GI PHYSIOLOGY CONFERENCE

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SWALLOWING

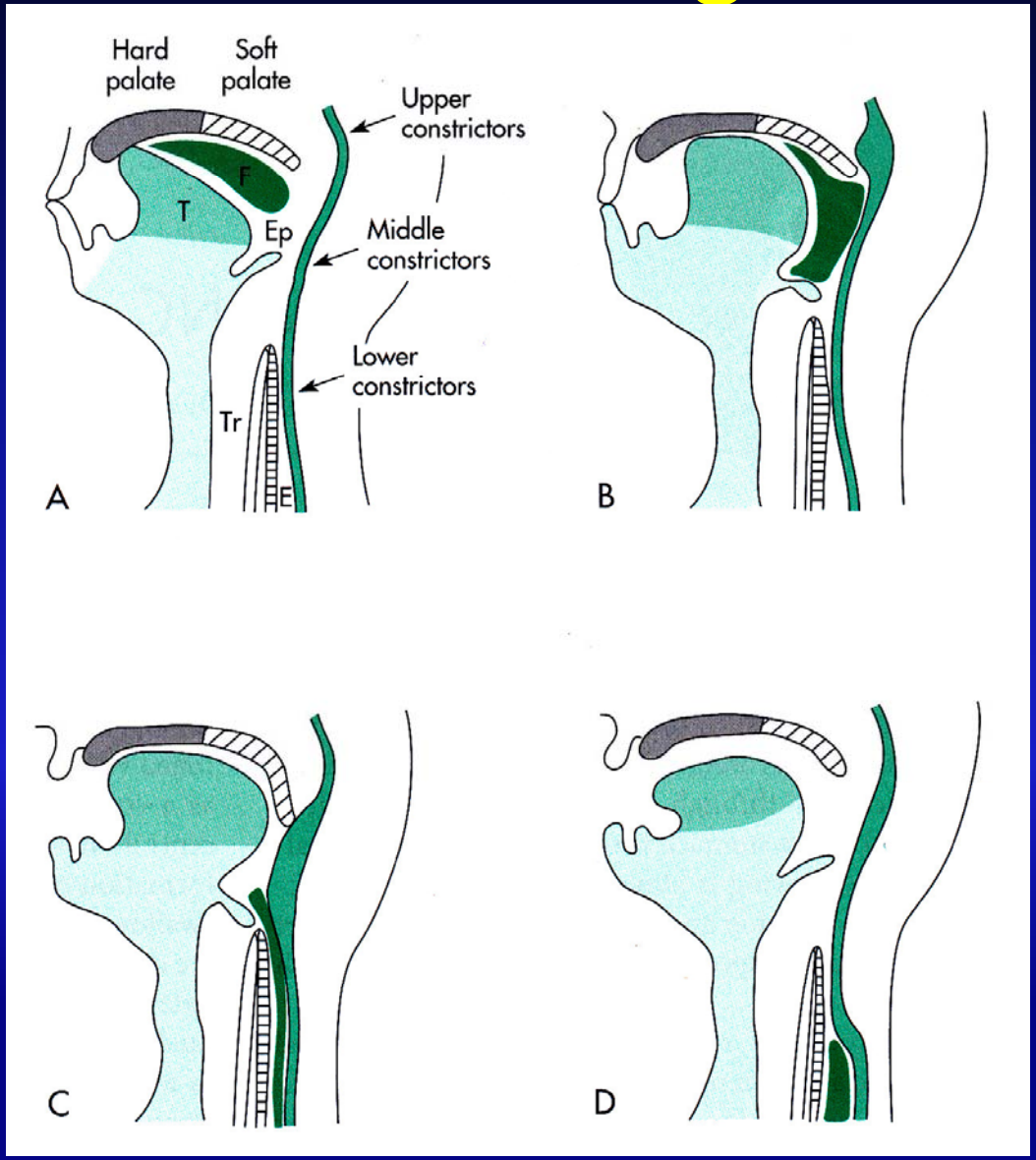
Swallowing

- It is the process that propels the food to the stomach
- It involves the oral cavity, pharynx, esophagus, and orad portion of the stomach

Swallowing

- The portion to be swallowed is separated by the tongue
- As the material passes to the oropharynx, the nasopharynx closes
- Respiration is inhibited and the glottis closes
- Peristaltic contraction of the pharyngeal muscles and relaxation of the upper esophageal sphinter, propel the bolus to the esophagus

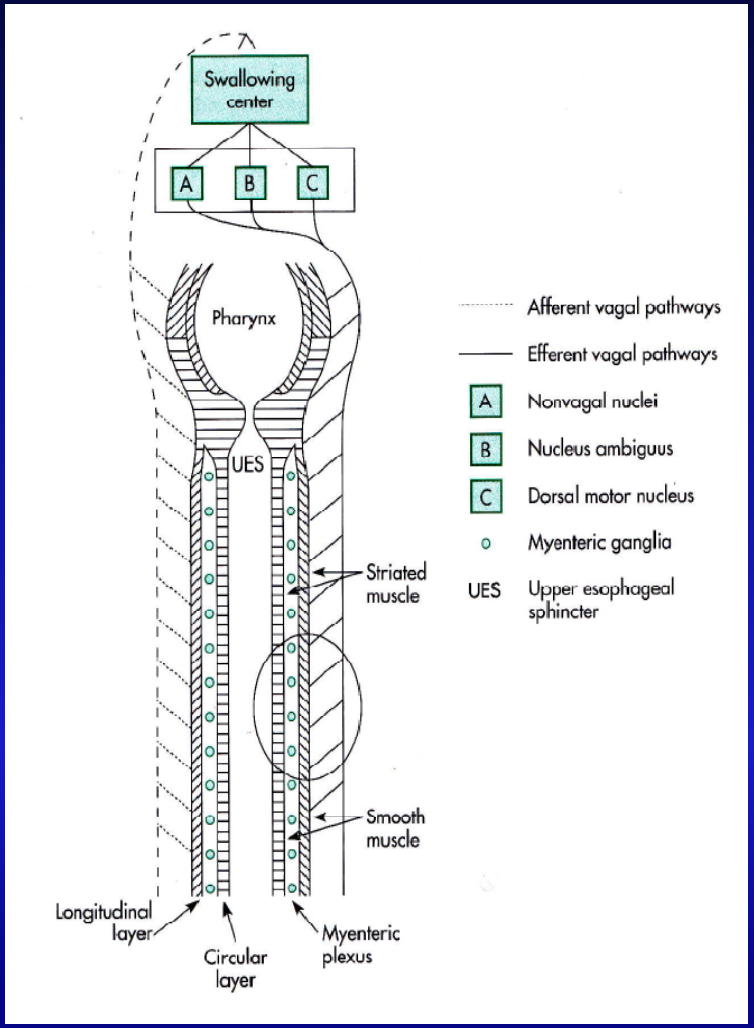
Swallowing



Swallowing

- Coordination is central in origin (swallowing center) located in the reticular formation of the brainstem

Swallowing center



Esophagus

- UES can be identified as the cricopharyngeal muscle. This muscle as well as the proximal third of the esophagus are striated muscle
- The distal third of the esophagus is smooth muscle.
- The distal 1-2 cm that acts as the lower esophageal sphiter (LES), has no sphinter muscle

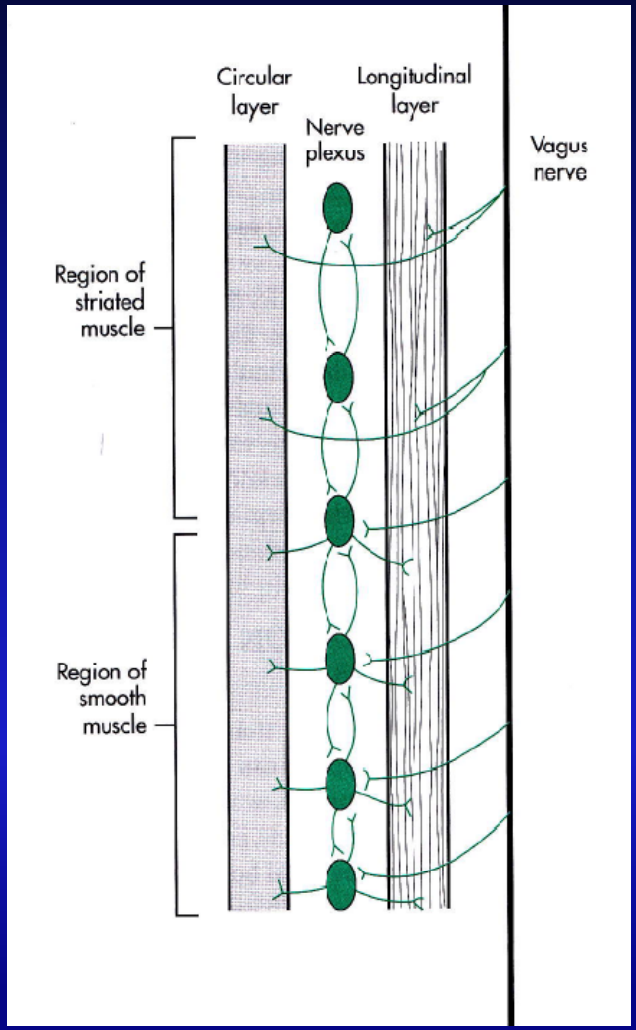
Esophagus

- The middle third of the esophagus is composed of a mixture of smooth and striated muscles
- Shortly before the distal pharyngeal muscle contract, the EUS opens. Once the bolus passes, the sphinter assumes its resting tone
- Then, the body of the esophagus undergoes a peristaltic contraction

Esophagus

- Shortly, before the peristaltic contraction reaches the LES, the sphinter relaxes and once the bolus passes, the sphinter goes back to its resting level
- The peristalsis is coordinated by the intrinsic nerve plexus not by the central nervous system

Esophagus



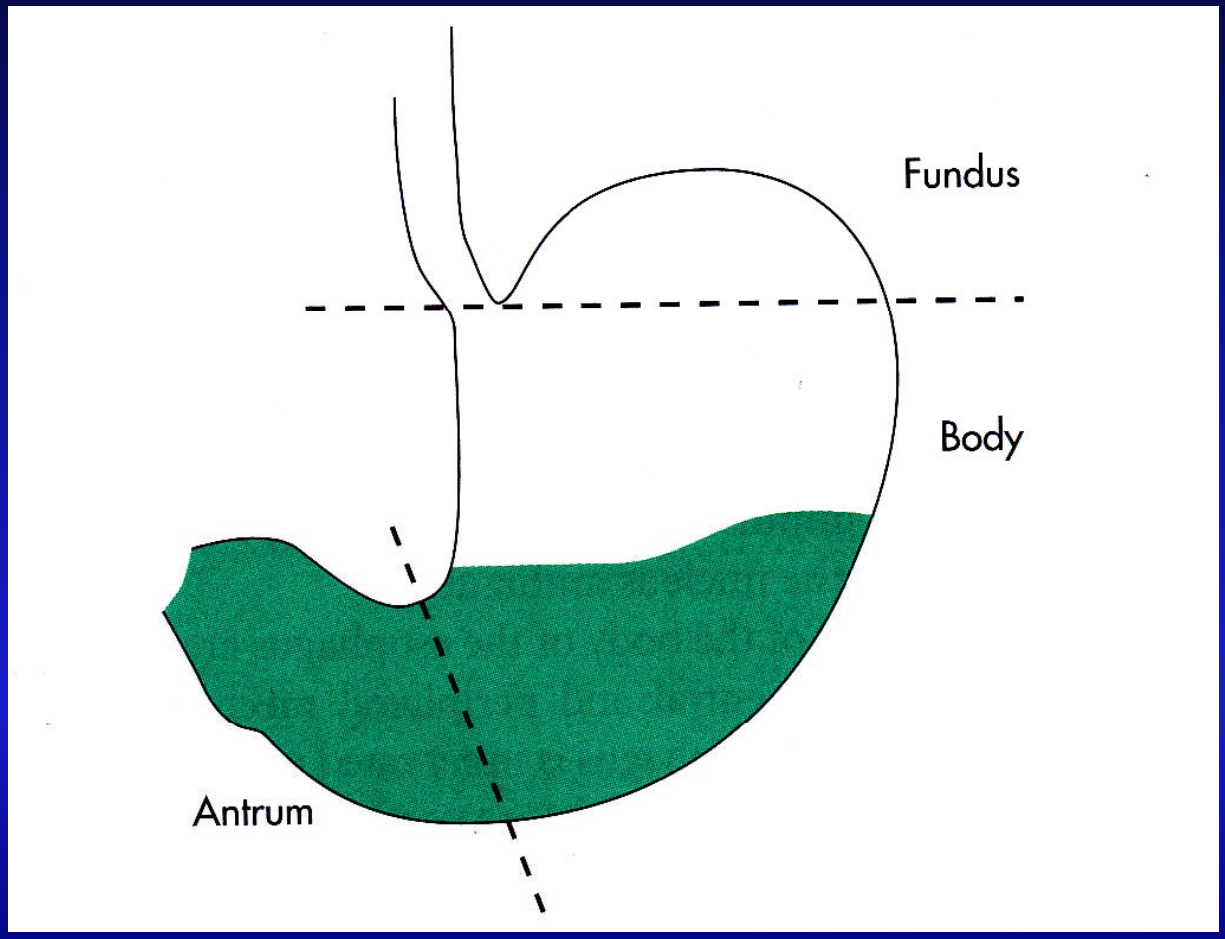
Esophagus

- When the esophageal peristalsis is preceded by a pharyngeal pharyngeal phase, it is called primary peristalsis
- In the absence of pharyngeal phase, the esophageal peristalsis is called secondary peristalsis. It is eliceted when the esophagus is distended

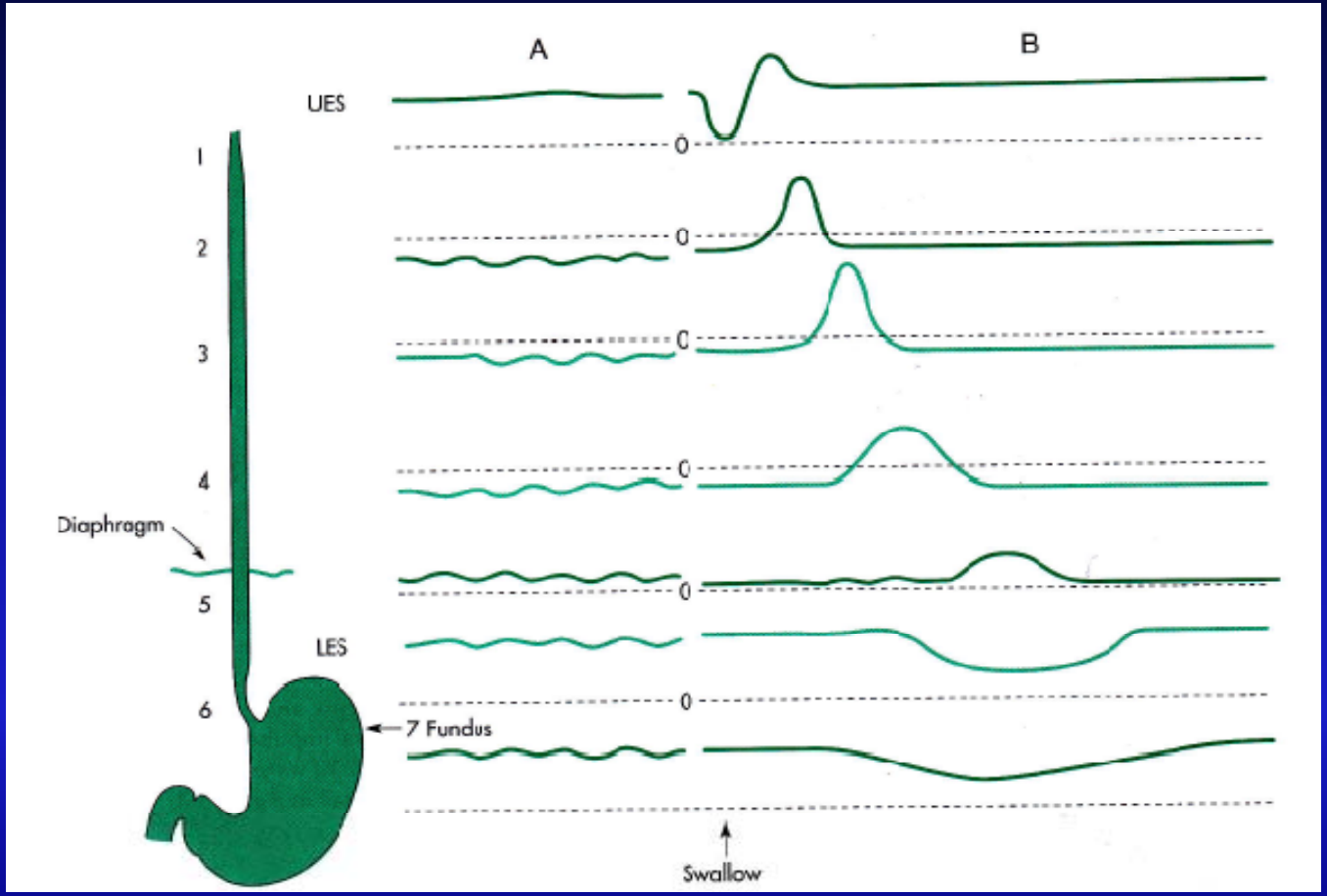
Stomach

- The orad portion of the stomach includes the fundus and the proximal gastric body
- The caudad portion consist of the distal body and the antrum
- The orad portion accommodates the ingested food
- Both, the orad and the caudad portion are involved in the regulation of the gastric emptying

Stomach



Stomach



SALIVARY SECRETION

Saliva

- Saliva is involved in lubrication, protection and digestion
- For lubrication, the saliva depends on its mucus content and it facilitates the swallowing process
- For protection, the saliva dilutes and cools hot solutions (coffee, tea). It neutralizes and dilutes gastric acid and pepsin (e.g. vomiting)

Saliva

- The saliva dissolves and washes out food particles from between the teeth
- It contains lysoyme, lactoferrin, and IgA
- It secretes fluoride and calcium which are incorporated into the teeth
- For digestion in contains alfa-amylase and lipase

Saliva

- The parotid glands secrete a fairly watery juice, the submudibular and sublingual glands secrete a more viscid saliva
- Salivon is the functional unit and it consist of acinus, intercalated duct and striated duct. Myoepithelial cells are present surrounding the acinar cells

Salivon

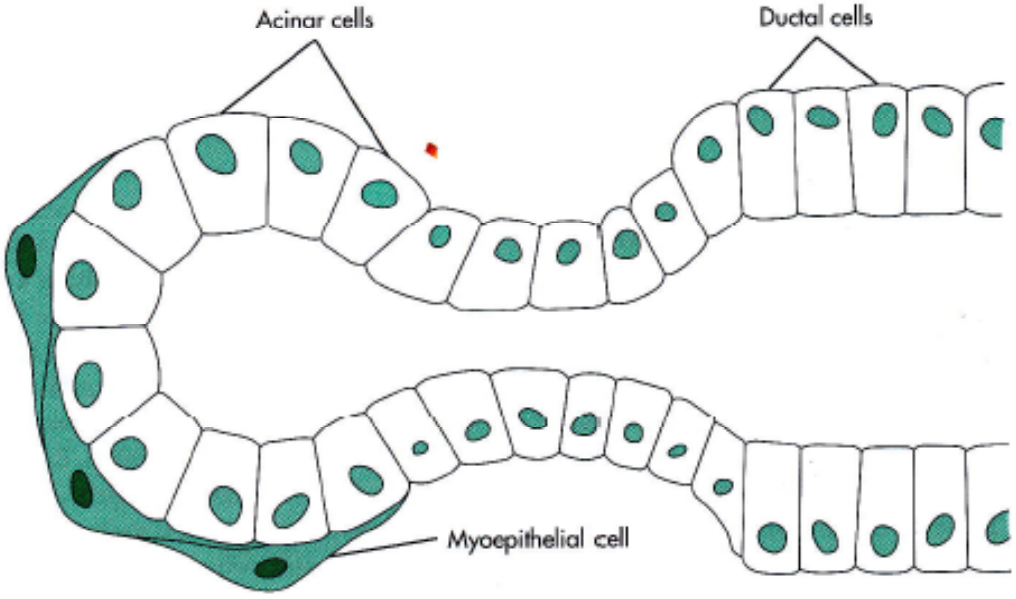


FIGURE 7-1 ■ Cells lining the various portions of the salivon.

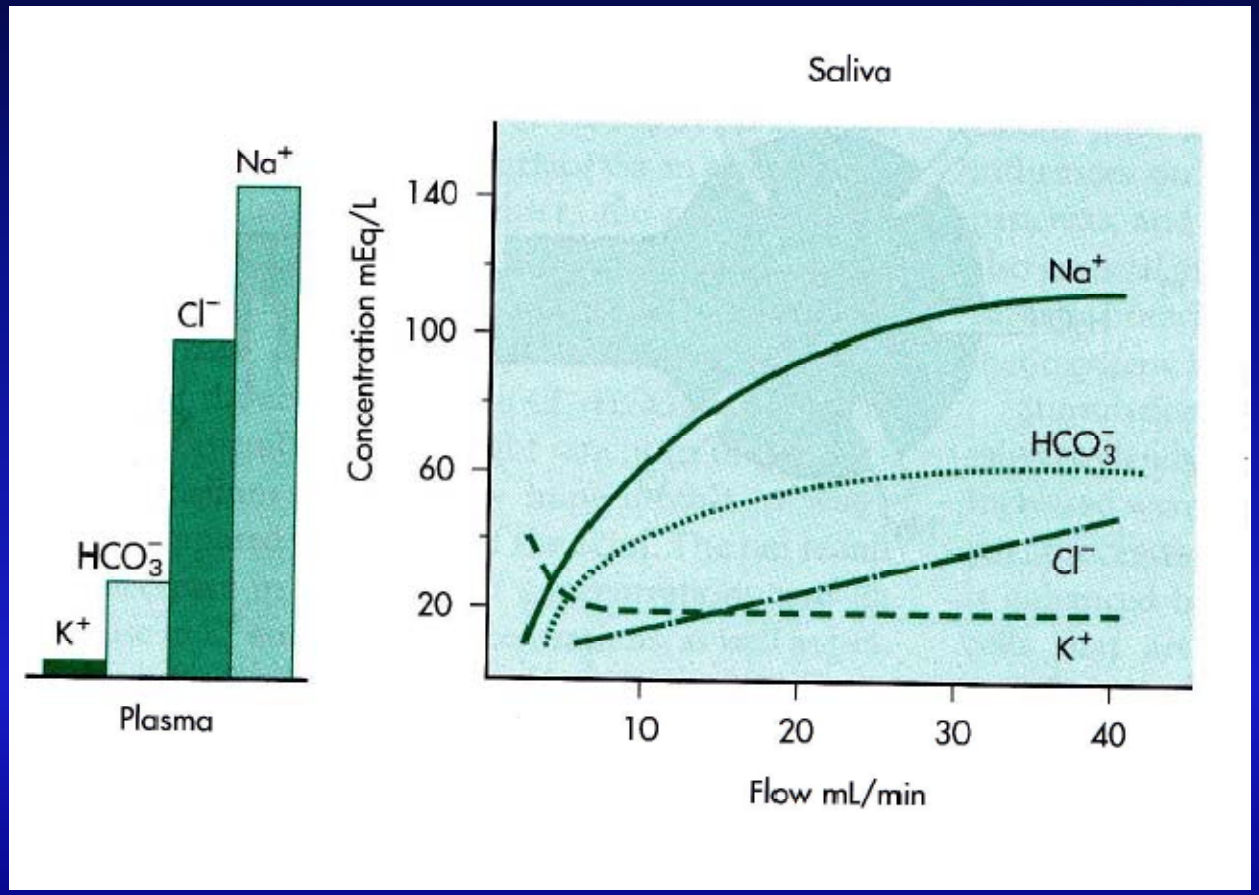
Composition of saliva

- The osmolality is significantly lower than that of the plasma, however, as the secretory rate increases, the osmolality also increases
- Saliva has the high concentration of K
- The concentration of HCO3- is higher that that in the plasma, except at low rates
- The fluid a the intercalated ducts is similar to the plasma

Composition of saliva

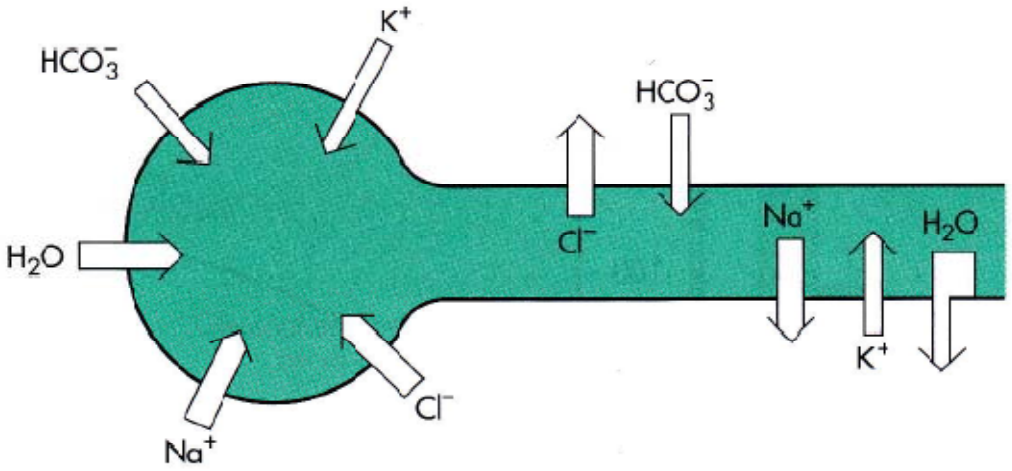
- The higher the flow of the saliva, less time is available for modification, and the saliva resembles the plasma with the exception of the HCO_3^- (most salivary agonist stimulate HCO_3^- secretion)
- The salivary glands produces kallikrein and it is released when the metabolism increases. Kallikrein converts plasma protein into bradykinin, a potent vasodilator

Composition of saliva



Composition of saliva

FIGURE 7-4 ■ Movements of ions and water in the acinus and duct of the salivon.



Regulation of salivary secretion

- The ANS controls essentially all salivary gland secretions
- ADH and aldosterone modify the saliva composition but they do not regulate the flow of the saliva
- Both the parasympathetic and sympathetic system stimulate salivary secretion. However the parasympathetic has much greater influence

Regulation of salivary secretion

- Parasympathetic fibers innervates the myoepithelial cells and the surrounding blood vessels
- In general, agonist that release Ca++ (muscarinic receptors) have greater effect on the volume of the acinar cells secretion, while those elevating cAMP (B-adrenergic)increases enzyme and mucus content

Regulation of salivary secretion

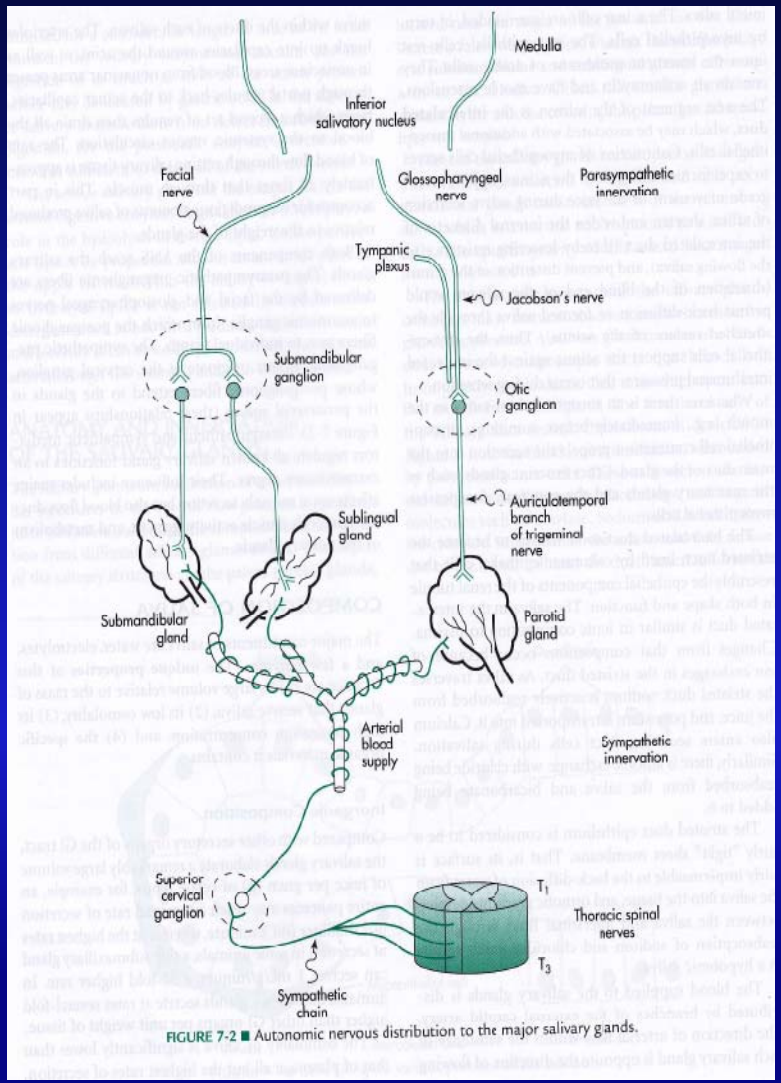


FIGURE 7-2 ■ Autonomic nervous distribution to the major salivary glands.

Regulation of salivary secretion

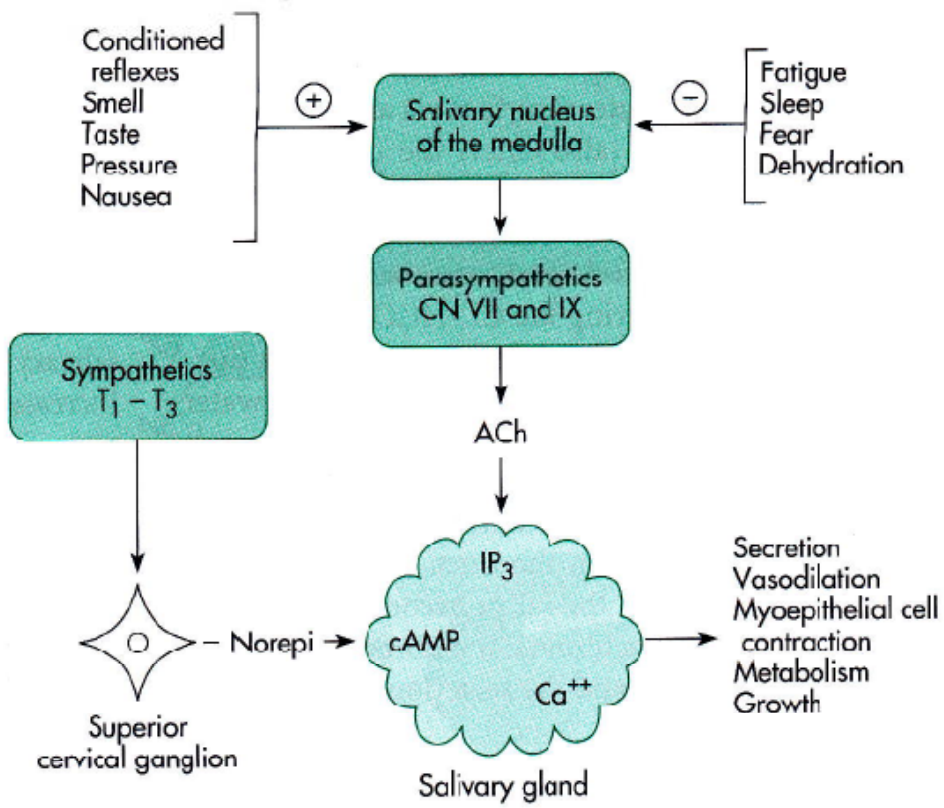


FIGURE 7-6 ■ Summary of the regulation of salivary gland function. ACh, acetylcholine; cAMP, cyclic adenosine monophosphate; CN, cranial nerve; IP_3, inositol triphosphate; Norepi, norepinephrine.

References

- Norman W. Weisbrodt, Gastrointestinal Physiology 7th edition, 23-30
- Leonard R. Johnson, Gastrointestinal Physiology 7th edition, 57-65

Thanks

The University of Texas
Medical School at Houston