

HUMAN ANATOMY AND PHYSIOLOGY-II

UNIT-II DIGESTIVE SYSTEM



**Centurion
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*Shaping Lives...
Empowering Communities...*

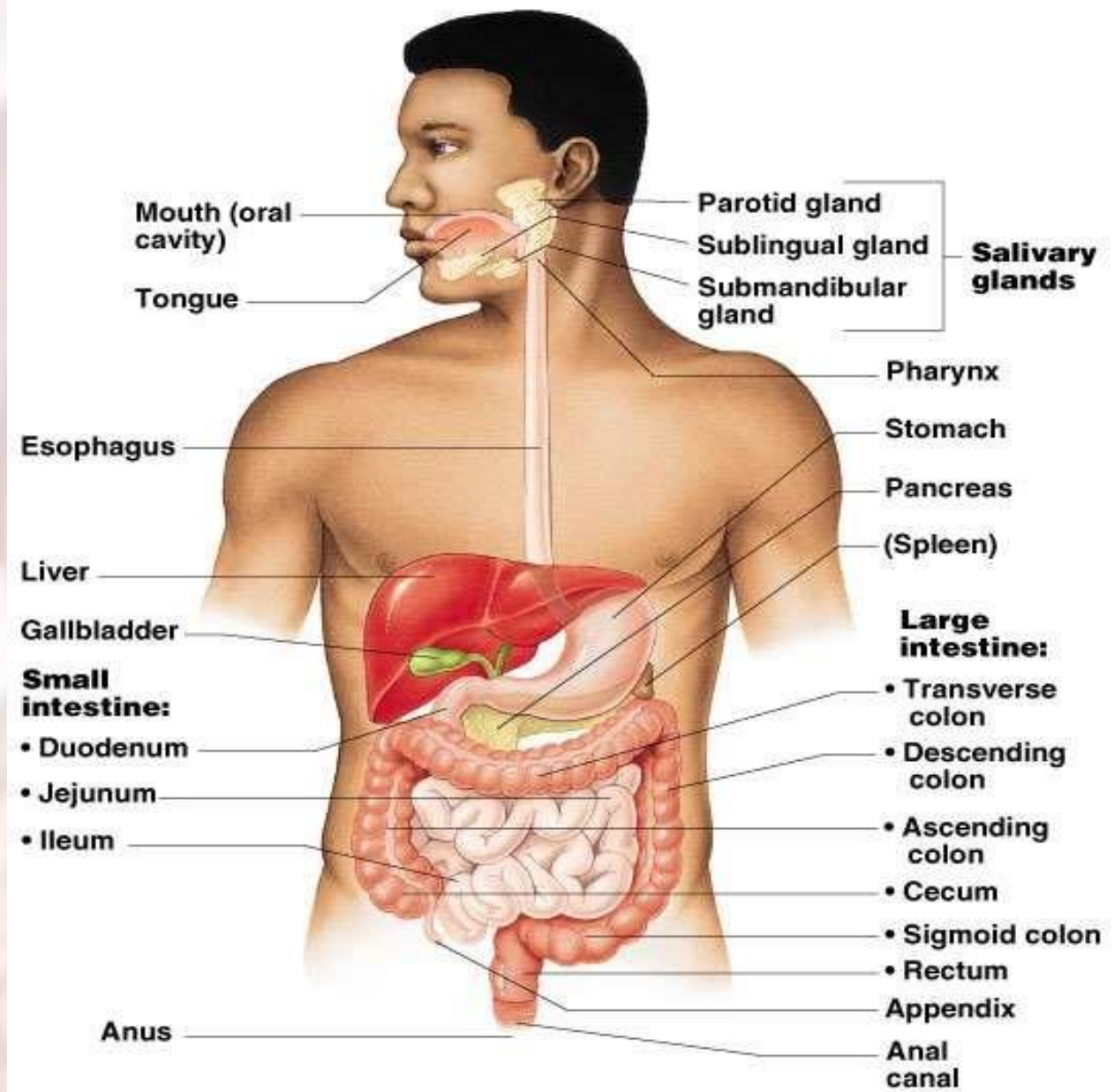
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- Anatomy of GI Tract with special reference to anatomy and functions of stomach
- Acid production in the stomach, regulation of acid
- Production through parasympathetic nervous system, Pepsin role in protein digestion
- Small intestine and large intestine,
- Anatomy and functions of salivary glands,
- Pancreas and liver
- Movements of GIT,
- Digestion and absorption of nutrients
- Disorders of GIT

- It is a collective name used to describe the alimentary canal, its accessory organs and a variety of digestive processes that take place at different levels in the canal to prepare food eaten in the diet for absorption.
- The alimentary canal begins at the mouth, passes through the thorax, abdomen and pelvis and ends at the anus

Organs of the Digestive System

- ⊙ Mouth
- ⊙ teeth
- ⊙ Salivary glands
- ⊙ Pharynx
- ⊙ Esophagus
- ⊙ Stomach
- ⊙ Liver
- ⊙ Gallbladder (GB)
- ⊙ Pancreas
- ⊙ Small intestine
- ⊙ Large intestine
- ⊙ Rectum
- ⊙ Anus



Ingestion This is the taking of food into the alimentary tract, i.e. eating and drinking.

Propulsion This mixes and moves the contents along the alimentary tract.

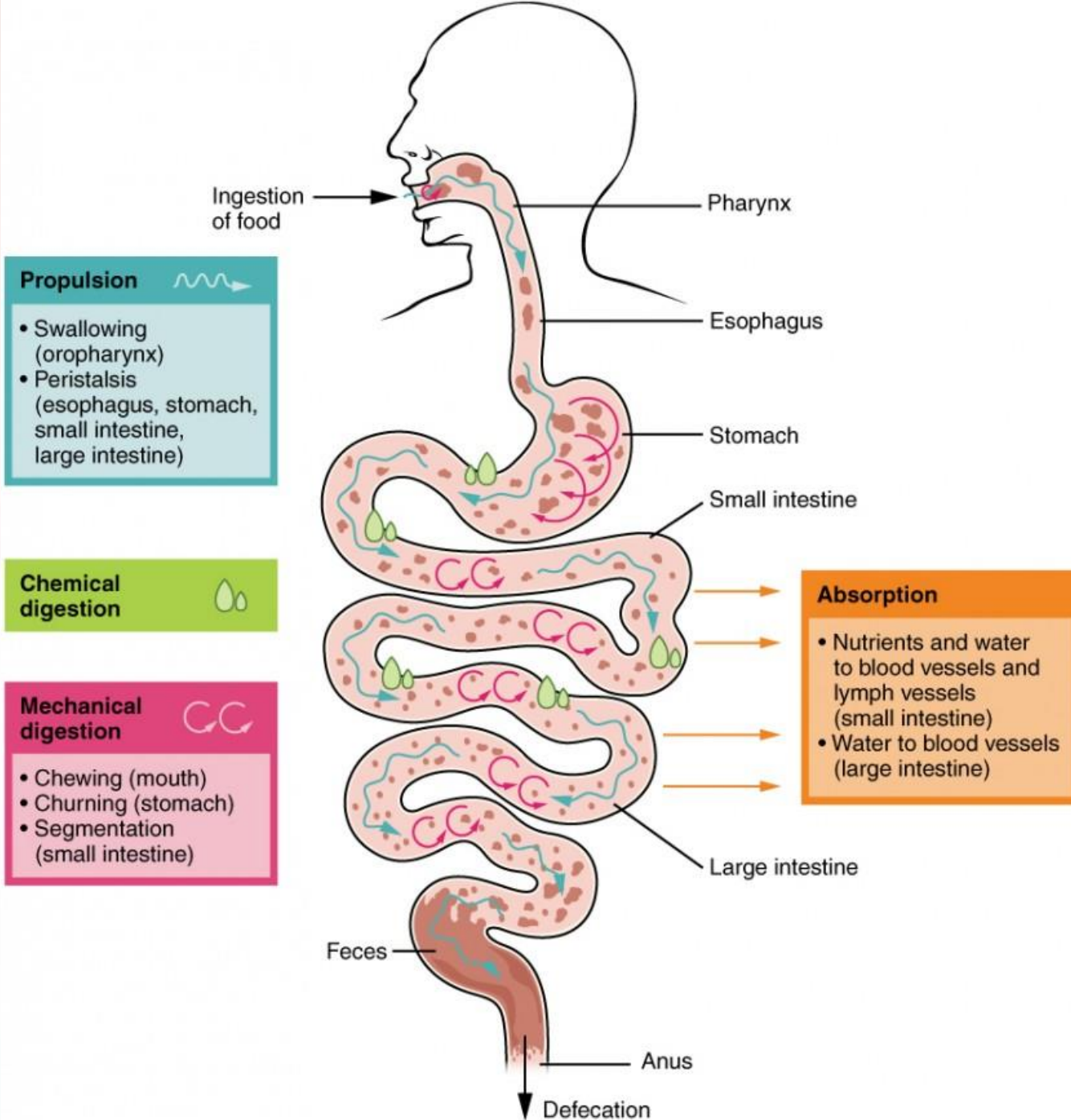
Digestion This consists of:

mechanical breakdown of food by, e.g. mastication (chewing)

chemical digestion of food into small molecules by enzymes present in secretions produced by glands and accessory organs of the digestive system.

Absorption This is the process by which digested food substances pass through the walls of some organs of the alimentary canal into the blood and lymph capillaries for circulation and use by body cells.

Elimination Food substances that have been eaten but cannot be digested and absorbed are excreted from the alimentary canal as faeces by the process of defaecation.



Basic structure of the alimentary canal

The walls of the alimentary tract are formed by four layers of tissue:

- adventitia or serosa – outer covering
- muscle layer
- submucosa
- mucosa – lining

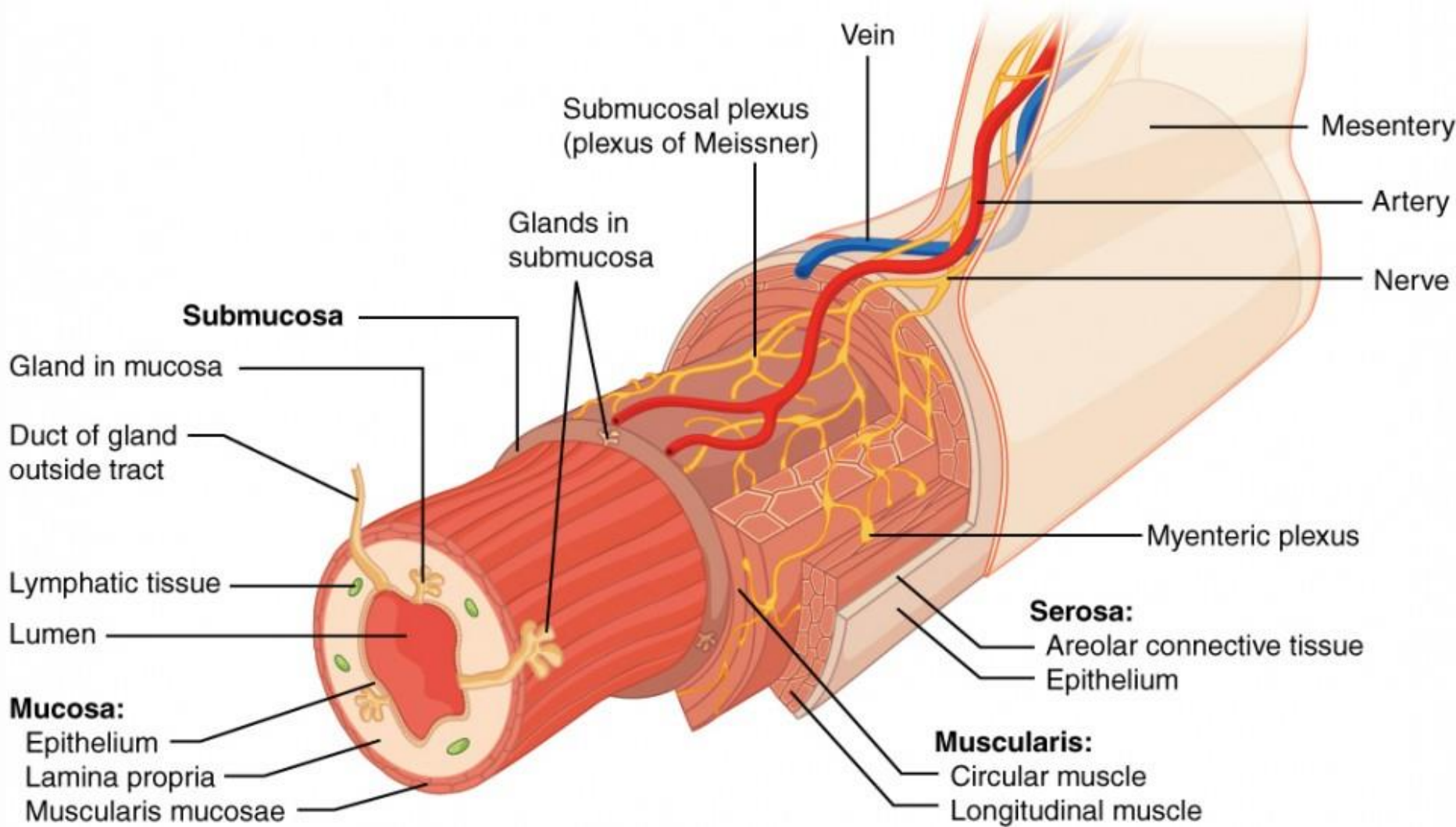
Adventitia or serosa :

outermost layer.

- In the thorax it consists of loose fibrous tissue
- in the abdomen the organs are covered by a serous membrane (serosa) called peritoneum.

Peritoneum

- The peritoneum is the largest serous membrane of the body
- containing a small amount of serous fluid, within the abdominal cavity.
- richly supplied with blood and lymph vessels, and contains many lymph nodes **conti.....**



- provides a physical barrier to local spread of infection, and can isolate an infective focus such as appendicitis
- It has two layers:
 - i. the parietal peritoneum, which lines the abdominal wall
 - ii. the visceral peritoneum, which covers the organs (viscera) within the abdominal and pelvic cavities

Muscle layer:

- consists of two layers of smooth (involuntary) muscle
- Between these two muscle layers are blood vessels, lymph vessels and a plexus (network) of sympathetic and parasympathetic nerves, called the myenteric plexus
- These nerves supply the adjacent smooth muscle and blood vessels
- Contraction and relaxation of these muscle layers occurs in waves, which push the contents of the tract onwards. This type of contraction of smooth muscle is called peristalsis

Submucosa

consists of loose areolar connective tissue containing collagen and some elastic fibres, which binds the muscle layer to the mucosa.

The nerve plexus is the submucosal plexus containing sympathetic and parasympathetic nerves

Mucosa

consists of three layers of tissue

mucous membrane formed by *columnar epithelium* is the innermost layer, and has three main functions: protection, secretion and absorption

lamina propria consisting of loose connective tissue, which supports the blood vessels that nourish the inner epithelial layer, and varying amounts of lymphoid tissue that has a protective function

muscularis mucosa, a thin outer layer of smooth muscle that provides involutions of the mucosa layer, e.g. gastric glands villi

Nerve supply :

The alimentary canal and its related accessory organs are supplied by nerves from both divisions of the autonomic nervous system, i.e. both parasympathetic and sympathetic parts

The Parasympathetic supply

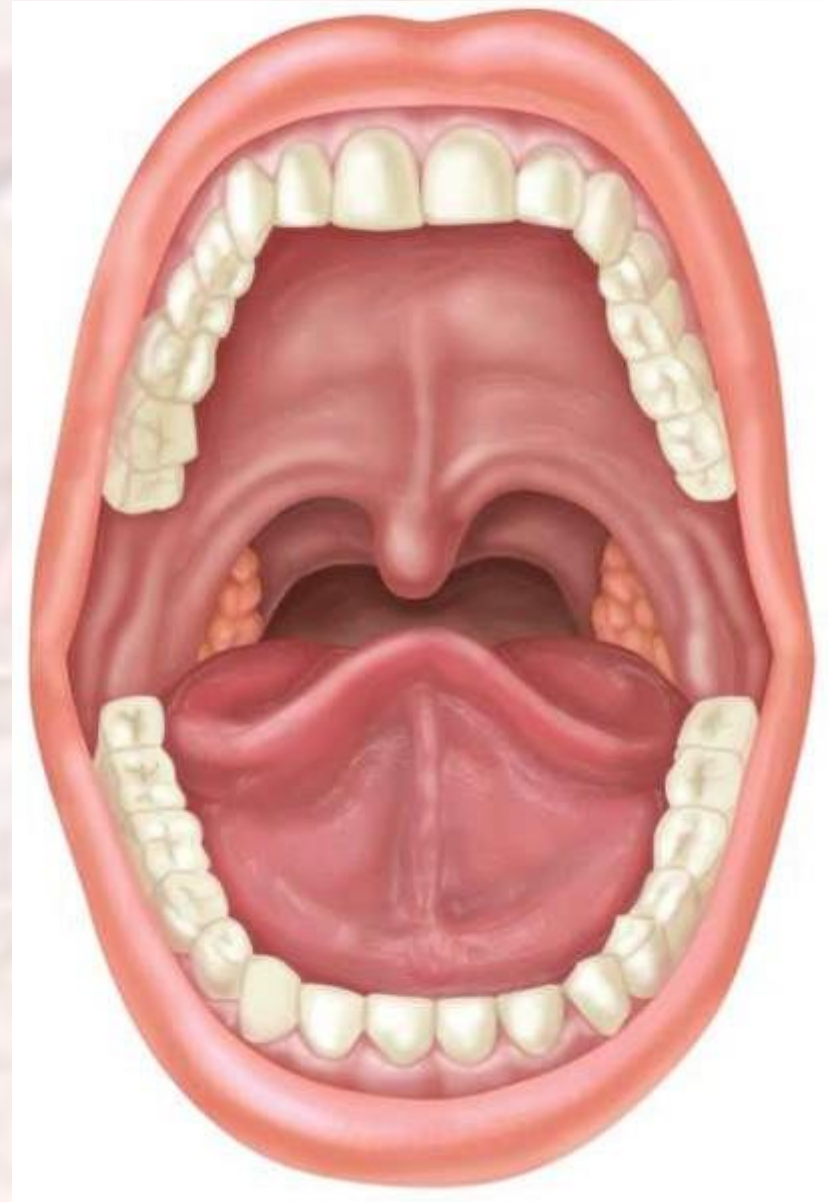
- increased muscular activity, especially peristalsis, through increased activity of the myenteric plexus
- increased glandular secretion, through increased activity of the submucosal plexus

The Sympathetic SUPPLY

- decrease muscular activity, especially peristalsis, because there is less stimulation of the myenteric plexus
- decrease glandular secretion, as stimulation of the submucosal plexus is reduced.

Oral Cavity (mouth)

- Roof is **palate**
 - Hard – bony anterior
 - Soft – flexible posterior
- Hanging down from soft palate is **uvula**
 - Speech production
 - Location of **gag reflex**

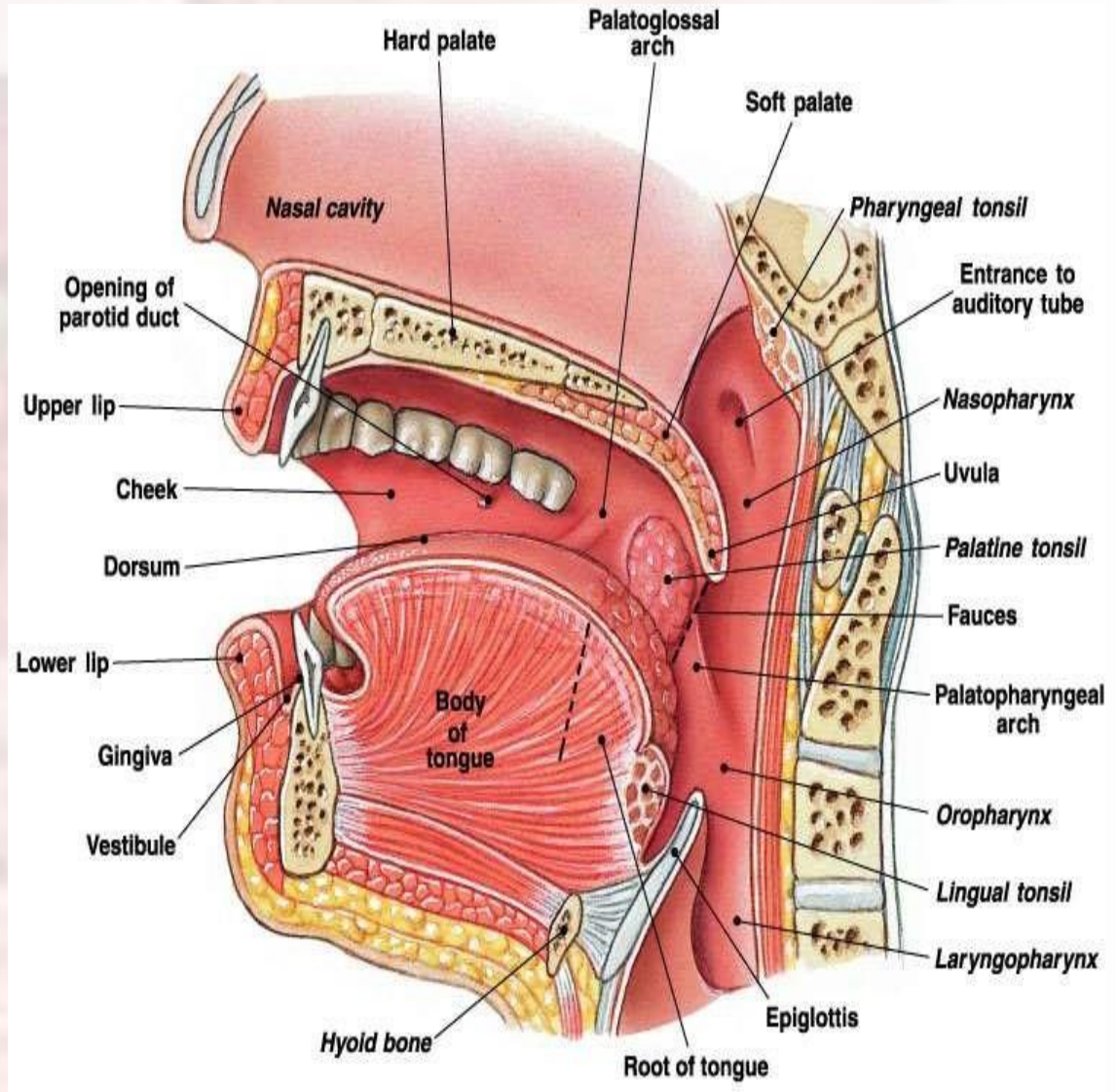


The mouth or oral cavity is bounded by muscles and bones:

- Anteriorly – by the lips
- Posteriorly – it is continuous with the oropharynx
- Laterally – by the muscles of the cheeks
- Superiorly – by the bony hard palate and muscular soft palate
- Inferiorly – by the muscular tongue and the soft tissues of the floor of the mouth.

Oral Cavity

- Cheeks are lateral walls
- Lips are anterior opening
- Entire cavity lined with mucous membrane



Oral Cavity

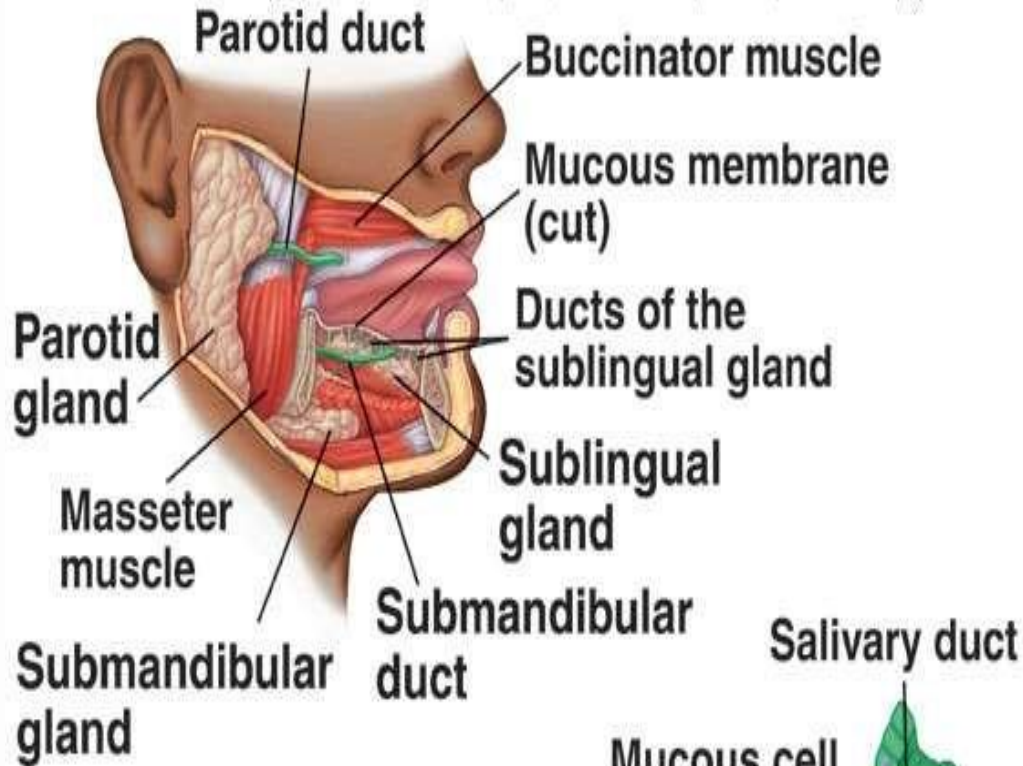
- Digestion begins when food enters mouth
 - Mechanically broken up by chewing
- **Tongue** moves food within mouth
- Mixes with **saliva**
 - Digestive enzymes
 - Lubricates
- **Taste buds** on tongue surface
 - Detect bitter, sweet, salty, sour flavors

Processes of the Mouth

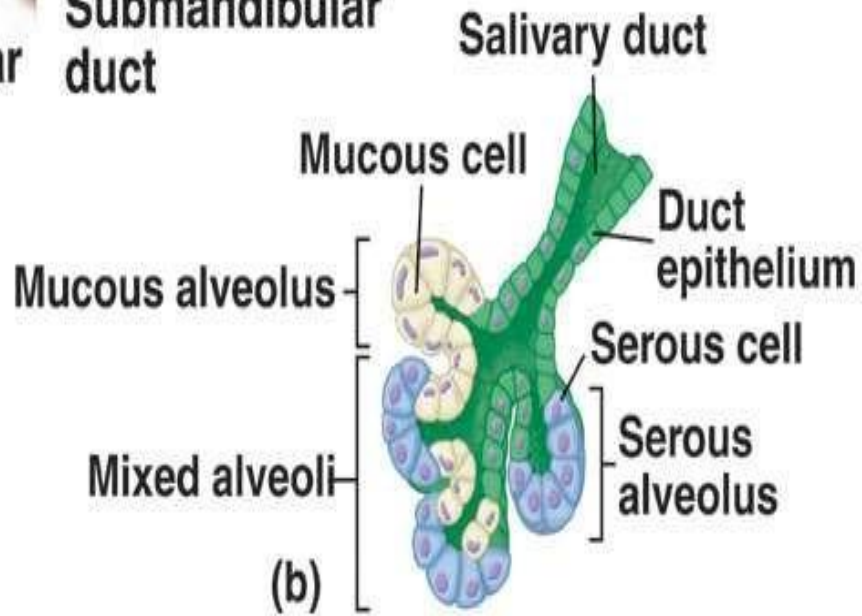
- Mastication (chewing) of food
- Mixing masticated food with saliva
- Initiation of swallowing by the tongue
- Allowing for the sense of taste

Salivary Glands

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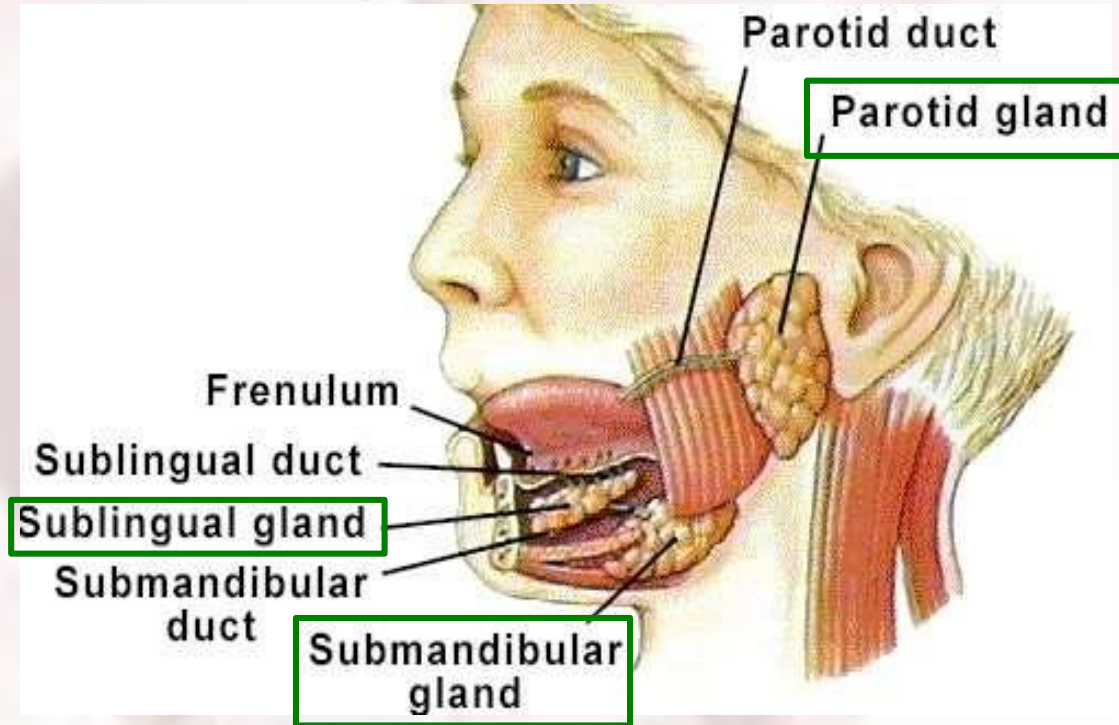


(b)

Produce saliva

- Prevents bacterial infection
- Lubrication
- Contains salivary amylase
 - Breaks down starch

Three pairs of Salivary Glands



- Parotid – lateral side of face, anterior to ear, drain by parotid duct to vestibule near 2nd upper molar
- Submandibular – medial surface of mandible – drain near lingual frenulum drain posterior to lower molars
- Sublingual – in floor of mouth - drain near frenulum

Structure of the salivary glands

- The glands are all surrounded by a fibrous capsule.
- consist of a number of lobules made up of small acini lined with secretory cells
- Blood supply Arterial supply is by various branches from the external carotid arteries and venous drainage is into the external jugular veins.

Composition of saliva

- Saliva is the combined secretions from the salivary glands and the small mucus-secreting glands of the oral mucosa.
- About 1.5 litres of saliva is produced daily and it consists of:
 - water
 - mineral salts
 - a digestive enzyme: salivary amylase ,mucus lysozyme,
 - immunoglobulins
 - blood-clotting factors.

Secretion of saliva

Secretion of saliva is under autonomic nerve control.

- Parasympathetic stimulation causes profuse secretion of watery saliva with a relatively low content of enzymes and other organic substances.
- Sympathetic stimulation results in secretion of small amounts of saliva rich in organic material, especially from the submandibular glands.
- Reflex secretion occurs when there is food in the mouth and the reflex can easily become conditioned so that the sight, smell and even the thought of food stimulates the flow of saliva

Function

- Mixture of mucus and serous fluids
- Helps to form a food bolus
- Contains salivary amylase to begin starch digestion
- Dissolves chemicals so they can be tasted

Teeth

- The role is to masticate (chew) food
- Humans have two sets of teeth
 1. Deciduous (baby or milk) teeth
 - 20 teeth are fully formed by age two
 2. Permanent teeth
 - Replace deciduous teeth beginning between the ages of 6 to 12
 - A full set is 32 teeth, but some people do not have wisdom teeth

Classification of Teeth

Incisors

Central (6–8 mo)

Lateral (8–10 mo)

Canine (eyetooth)
(16–20 mo)

Molars

First molar (10–15 mo)

Second molar (about 2 yr)

Deciduous
(milk) teeth

Incisors

Central (7 yr)

Lateral (8 yr)

Canine (eyetooth)
(11 yr)

**Premolars
(bicuspid)**

First premolar (11 yr)

Second premolar (12–13 yr)

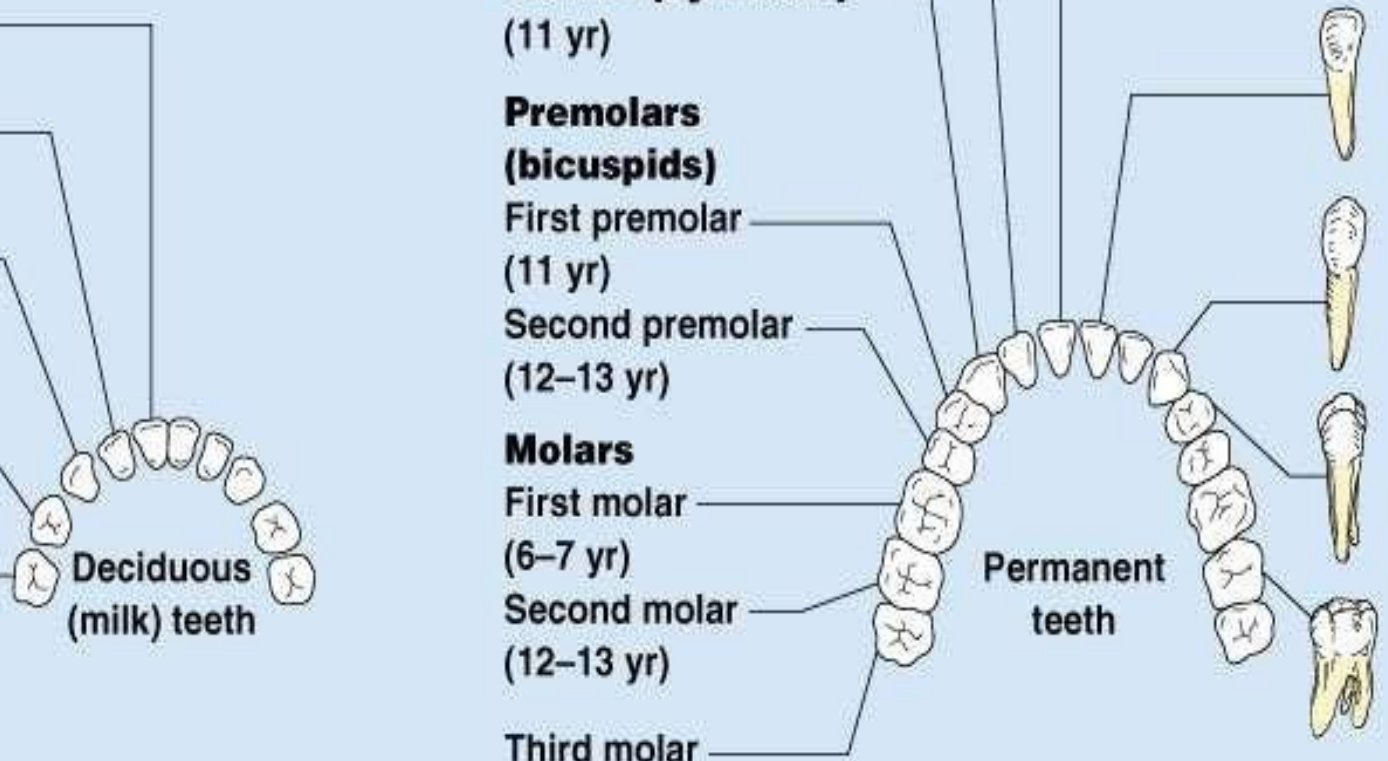
Molars

First molar (6–7 yr)

Second molar (12–13 yr)

Third molar (wisdom tooth)
(17–25 yr)

Permanent
teeth




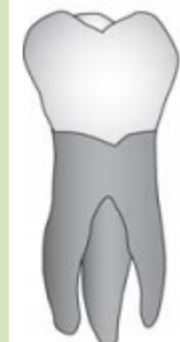


Function of Teeth

Teeth have different shapes depending on their functions.

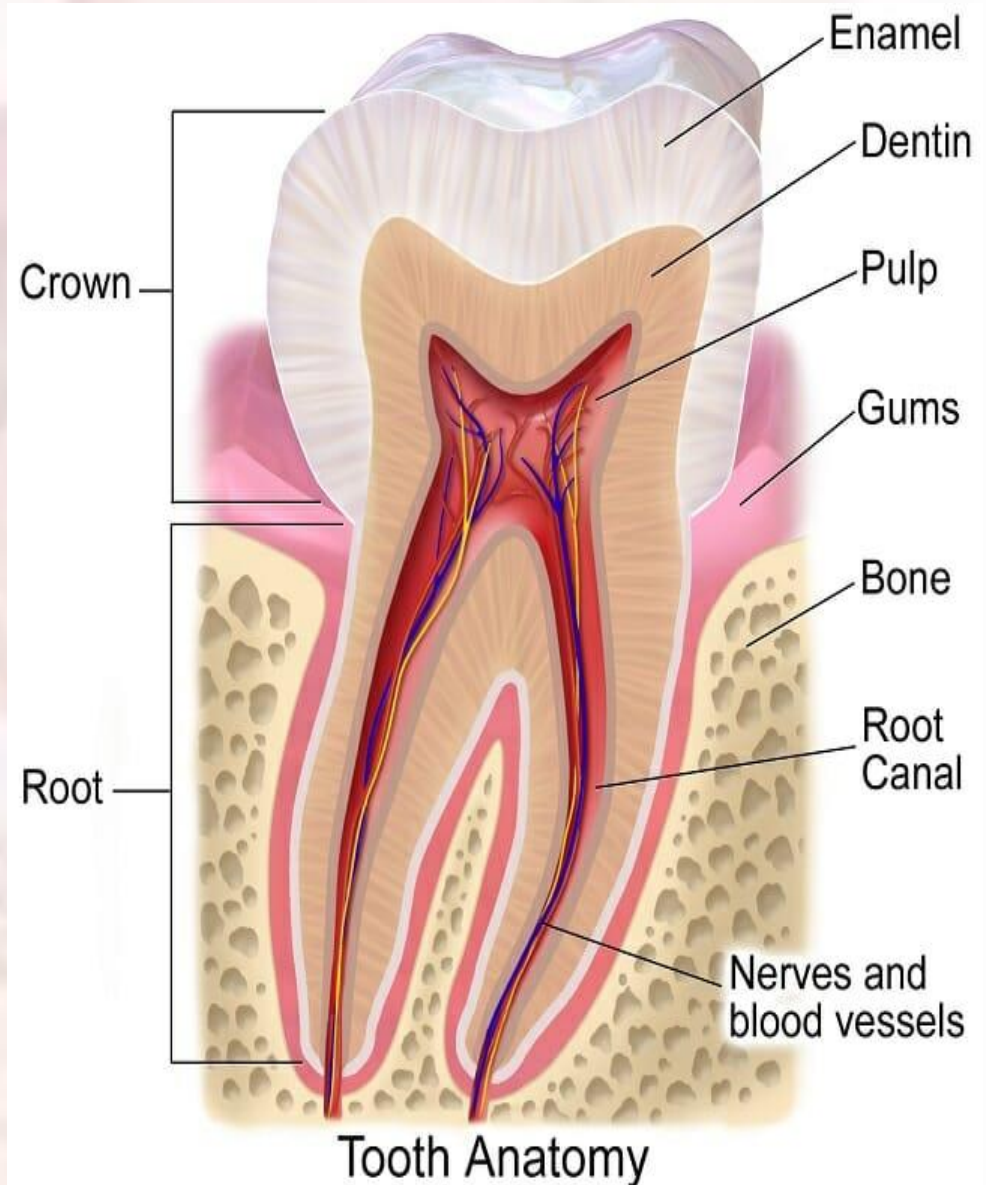
- i. Incisors and canine teeth are the cutting teeth and are used for biting off pieces of food
- ii. Premolar and molar teeth, with broad, flat surfaces, are used for grinding or chewing food

Types of human teeth

	Incisor	Canine	Premolar	Molar
				
Position in mouth	Front	Either side of incisors	Behind canine	Back
Description	Chisel-shaped (sharp edge)	Slightly more pointed than incisors	2 points (cusps), 1 or 2 roots	4 or 5 cusps 2 or 3 roots
Function	Biting of pieces of food	Similar function to incisors	Tearing and grinding food	Chewing and grinding food

Structure of a Tooth

- the crown – the part that protrudes from the gum
- the root – the part embedded in the bone
- the neck – the slightly narrowed region where the crown merges with the root.



- In the centre of the tooth is the pulp cavity containing blood vessels, lymph vessels and nerves, and surrounding this is a hard ivory-like substance called dentine.
- Outside the dentine of the crown is a thin layer of very hard substance, the enamel.
- The root of the tooth, on the other hand, is covered with a substance resembling bone, called cement, which secures the tooth in its socket.
- Blood vessels and nerves pass to the tooth through a small foramen (hole) at the apex of each root.

Blood supply

arterial blood supply to the teeth is by branches of the maxillary arteries.

The venous drainage is by a number of veins which empty into the internal jugular veins.

Nerve supply

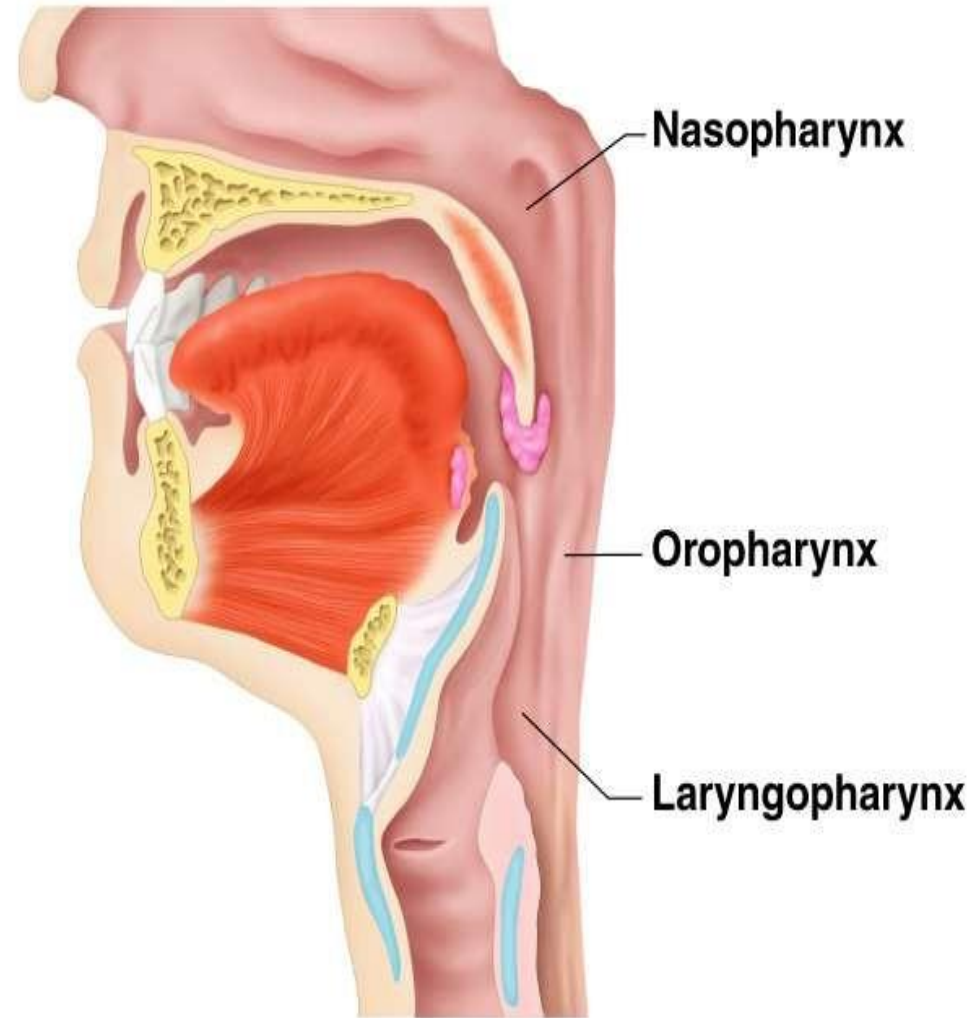
The nerve supply to the upper teeth is by branches of the maxillary nerves and to the lower teeth by branches of the mandibular nerves.

These are both branches of the trigeminal nerves

(5th cranial nerves)

Pharynx Anatomy

- Nasopharynx – not part of the digestive system
- Oropharynx – posterior to oral cavity
- Laryngopharynx – below the oropharynx and connected to the esophagus



(a)

Pharynx Function

- Serves as a passageway for air and food
- Food is propelled to the esophagus by two muscle layers
 - Longitudinal inner layer
 - Circular outer layer
- Food movement is by alternating contractions of the muscle layers (peristalsis)

Blood supply

- The blood supply to the pharynx is by several branches of the facial arteries.
- Venous drainage is into the facial veins and the internal jugular veins.

Nerve supply

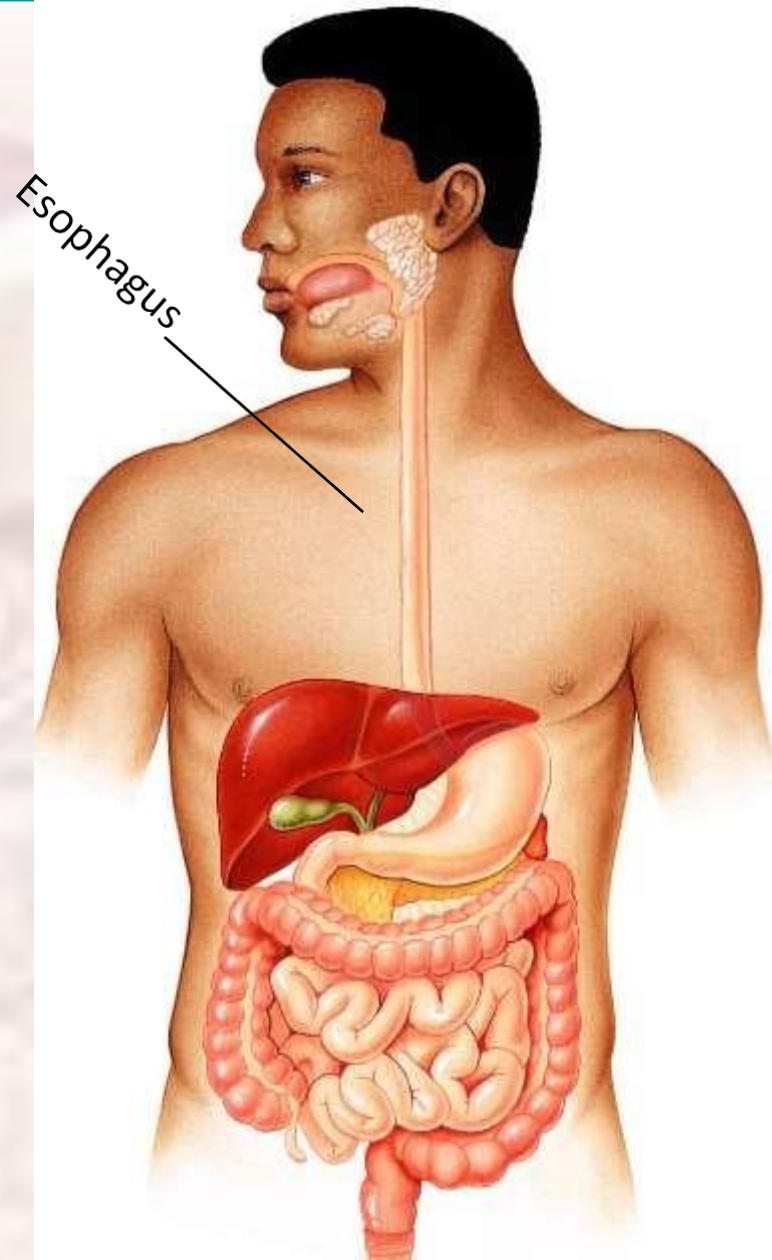
- This is from the pharyngeal plexus and consists of parasympathetic and sympathetic nerves.
- Parasympathetic supply is mainly by the glossopharyngeal and vagus nerves and sympathetic from the cervical ganglia.

Esophagus

- 10 inches long in adults
- Food enters from pharynx
- Runs from pharynx to stomach through the diaphragm
- Conducts food by peristalsis (slow rhythmic squeezing)
- Passageway for food only (respiratory system branches off after the pharynx)

Joins stomach at cardiac orifice*

Cardiac sphincter at cardiac orifice to prevent regurgitation (food coming back up into esophagus)



Functions of the mouth, pharynx and oesophagus

- Formation of a bolus When food is taken into the mouth it is chewed (masticated) by the teeth and moved round the mouth by the tongue and muscles of the cheeks .
- It is mixed with saliva and formed into a soft mass or bolus ready for swallowing.
- The length of time that food remains in the mouth depends, to a large extent, on the consistency of the food.
- Some foods need to be chewed longer than others before the individual feels that the bolus is ready for swallowing.
- The mouth is closed and the voluntary muscles of the tongue and cheeks push the bolus backwards into the pharynx.

A young girl with a large red bow in her hair, wearing a patterned dress, smiling. The image is faded and serves as a background for the text.

Thank You