

THE ESOPHAGUS

ESOPHAGEAL MOTILITY & GERD

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OBJECTIVES



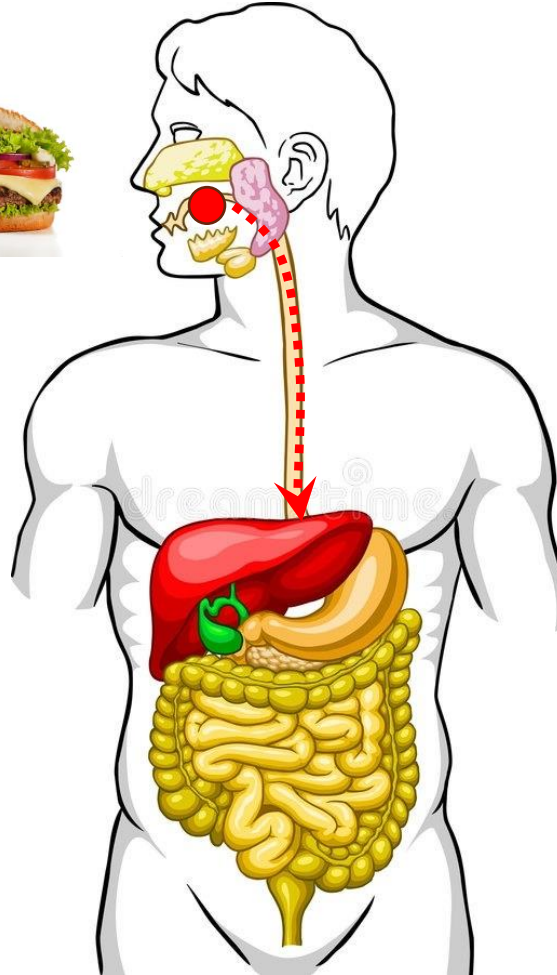
- Discuss the role of the mouth in digestion.
- Define mastication and explain how is it brought about.
- Discuss the components of the mastication “chewing” reflex.
- Define swallowing and discuss its stages.
- Explain the changes that occur in each stage of swallowing as well as the nervous input and output of each stage.
- Discuss the types of movement that occur in the esophagus.
- Discuss the role of the lower esophageal sphincter and how is it controlled.
- Define gastroesophageal reflux disease (GERD) and achalasia and the pathophysiologic mechanisms underlying their occurrence.



INTRODUCTION



Our first stop in our journey with the burger is the **mouth & esophagus**



THE MOUTH



THE MOUTH



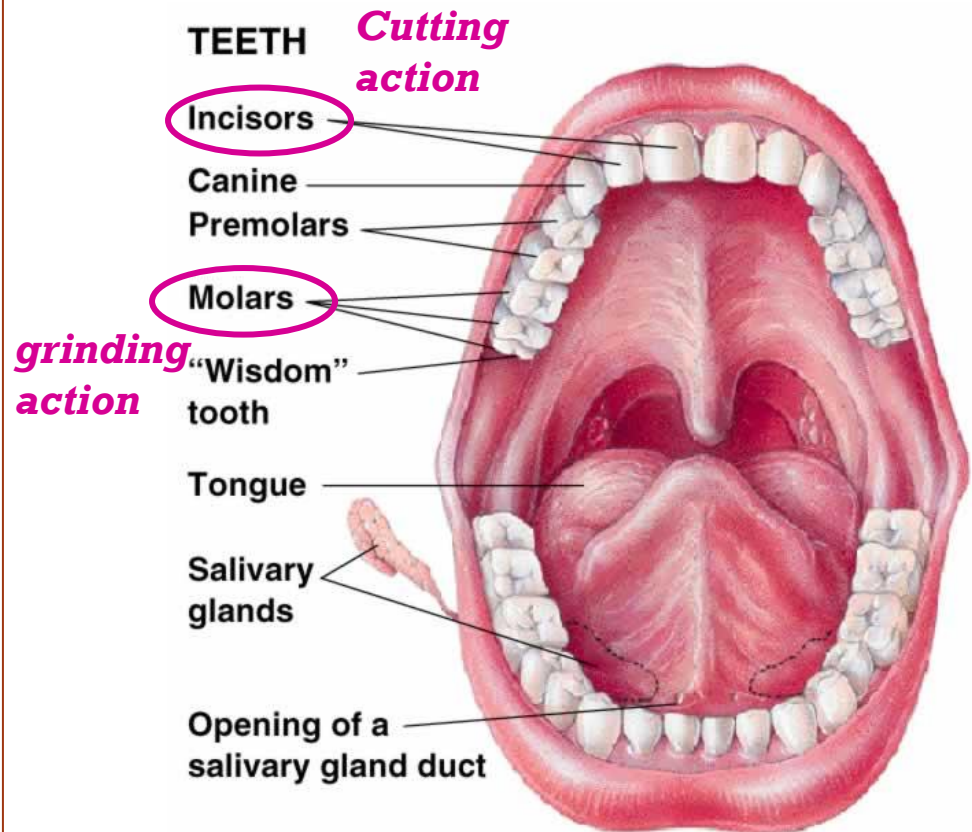
- ***What is the role of the mouth in digestion?***

- ✓ Mechanical digestion.
- ✓ Chemical digestion.

- ***What is the process of cutting and grinding food in the mouth called?***

Mastication “chewing”

- **What are the muscles involved in chewing and what is their innervation?**



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MASTICATION “CHEWING”



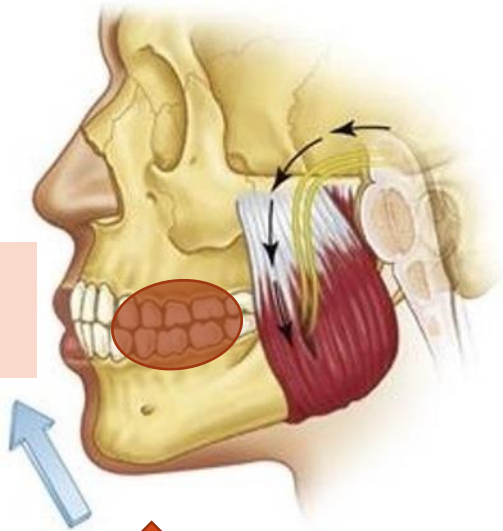
- *Why is it important to chew food?*
- *How is it achieved?*

Chewing reflex

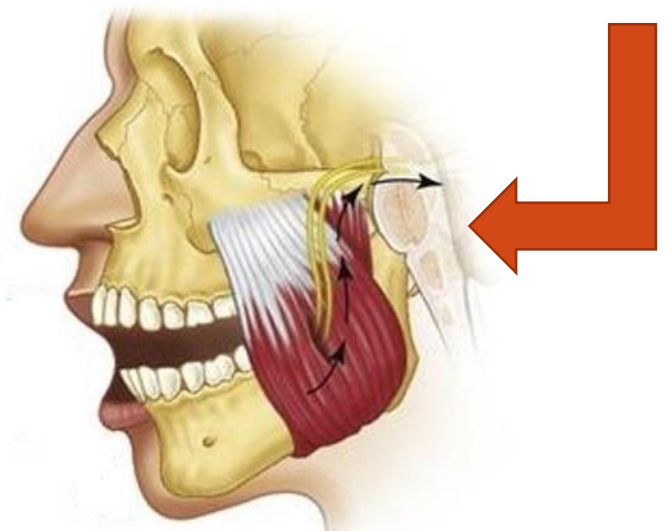
Food inside mouth

Reflex inhibition of muscles of mastication

Rebound contraction



The cycle goes on



Stretches the muscles of mastication

Jaw drops



THE MOUTH



▪ Digestion in the mouth

- Minimal.
- Mechanical breakdown of food.
- Carbohydrate digestion starts due to salivary amylase.

▪ Secretion in the mouth

- Receives secretions from salivary glands.

▪ Absorption in the mouth

- Not much

TEETH

Incisors

Canine

Premolars

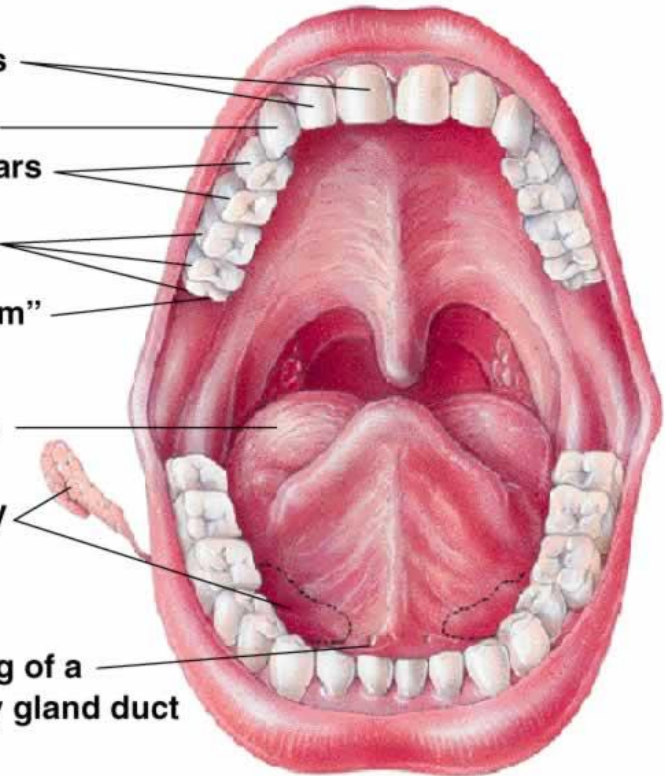
Molars

“Wisdom”
tooth

Tongue

Salivary
glands

Opening of a
salivary gland duct



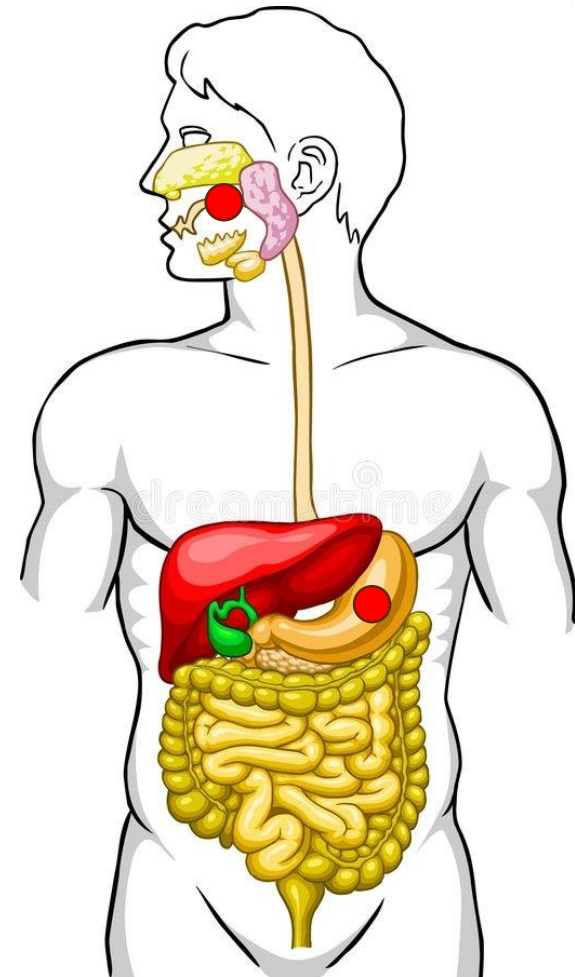
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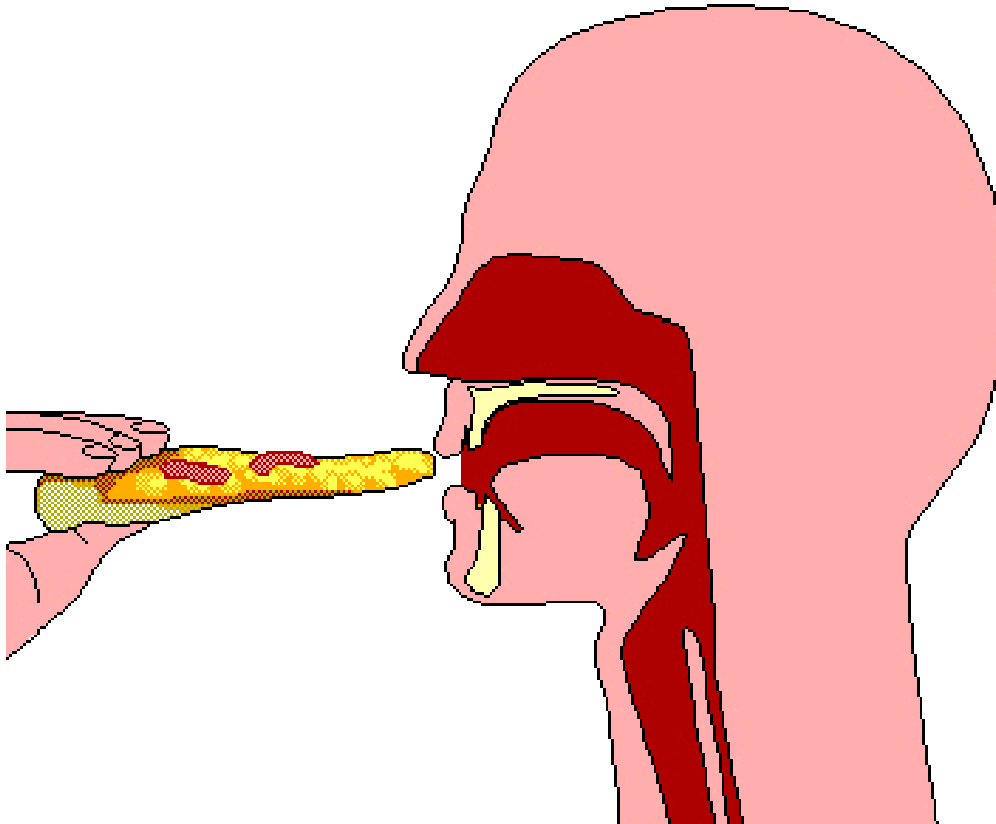
DEGLUTITION “SWALLOWING”



- **Swallowing** is the entire process of moving food from mouth through esophagus and into the stomach.
- Swallowing is a complicated process... **why?**
- The process of swallowing can be divided into 3 stages:
 - **Voluntary** stage.
 - **Pharyngeal** stage.
 - **Esophageal** stage. } **Involuntary**



DEGLUTITION “SWALLOWING”



Looking at the video, can you identify the processes happening to allow swallowing?



STAGES OF SWALLOWING



1. **Voluntary stage** → initiates swallowing and moves bolus from mouth to pharynx.
2. **Pharyngeal stage** → involuntary and moves food bolus through pharynx and into esophagus.
3. **Esophageal stage** → involuntary and moves bolus from esophagus and into the stomach

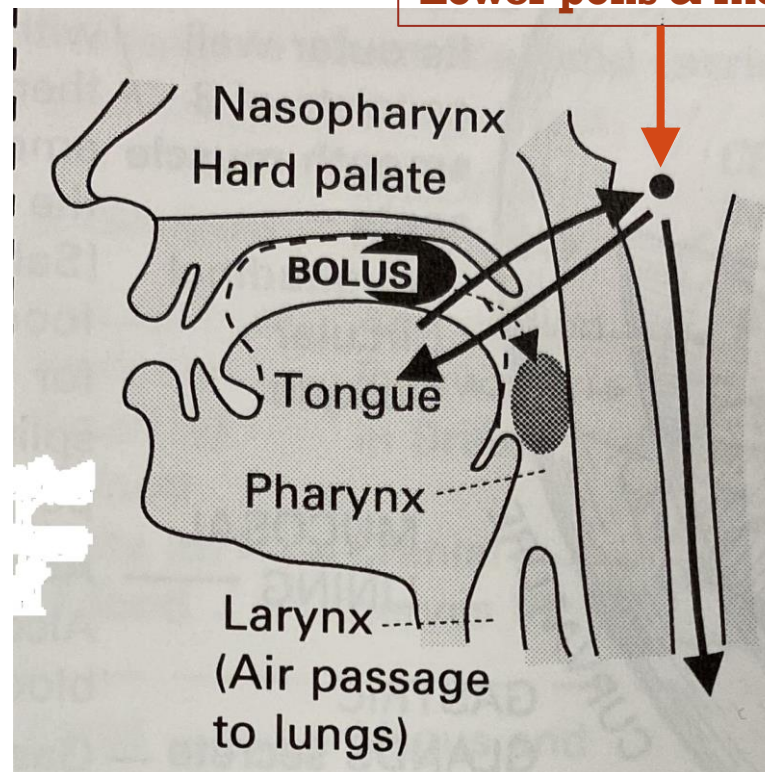


VOLUNTARY STAGE



When food is ready for swallowing → voluntarily squeezed or rolled into pharynx.

**Swallowing center
Lower pons & medulla**



Tongue moves
upward &
backward
against palate



PHARYNGEAL STAGE



Swallowing center
Lower pons & medulla

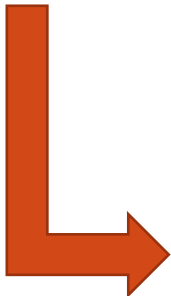
inhibit

Respiratory center

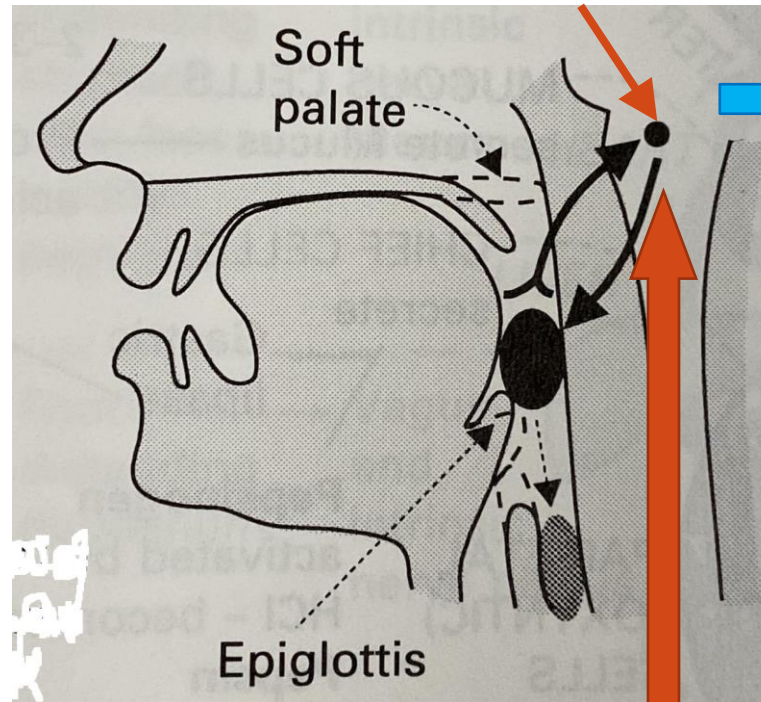
When food bolus enters posterior mouth & pharynx



Stimulates sensory nerve endings
“**tonsillar pillars**”
being the most sensitive



CN V & CN IX



Motor output

CN V
CN IX
CN X
CN XII

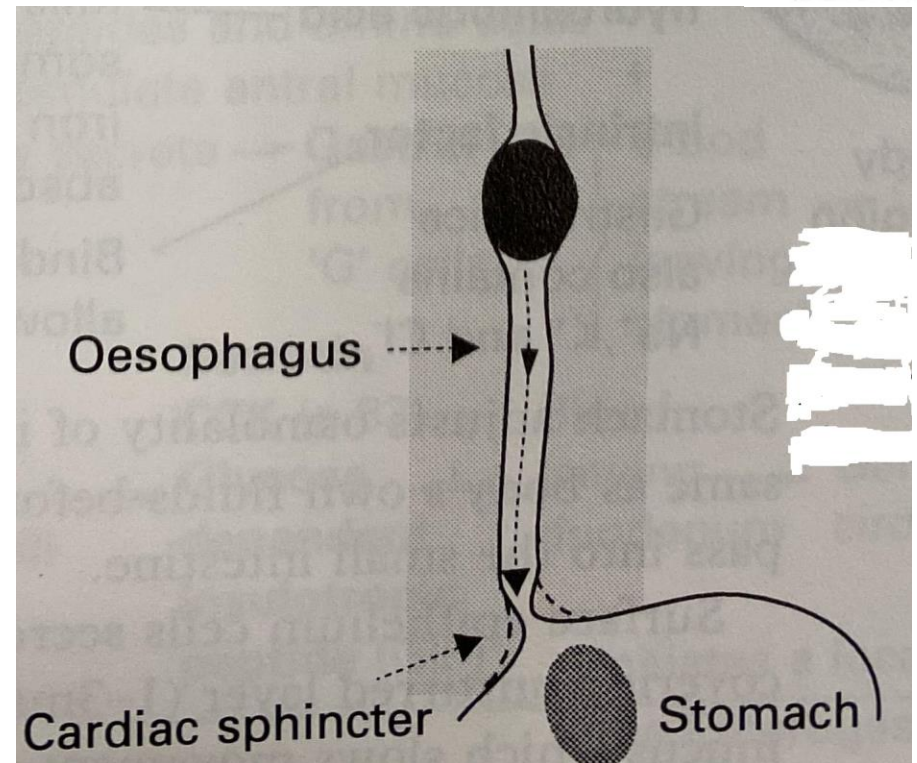
1. Soft palate pulled up-close nose.
2. Approximation of palatopharyngeal folds.
3. Larynx move up and anteriorly.
4. Vocal cords are brought together.
5. Epiglottis swings back
6. Pharyngeal muscles contract → peristalsis starts.

Sensory input

ESOPHAGEAL STAGE



- Conducts food to stomach.
- Achieved by peristalsis.
- Two types of peristaltic movement in the esophagus;
 1. **Primary** peristalsis.
 2. **Secondary** peristalsis.

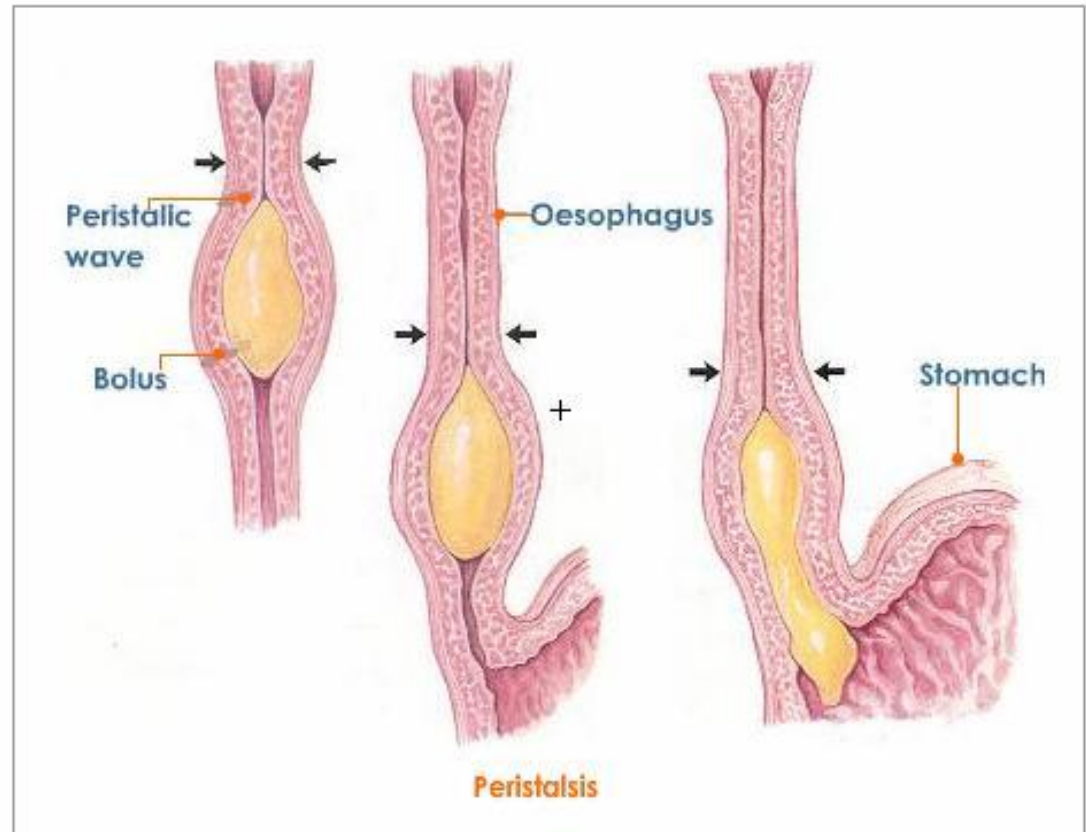


ESOPHAGEAL STAGE



PRIMARY PERISTALSIS

- Continuation of the peristaltic wave that began in the pharynx.
- It takes 8-10 sec.
- If food bolus reaches stomach → job is done!
- When peristalsis approaches the stomach it is preceded by a wave of relaxation → **receptive relaxation of LES**
- If it fails to deliver the food bolus to stomach → **secondary peristalsis**

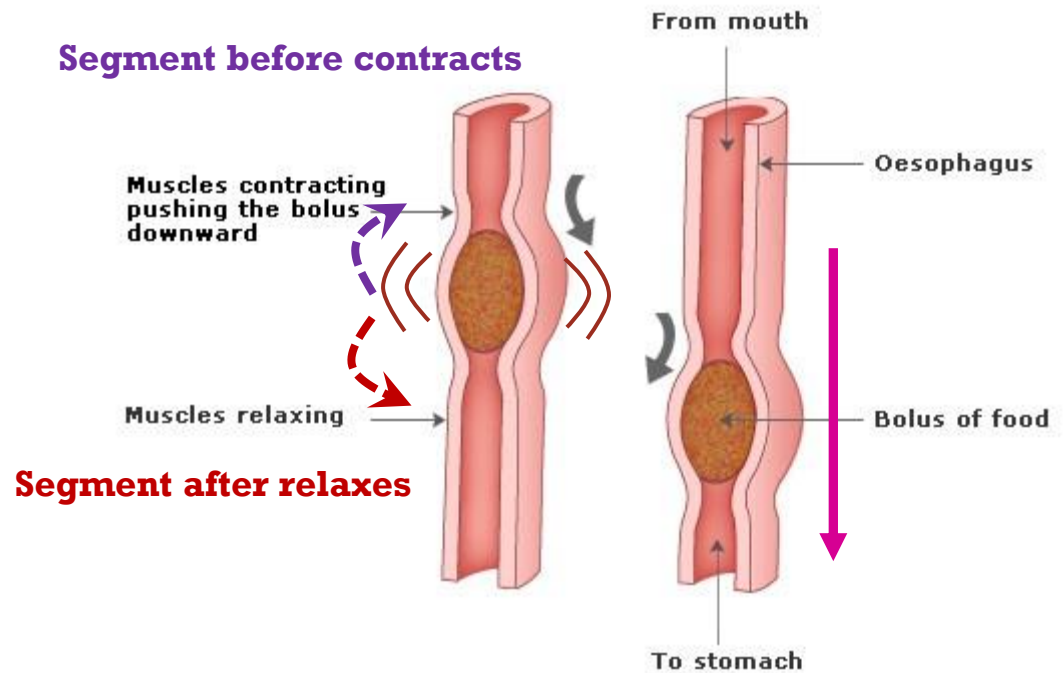


ESOPHAGEAL STAGE

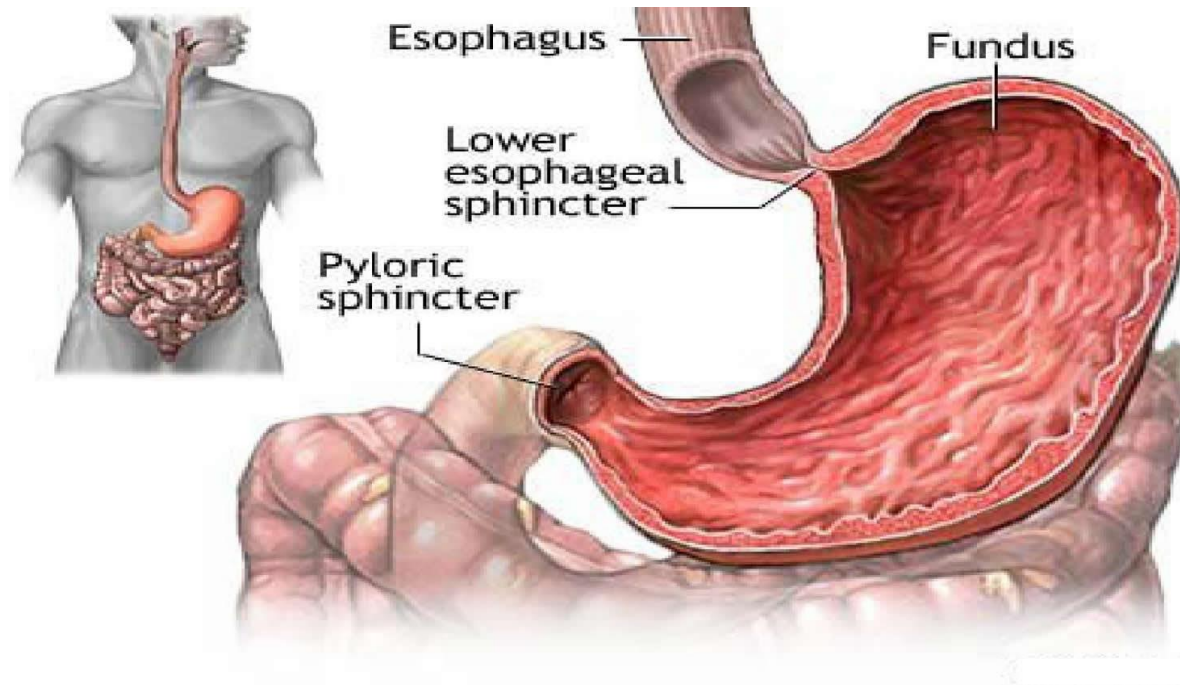


SECONDARY PERISTALSIS

- food bolus gets stuck in the esophagus → *secondary peristalsis*.
- Initiated at the site of distention of the esophagus by the food bolus.
- Continue until food bolus is delivered into stomach.



LOWER ESOPHAGEAL SPHINCTER



- 3 cm above the junction of esophagus with stomach, circular muscle fibers function as a sphincter → LES.
- The LES is normally kept tonically constricted.
- ***Why is it important?***

Can you name factors that can modify the tone of the LES?



DISORDERS OF THE ESOPHAGUS



ACHALASIA

- LES fails to relax properly in response to swallowing.
- Functional obstruction.
- *What do you think would happen?*
- Degeneration of the myenteric plexus, loss of inhibitory neurons.

GERD

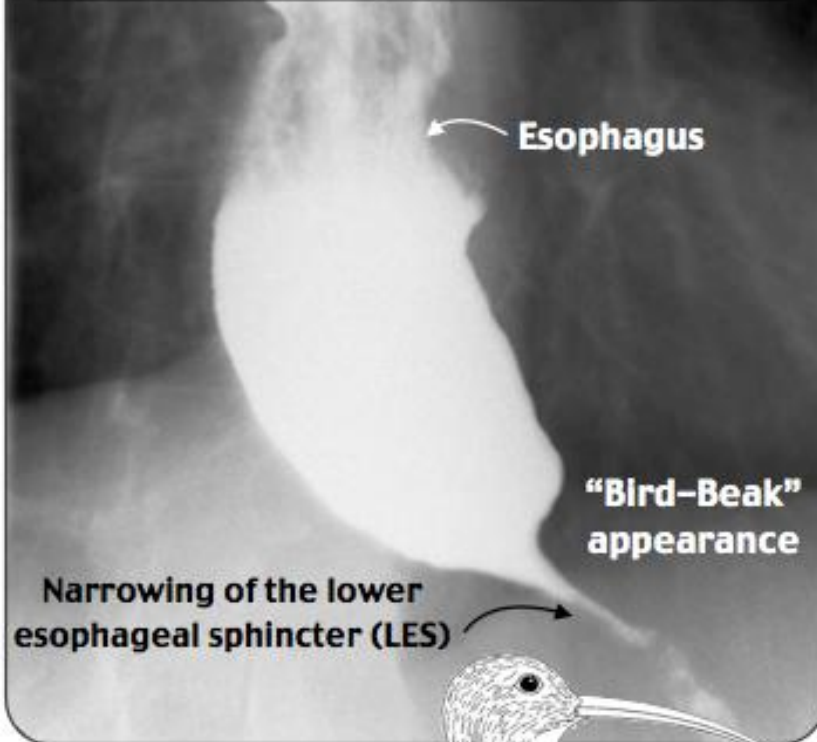
- LES fails to constrict properly **OR** Loss of lower esophageal sphincter tone.
- *What do you think would happen?*



Achalasia

Clinical

- Dysphagia
- Odynophagia
- Regurgitation of undigested food



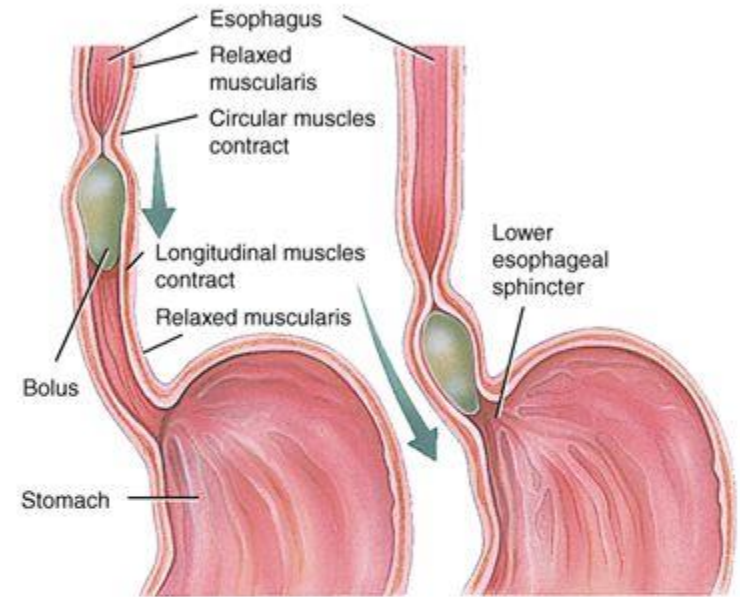
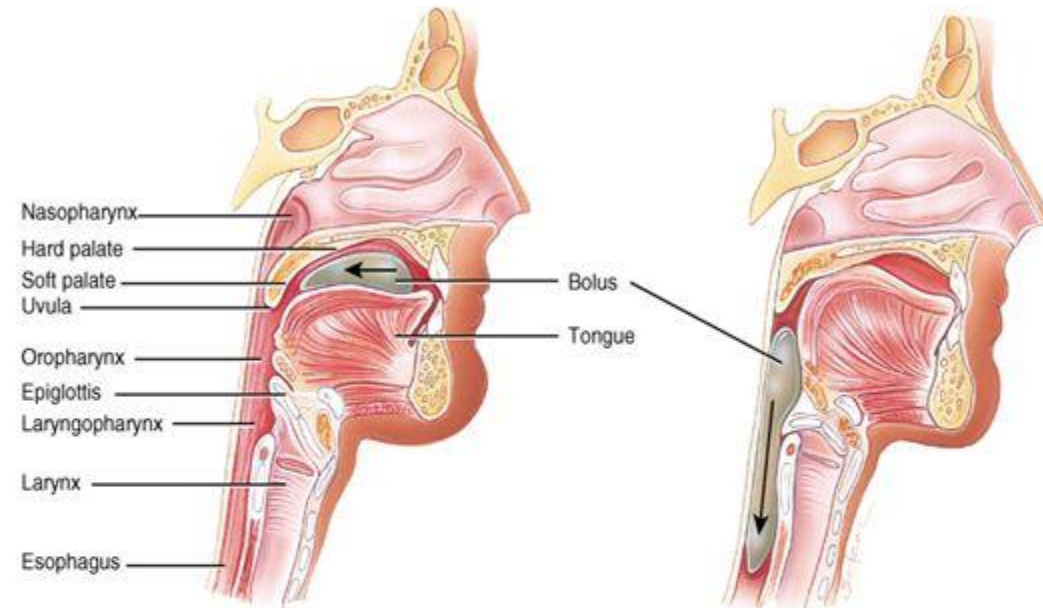
ESOPHAGEAL SECRETIONS



- Entirely mucus.
- What is its importance?
 - ✓ Lubrication.
 - ✓ Protection against acidic juices of the stomach.
- Not much absorption occurs in the esophagus.



Physiology of the Esophagus - Swallowing



- **Voluntary phase**---tongue pushes food to back of oral cavity
- **Involuntary phase**----**pharyngeal stage**
 - breathing stops & airways are closed
 - soft palate & uvula are lifted to close off nasopharynx
 - vocal cords close
 - epiglottis is bent over airway as larynx is lifted
 - controlled by autonomic nervous system

Esophageal stage

- Peristalsis pushes food down
 - circular fibers behind bolus
 - longitudinal fibers in front of bolus shorten the distance of travel
- Travel time is 4-8 seconds for solids and 1 sec for liquids
- Lower sphincter relaxes as food approaches

REFERENCES



- Sherwood. Human Physiology: From cells to Systems, 7th ed.
- Guyton & Hall Textbook of Medical Physiology. 13th ed.
- Mackenna & Callander. Illustrated Physiology. 6th ed.





Thank you

