Saliva

- **Reference Books:**

- **Text Book of Medical physiology** (Guyton and Hall) Eleventh edition

- **Fundamentals of Clinical Chemistry** (Tietz) Sixth

Saliva:

Mixture of oral fluids (Salivary glands secretions, cellular materials and food debris).

- Daily secretion of saliva normally ranges between 800 and 1500 milliliters, as shown by the average value of 1000 milliliters.
- Saliva contains two major types of protein secretion:

(1) a *serous secretion* that contains *ptyalin* (an α-amylase), which is an enzyme for digesting starches.

(2) *mucus secretion* that contains *mucin* for lubricating and for surface protective purposes.

- Saliva has a pH between 6.0 and 7.0, a favorable range for the digestive action of ptyalin.

Salivary glands:

The glands in the mouth that produce saliva.

There are three pairs secrete saliva into mouth via ducts.

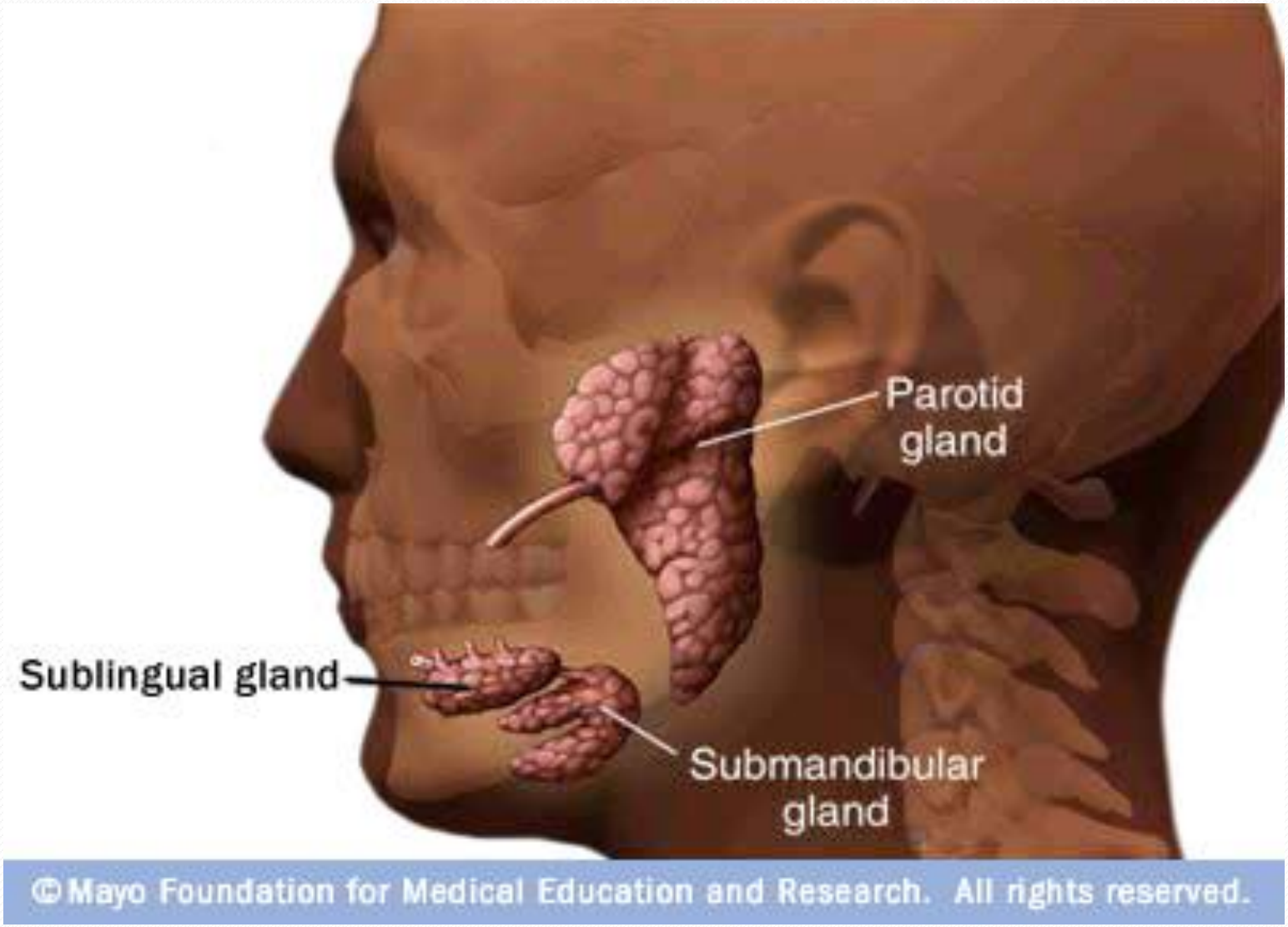
Each of these glands is paired.

1- Parotid. located in front of the ears.

2-Submandibular (submaxillary). Under the mandible (lower jaw).

3-sublingual glands. under the tongue.

Most of the mucosal surfaces within the mouth also contain many minor mucus-secreting salivary glands


Parotid gland
Sublingual gland
Submandibular gland
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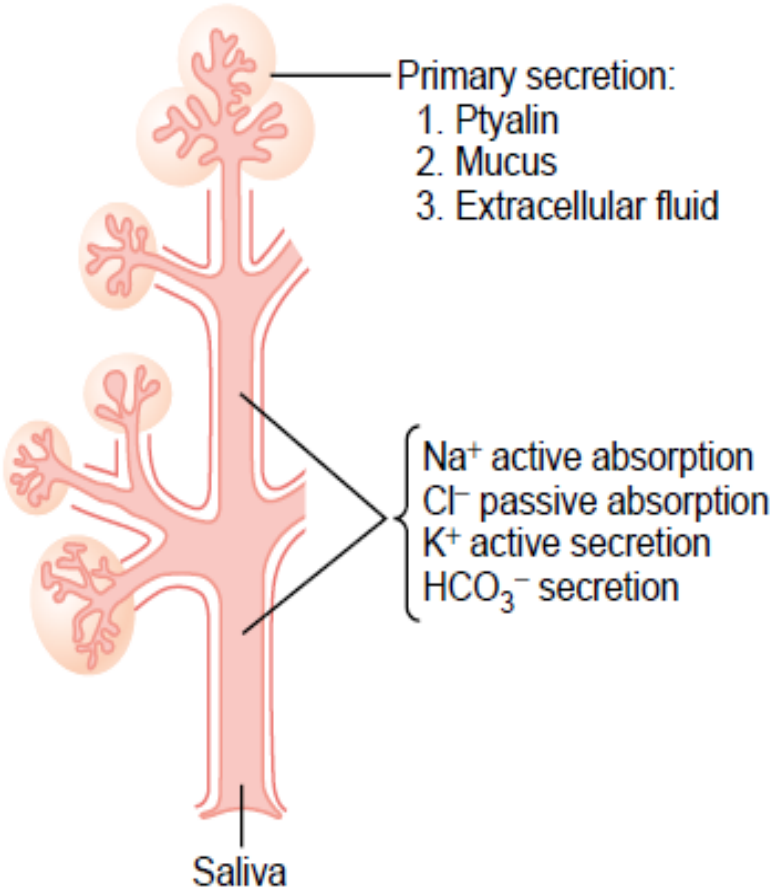
Secretion of Ions in Saliva:

- Saliva contains especially large quantities of potassium and bicarbonate ions. the concentrations of both sodium and chloride ions are several times less in saliva than in plasma.

- Salivary secretion is a two-stage operation: the first stage involves the acini, and the second, the salivary ducts. The acini secrete a primary secretion that contains ptyalin and/or mucin in a solution of ions in concentrations not greatly different from those of typical extracellular fluid. As the primary secretion flows through the ducts, two major active transport processes take place that markedly modify the ionic composition of the fluid in the saliva.

Formation and secretion of saliva by a submandibular salivary gland



- **First,** sodium ions are actively reabsorbed from all the salivary ducts and potassium ions are actively secreted in exchange for the sodium. Therefore, the sodium ion concentration of the saliva becomes greatly reduced, whereas the potassium ion concentration becomes increased. However, there is excess sodium reabsorption over potassium secretion, and this creates electrical negativity of about -70 millivolts in the salivary ducts; this in turn causes chloride ions to be reabsorbed passively. Therefore, the chloride ion concentration in the salivary fluid falls to a very low level, matching the ductal decrease in sodium ion concentration.

- **Second,** bicarbonate ions are secreted by the ductal epithelium into the lumen of the duct. This is at least partly caused by passive exchange of bicarbonate for chloride ions, but it may also result partly from an active secretory process.
- **Under resting conditions,**

1) The concentrations of sodium and chloride ions in the saliva are only about 15 mEq/L each, about one seventh to one tenth their concentrations in plasma.

2) The concentration of potassium ions is about 30 mEq/L, seven times as great as in plasma; and the concentration of bicarbonate ions is 50 to 70 mEq/L, about two to three times that of plasma.

- **During maximal salivation**
- The salivary ionic concentrations change considerably because the rate of formation of primary secretion by the acini can increase as much as 20-fold. This acinar secretion then flows through the ducts so rapidly that the ductal reconditioning of the secretion is considerably reduced. Therefore, when abundant quantities of saliva are being secreted, the sodium chloride concentration rises only to one half or two thirds that of plasma, and the potassium concentration rises to only four times that of plasma.

Function of Saliva for Oral Hygiene.

- In awake conditions 0.5 ml of saliva is secreted every one minute but during sleep, secretion becomes very little.
- Saliva secretion plays an important role for maintaining healthy oral tissues. The mouth is loaded with pathogenic bacteria that can easily destroy tissues and cause dental caries. Saliva helps prevent the deteriorative processes in several ways.
- First, the flow of saliva itself helps wash away pathogenic bacteria as well as food particles that provide their metabolic support.

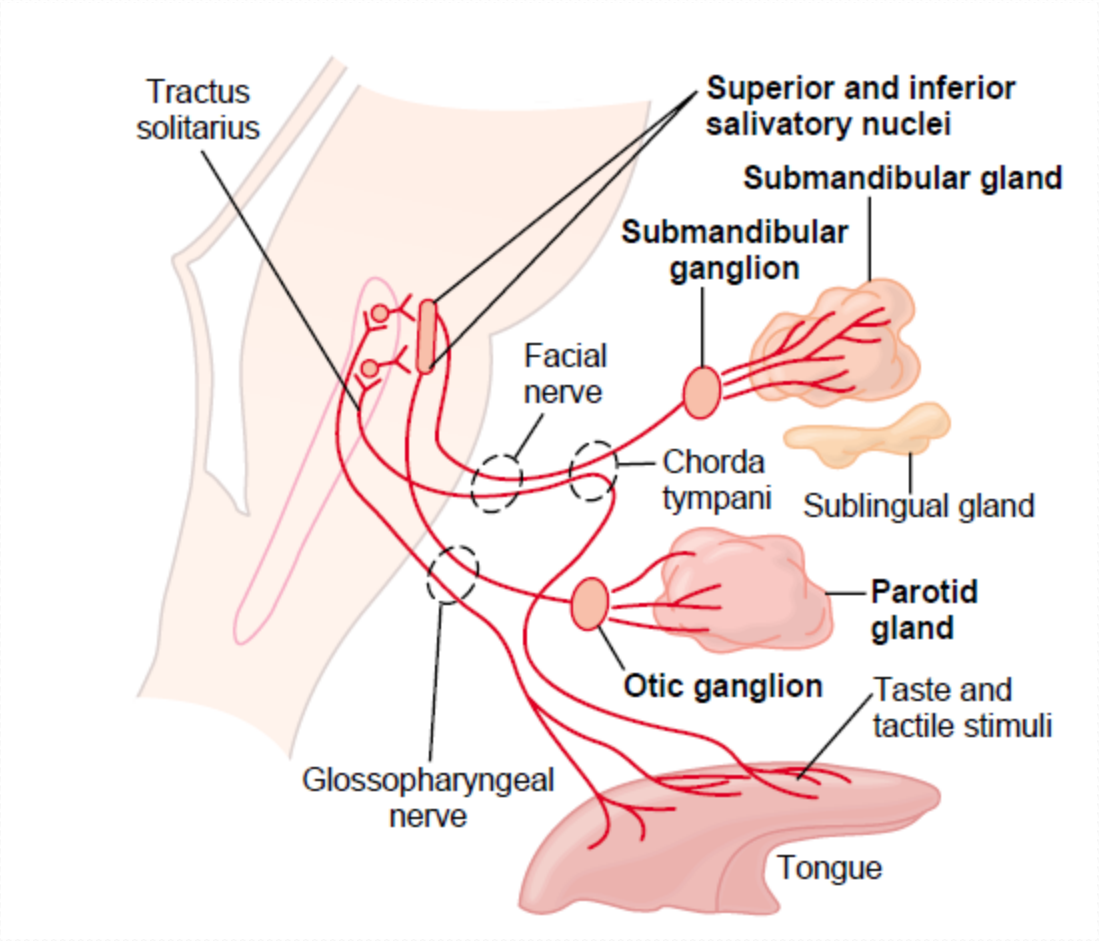
- Second, saliva contains several factors that destroy bacteria. One of these is thiocyanate ions and another is several proteolytic enzymes most important, lysozyme that (a) attack the bacteria, (b) aid the thiocyanate ions in entering the bacteria where these ions in turn become bactericidal, and (c) digest food particles, thus helping further to remove the bacterial metabolic support.
- Third, saliva often contains significant amounts of protein antibodies that can destroy oral bacteria, including some that cause dental caries. In the absence of salivation, oral tissues often become ulcerated and otherwise infected, and caries of the teeth can become extensive.

Nervous Regulation of Salivary Secretion:

- The salivary glands are controlled mainly by parasympathetic nervous signals all the way from the superior and inferior salivatory nuclei in the brain stem.
- The salivatory nuclei are located approximately at the juncture of the medulla and pons and are excited by both taste and tactile stimuli from the tongue and other areas of the mouth and pharynx.

- Many taste stimuli, especially the sour taste (caused by acids), produce abundant secretion of saliva often 8 to 20 times the basal rate of secretion. Also, certain tactile stimuli, such as the presence of smooth objects in the mouth (e.g., a pebble), cause marked salivation, whereas rough objects cause less salivation and occasionally even inhibit salivation.

Parasympathetic nervous regulation of salivary secretion



- Salivation can also be stimulated or inhibited by nervous signals arriving in the salivatory nuclei from higher centers of the central nervous system. For instance, when a person smells or eats favorite foods, salivation is greater than when disliked food is smelled or eaten. The *appetite area* of the brain, which partially regulates these effects, is located in proximity to the parasympathetic centers of the anterior hypothalamus, and it functions to a great extent in response to signals from the taste and smell areas of the cerebral cortex or amygdala.

- Salivation also occurs in response to reflexes originating in the stomach and upper small intestines particularly when irritating foods are swallowed or when a person is nauseated because of some gastrointestinal abnormality. The saliva, when swallowed, helps to remove the irritating factor in the gastrointestinal tract by diluting or neutralizing the irritant substances.
- *Sympathetic stimulation* can also increase salivation a slight amount, much less so than does parasympathetic stimulation. The sympathetic nerves originate from the superior cervical ganglia and travel along the surfaces of the blood vessel walls to the salivary glands.

- A secondary factor that also affects salivary secretion is the blood supply to the glands because secretion always requires adequate nutrients from the blood. The parasympathetic nerve signals that induce copious salivation also moderately dilate the blood vessels. In addition, salivation itself directly dilates the blood vessels, thus providing increased salivary gland nutrition as needed by the secreting cells. Part of this additional vasodilator effect is caused by kallikrein secreted by the activated salivary cells, which in turn acts as an enzyme to split one of the blood proteins, an alpha 2-globulin, to form bradykinin, a strong vasodilator.

Saliva (Tests)

- Saliva is easy to access and collection is non-invasive
- Used to identify individuals with disease (presence of biomarkers) and to monitor progress under treatment
- Viral infections such as human immunodeficiency virus (HIV), herpes, hepatitis C, and Epstein-Barr virus infection → polymerase chain reaction (PCR) techniques
- Bacterial infections, such as Helicobacter pylori, can likewise be detected in saliva

Saliva (clinical disorders)

- Abnormal production of the salivary glands can cause serious complications & adverse effects to salivary functions.
- Xerostomia (dry mouth) is caused by impaired salivary secretion
- Congenital or develop as part of an autoimmune process
- Decrease in secretion → reduces pH in the oral cavity → tooth decay and is associated with esophageal erosions → difficulty swallowing.