Ashur University
College of Medicine

Grade 2
PHYSIOLOGY OF
GASTROINTESTINAL TRACT
(GIT)
Lec. 2

# Peristalsis and Swallowing



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# Objectives:

- Define Peristalsis.
- Define swallowing and its stages.



# Peristalsis

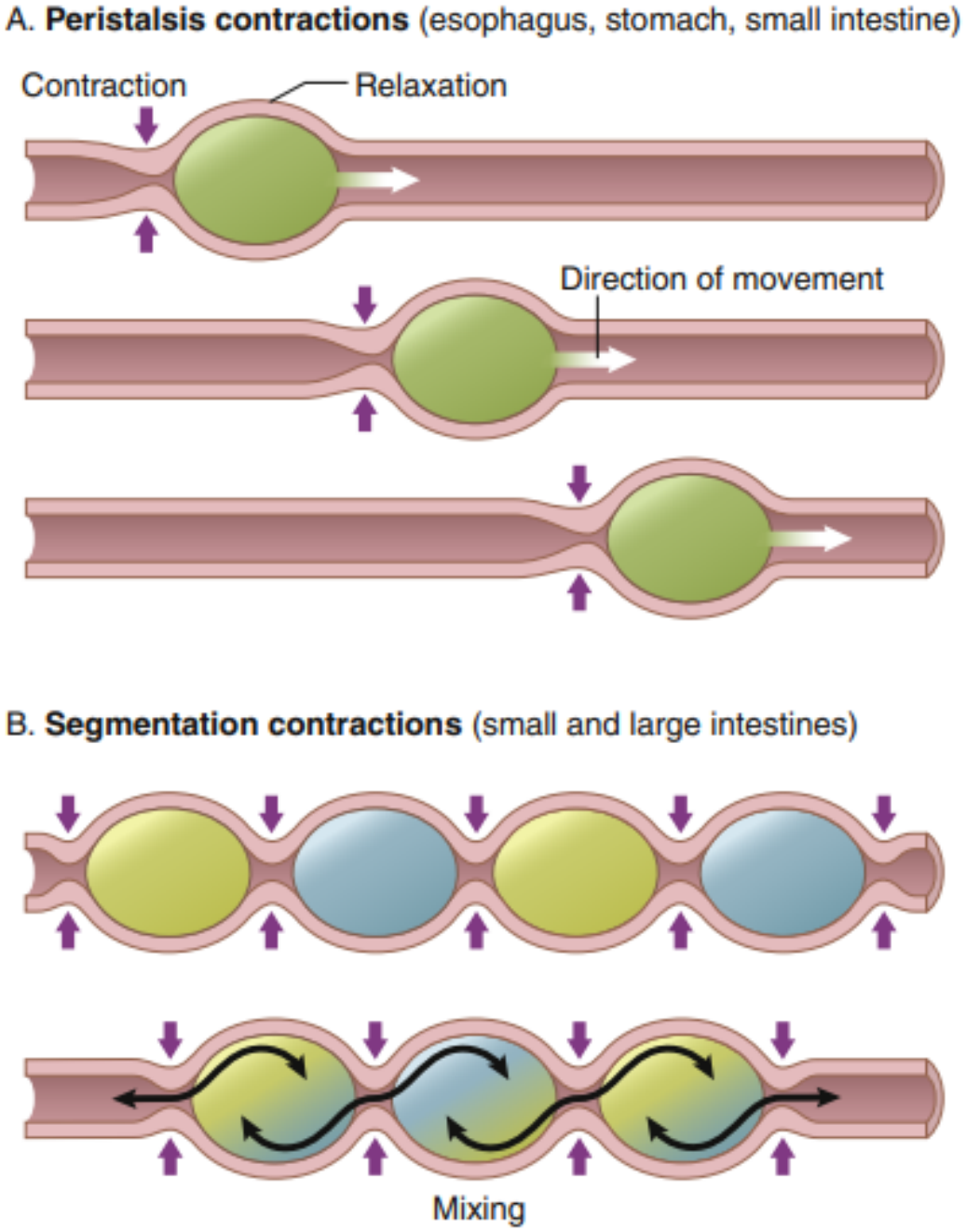
- **A reflex response that is initiated when the gut wall is stretched by the contents of the lumen, and it occurs in all parts of the gastrointestinal tract from the esophagus to the rectum.**
- **The basic propulsive movement of the gastrointestinal tract is peristalsis**

**PROPULSIVE MOVEMENTS—PERISTALSIS.**

- The stretch initiates a circular contraction behind the stimulus and an area of relaxation in front of it. **The wave of contraction then moves in an oral to caudal direction**, propelling the contents of the lumen forward at rates that vary from 2 to 25 cm/s.
- Peristaltic activity can be increased or decreased by the autonomic input to the gut, but its occurrence is independent of the extrinsic innervation.
- It appears that local stretch releases serotonin, which activates sensory neurons that activate the myenteric plexus.

**Figure :**

**Peristalsis involves contraction and downstream relaxation in the esophagus, stomach and small intestine propel the contents toward the anus. Intermittent segmentation contractions in separate sections of the small and large intestines mix their contents with little forward movement.**



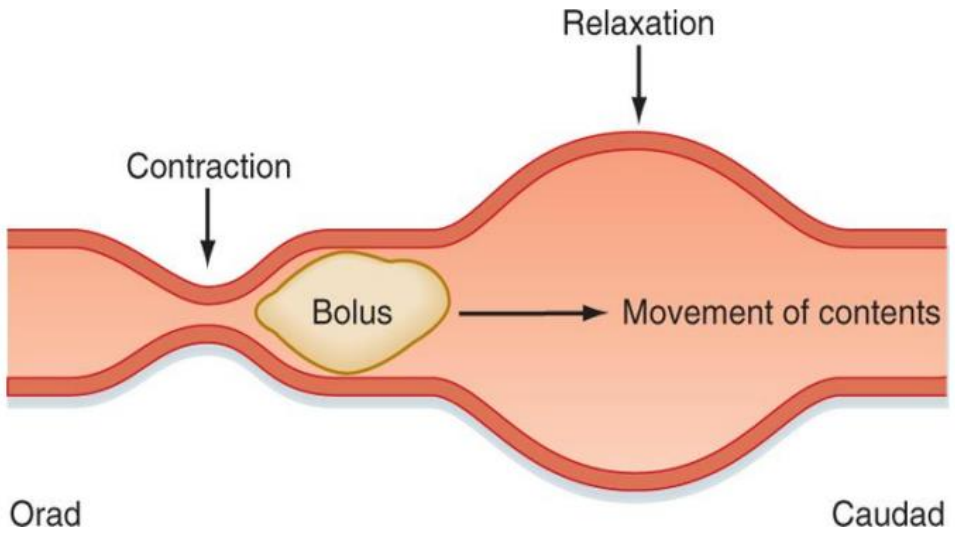
## Peristaltic Waves Move Toward the Anus With Downstream Receptive Relaxation—"Law of the Gut ".

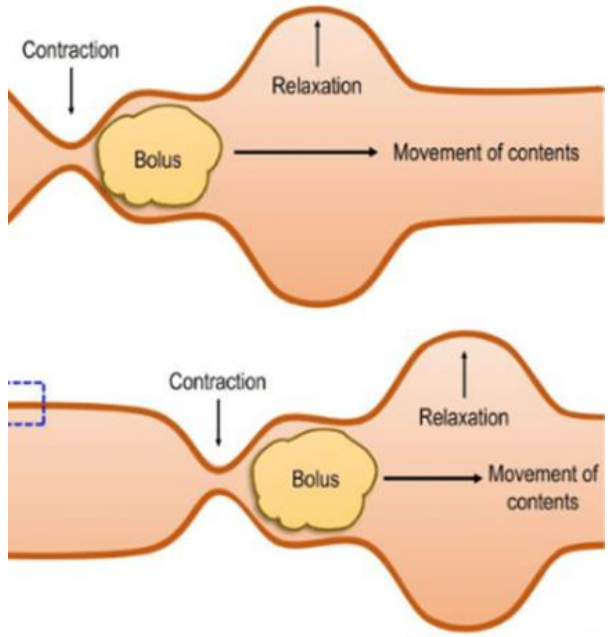
The gut sometimes relaxes several centimeters downstream toward the anus, which is called **"receptive relaxation**," thus allowing the food to be propelled more easily toward the anus than toward the mouth.

The peristaltic reflex plus the anal direction of movement of the peristalsis is called the **"law of the gut."**

Orad → toward the mouth.

Caudad → toward the tail.



# MASTICATION OR CHEWING:

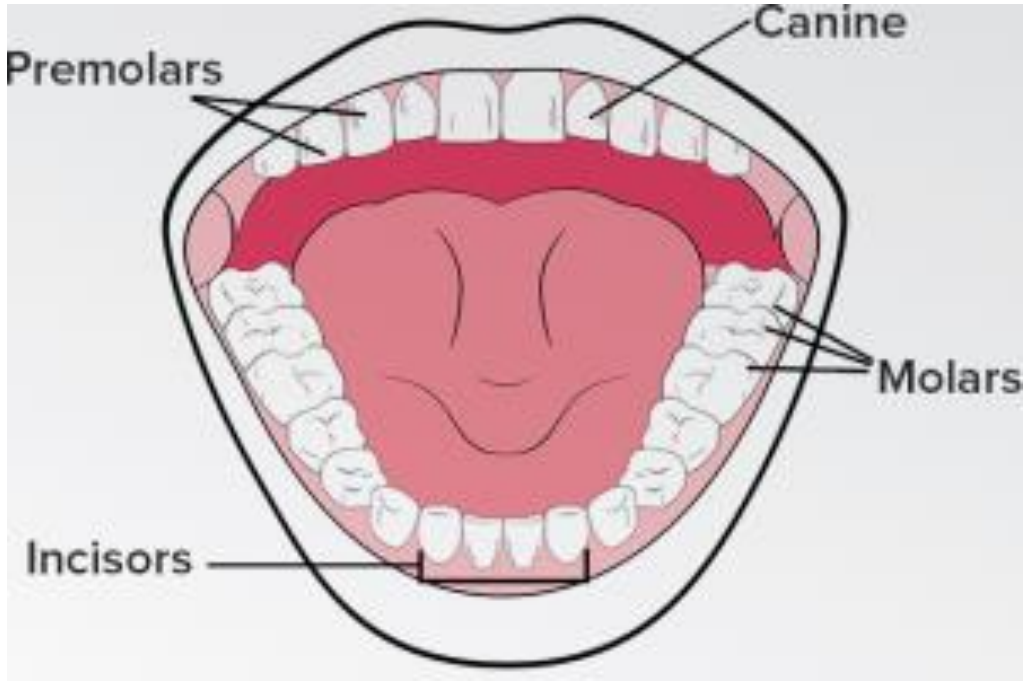
There are **four** main types of teeth, each with a specific role.

**Incisors - cut food.**

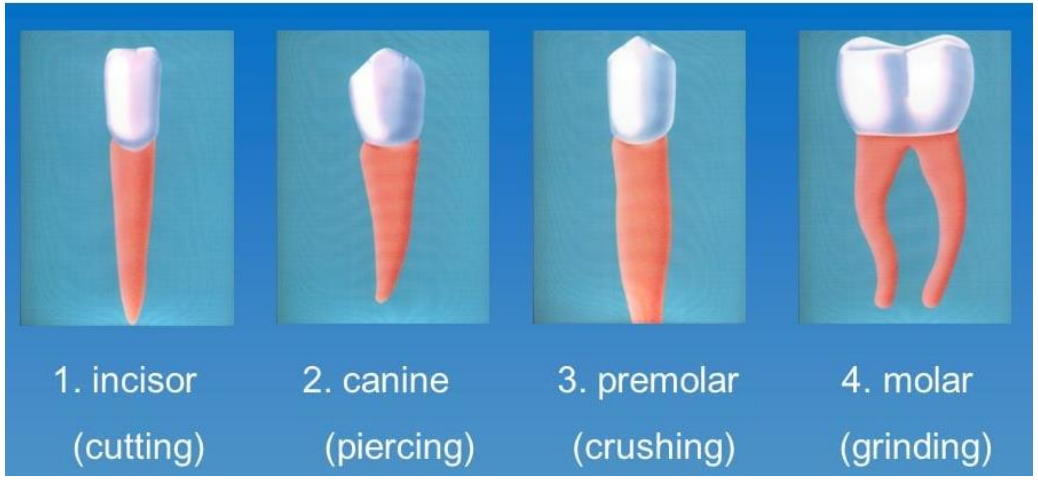
**Canines - tear food.**

**Premolars - crush food.**

**Molars - grind food for swallowing.**




The four types of teeth

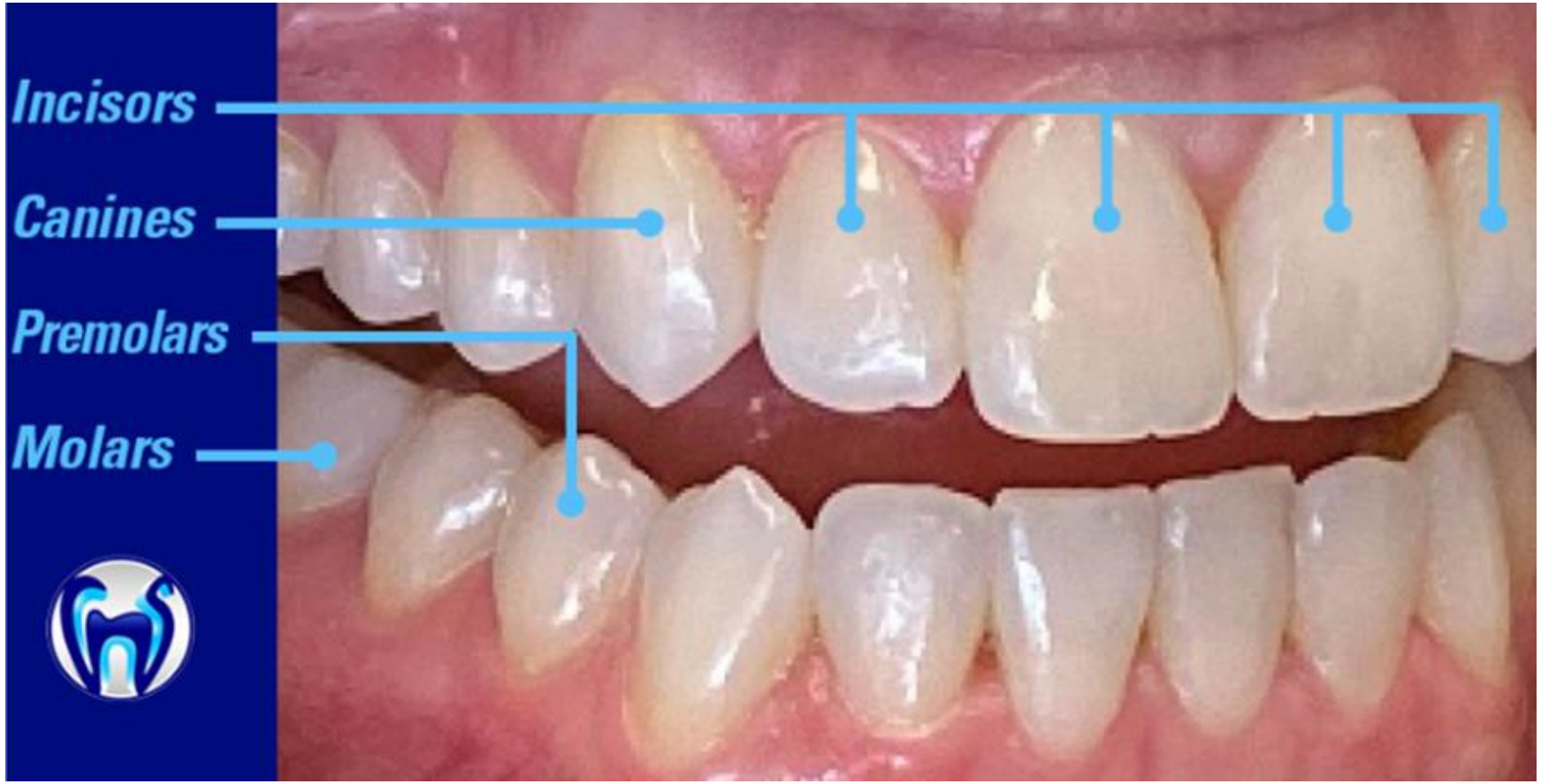



**Canine teeth →**



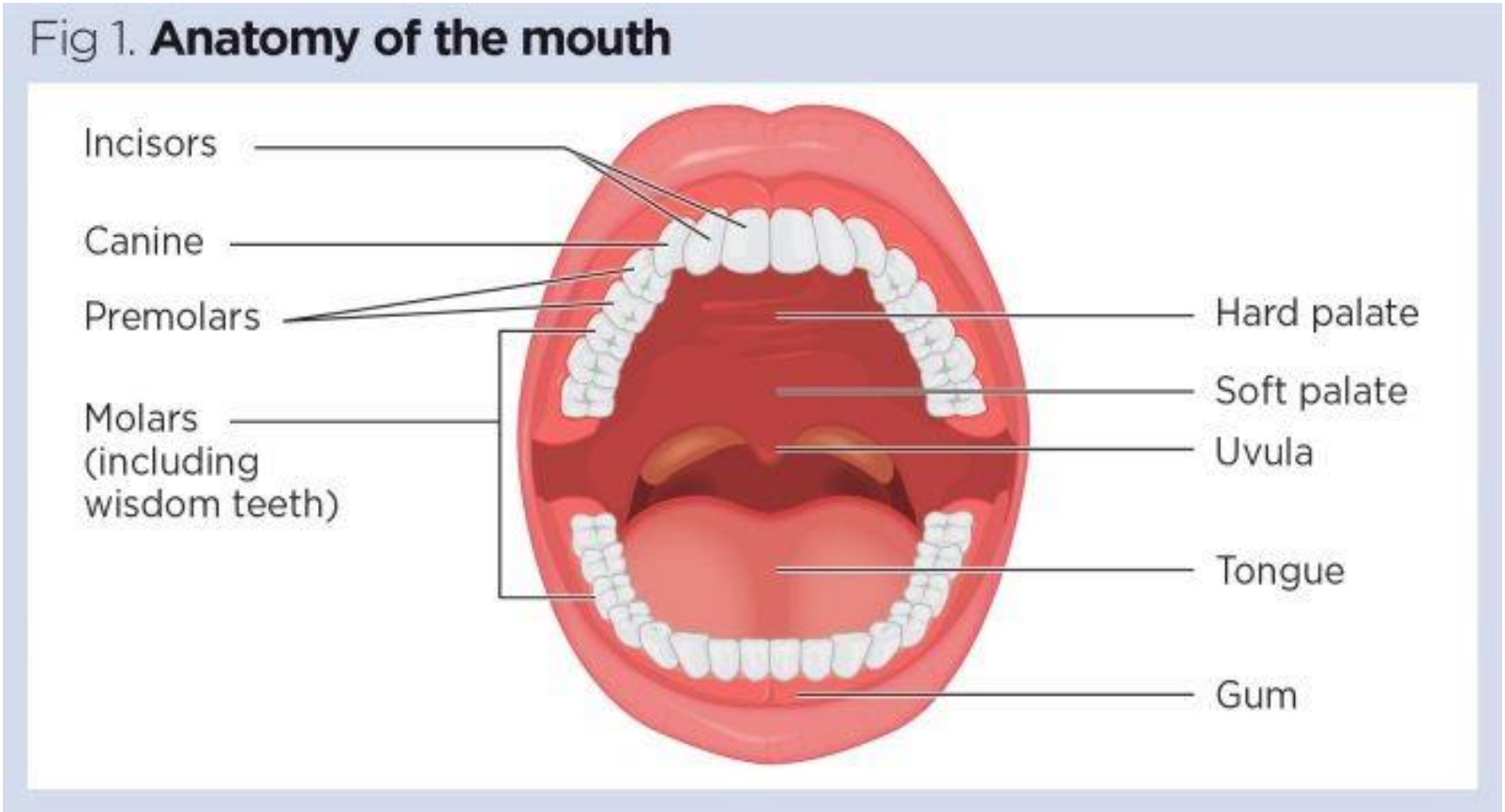
- **TEETH:**

they are important for the process of mastication (chewing).



# TONGUE:

- This is an extremely mobile mass of striated muscle covered with a mucus membrane. It moves food around the mouth to help for chewing and swallowing.



# DEGLUTITION OR SWALLOWING

Swallowing is a complicated mechanism, principally because the pharynx (It is musculomembranous tube, about 12 –14 cm long) subserves respiration and swallowing.

In general, swallowing can be divided into the following stages:

(1) **Oral stage**, which is **voluntary** and initiates the swallowing process;

(2) **Pharyngeal stage**, which is **involuntary** and constitutes passage of food through the pharynx into the esophagus.

(3) **Esophageal stage**, **involuntary** phase that transports food from the pharynx to the stomach.

# Stages of Swallowing



# ORAL STAGE:

- Swallowing starts by closing the mouth and the bolus will be maneuvered or moved to the postero-dorsal surface of the tongue
- The tongue will squeeze or roll the bolus against the hard palate in an upward and backward direction.
- Thus the bolus will be forced into the pharynx. Saliva is necessary for normal swallowing.

Oral stage begins when food is placed in the mouth and moistened with saliva. **Moistened food is called a food bolus**. **The food bolus is voluntarily chewed with the teeth that are controlled by the muscles of mastication (chewing)**

# PHARYNGEAL STAGE:

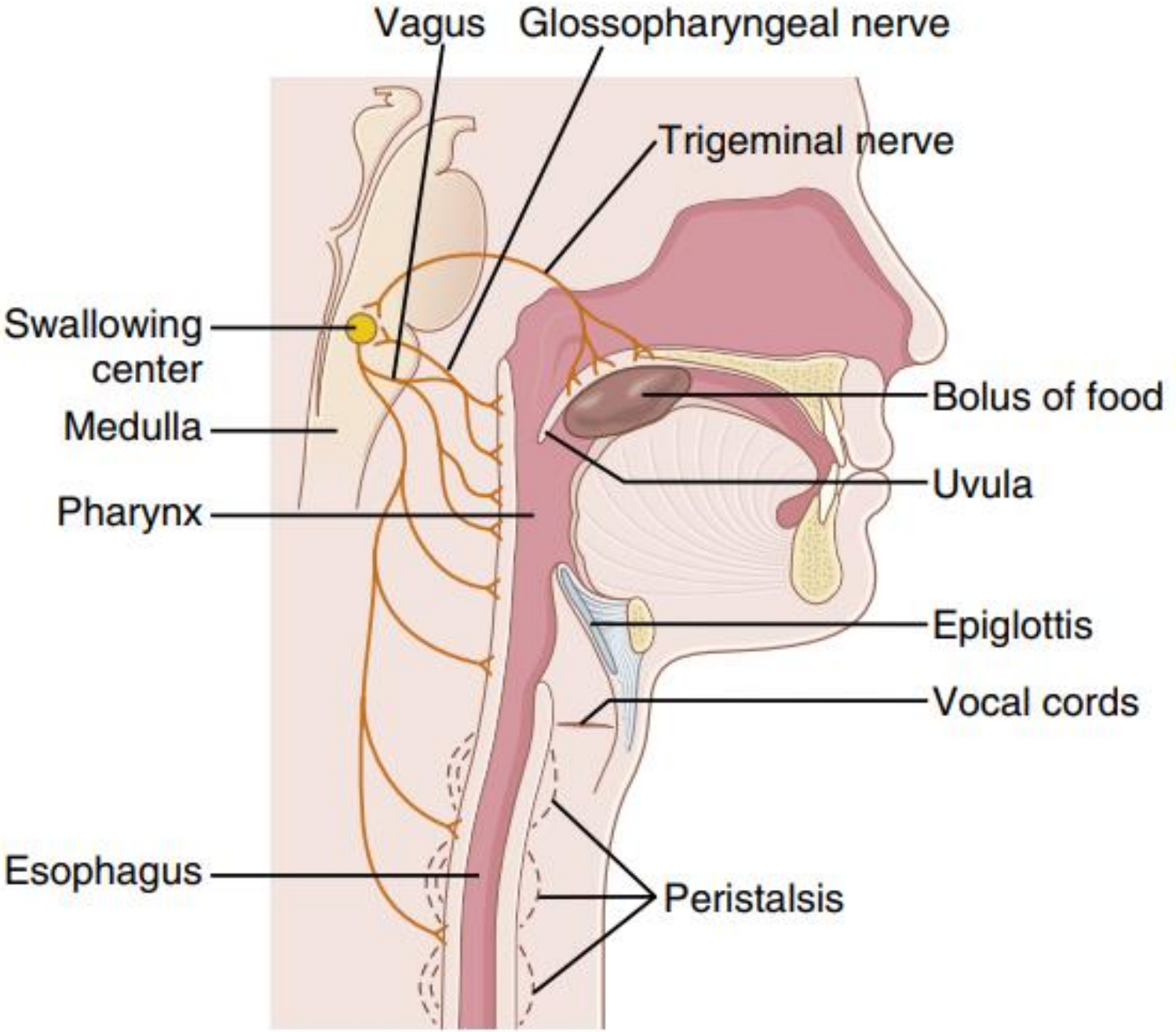
- When the bolus is pushed backwards in the mouth, it stimulates the **swallowing receptor** areas all around the opening of the pharynx and particularly on the tonsillar pillars→ sensory branch of the **trigeminal (5th) and glossopharyngeal (9th) nerves** → brainstem where the swallowing or the deglutition center is situated →the pharynx through **5th, 9t , 10th and 12th cranial nerves.**
- These motor impulses will produce a series of automatic pharyngeal muscular contractions.
- The **pharyngeal phase has TWO crucial biological features**:

**1- Food passage**, propelling the food bolus through the pharynx and upper esophageal sphincter (UES) to the esophagus; and

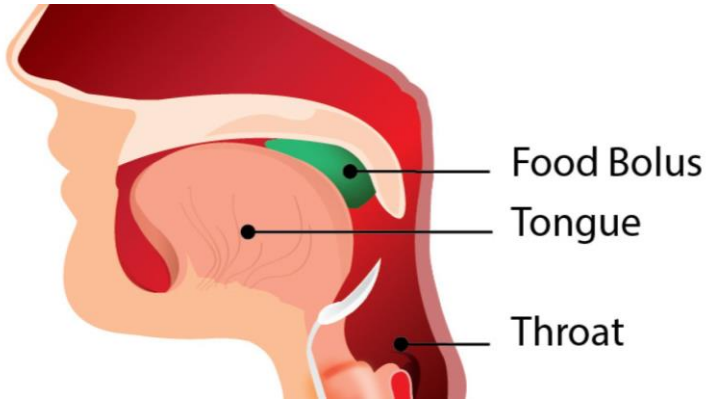
**2- Airway protection**, insulating the larynx and trachea from the pharynx during food passage to prevent the food from entering the airway.

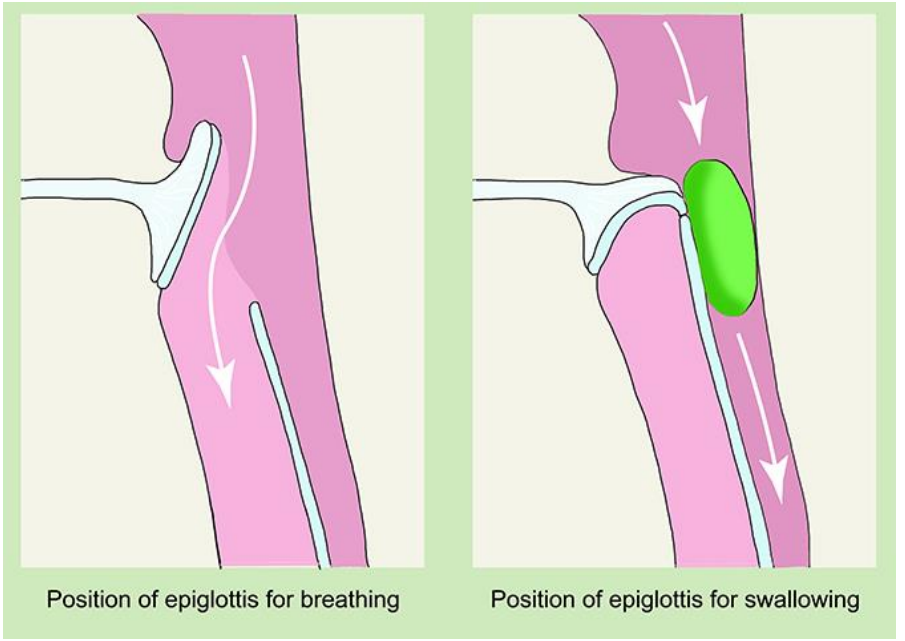
**Figure :**

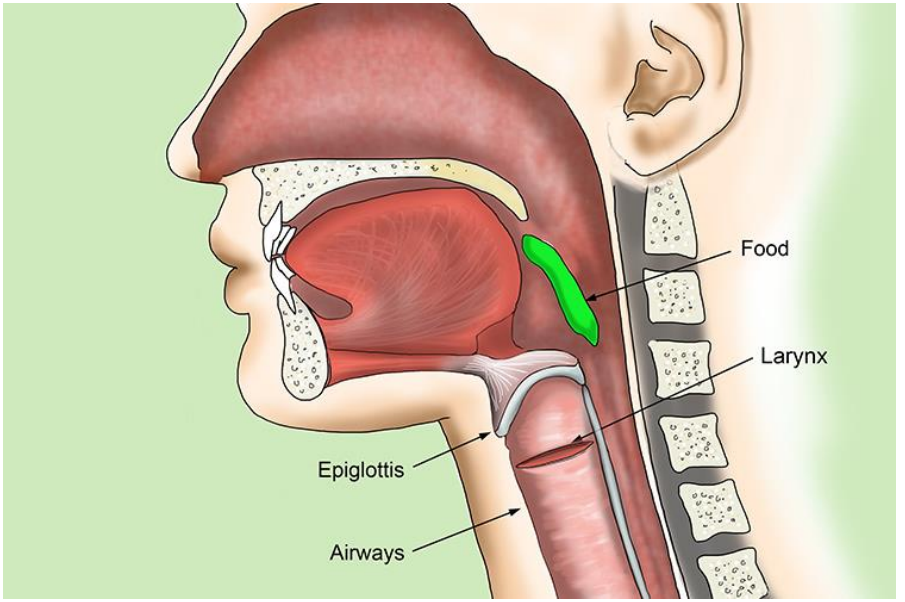
**Swallowing mechanism**



- The swallowing movements have to serve two quiet different functions:
- First is to propel the food through the pharynx and into the oesophagus.
- Second is to protect the airways both above and below form the possible entrance of food particles.



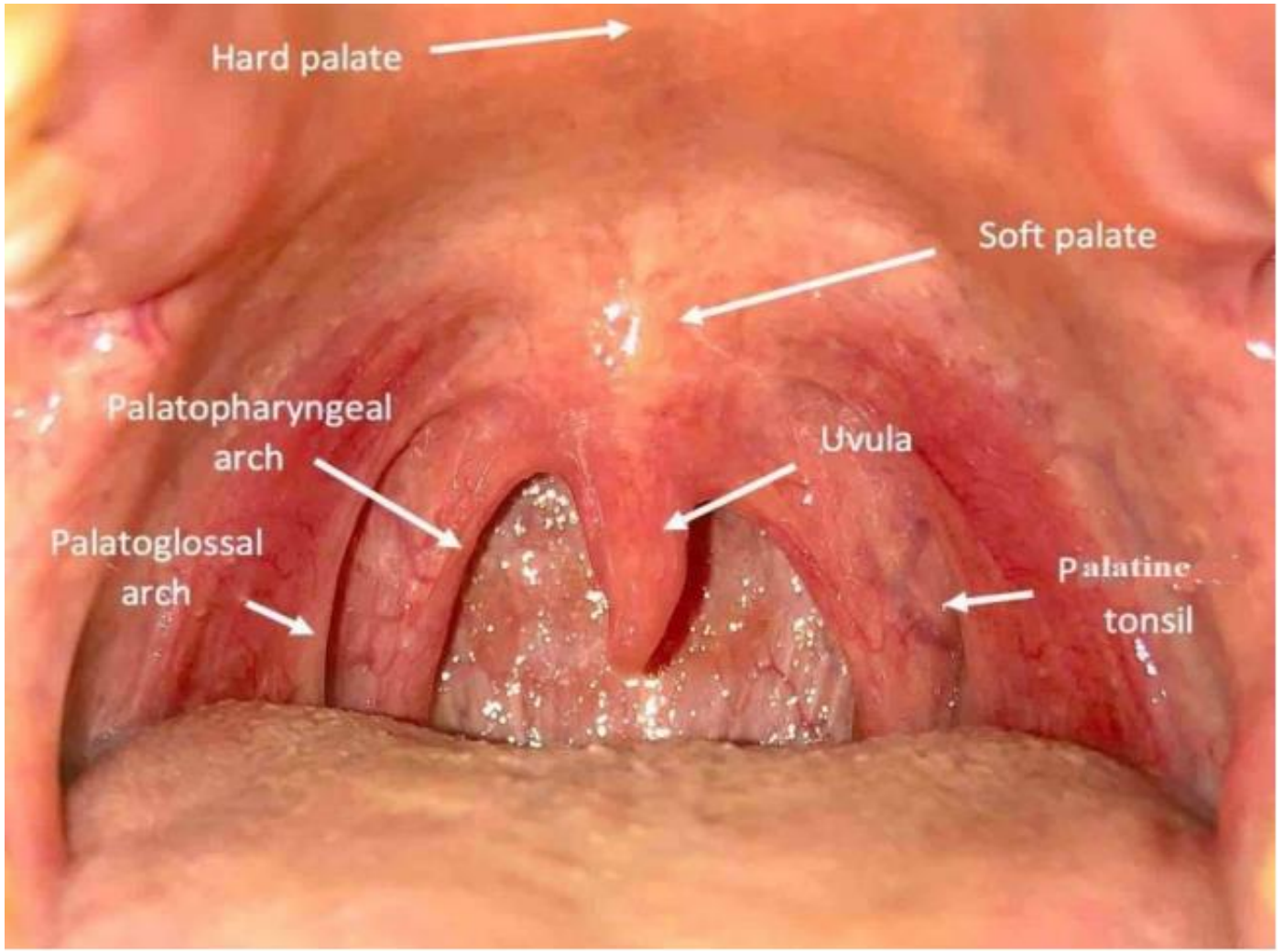



• The pharyngeal movements that occur in the second stage of swallowing are the followings:-

• **The soft palate will be pulled upwards** in order to close the posterior nares, so that no food or fluid will enter the nasal cavity **(protective).**

•**The palatopharyngeal folds** on each side of the pharynx are pulled medially to approximate each other. In this way, these folds form a sagittal slit through which the food must pass into the posterior pharynx.



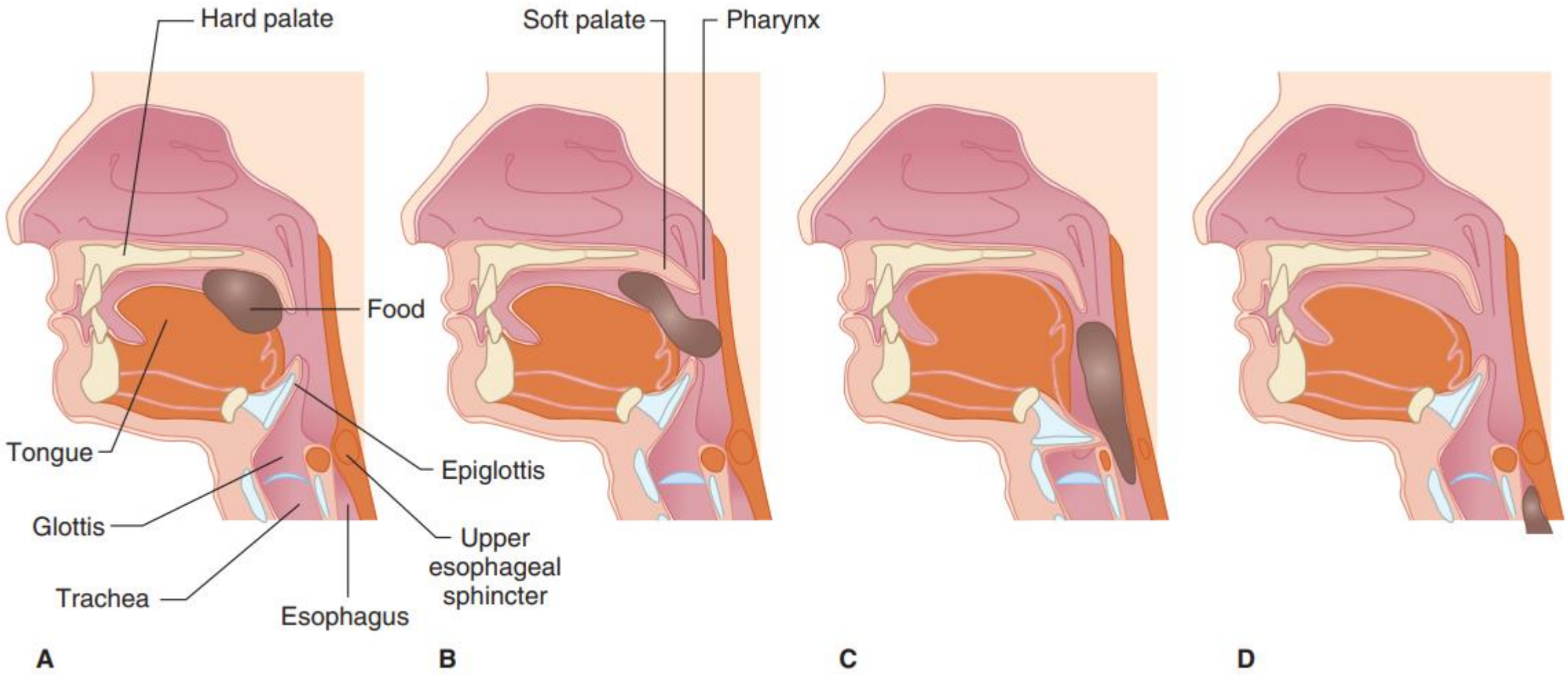



**FIGURE Movement of food through the pharynx and upper esophagus during swallowing :**

**(A) The tongue pushes the food bolus to the back of the mouth.**

**(B) The soft palate elevates to prevent food from entering the nasal passages.**

**(C) The epiglottis covers the glottis to prevent food from entering the trachea and the upper esophageal sphincter relaxes.**

**(D) Food descends into the esophagus**

- **The vocal cords of the larynx are strongly approximated, and the larynx is pulled upward and anteriorly by the neck muscles.** These actions, combined with the presence of ligaments that prevent upward movement of the epiglottis, cause the epiglottis to swing backward over the opening of the larynx. **All these effects acting together prevent passage of food into the nose and trachea**.**This is a protective mechanism.**

- The upward movement of the larynx also pulls up and enlarges the opening to the esophagus. At the same time, the upper 3 to 4 centimeters of the esophageal muscular wall, called **the upper esophageal sphincter (also called the pharyngoesophageal sphincter), relaxes**. Thus, food moves easily and freely from the posterior pharynx into the upper esophagus.

- **The upper oesophageal sphincter will relax to allow the food to pass from the posterior pharynx to the oesophagus**. This sphincter (made from crico-pharyngeus muscle) is in a state of tonic contraction normally between swallows and thus it **prevents the air form going to the oesophagus during respiration.**

The physiological role of this sphincter is :

**1- To protect against reflux of food into the airways**

**2- Prevent entry of air into the digestive tract.**

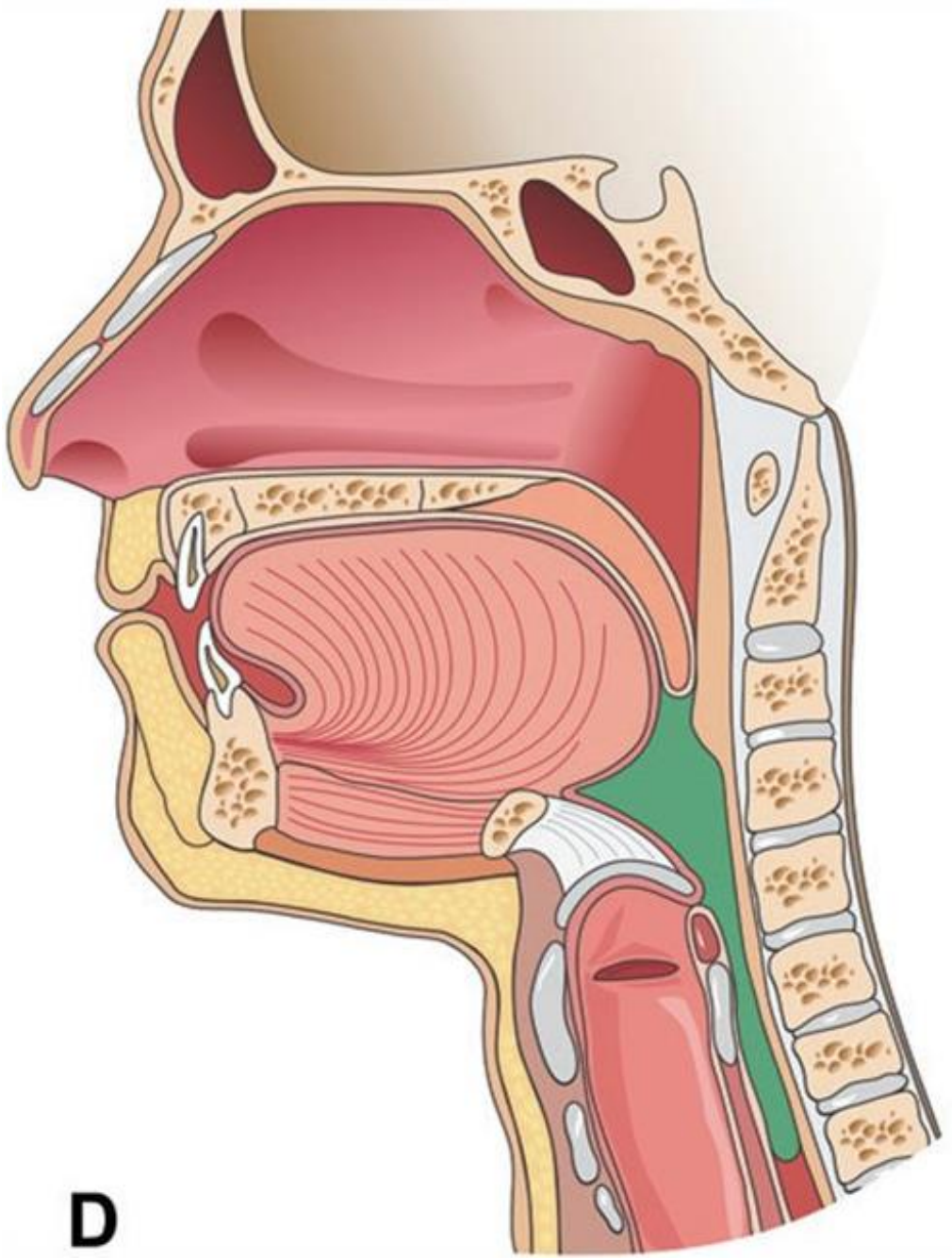
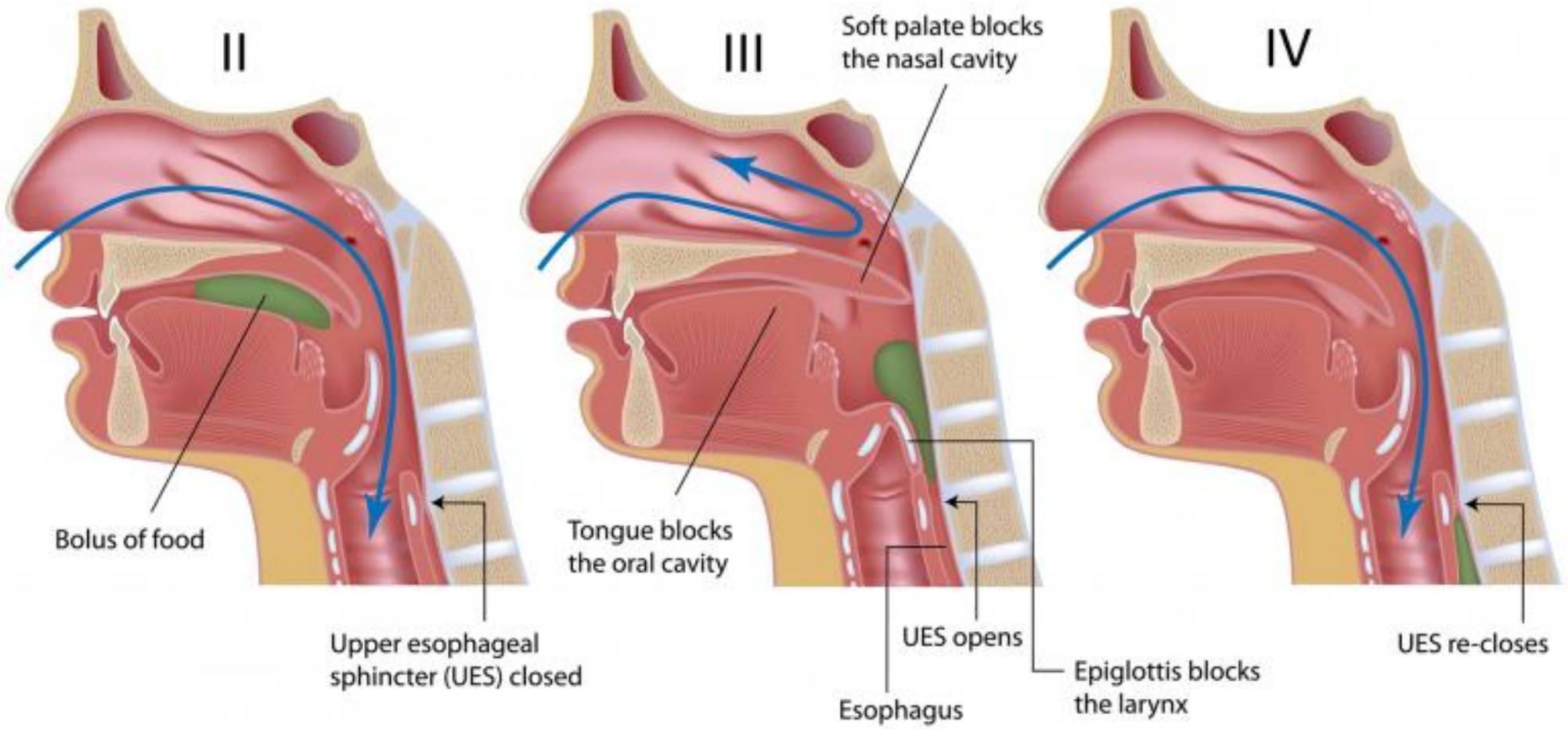


**Figure :**

**Two crucial biological features:**

**1- Food passage from the oral cavity into stomach and**

**2- Protecting material from entering the airway**



# Summary of the mechanics of the pharyngeal stage

To summarize the mechanics of the pharyngeal stage of swallowing:

**1- The trachea is closed**.

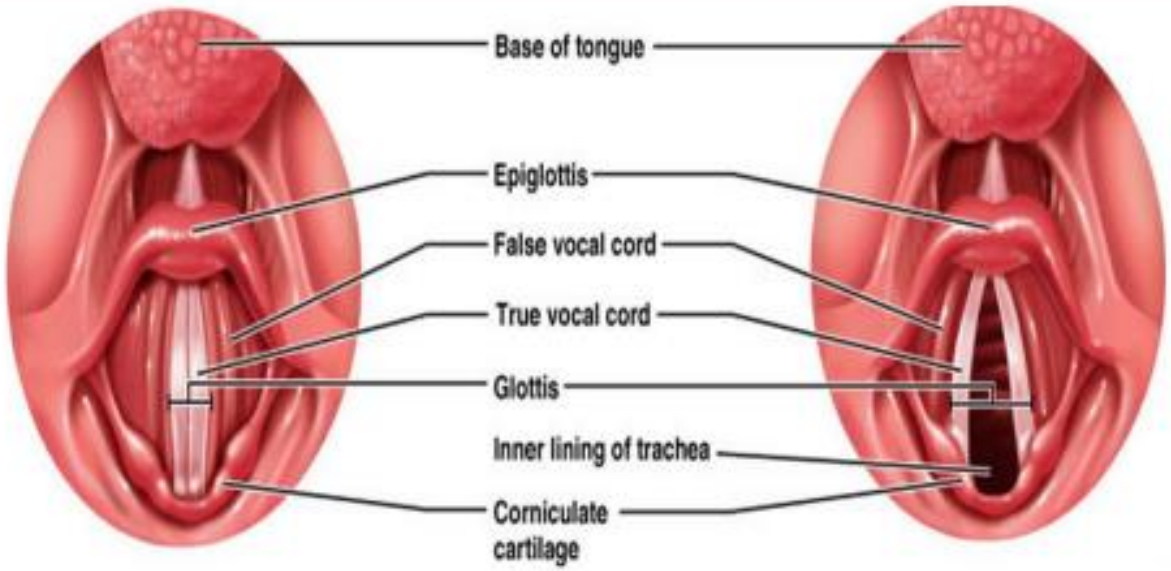
**2- The esophagus is opened**

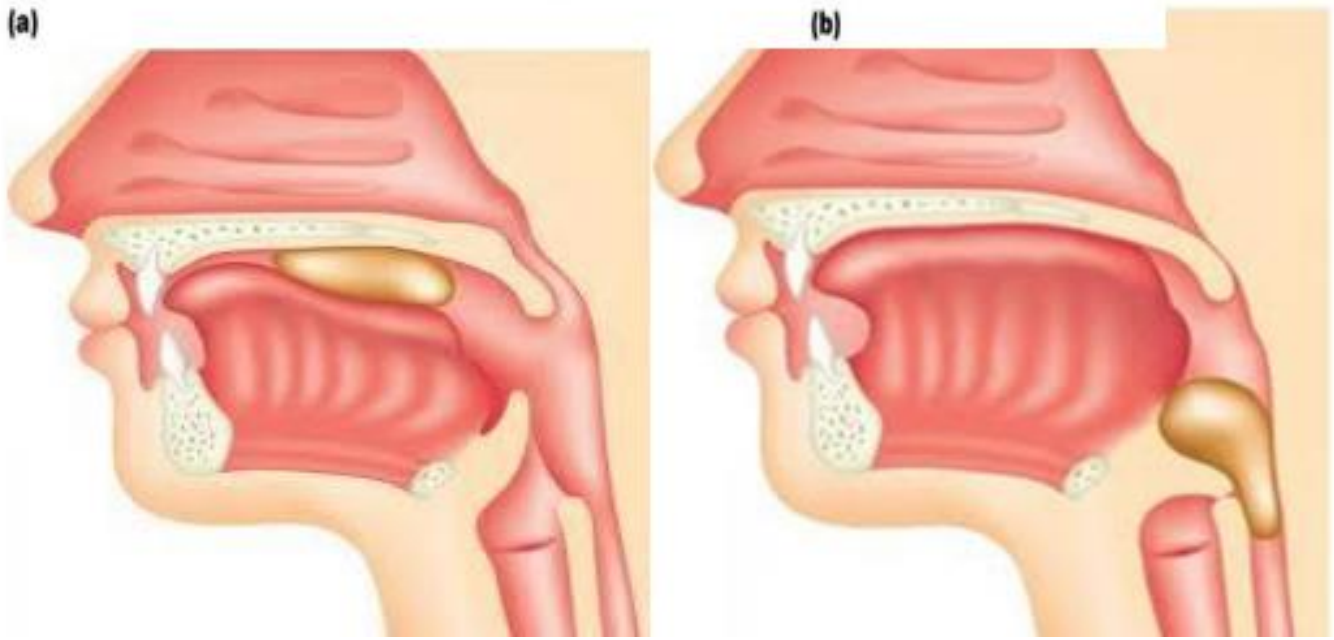
**3- Fast peristaltic wave initiated by the nervous system of the pharynx forces the bolus of food into the upper esophagus,**

with the **entire process occurring in less than 2 seconds**.

# Summary of The Pharyngeal Stage

- The trachea is closed.
- The esophagus is opened
- A fast peristaltic wave initiated by the nervous system of the pharynx forces the bolus of food into the upper esophagus
- Time of process is < 2 seconds.



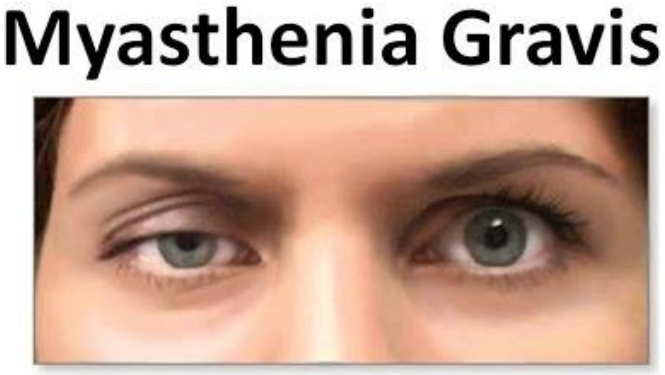



- **Swallowing can be greatly affected or prevented by**:
- Any damage to the **cranial nerves (5 th , 9 th , 10th)**
- Or to the swallowing center such as in **poliomyelitis or encephalitis**.
- Or to the swallowing muscle as in **muscle dystrophy**
- Failure of neuromuscular transmission as in **myasthenia gravis**.
- One of the most important conditions of paralysis of the swallowing mechanism occurs when the patient is under **deep anesthesia**.





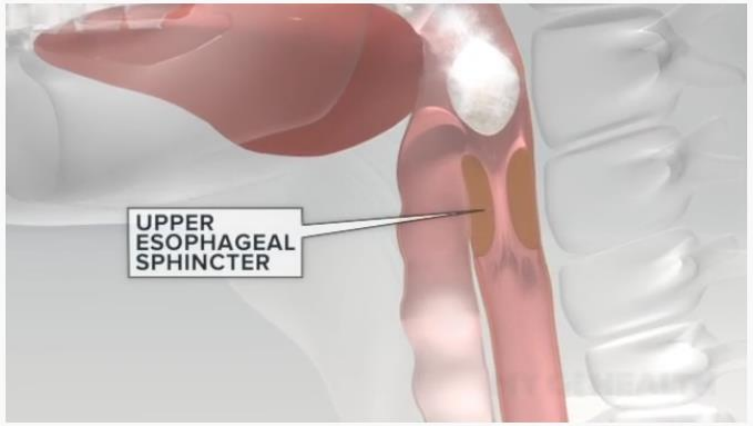


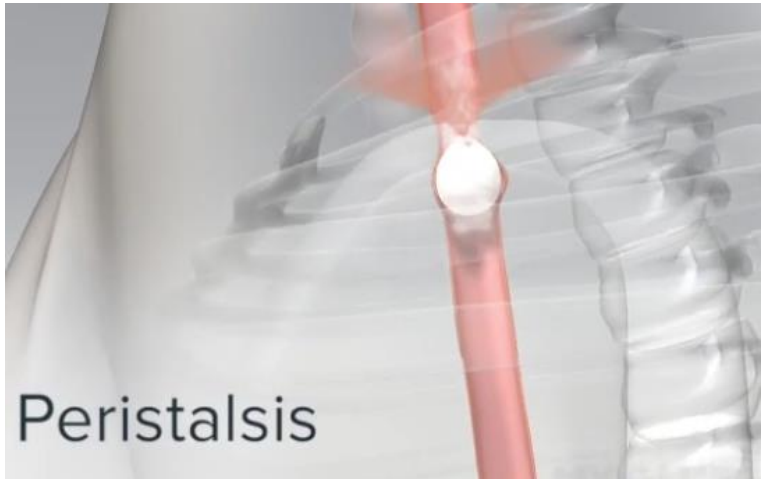





# OESOPHAGEAL STAGE:

- The oesophageal stage of swallowing begins with the **relaxation of the upper oesophageal sphincter**.
- Immediately after the bolus has passed, the sphincter closes, the **glottis opens and breathing returns.**
- Once in the oesophagus the bolus is moved towards the stomach by a progressive wave of muscle contraction which is known as **peristaltic wave.**
- **Swallowing can occur while a person is upside down since it is not primarily gravity but the peristaltic wave which moves the bolus to the stomach.**



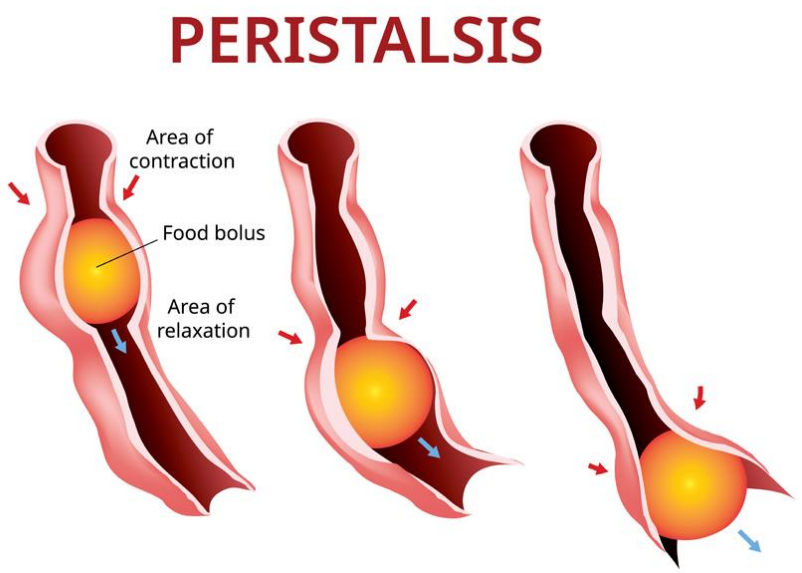


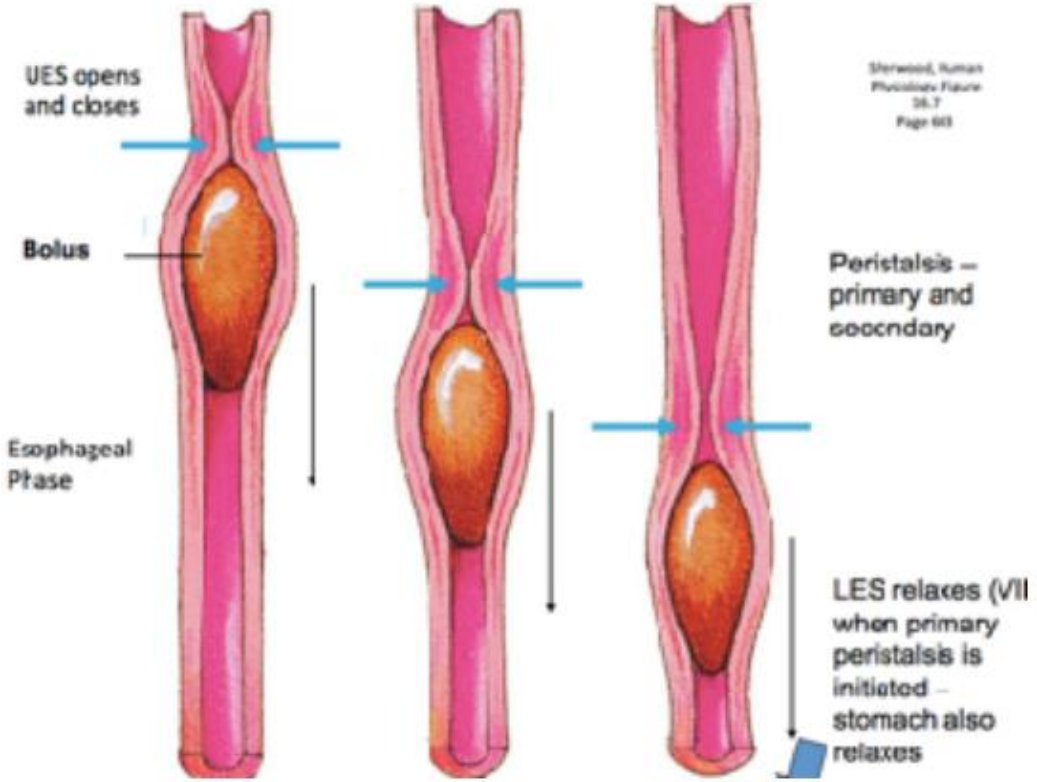

# OESOPHAGEAL STAGE ….Cont

In upright position liquids and semi-solids foods generally fall by gravity to the lower oesophagus ahead of the peristaltic wave. The oesophagus has two types of movements:

**1-Primary peristalsis**

**2-Secondary peristalsis**



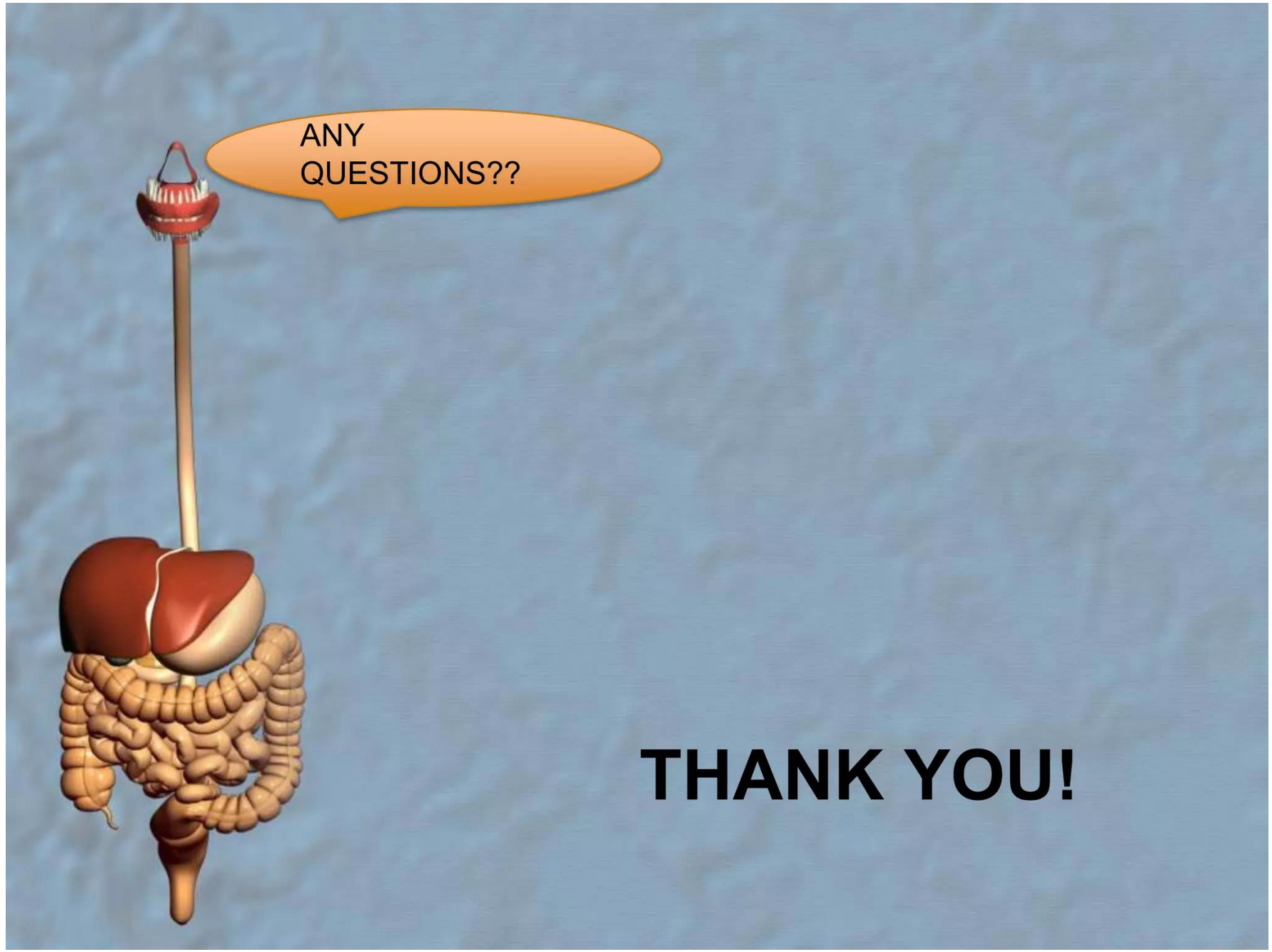



# Peristalsis

**1-Primary peristalsis**: is the continuation of the peristaltic wave that started higher up in the pharynx. It will take about 8-10 seconds to pass from the pharynx to the stomach.

**The vagus nerve is the main nerve that controls this primary peristalsis.** If this primary peristalsis fails for some reason to move all the food then secondary peristalsis will start.

**2-Secondary peristalsis**: it will be stimulated by the distension of the oesophagus by the retained food. **The myenteric plexus of the oesophagus are responsible for these secondary peristalsis.**


ANY
QUESTIONS??
THANK YOU!