TIU - Faculty of Science
Medical Analysis Department

Digestive system

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Systematic physiology – 2nd Stage /2nd Semester

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2020 - 2021

1. What are the functions of digestive system system?
2. What are components of digestive system?
3. What are the functions of saliva?


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Overview of the Digestive System

The Digestive System Consists of ;

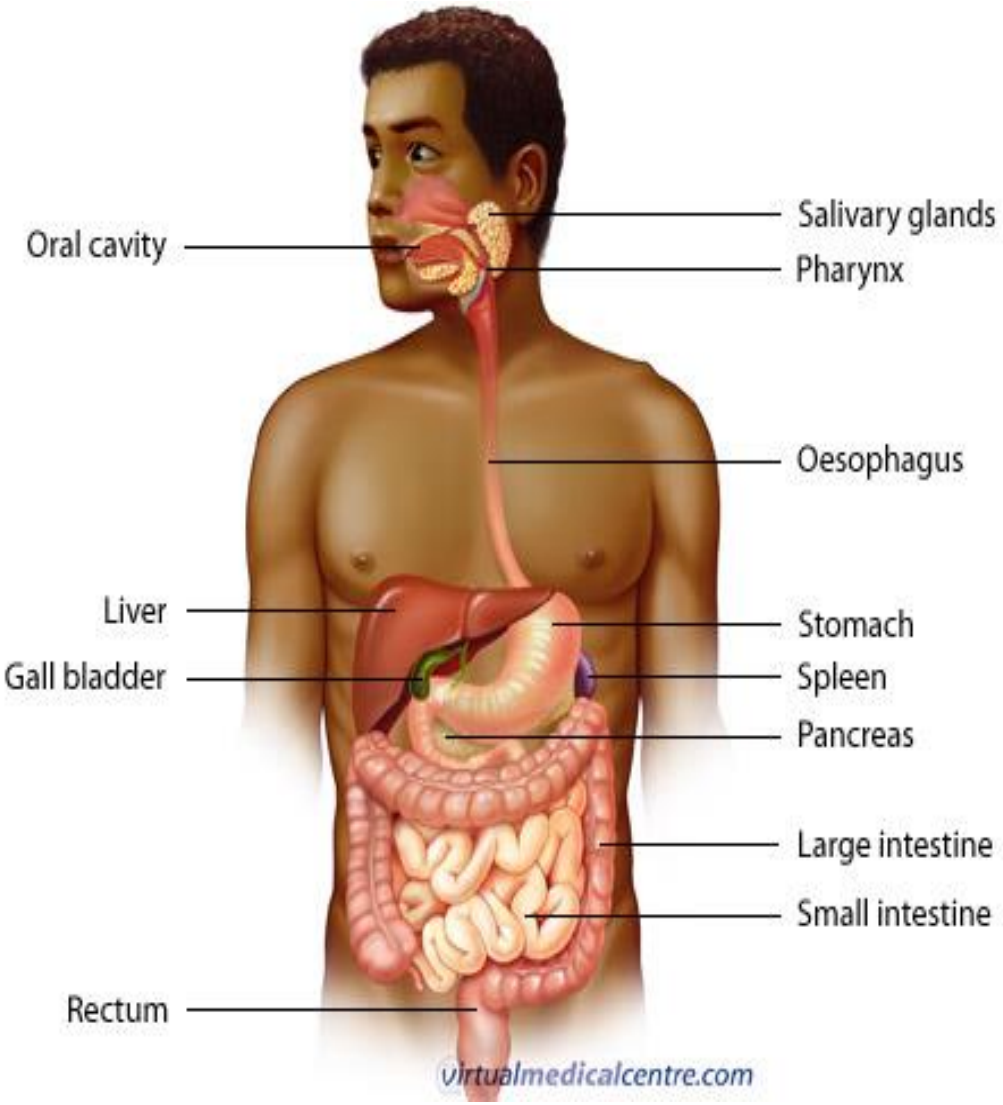
a) **Long hollow muscular** tube or canal or tract called gastrointestinal tract or **(GIT)**: it is about 5 meters long

b) **Accessory glands:** include:
   - Salivary glands
   - Liver and gall bladder
   - Pancreas

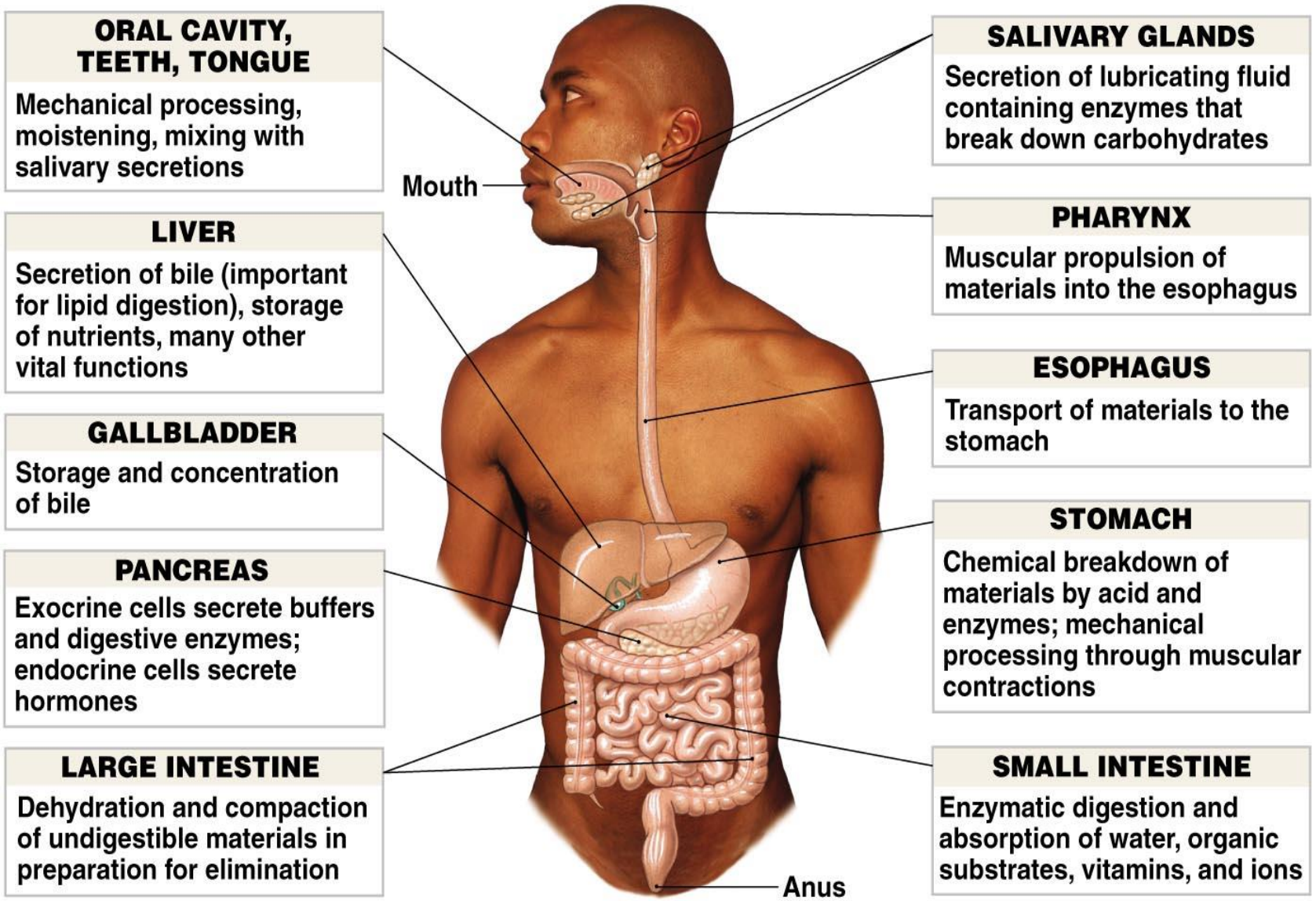
Overview of the Digestive Tract

GIT consists of;

- Oral cavity or mouth
- Pharynx
- Esophagus
- Stomach
- Small intestine
- Large intestine
- Rectum
- Anus



Components of Digestive System and Their Functions

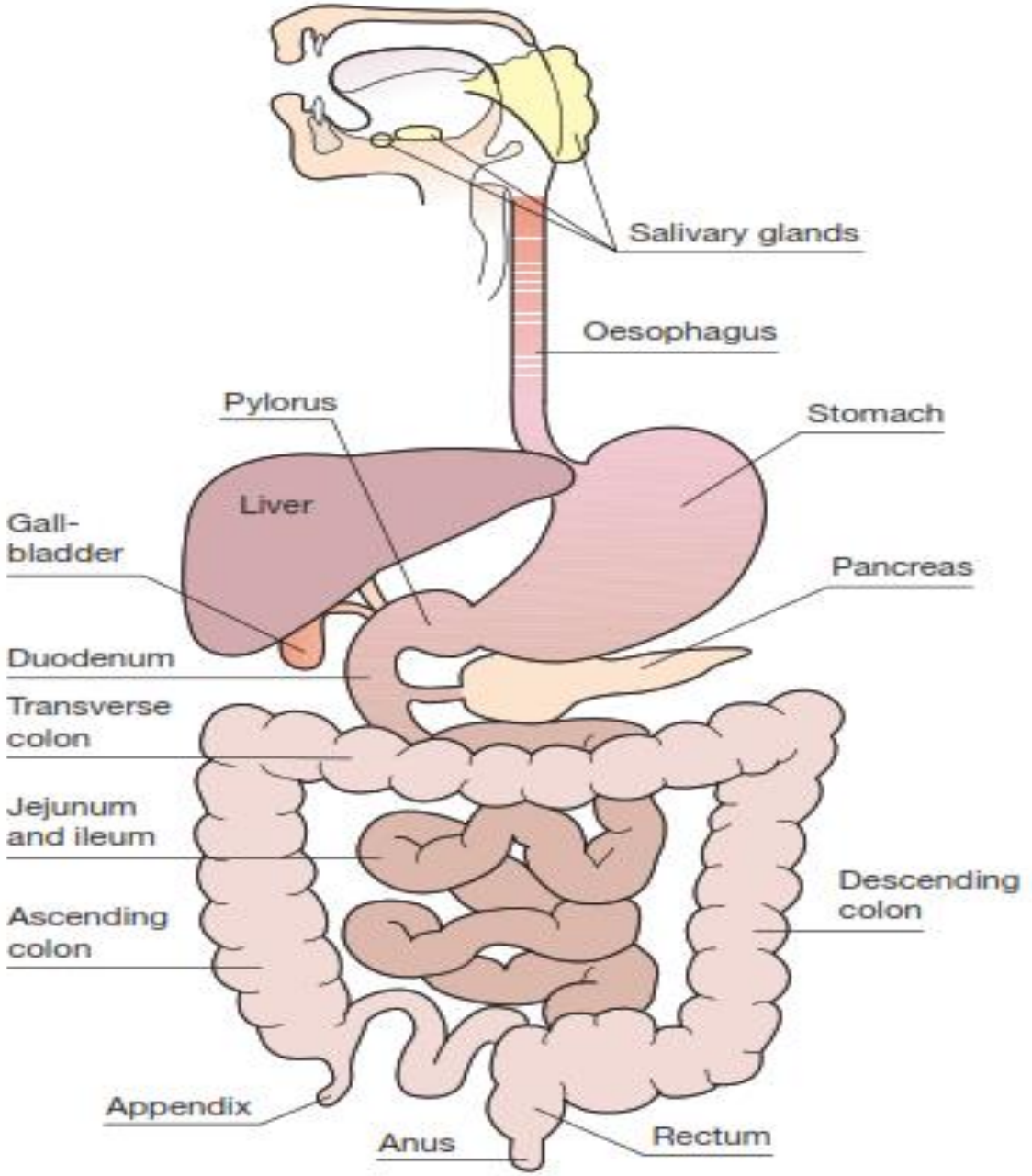


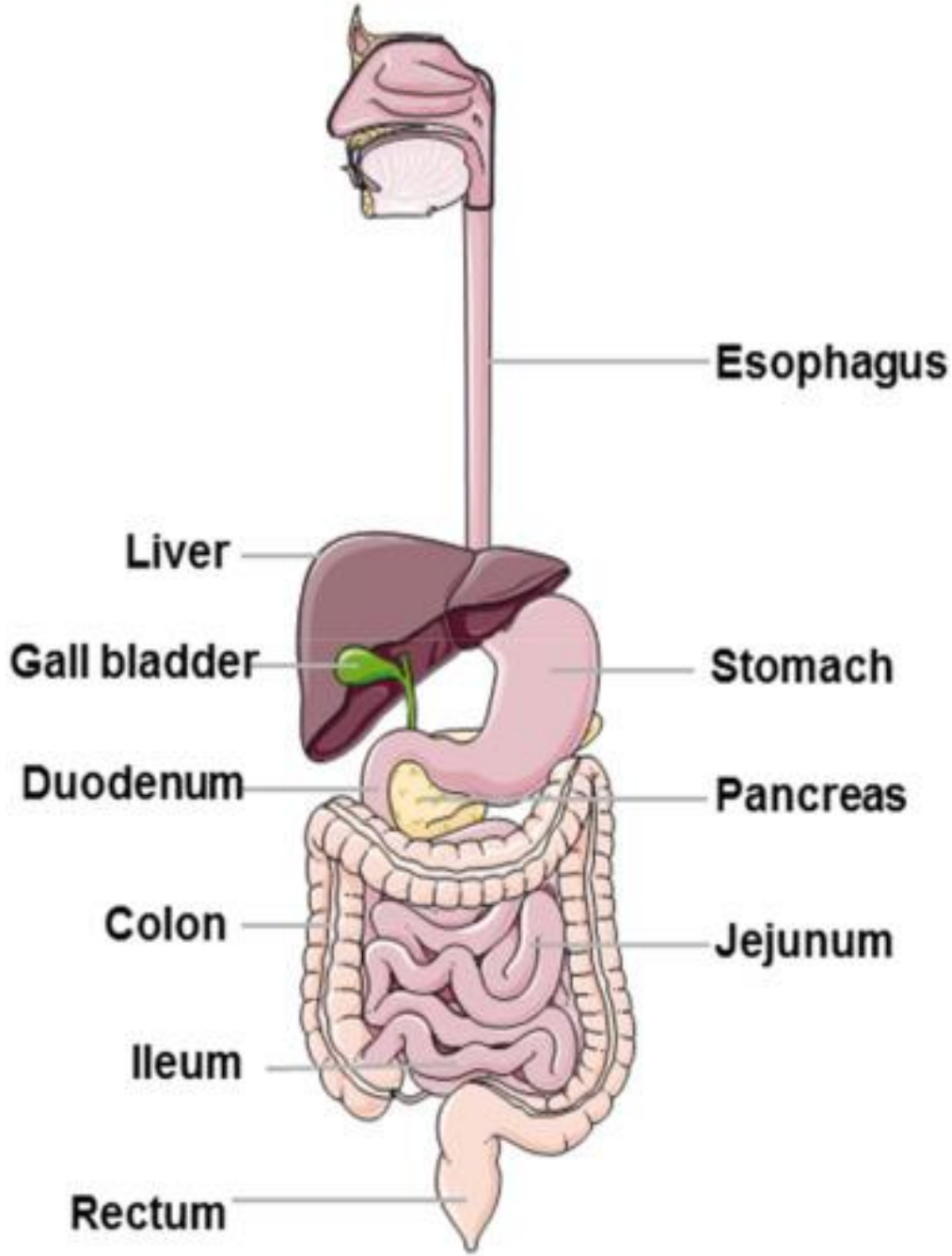
Main Functions of Digestive System

- 4 major activities of GI tract
  1. **Motility**
     - Propel ingested food from mouth toward rectum
  2. **Secretion of juices e.g. saliva**
     - Aid in digestion and absorption
  3. **Digestion**
     - Food broken down into absorbable molecules
  4. **Absorption**
     - Nutrients, electrolytes, and water are absorbed or transported from lumen of GIT to blood stream

The **gastrointestinal (GI) tract** is responsible for the breakdown of food into its component parts so that they can be absorbed into the body. It is made up of the **mouth**, **oesophagus**, **stomach** and **small and large intestines**. The **salivary glands**, **liver**, **gallbladder** and **pancreas** are organs distinct from the GI tract, but all secrete juices into the tract and aid the digestion and absorption of the food (Figure 40.1).

Figure 40.1 The gastrointestinal tract





Composition of saliva

- **Parotid glands** (serous acini) watery proteinaceous saliva, rich in electrolytes and enzymes (amylase) but little mucus
- **Sublingual glands** (mucous acini) viscous mucus saliva rich in mucins, antibodies and antigens, proteins and carbohydrates
- **Submandibular glands** (mixed serous and mucous acini) containing electrolytes, enzymes and mucus-secreting cells
- **Minor salivary glands** (mainly mucous acini)

Saliva and mastication

The GI tract starts in the mouth, where food is initially **chewed** (**masticated**) and mixed with salivary secretions. **Mastication** is the process of systematic mechanical breakdown of food in the mouth. The amount of mastication necessary in order to swallow the food depends on the nature of the ingested food: solid foods are subjected to vigorous chewing, whereas softer foods and liquids require little or no chewing and are transported almost directly into the oesophagus by swallowing. Mastication is necessary for some foods, such as red meats, chicken and vegetables, to be fully absorbed by the rest of the GI tract. However, fish, eggs, rice, bread and cheese do not require chewing for complete absorption in the tract.

During mastication three pairs of glands, the **parotid**, **submandibular** and **sublingual**, secrete saliva. Saliva is **hypotonic**, and its composition differs between glands and whether they are resting or stimulated (Figure 40.3). The major functions of saliva are: to **moisten** and **lubricate** the mouth, particularly during eating and speech; to **dissolve** food molecules so that they can react with taste receptors; to **ease swallowing**; to begin **digestion** of polysaccharides (complex sugars) with **amylase**; and to **protect** the oral cavity by coating the teeth with a proline-rich protein or pellicle that can serve as a protective barrier on the tooth surface. Saliva also contains immunoglobulins and antimicrobials that have a protective role in avoiding bacterial infections.

Figure 40.3 Saliva

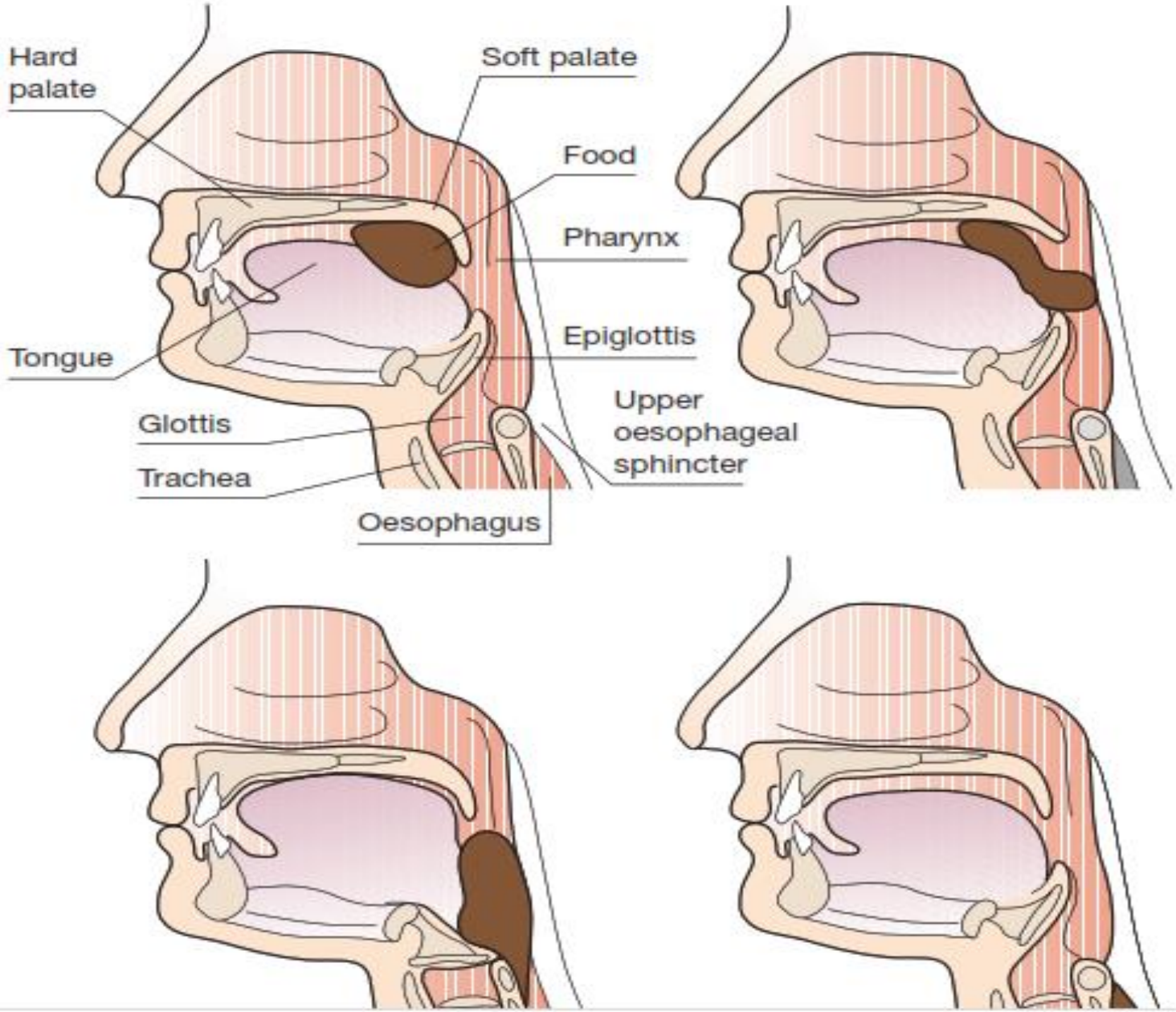
Salivary flow rates (whole mouth)

- Resting flow rates
  Mean SD: 0.3 0.22 mL/min
- Stimulated flow rates
  Mean SD: 1.7 2.1 mL/min
- Total daily flow rates
  Between 500–1000 mL/day

Saliva in the mouth is hypotonic (more water when compared with extracellular fluid) and contains over 99% water

Control of salivary secretion is mediated via sympathetic and parasympathetic nerves to the glands, and depends on reflex responses which, in humans, have been shown to be elicited by the stimulation of gustatory (taste) receptors and periodontal and mucosal mechanoreceptors during mastication. Although it was thought that olfactory afferent stimulation (smell) also had a general reflex effect on salivary secretion, it has now been shown that this reflex operates via the submandibular/sublingual glands and not the parotid in humans. The sight and thought of food in humans have very little effect on salivary production. The perception of an increased salivary production is thought to be related to the sudden awareness of saliva already present in the mouth.

Figure 40.4 Swallowing. Movement of food from the mouth through to pharynx and upper oesophagus



Swallowing

Swallowing occurs in a number of phases. The first phase is **voluntary** and involves the formation of a bolus of food by chewing and tongue movements (backwards and upwards), which push the food into the pharynx. The remaining phases are not voluntary, but **reflex responses** initiated by the stimulation of mechanoreceptors with afferents in the **glossopharyngeal (IX) and vagus (X) nerves** to the medulla and pons (brain stem); here, there is a group of neurones (the '**swallowing centre**') which coordinates the complex sequence of events that eventually delivers the bolus into the oesophagus. The **soft palate** elevates to prevent food from entering the **nasal cavity**, respiration is inhibited, the **larynx** is raised, the **glottis** is closed and the food pushes the tip of the **epiglottis** over the tracheal opening, preventing food from entering the trachea. As the bolus enters the **oesophagus**, these changes reverse, the larynx opens and breathing continues (Figure 40.4).