Topic 5. Large and small salivary glands.

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Histological structure of secretory portions			
Types		**Features**	**Morphological structure of cells**
1.	**Serous acinus**	1) It is consists of **serous secretory cells** and **myoepitheliocytes**. 2) Secretory portion has a rounded shape. 3) Myoepithelial cells are situated inside the basal lamina of the secretory units and the initial part of the duct system.	1) **Serous cells** produce proteins 2) **Serous cells** have rounded nuclei, rough ER in the basal third and protein-rich secretory basophilic granules in the basal part. 3) **Myoepitheliocytes** are well developed and branched (basket cells). 4) **Myoepitheliocytes** prevent distention of the secretory portion when the lumen is filled with a secret and their contraction accelerates movement of the product.
2.	**Mucous acinus**	1) It is consists of **mucous cells**. 2) Secretory portion has a rounded shape or tubular	1) The nuclei of **mucous cells** are flattened with condensed chromatin.

		shape.	2) The nuclei are located near the bases of the cells. 3) Cytoplasm includes hydrophilic glycoprotein mucins.
3.	**Mixed acinus**	1) It is consists of **mucous cells** and **serous secretory cells.** 2) Secretory portion are mucous tubules capped with serous cells. Such caps are called **serous demilunes.**	1) **Serous cells** have rounded nuclei, rough ER in the basal third and protein-rich secretory basophilic granules in the basal part. 2) **Mucous cells** have flattened nuclei which are located near the bases of the cells and cytoplasm with hydrophilic glycoprotein mucins.

Histological structure of duct system		
Part		**Features**
1.	**Intercalated duct**	1) It is lined by **simple cuboidal epithelium** 2) They are short ducts which connect with each other and form striated duct.
2.	**Striated duct**	1) It is lined by **simple columnar epithelium** 2) **Columnar cells have** striations which consist of folds of the basal plasma membrane. 3) The folds contain many **mitochondria** that provide adenosine triphosphate for active transport.
3.	**Lobar duct**	It is lined by pseudostratified or stratified cuboidal epithelium.
4.	**Excretory duct**	It is lined by stratified columnar epithelium.
5.	**Main duct**	It is lined by nonkeratinized stratified squamous epithelium.

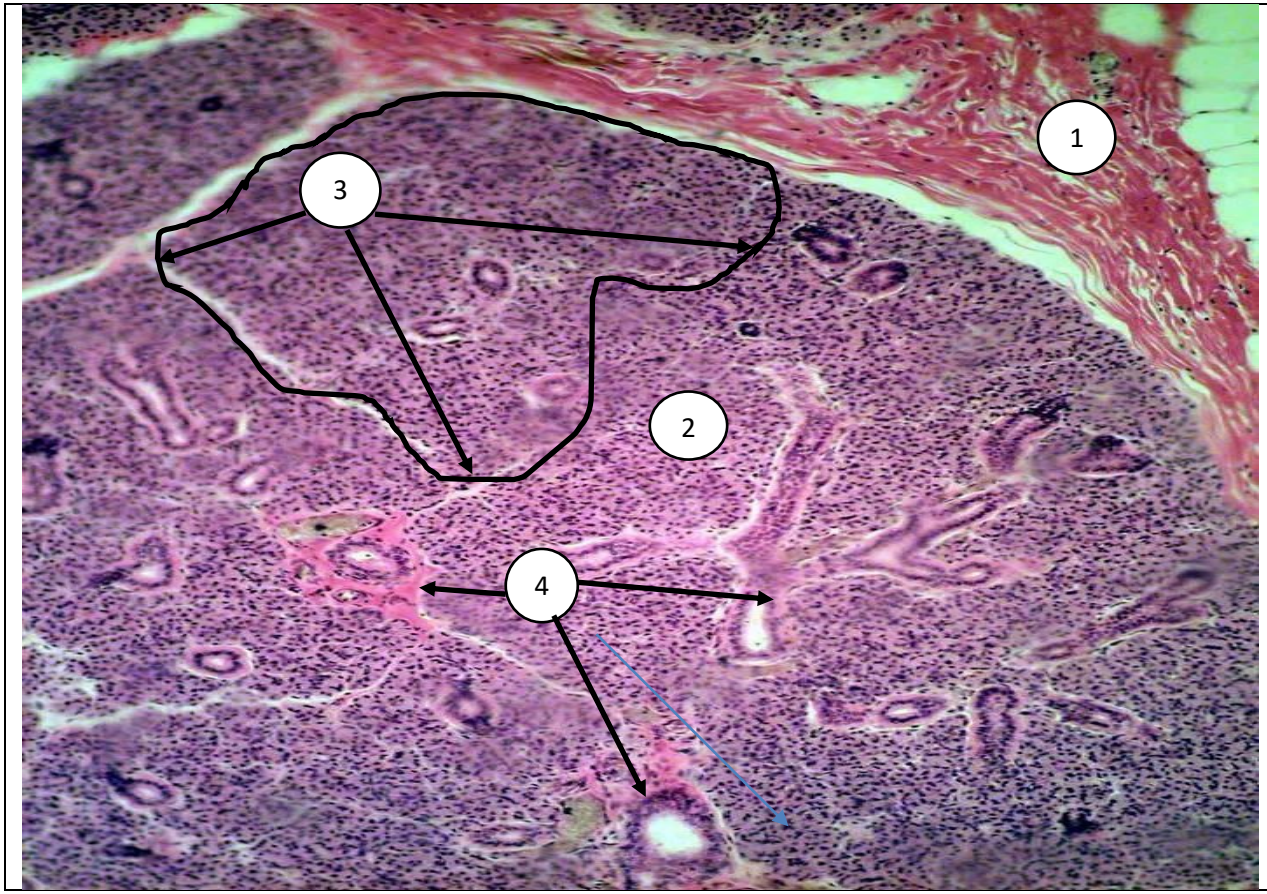
Parotid glands (have one type of secretory portions)			
Parts		**Features**	**Functions**
1.	**Serous acinus**	It includes **only serous acinuses.** They consist of **serous cells** and **myoepitheliocytes.** **1) Serous cells** have rounded nuclei, rough ER in the basal third and protein-rich secretory basophilic granules in the basal part. **2) Myoepitheliocytes** are well developed and branched (basket cells).	1) **Serous cells** produce proteins: -amylase and proline-rich proteins. 2) **Myoepitheliocytes** have contractile properties.
2.	**Intercalated ducts**	They are lined by simple cuboidal epithelium	They are short ducts which connect with each other and form striated duct.
3.	**Striated ducts**	1) They are lined by **simple columnar epithelium** 2) **Columnar cells have** striations which consist of folds of the basal plasma membrane. 3) The folds contain many **mitochondria** that provide adenosine triphosphate for active transport.	Such folds greatly increase the cell surface area, facilitating ion absorption, and are characteristic of cells specialized for ion transport.
4.	**Lobar ducts**	They are lined by pseudostratified or stratified cuboidal epithelium.	They collect the secret from the striated ducts and carry it to the excretory duct.
5.	**Excretory duct**	It is lined by stratified columnar epithelium.	It collects the secret from the lobar ducts to the main duct.
6.	**Main duct**	It is lined by nonkeratinized stratified squamous epithelium.	It carries the secret from the excretory duct to the oral cavity. It opens opposite the secondary upper molars
7.	**Capsule** consists of dense irregular connective tissue. **Septa** consist of loose connective tissue. They penetrate the gland and subdivide it into lobes and lobules.		

Submandibular glands (have two types of secretory portions)			
Parts		**Features**	**Functions**
1.	**Serous acinus**	They consist of **serous cells** and **myoepitheliocytes.** **1) Serous cells** have rounded nuclei, rough ER in the basal third and protein-rich secretory basophilic granules in the basal part. **2) Myoepitheliocytes** are well developed and branched (basket cells).	1) **Serous cells** produce proteins: -amylase and proline-rich proteins. 2) **Myoepitheliocytes** have contractile properties.
2.	**Mixed acinus**	1) It is consists of **mucous cells** and **serous secretory cells.** 2) Secretory portion are mucous tubules capped with serous cells. Such caps are called **serous demilunes.**	1) **Serous cells** have rounded nuclei, rough ER in the basal third and protein-rich secretory basophilic granules in the basal part. 2) **Mucous cells** have flattened nuclei which are located near the bases of the cells and cytoplasm with hydrophilic glycoprotein mucins.
3.	**Intercalated ducts**	They are lined by simple cuboidal epithelium	They are short ducts which connect with each other and form striated duct.
4.	**Striated ducts**	1) They are lined by **simple columnar epithelium** 2) **Columnar cells have** striations which consist of folds of the basal plasma membrane. 3) The folds contain many **mitochondria** that provide adenosine triphosphate for active transport.	Such folds greatly increase the cell surface area, facilitating ion absorption, and are characteristic of cells specialized for ion transport.
5.	**Lobar ducts**	They are lined by pseudostratified or stratified cuboidal epithelium.	They collect the secret from the striated ducts and carry it to the excretory duct.
6.	**Excretory duct**	It is lined by stratified columnar epithelium.	It collects the secret from the lobar ducts to the main duct.

7.	**Main duct**	It is lined by nonkeratinized stratified squamous epithelium.	It carries the secret from the excretory duct to the oral cavity. It opens into the oral cavity at the sublingual caruncles on both sides of the frenulum linguae.
8.	**Capsule** consists of dense irregular connective tissue. **Septa** consist of loose connective tissue. They penetrate the gland and subdivide it into lobes and lobules.		

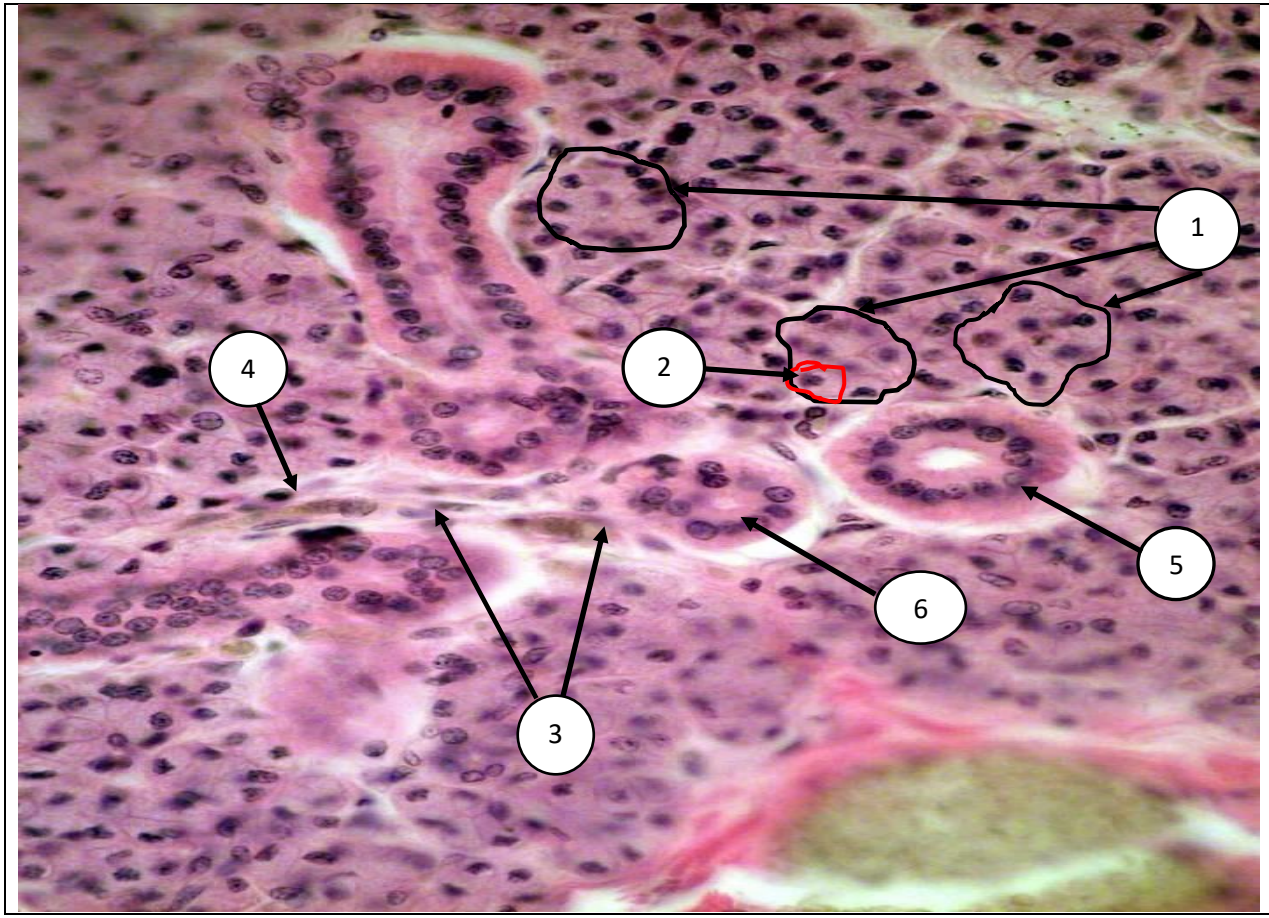
Sublingual glands (have three types of secretory portions)			
Parts		**Features**	**Functions**
1.	**Mucous acinus**	1) It is consists of **mucous cells**. 2) Secretory portion has a rounded shape or tubular shape. 3) They are prevail over others types of secretory portions.	1) The nuclei of **mucous cells** are flattened with condensed chromatin. 2) The nuclei are located near the bases of the cells. 3) Cytoplasm includes hydrophilic glycoprotein mucins.
2.	**Mixed acinus**	1) It is consists of **mucous cells** and **serous secretory cells.** 2) Secretory portion are mucous tubules capped with serous cells. Such caps are called **serous demilunes.**	1) **Serous cells** have rounded nuclei, rough ER in the basal third and protein-rich secretory basophilic granules in the basal part. 2) **Mucous cells** have flattened nuclei which are located near the bases of the cells and cytoplasm with hydrophilic glycoprotein mucins.
3.	**Serous acinus**	They consist of **serous cells** and **myoepitheliocytes.** **1) Serous cells** have rounded nuclei, rough ER in the basal third and protein-rich secretory basophilic granules in the	1) **Serous cells** produce proteins: -amylase and proline-rich proteins.

		basal part. **2) Myoepitheliocytes** are well developed and branched (basket cells).	2) **Myoepitheliocytes** have contractile properties.
4.	**Intercalated ducts**	They are lined by simple cuboidal epithelium	They are short ducts which connect with each other and form striated duct.
5.	**Striated ducts**	1) They are lined by **simple columnar epithelium** 2) **Columnar cells have** striations which consist of folds of the basal plasma membrane. 3) The folds contain many **mitochondria** that provide adenosine triphosphate for active transport.	Such folds greatly increase the cell surface area, facilitating ion absorption, and are characteristic of cells specialized for ion transport.
6.	**Lobar ducts**	They are lined by pseudostratified or stratified cuboidal epithelium.	They collect the secret from the striated ducts and carry it to the excretory duct.
7.	**Excretory duct**	It is lined by stratified columnar epithelium.	It collects the secret from the lobar ducts to the main duct.
8.	**Main duct**	It is lined by nonkeratinized stratified squamous epithelium.	It carries the secret from the excretory duct to the oral cavity. This glands have about 8 to 20 small ducts, which open into the crest of the sublingual fold on the floor of the oral cavity.
9.	**Capsule** consists of dense irregular connective tissue. **Septa** consist of loose connective tissue. They penetrate the gland and subdivide it into lobes and lobules.		



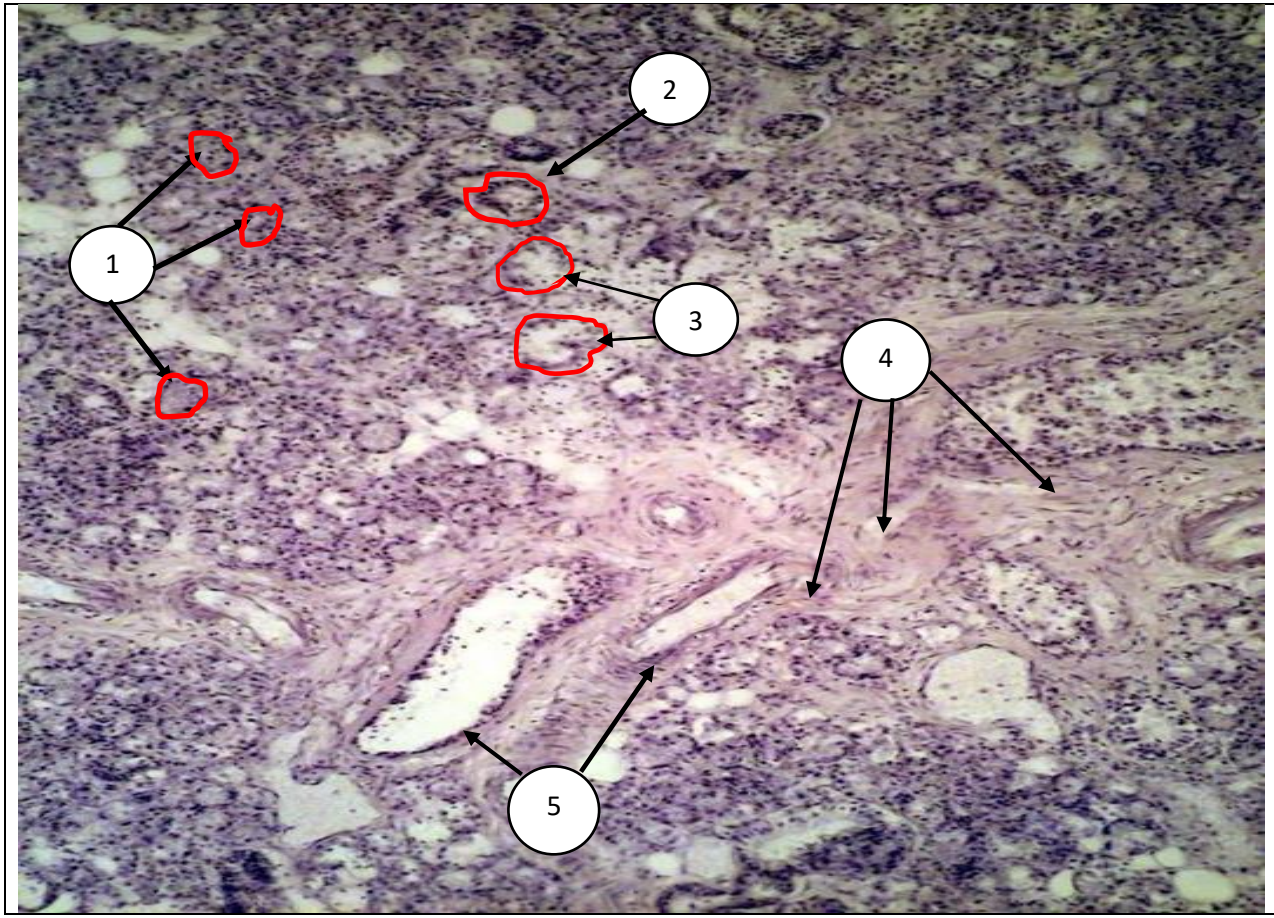
Parotid salivary gland
Magnification X 40, hematoxylin-eosin staining.

On preparations of a cross section of a parotid gland there are capsule (1) which is consist of dense connective tissue. Under the capsule there is the parenchyma of the gland (2). The parenchyma consist of lobules (3). Between the lobes there are layers of interlobular connective tissue (4), containing blood vessels and ducts.



Lobule of parotid salivary gland
Magnification X 100, hematoxylin-eosin staining

On the preparation of the cross section of the parotid gland there are alveolar secretory portions (1), consisting of serous secretory epitheliocytes (2). Between the secretory portions there are layers of loose connective tissue (3) which include blood vessels (4), striated (5) and intercalated ducts (6).



Sublingual gland
Magnification X 40, hematoxylin-eosin staining.

On a preparation of a cross section of Sublingual gland's lobe there are alveolar secretory portions: serous (1), mixed (2), mucous (3). Between the lobes of the gland there is loose connective tissue (4) which contains blood vessels (5).

VOCABULARY

Large salivary glands are paired symmetrical glands with long excretory ducts. They consist of submandibular, sublingual and parotid glands. These glands are composed of two general types of secretory cells - serous and mucous one and a duct system. Mucous cells are usually cuboidal to columnar in the shape. They are mucus-secreting cells. Each salivary gland originates from the oral cavity epithelium, in the process of its development.

Small salivary glands - are situated in the submucosa of various parts of the oral cavity. They include palatal, lingual, labial, buccal and molar glands. Small glands release highly glycosylated mucins containing blood group factors and are possibly active in the process of tissue lubrication. They also produce some antimicrobial proteins and immunoglobulins, and the tongue serous (von Ebner) glands secrete food enzymes and proteins that are likely to contribute to taste sensation.

Serous cells are generally of pyramidal shape, with a wide base that is resting on the basal lamina and a narrow apical surface with short, irregular microvilli facing the lumen. Serous acinar cells contain discrete secretory granules, which can be seen more clearly electronmicroscopically. The secretory granules contain protein and glycoprotein. The serous acinar cells contain rough endoplasmic reticulum, where protein is produced by the ribosomes.

Mucous cells - are seen light microscopically to contain a diffuse mass of secretory material that is weakly stained. They are seen electronmicroscopically to be packed with secretory granules. Electronmicroscopic histochemistry shows that mucous secretory granules are bipartite with little protein and extensive mucin in separate compartments. Rough endoplasmic reticulum, Golgi apparatus, and mitochondria are difficult to discern, and the nucleus is irregular in outline and usually at the base of the cell.

Myoepithelial cells - contractile cells associated with the secretory end-pieces. They are branching or stellate-shaped cells with processes containing actin and myosin that embrace the secretory cells. Although their structural and functional characteristics are similar to those of smooth muscle cells, myoepithelial cells are derived from epithelium are found on the epithelial surface of the basal lamina and reside on the epithelial side of the basal lamina. The myoepithelial cells provide support for the secretory cells and their contraction helps to expel saliva from the end-pieces into the ductal system.

Terminal secretory unit – is a functional subunit of the salivary gland which is called an acinus. Despite its size and

location, the terminal secretory compartment is composed of epithelial secretory cells, namely serous and mucous acini. The serous and mucosal cells, together with myoepithelial cells, are organised in acinuses, which are mostly spherical or tubular in shape and have a central drain.

Intercalated ducts - small ducts in salivary glands connecting the secretory cells to larger striated ducts.

Striated ducts - intralobular salivary ducts with a striated appearance due to membrane infoldings and aligned mitochondria; active in electrolyte secretion and absorption.

Terminal excretory ducts – these ducts are arranged within the connective tissue between gland lobules and are wider in diameter than the striated duct. These ducts are covered with pseudostratified epithelium with columnar cells extended from the basal lamina into the luminal space of the duct and small basal cells placed on the basal lamina. In the process of fusion of small ducts into large excretory ducts, the number of basal cells grows, and dispersed mucous (goblet) cells are also observed. The main excretory duct may become stratified near the oral opening. Brush cells with long microvilli and apical vesicles are visible, which are assumed to be receptor cells because they show nerve endings close to the basal part of the cell. Dendritic cells are also prominent and play an important role in immune defence.

Hand AR, Pathmanathan D, Field RB. Morphological features of the minor salivary glands. *Arch Oral Biol*. 1999;44 Suppl 1:S3-S10. doi:10.1016/s0003-9969(99)90002-x

Links:

https://entokey.com/salivary-gland-histology/
https://www.sciencedirect.com/science/article/pii/B0123868602006286
https://www.intechopen.com/chapters/63843

TESTS

1. The micropreparation of the **submandibular salivary** gland indicates a number of **basket-shaped cells** focused **around the acini and the excretory ducts.** These **cells surround the bases of serous cells and are called myoepithelial cells**. What tissue do these cells belong to?

Muscular tissue

Epithelial tissue
Neural tissue
Special connective tissue
Loose fibrous connective tissue

2. What **substance** is responsible for **making saliva viscous and mucous** and **provides a protective function**, in particular, **protection against mechanical damage to the oral mucosa**?
Mucin
Glucose
Kallikrein
Amylase
Lysozyme

3. A histological preparation made from the **gland** revealed **acini containing 10-15 conical cells with basophilic cytoplasm**, a **round nucleus** and a well-developed **granular endoplasmic reticulum**. The acini are surrounded by the **basement membrane, which contains myoepithelial cells** in the extensions. The section from which organ is shown on the specimen?
Parotid salivary glands
Pancreas
Lungs
Sublingual
Liver

4. An **abnormality in the development of a newborn** in the form of a **disorder of the structure of the major salivary glands** has been detected. As a result of damage to which **embryonic germ**, this pathology was created?
Ectoderm
Splanchnotom
Somites
Entoderm

Mesenchyme

5. The histologic specimen of the **submandibular gland** demonstrates the **excretory duct**. The mucous membrane of the **duct is lined with cuboidal epithelium**, the cells of which **have poorly developed organelles**. What is the excretory duct?
Intercalated
Striated
Interlobular
Common excretory
-
6. The micropreparation of the **parotid gland shows secretory acini** with **serous cells that synthesize mainly enzymes**. Based on the **chemical composition classification, the parotid gland belongs to** the following glands:
Serous
Mucous
Seromucous
Enzymatic
-

7. The examination of a microsection from an unidentified **organ** revealed several **acini containing 10-15 cone-shaped cells with basophilic cytoplasm, a round nucleus, and a well-developed rough endoplasmic reticulum**. The acinar is surrounded by the basement membrane, in the branches of which **myoepithelial cells** are localized. What organ is the section made of?
Parotid gland
Pancreas
Lungs
Sublingual gland
Liver

8. **Submandibular salivary gland** is known to have **mucous end sections consisting of mucocytes**. What are the characteristics of these cells?

Flattened nucleus and light cytoplasm
Basophilic cytoplasm
Rounded nucleus in the center of the cell
Microvilli
Basal striation

9. Certain **diseases** of the salivary glands are associated with **dysfunction of their excretory ducts**. **What types of salivary gland ducts** are distinguished?
Intra-, interlobular duct and common duct
Intralobular ducts, striated and common duct
Glistering, striated and common duct
Intra-, interlobular ducts
Intralobular ducts and outside the gland ducts

10. The examination of the histologic specimen of the **gland** reveals only **serous terminal portions**. The interlobular connective tissue shows ducts lined with bilayer or multilayer epithelium. Identify this structure.
Parotid gland
Submandibular salivary gland
Pancreas
Sublingual salivary gland
Liver

11. It has been proven that the secret of the **parotid gland** is excreted in the oral cavity through the ducts. Some **ducts are lined by epitheliocytes with basal striations and microvilli**. Which duct is characterized by the following features?
Striated ducts
Excretory ducts
Intralobular ducts
Intercalated ducts
Interlobular

12. Many small **salivary gland ducts open to the surface of the tongue**, which is an atypical topographic location for the glands. Indicate the **position of the salivary gland of the tongue**?

Muscularis mucosae
Mucous membrane
Submucosa
Epithelium of the tongue superior surface
Epithelium of the tongue inferior surface

13. For medical reasons, a 47-year-old patient had one of his **salivary glands removed**, after which the content of **amylase in his saliva decreased rapidly**. Which gland was deleted?

Parotid
Buccal
Submucosa
Gingival
Sublingual

14. In the **parotid salivary glands**, a viral process causes rapid **sclerosis of the parenchyma** and a **decrease in the production of biologically active hormones**. This **disrupts the regeneration** of the oral mucosa. What is absent in saliva?

Growth factors of epithelium
Interstitial cell-stimulation factors
Colony-stimulating factors(CSF)
Lysozyme
Parotin

15. The **epithelium of the interlobular excretory ducts is affected** as a result of chronic inflammation of the parotid gland. What epithelium is damaged?

Slightly stratified epithelium
Stratified columnar
Simple squamous

Stratified ciliated
-

16. The **secretory compartments of the parotid glands** have been damaged as a result of acute inflammation. Which cells will be affected as a result?
Serous and myoepithelial cells
Serous and mucosus
Myoepithelial
Serous and mucosus
Mucosus and myoepithelial cells

17. In the preparation of the extracted salivary gland, we detect a small stone in the **duct**, the wall of which **is lined with stratified squamous epithelium**. In which duct was the stone found?
Excretory ducts
Interlobular
Striated
Intercalated
Intercellular

Links:
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