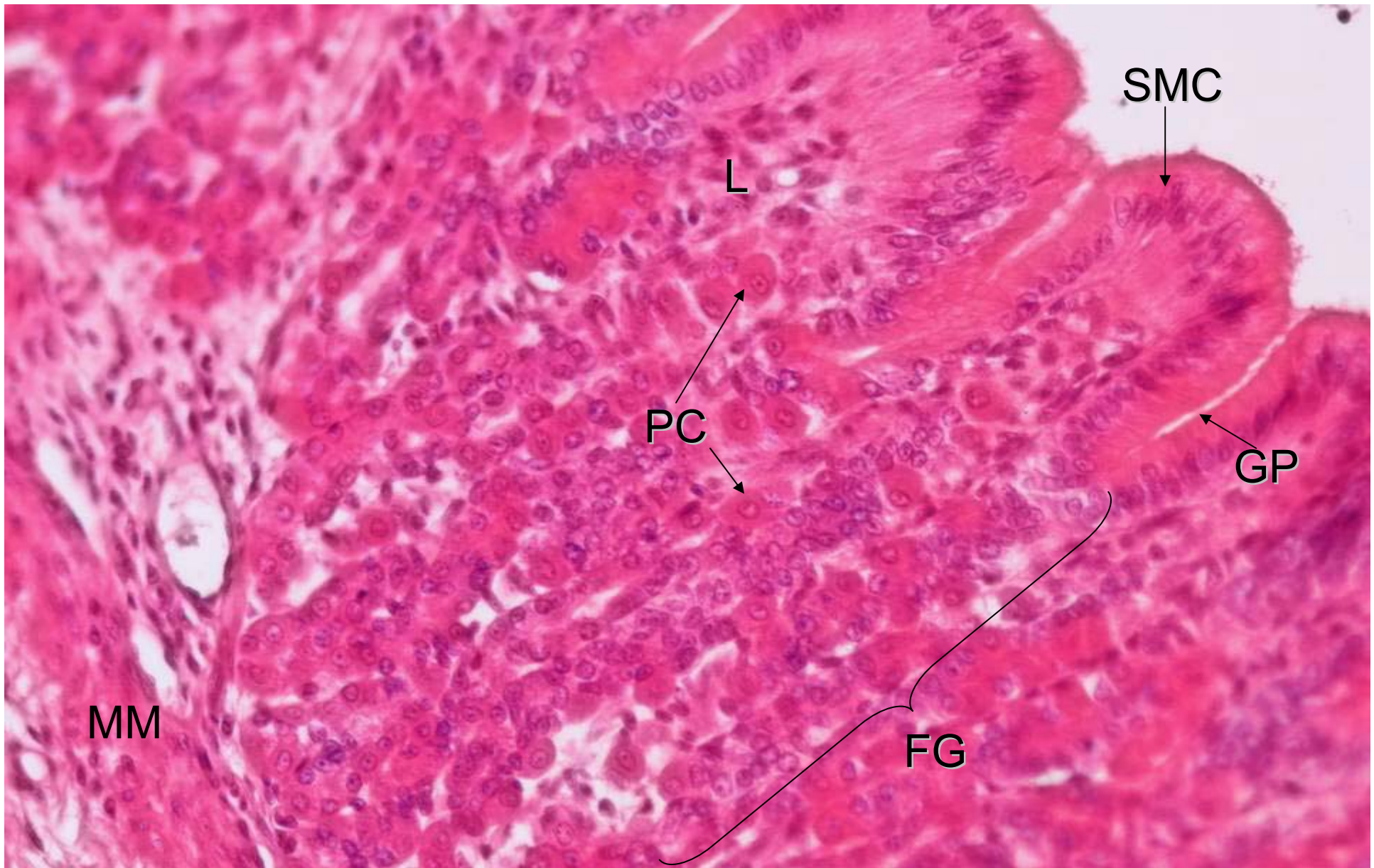


Fig 8. 93W4508
Middle part, Stomach,
fundus, H&E

GP: Gastric pit
SMC: Surface mucous cell
L: Lamina propria

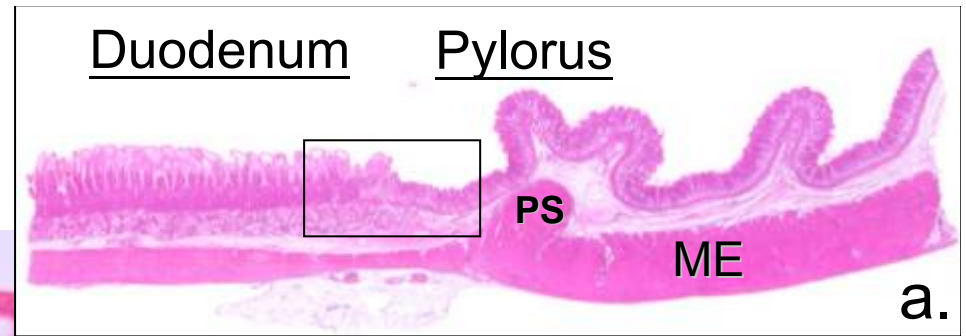
GG: Gastric gland
PC: Parietal cell
MM: Muscularis mucosa

Fig 8. 93W4508 Middle part, Stomach, fundus, H&E.

The gastric pit, the depression formed by the surface mucous cells (SMC). Just below the gastric pits (GP) are the fundic glands (FG), in which one can identify parietal cells (P). The parietal cells are recognized by their copious eosinophilic cytoplasm and central nucleus, which is often described as a “fried egg appearance”. The glands extend down to the muscularis mucosa (MM). The lamina propria (L) is highly cellular because of the presence of large numbers of lymphocytes.

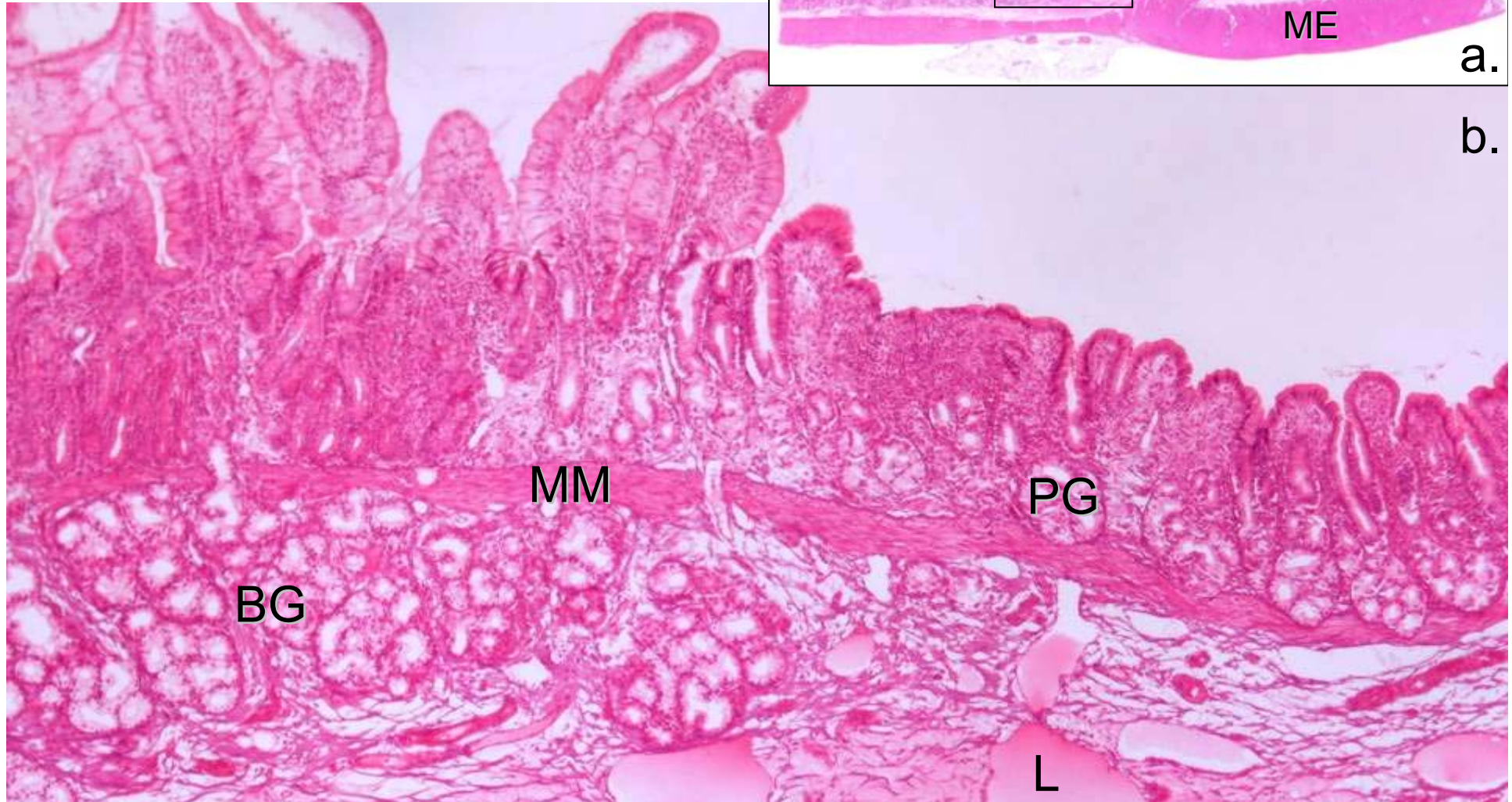
Examine the cardiac and pylorus gland of this slide at higher magnification (not shown here). The cardiac glands are composed mainly of mucus-secreting cells. The pyloric glands are branched and coiled; the gastric pits of the pylorus occupy about half the thickness of the pyloric mucosa.

Fig 9. **93W4522** Stomach and Duodenum (Is) H&E



a.

b.



PS: pyloric sphincter ME: Muscularis externa PG: Pyloric gland
BG: Brunner's gland MM: Muscularis mucosa

Fig 9. 93W4522 Stomach and Duodenum (Is) H&E.

Fig 9a. shows the junction between the pylorus and the duodenum. The pyloric sphincter (PS) appears as a thickened region of smooth muscle below the pyloric mucosa. Its thickness, mostly due to the amplification of the circular layer of smooth muscle of the muscularis externa (ME), can be appreciated by comparison with the muscularis externa in the duodenum. The area marked by the rectangle is shown at higher magnification in Fig 9b.

Pyloric glands (PG) are branched, coiled, tubular glands. The lumen is relatively wide, and the secretory cells are similar in appearance to the surface mucous cells. The submucosa of the duodenum contains submucosal glands, Brunner's glands (BG). These glands are below the muscularis mucosa (MM). The microscopic structure of the duodenum is similar to the jejunum shown in Fig 10. However, the jejunum does not have submucosal gland.

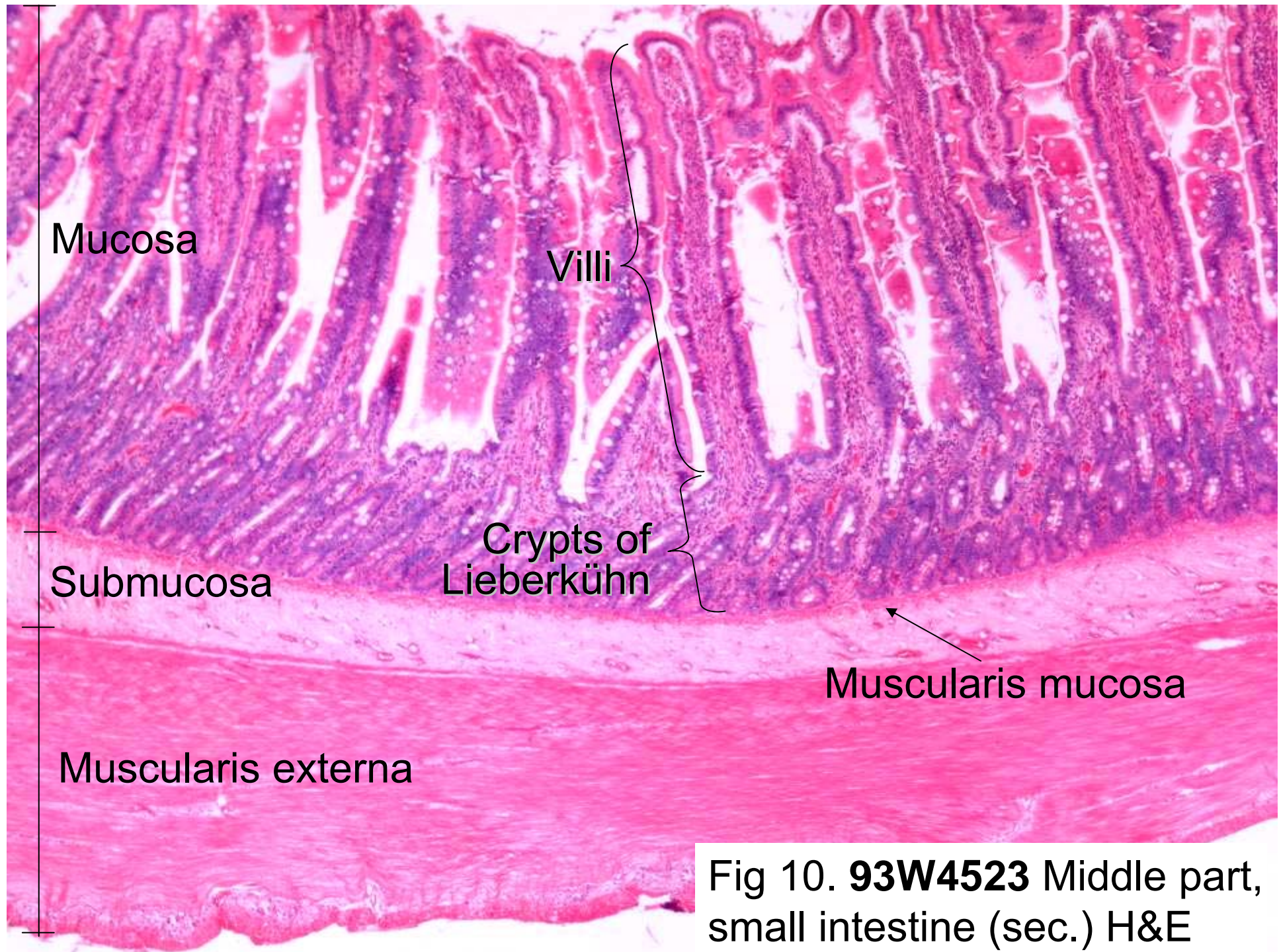


Fig 10. 93W4523 Digestive system, Composite (sec.) H&E.

There are three tissues in this slide: upper, colon; **middle, small intestine**; lower, stomach.

The second tissue of this slide is a longitudinal section of the small intestine. The layers of the wall, in order from the lumen, are the mucosa, the submucosa, the muscularis externa, and the serosa (extremely thin layer in this slide). The mucosa reveals several longitudinally sectioned villi and cross-sectioned crypts of Lieberkühn. The intestinal villi are lined by a simple columnar epithelium which is continuous with the crypts of Lieberkühn. The crypts of Lieberkühn extend as far as the muscularis mucosa.



Fig 11. **93W4523** Middle part,
small intestine (sec.) H&E

E: Enterocytes
L: Lamina propria

G: Goblet cell

Fig 11. 93W4523 Middle part, small intestine (sec.) H&E. Several cell types can be identified in this photomicrograph. Enterocytes (E) are tall columnar cells with surface microvilli that are seen as a striated border in light microscopy. Goblet cells (G) are scattered among the enterocytes and stained paler. The lamina propria (L) contains considerable numbers of lymphocytes and other cells of the immune system. The lamina propria extends between the crypts and into the core of each villus and contains a rich vascular and lymphatic network.

Summary

- The basic structural organizations of the wall of alimentary tube are mucosa, submucosa, muscularis externa, and adventitia / serosa.
- The mucosa consists of epithelium, lamina propria, and muscularis mucosa.
- Auerbach's plexus

Summary

		<i>Epithelium</i>	<i>Characteristics</i>	<i>Characteristics in subdivisions</i>
Esophagus	Upper portion	Stratified squamous epi.	Esophageal gland	Skeletal m.
	Middle portion			Skeletal and smooth muscle
	Lower portion			Smooth m.
Stomach	Cardia Body/fundus Pylorus	Simple columnar epi.	Surface mucous cell Parietal cell Gastric pit Gastric gland	
Small intestine	Duodenum	Simple columnar epi.	Villi Crypts of Lieberkühn Enterocytes Goblet cell	Brunner's gland
	Jejunum			
	Ileum			Peyer's patch