

Topic 9. Esophagus. Stomach.

General structure of ESOPHAGUS wall			
1.	Mucosa	Epithelium	Nonkeratinized stratified squamous and can be keratinized.
		Lamina propria (includes glands in the lower third)	Loose connective tissue with many fibers, fibroblasts, macrophages, mast cells, plasma cells, leukocytes and esophageal cardiac glands .
		Muscularis mucosae (lamina muscularis mucosae)	Smooth muscles tissue.
2.	Submucosa	It includes glands.	Loose connective tissue (or dense irregular connective tissue) with mucous esophageal glands (esophageal glands proper).
3.	Muscularis externa	It has two layers of muscle: inner circular and outer longitudinal layers.	Smooth muscles tissue and striated muscles tissue
4.	Adventitia or serosa	Adventitia (upper and middle thirds) and serosa (lower third) have one difference.	Adventitia includes only loose connective tissue. Serosa consists of loose connective tissue and mesothelium.

Special structures of different thirds of the ESOPHAGUS		
Parts (thirds)		Structural features
1.	The upper third	<p>1) Connects the oropharynx to the middle third of esophagus.</p> <p>2) Esophageal glands proper secrete mucus which lubricate the wall of esophagus (location - submucosa).</p> <p>3) Muscularis externa contains only skeletal muscle fibers.</p> <p>4) These are voluntary muscle fibers and are innervated by the glossopharyngeal nerve (CN IX).</p>
2.	The middle third	<p>1) The esophageal glands proper in the submucosa are less numerous than in the upper esophagus.</p> <p>2) The muscularis externa contains both skeletal and smooth muscles.</p>
3.	The lower third	<p>1) Connects the esophagus to the cardia of the stomach.</p> <p>2) This region contains large numbers of mucous glands in the lamina propria and submucosa.</p> <p>3) Mucous glands are called esophageal cardiac glands (location - lamina propria) and produce mucous secretions to protect the lower esophagus from being damaged by reflux of acidic gastric juices from the stomach.</p> <p>4) Contains only smooth muscle fibers in the muscularis externa.</p> <p>5) It controls by the enteric branches of the vagus nerve (CN X).</p>

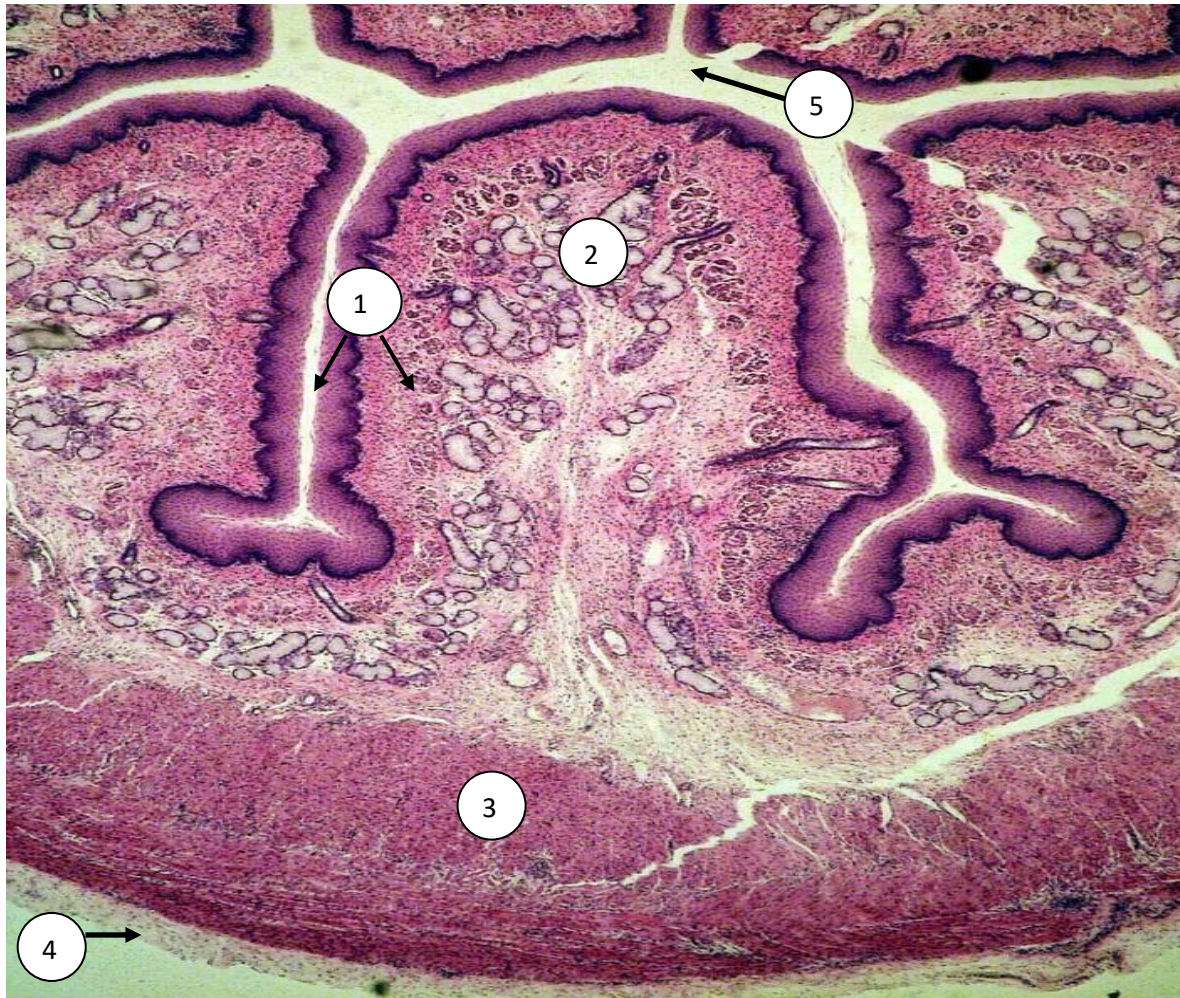
General structure of STOMACH wall			
1.	Mucosa	Epithelium	Simple columnar
		Lamina propria	Loose connective tissue with stomach glands .
		Muscularis mucosae (lamina muscularis mucosae)	Smooth muscles tissue.
2.	Submucosa	It does not contain glands.	Loose connective tissue (or dense irregular connective tissue).
3.	Muscularis externa	It has three layers of muscle: inner oblique layer, middle circular layer, and outer longitudinal layers.	Smooth muscles tissue.
4.	Serosa	It consists of loose connective tissue and mesothelium.	Serosa consists of loose connective tissue and mesothelium.

Special structures of different parts of the STOMACH		
Parts		Structural features
1.	Cardia	1) It is connects to the lower esophagus . 2) It is at the esophagogastric junction , which is characterized by a change from the nonkeratinized stratified squamous epithelium (esophagus) to the simple columnar epithelium (stomach). 3) There is gastroesophageal sphincter (lower esophageal sphincter) or cardiac sphincter . 4) Branched tubular glands (cardiac glands) which situated in the lamina propria. They include mucus-secreting cells, stem cells, enteroendocrine cells and parietal cells . 5) Secret of cardiac glands - mucus and lysozymes .
2.	Fundus	1) It is the largest portion of the stomach and has short gastric pits. 2) There are branched tubular glands (fundic glands) in the lamina propria.

		3) They include parietal cells, chief cells, stem cells, mucous neck cells and enteroendocrine cells .
3.	Body	1) It is the largest portion of the stomach and has short gastric pits. 2) There are branched tubular glands (gastric glands) in the lamina propria. 3) They include parietal cells, chief cells, stem cells, mucous neck cells and enteroendocrine cells .
4.	Pylorus	1) It is the lower end of the stomach, which connects with the duodenum. 2) There is pylorus sphincter (pyloric valve) surrounds the end of the pylorus region. 3) There are pyloric glands in the lamina propria. 4) Pyloric glands include mucus-secreting cells and two special types of enteroendocrine cells: gastrin-secreting cells (G cells) and somatostatin-secreting cells (D cells).

Structure and functions of the STOMACH glands		
Types of cell		Structural features and functions
1.	Chief cells	1) In the cytoplasm there are large amount of rER in the basal portion of the cell (it has basophilic staining). 2) In the apical region of the cell there are secretory vesicles (zymogen granules) which include pepsinogen and lipase. 3) They produce pepsinogen which is the precursor enzyme of the gastric secretion. 4) Pepsinogen is converted to the pepsin by HCl. 5) Pepsin hydrolyzes proteins into small peptides by splitting interior peptide bonds.
2.	Parietal cells	1) They are localized in the neck of the fundic glands and in the deeper part of the gland, in the upper and middle portions of the neck. 2) In the cytoplasm there are extensive amount of membrane comprising the intracellular canaliculus, tubulovesicular system, mitochondria, and the relatively small number of ribosomes. 3) The cytoplasm stains with eosin largely, nucleus are spherical.

		4) They produce HCl and intrinsic factor. 5) HCl is converted pepsinogen to the pepsin . 5) Intrinsic factor is a glycoprotein that complexes with vitamin B12 in the stomach and duodenum, a step necessary for subsequent absorption of the vitamin in the ileum.	
3.	Mucous neck cells	1) Cells are located in the neck region of the fundic gland. 2) Cells secrete less alkaline soluble mucus. 3) Cells are present in clusters or as single cells between parietal cells in the necks of gastric glands. 4) They are irregular in shape, with the nucleus at the base of the cell and the secretory granules near the apical surface.	
4.	Enteroendocrine cells	G cells	1) They are found at the base of the pyloric glands. 2) Nuclei is basally positioned and clear cytoplasm containing secretory granule 3) They are gastrin-secreting cells. 4) Gastrin stimulates parietal cells to secrete HCl
		D cells	1) Nuclei is basally positioned and clear cytoplasm containing secretory granule 2) They are somatostatin-secreting cells. 3) Somatostatin inhibits the release of gastrin by G cells.
5.	Stem cells	1) They are few in number and found in the neck region of the glands. 2) They are low columnar cells with basal nuclei and divide symmetrically. 3) Some of the daughter cells move upward to replace the pit and surface mucous cells, which have a turnover time of 4–7 days.	



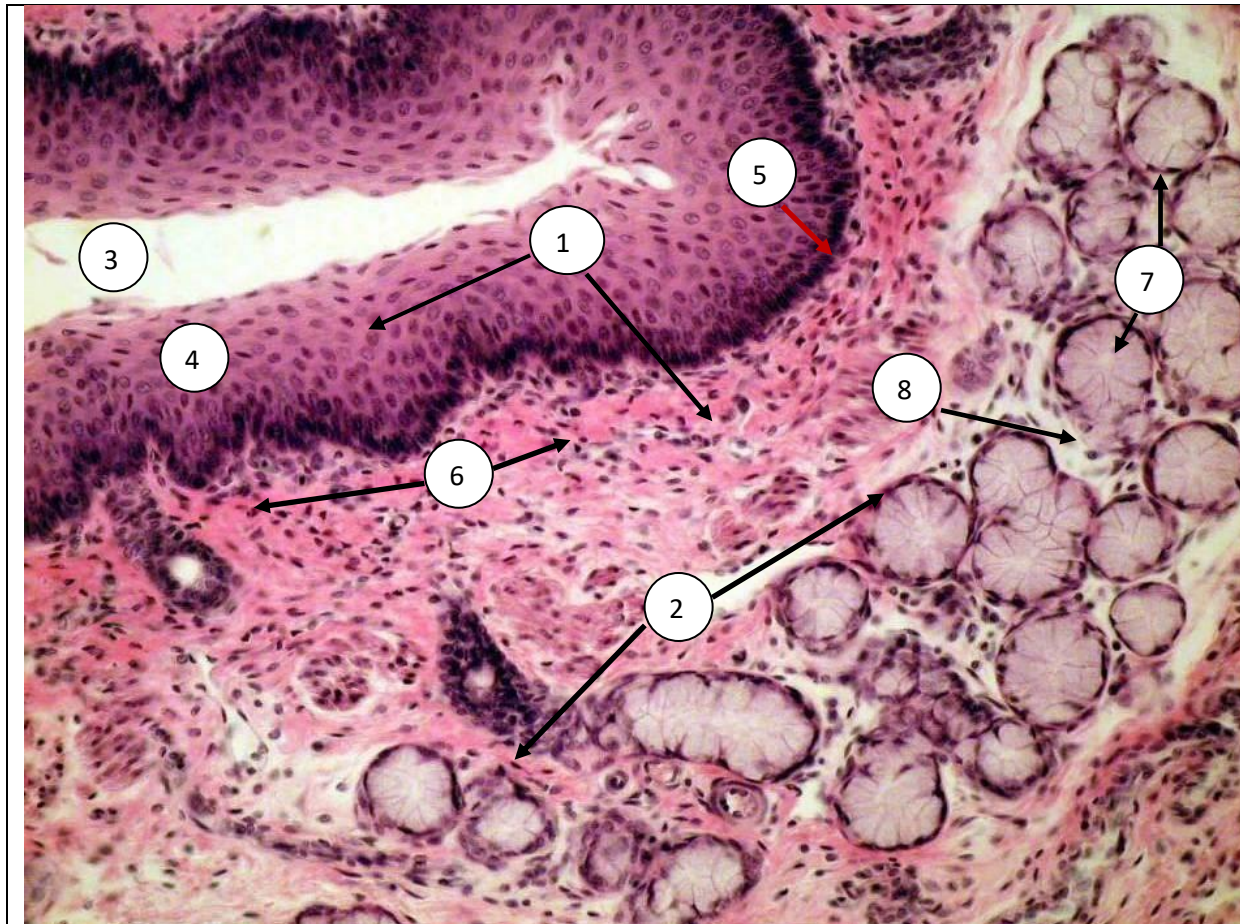
Esophagus
Magnification X 100.

On the preparation of the esophagus there are four layers of wall: mucosa (1), submucosa (2), muscularis externa (3) and adventitia (4). The space in the center of the organ is called the lumen (5).



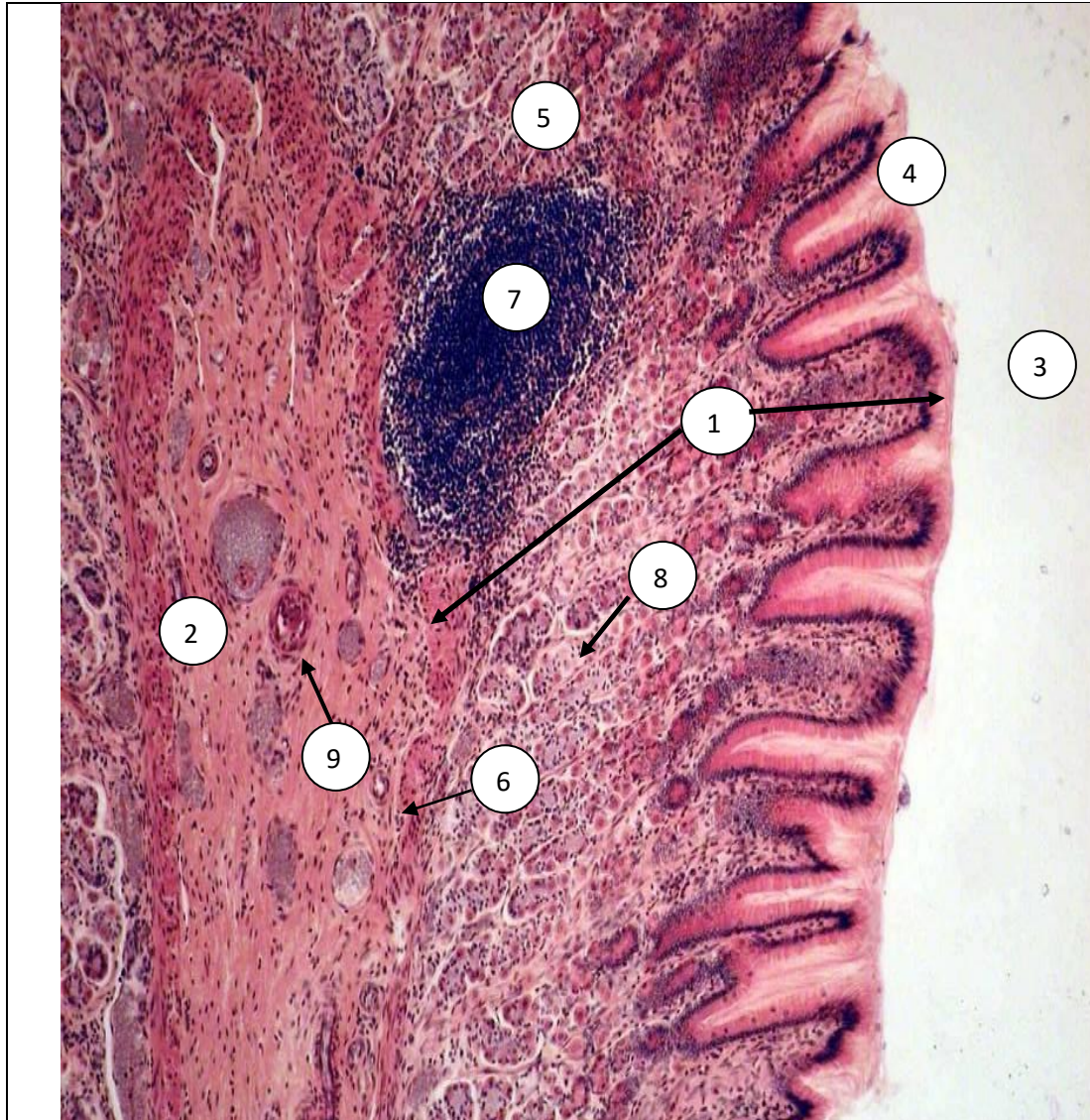
Esophagus
Magnification X 100.

On the preparation of the esophagus there are three layers of wall: mucosa (1), submucosa (2), muscularis externa (3) except adventitia. The space in the center of the organ is called the lumen (4). Muscularis externa consists of inner circular layer and outer longitudinal layer of muscle cells.



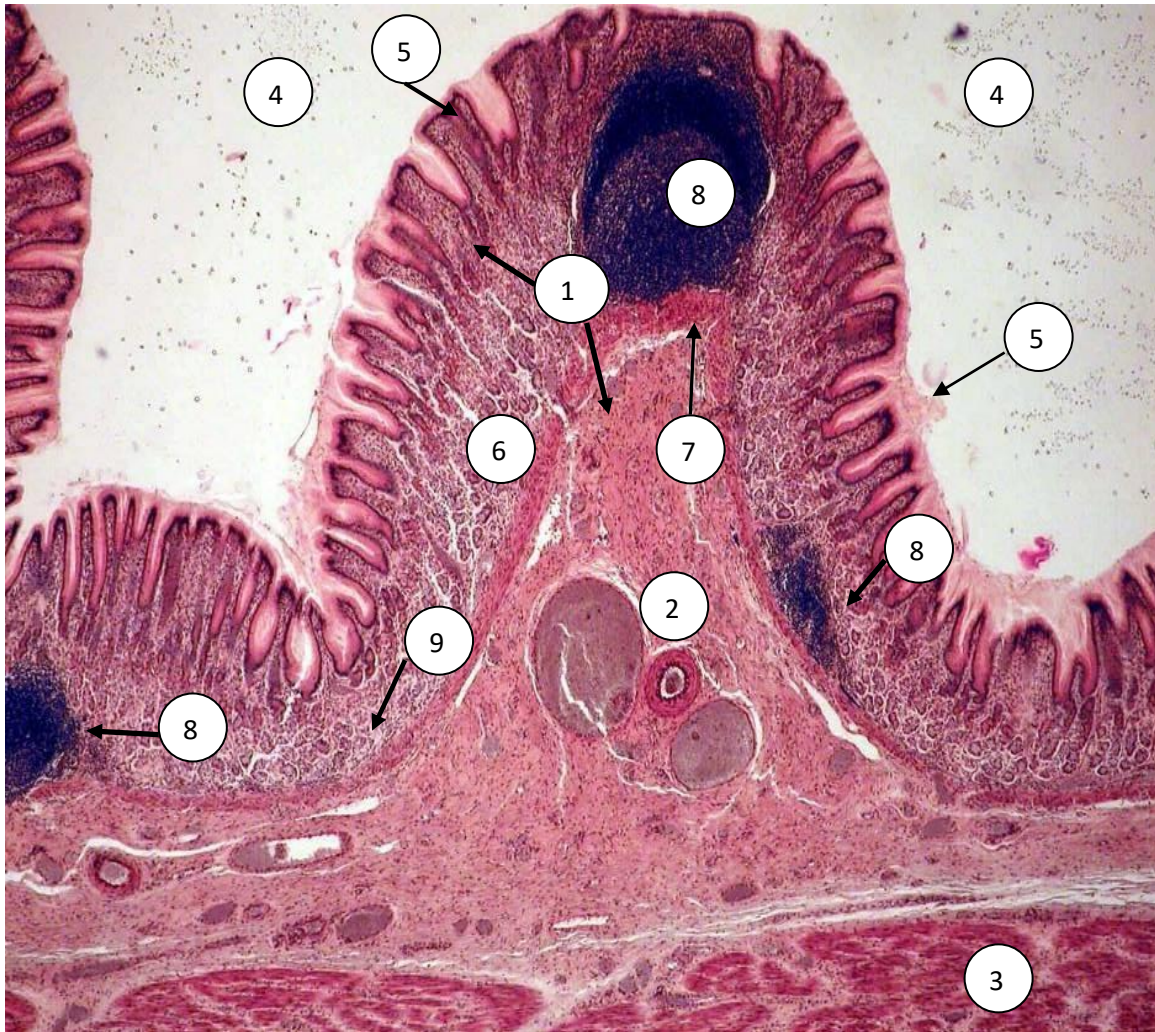
Esophagus Magnification X 100.

On the preparation of the esophagus there are two layers of wall: mucosa (1), submucosa (2) except muscularis externa and adventitia. The space in the center of the organ is called the lumen (3). Mucosa consists of stratified squamous epithelium (4), lamina propria (5) and muscularis mucosae (6). In the submucosa there are esophageal glands proper (7) and dense irregular connective tissue (8) with elastic fibers.



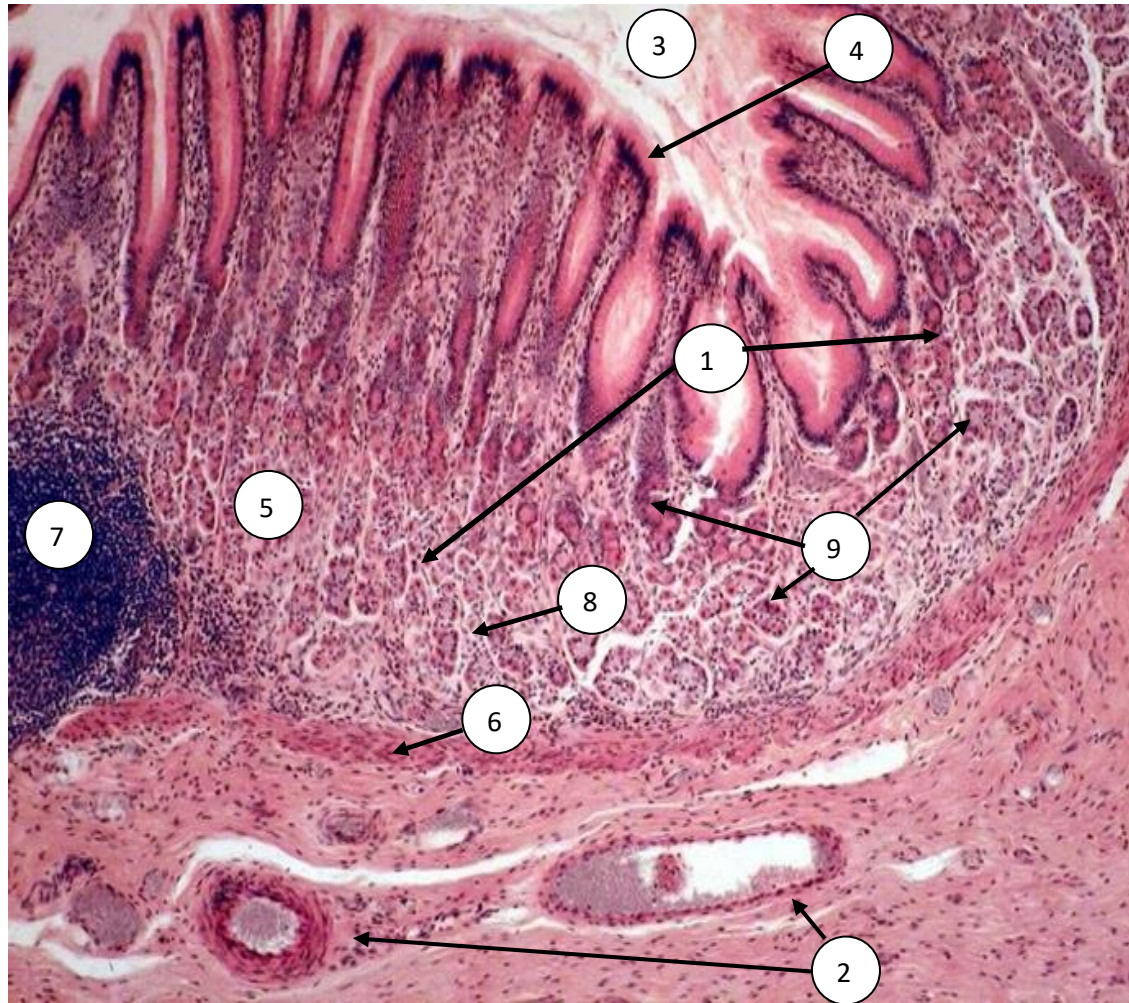
Stomach Magnification X 100.

On the preparation of the stomach there are two layers of wall: mucosa (1), submucosa (2), except muscularis externa and serosa. The space on the right is called the lumen (3). Mucosa consists of simple columnar epithelium (4), lamina propria (5) and lamina muscularis mucosae (6). In the lamina propria there are lymph follicles (7) and loose connective tissue (8). Submucosa (2) consists of dense irregular connective tissue and blood vessels (9).



Stomach Magnification X 40.

On the preparation of the stomach there are three layers of wall: mucosa (1), submucosa (2), muscularis externa (3) except serosa. The space in the upper right and left corners is called the lumen (4). Mucosa consists of simple columnar epithelium (5), lamina propria (6) and lamina muscularis mucosae (7). In the lamina propria there are lymph follicles (8) and loose connective tissue (9). Submucosa (2) consists of dense irregular connective tissue and blood vessels.



Stomach Magnification X 100.

On the preparation of the stomach there are two layers of wall: mucosa (1), submucosa (2), except muscularis externa and serosa. The space on the right is called the lumen (3). Mucosa consists of simple columnar epithelium (4), lamina propria (5) and lamina muscularis mucosae (6). In the lamina propria there are lymph follicles (7), loose connective tissue (8) and gastric glands (9). Submucosa (2) consists of dense irregular connective tissue and blood vessels (marked with arrows).



Stomach Magnification X 100.

On the preparation of the stomach there are two layers of wall: mucosa (1), submucosa (2), except muscularis externa and serosa. The space on the right is called the lumen (3). Mucosa consists of simple columnar epithelium (4), lamina propria (5) and lamina muscularis mucosae (6). In the lamina propria there are loose connective tissue (7) and gastric glands (8). Submucosa (2) consists of dense irregular connective tissue and blood vessels.

VOCABULARY

Esophageal cardiac glands (so called due to their similarity in structure to the cardiac glands in the stomach) are located in the lamina propria of the esophageal mucosa. They are found in the distal part of the esophagus. By structure, they are simple tubular glands.

Esophageal glands – are acinar, with cubic-shaped cells, located in the submucosa, which secrete mucus, bicarbonates and epidermal growth factor into the esophageal lumen through the collection system. Mucus performs mainly the function of lubrication, because, compared to the stomach, it does not create a noticeable viscous protective layer over the multilayer squamous epithelium. The released bicarbonate protects the mucosa by neutralizing the acid released during reflux, thereby increasing the pH to normal.

Gastric glands. There are 3 kinds of glands in the stomach: cardiac, gastric and pyloric glands, which are named based on the area in which they are located. These glands secrete digestive ferments and the mucous contents of the stomach. The gastric glands of the fundus/body play an important role in the production of gastric digestive juice, whereas the cardiac and pyloric glands mainly produce a mucous secretion that protects the stomach from the aggressive effects of hydrochloric acid and prevents self-digestion of the stomach.

Gastric pit made of superficial epithelium invaginations. They are connected to the gastric glands and therefore provide the flow of glandular secretions into the stomach lumen. The pits are covered by the same type of mucus-secreting surface epithelium that is present in the gastric mucosa. On histological section they are usually cut crosswise and not lengthwise, so they look like small round holes instead of tubular invaginations. Gastric pits and gastric glands are composed of the same 5 types of cells: stem cells, mucous neck cells, parietal cells, chief cells and enteroendocrine cells.

Gastric rugae. The interior wall (mucous membrane and submucosal layer) is folded into ridges known as rugae, or gastric folds, which enable the stomach to stretch during meals.

Cardiac glands and pyloric glands in general are characterized by the absence of parietal and chief cells, but have a large number of mucous neck cells. These departments are the transition zones between the stomach and other parts of the

gastrointestinal tract. Hence, the mucous secretion they release protects the esophagus and duodenum from the aggressive influence of gastric juice.

Links:

<https://www.sciencedirect.com/topics/immunology-and-microbiology/esophageal-gland>

<https://www.kenhub.com/en/library/anatomy/stomach-histology>

TESTS

1. The man of 35 years with a **stomach ulcer the resection** of antral department of stomach is made. Which secretion of **gastrointestinal hormone as a result** of operation will be broken most of all?

Gastrin

Secretin

Neurotenzin

Hystamine

Holecystokinin

2. At the patient at gastroscopy the insufficient quantity amount of **mucus on a surface of mucosa is revealed**. To what infringement of **function of stomach's cells** it is connected?

Columnar cells

Parietal cells

Endocrinocytes

Cervical cells

Chief cells

3. On histologic preparation the cross-section of **alimentary tubular organ's** wall which mucous shall **is covered by nonkeratinized epithelia** is submitted. What is the organ?

Esophagus

Uterus

Duodenun

Small intestine

Appendix

4. On the fourth week of embryonic developments **occurs physiological atresia of esophagus**. Up to the end of the eighth week it again becomes passable. What biological **process provides recanalisation of esophagus** at human embryo?

Apoptosis

Descumation

Meiosis

Necrosis

Mitosis

5. During histological examination of **the stomach** it was found out a significant reduction or complete **absence of parietal cells in the glands**. Mucose membrane of what part of the stomach was studied?

Pyloric part

Fundus of stomach

Cardia

Body of stomach

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6. When the pH level of the stomach lumen decreases to less than 3, the **antrum of the stomach releases peptide that acts in paracrine fashion to inhibit gastrin release**. This peptide is:

GIF

Acetylcholine

Gastrin-releasing peptide (GRP)

Somatostatin

Vasoactive intestinal peptide (VIP)

7. Examination of a 43 y.o. patient revealed that his stomach has difficulties with digestion of protein food. **Gastric juice analysis revealed low acidity**. Function of which **gastric cells is disturbed** in this case?

Parietal exocrinocytes

Main exocrinocytes
Mucous cells (mucocytes)
Endocrinous cells
Cervical mucocytes

8. An electron microphotography of a fragment of **proper gastric gland shows a big irregular round-shaped cell**. There are **a lot of intracellular tubules and mitochondria in the cytoplasm**. Specify this cell:

Parietal cell

Principal cell
Undifferentiated cell
Mucous cell
Endocrine cell

9. A patient ill with chronic gastritis went for endogastric pH-metry that allowed revealing **decreased acidity of gastric juice**. It is indicative of diminished function of the following cells:

Parietal exocrinocytes

Chief exocrinocytes
Endocrinocytes
Cervical cells
Accessory cells

10. A patient underwent gastroscopy that revealed **insufficient amount of mucus covering the mucous membrane**. This phenomenon is caused by the dysfunction of the following cells of stomach wall:

Cells of prismatic glandular epithelium

Parietal cells of gastric glands
Principal exocrinocytes of gastric glands
Cervical cells of gastric glands
Endocrinocytes

11. The 60 years old patient is suffering from chronic gastritis. At the endoscopy of the **stomach observed changes in the epithelium of the mucosa**. Which type of epithelium covers of the stomach mucosa?

Simple columnar mucous epithelium

Pseudostratified ciliated columnar epithelium

Simple squamous epithelium

Simple cuboidal epithelium

Simple columnar brush-border epithelium

12. The patients with burnings of the **esophagus was examined** by the doctor and found that lesions of the mucous membrane are not deep. Due to **which layer of cells will take place regeneration** of damaged epithelium.

Basal

Spinous

Grained

Intermediate

Surface

13. On histological slide represented a cross section of a **hollow organ wall**, which has a mucous membrane consist of **nonkeratinized stratified epithelium**. What kind of structure is it?

Esophagus

Duodenum

Colon

Uterus

Appendix

14. On microscopic examination **were presented striated muscle tissue of the digestive system**. In what kind of organ the biopsy was taken?

Esophagus

Stomach

Duodenum

Ileum
Appendix

15. A malignant **tumor** which developed from the transverse **striated muscle of a digestive system organ** was submitted for pathologic anatomic research. The biopsy was taken from which organ?

Upper portion of esophagus

Stomach
Duodenum
Ileum
Lower portion of esophagus

16. During microscopic research of the **digestive system organ** it was discovered that it has a mucous membrane that is covered with a **stratified squamous non-keratinized epithelium** and a **lamina propria that contains simple tubular glands**, definitive sections of which consist of mucous and a few parietal cells. What organs is it?

Esophagus

Stomach
Small intestine
Trachea
Urethra

17. A **digestive tract organ** was selected for histological research. The mucosal and submucosal membranes form longitudinal folds. The superficial surface of the mucous membrane is smooth and lined by a **stratified squamous non-keratinized epithelium**. Define this organ?

Esophagus

Stomach
Duodenum
Large intestine (colon)
Trachea

18. In a histological investigation of the **neck region of the stomach's proper gland** we identify **small cells with a high nuclear-cytoplasmic ratio and mitotic figures**. Define the function of these cells?

Regeneration of glandular epithelium

Protective

Endocrine

Ion Cl⁻ secretion

Pepsinogen secretion

19. Under the action of harmful factors occurred focal damage of the **epithelium of the stomach**. What kind of cell can **provide regeneration** process?

Mucous neck cells

Parietal cells

Chief cells

Enteroendocrine cells

Mucocytes

20. On the electronic microphotographs of **fundic glands** were determined **a large, pale and round to pyramidal cells**. They **have one or 2 central nuclei and acidophilic cytoplasm**. The many **mitochondria** indicate that their **secretory activity** is energy-dependent. What kind of cell they are?

Parietal (oxyntic) cells

Mucous neck cells

Undifferentiated cells

Enteroendocrine cells

Chief cells

21. Insulin injection did for assess the completeness of vagotomy accompanied by a **significant increase of ph of gastric juice**. Which **cells of gastric glands** controls this process?

Parietal cells

Enteroendocrine cells

Chief cells
Mucous neck cells
Undifferentiated cells

22. On the histological sections of **fundic glands** we can see as **large cells with acidophilic cytoplasm**. What kind of component of **gastric juice is produced as a result of the activity of these cells?**

Hydrochloric acid

Pepsinogen
Mucus
Serotonin
Gastrin

23. The 20 years old patient suffers from rheumatism appointed of prolonged use of aspirin. What is the structural component of the **mucous membrane of the stomach is best suited to provide her protection** from damage?

Simple columnar mucous epithelium

Connective tissue
Muscle tissue
Multi-ciliated epithelium
Stratified squamous nonkeratinized epithelium

24. The patient biopsy from the **stomach** shows histologically revealed a significant reduction or complete **absence of parietal cells in the glands**. Which layer of mucous membrane they studied?

Pylorus

Fundus of stomach
Cardiac part
Body of stomach

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25. In 42 years old patient after radiotherapy of cancer of the **stomach** developed **pernicious anemia due to damage cells by producing intrinsic factor**. Which cells of fundic glands were damaged?

Parietal cells

Mucous neck cells

Surface mucous cells

Enteroendocrine cells

Chief cells

26. In the embryonic material **was damaged endoderm**. What kind of changes of development may arise in this process?

Stomach

Heart

Kidneys

Aorta

Salivary glands

27. Damaged by exposure to **various factors of gastric mucosa can restore its integrity**. By which cells of gastric glands can occur their **regeneration**?

Mucous neck cells

Parietal cells

Paneth cells

Chief cells

Enteroendocrine cells

28. By ingestion of a foreign body in the **stomach was damaged epithelium** of the child. How the **cell regeneration process** possible?

Mucous neck cells

Chief cells

Parietal cells

Connective tissue cells

Fat cells

29. During the **fibrogastroscopy** of the patient revealed damage of the mucosa layer. By which cells will occur in the treatment of **epithelial regeneration**?

Poorly differentiated mucous neck cells

Chief cells

Parietal cells

Enteroendocrine cells

Paneth cells

30. During inflammatory diseases of the **stomach damaged surface epithelium of the gastric mucosa**. What kind of epithelium was damaged?

Simple columnar mucous epithelium

Stratified squamous nonkeratinized epithelium

Stratified squamous keratinized epithelium

Simple cuboidal epithelium

Stratified cuboidal epithelium

31. Analysis of biopsy material of human **gastric mucosa, gastritis patient showed a dramatic decrease in the number of parietal cells**. How will change the components of gastric juice?

Reduce acidity

Increased acidity

Increased gastric juice

Reduction of gastric juice

Reducing mucus production

32. Examination of a patient, suffering from **atrophic gastritis, revealed megaloblastic anemia**. The anemia is likely to be caused by the deficiency of the following substance:

Gastromucoproteid

Vitamin B6
Vitamin B1
Iron
Erythropoietins

33. A patient underwent **gastroscopy that revealed insufficient amount of mucus covering the mucous membrane**. This phenomenon is caused by the **dysfunction of the following cells of stomach wall**:

Cells of prismatic glandular epithelium

Parietal cells of gastric glands
Principal exocrinocytes of gastric glands
Cervical cells of gastric glands
Endocrinocytes

34. During the examination of the patient's oral cavity dentist noticed that his tongue is rough hypertrophic nipples, deep furrows. The doctor advised the patient to consult a gastroenterologist. The examination revealed that he had considerably **increased acidity of gastric juice**. Hyperfunction of which cells in the glands of the mucous membrane of the stomach mainly caused this condition?

Parietal cells of fundic glands

Chief cells
Additional mucocytes
Goblet cells
Exocrine pancreatocytes

35. The 60 years old patient is suffering from **chronic gastritis**. During an endoscopy of the stomach observed changes in **the epithelium of the mucosa**. What epithelium has undergone a change?

Simple columnar mucous epithelium

Connective tissue
Muscle tissue
Multi-ciliated epithelium

Stratified squamous nonkeratinized epithelium

37. A patient with **hypersecretion of a gastric juice is advised to stay away from a diet rich in broth and vegetable broth**, because they **stimulate gastric secretion** due to the following mechanism:

Stimulate gastrin production by endocrine cells

Irritate taste buds

Irritate mechanic receptors of oral cavity

Irritate mechanic receptors of stomach

Stimulate stimulating production in duodenum

38. A resection of the **stomach with the removal of pyloric substance was performed**. What process of the **stomach** will be affected?

Chyme transit into duodenum

Intestine peristaltic

Reabsorption

Juice secretion in duodenum

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39. A 45 year old man has complaints about the dysfunction of his **stomach**. During a complex investigation a **tumor was found in the epithelial tissue**. What cells gave development to this tumor?

Mucous neck cells

Chief (zymogenic)

Enteroendocrine cells

Surface mucous cells

Parietal cells

40. The glands at the bottom of the **stomach contain cells**, which with their own secretions weaken or **strengthen the formation of gastric juice components, gastric motility and activity of the pancreas**. What are these cells?

Gastropancreatic endocrine

Chief zymogenic cells
Parietal cells
Simple columnar cells
Mucous neck cells

41. Due to the deficit synthesis of **intrinsic factor (gastr mucoprotein)** we detect **pernicious anaemia of Addison-Beimer** in a patient, which **cells of the principal glands in a stomach** are damaged

Parietal

Chief (zymogenic) cells
Mucous neck cells
Endocrine cells
Surface mucous cells

42. During microscopic investigation we observe a **digestive tract organ, relief of which presents folds and fields**. What **epithelium is covering the mucous membrane of this organ?**

Simple columnar epithelium

Simple cuboidal
Simple squamous
Striated non keratinized squamous
EPseudostratified columnar epithelium

43. An **organ** is selected for morphological research. The **wall of which consists of a mucosal, submucosal, muscular and serous layers**. Name this organ?

Stomach

Esophagus
Small intestine
Large intestine(colon)
Urethra

44. After an **intragastric Ph measurement** a patient with chronic gastritis is diagnosed with the **reduced acidity of gastric juice**. What cell function is reduced?

Parietal

Chief

Enteroendocrine

Mucous neck cells

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45. **Pepsinogen** is produced by the stomach's principal cells. However secretions of **other cells of the stomach are required in order to activate pepsinogen in the cavity of the stomach**. What is the name of these cells?

Parietal

Chief

Mucous neck cells

Enterendocrine cells

Mucous cells

Links:

<https://www.testcentr.org.ua/en/exams/all-about-the-exams/about-medical-licensing-exams>

<https://www.testcentr.org.ua/banks/stomat/k1-stom-f-eng.pdf>

<https://www.testcentr.org.ua/banks/med/k1-med-f-eng.pdf>

<https://histology.pdmu.edu.ua/resources/new/two/krok-krok>