

كلية المستقبل الجامعة قسم الفيزياء الطبية
المرحلة الثالثة

ANATOMY

L9

The Digestive System

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Introduction

The digestive system is also known as the gastrointestinal system or the alimentary canal. This vast system is approximately 10 m long. It travels the length of the body from the mouth through the thoracic, abdominal and pelvic cavities, where it ends at the anus. The digestive system has one major function: to convert food from the diet into a form that can be utilised by the cells of the body in order to carry out their specific functions.

The activity of the digestive system

The activity of the digestive system can be categorised into five processes:

- **Ingestion:** taking food into the digestive system.
- **Propulsion:** moving the food along the length of the digestive system.
- **Digestion:** breaking down food. This can be achieved *mechanically* as food is chewed or moved through the digestive system, or *chemically* by the action of *enzymes* mixed with the food as it moves through the digestive system.
- **Absorption:** the products of digestion exit the digestive system and enter the blood or lymph capillaries for distribution to where they are required.
- **Elimination:** the waste products of digestion are excreted from the body as faeces.

The organisation of the digestive system

The digestive system consists of the main digestive system structures and the accessory organs. The main digestive system structures include the mouth, pharynx, oesophagus, stomach, small intestine and large intestine.

Accessory organs also contribute to the function of the digestive system. The accessory organs are the salivary glands, the liver, the gallbladder and the pancreas.

The digestive system organs ..The mouth (oral cavity)

Food enters the mouth or oral cavity, and this is where the process of digestion begins. The oral cavity consists of several structures. Food enters the oral cavity in a process called **ingestion**. The food mixes with saliva. The **lips** and **cheeks** are formed of muscle and connective tissue. This allows the lips and cheeks to move food mixed with saliva around the mouth and begin **mechanical digestion**. The teeth contribute to mechanical digestion by grinding and tearing food. This process of chewing and mixing food with saliva is called **mastication**. The oral cavity can be exposed to very hot and very cold food as well as rough food particles. It is lined with mucus-secreting, stratified squamous epithelial cells. This layer provides some protection against abrasion, the effects of heat and continuous wear and tear. The lips and cheeks are also involved in speech and facial expression.

The tongue is a large, voluntary muscular structure that occupies much of the oral cavity. The superior surface of the tongue is covered in stratified squamous epithelium for protection against wear and tear. This surface also contains many little projections called papillae. The papillae (or taste buds) contain the nerve endings responsible for the sense of taste. The taste buds contribute to our enjoyment of food. As well as taste, other functions of the tongue include swallowing (deglutition), holding and moving food around the oral cavity and speech.

The palate forms the roof of the mouth and consists of two parts: the hard palate and the soft palate. The hard palate is located anteriorly and

is bony. The soft palate lies posteriorly and consists of skeletal muscle and connective tissue (see Figure 9.2). The palate plays a part in swallowing. The **palatine tonsils** lie laterally and are lymphoid tissue. The **uvula** is a fold of tissue that hangs down from the centre of the soft palate.

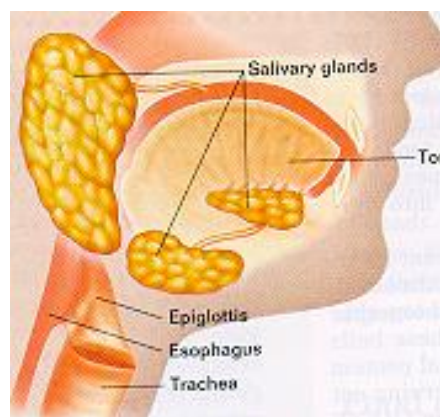
Teeth

Temporary teeth are also known as deciduous teeth or milk teeth. Temporary teeth begin to appear at about 6 months old. There are 20 temporary teeth, and these are replaced by permanent teeth from about the age of 6 years. There are 32 permanent teeth. Sixteen are located in the maxilla arch (upper) and 16 are located in the mandible (lower).

Salivary glands

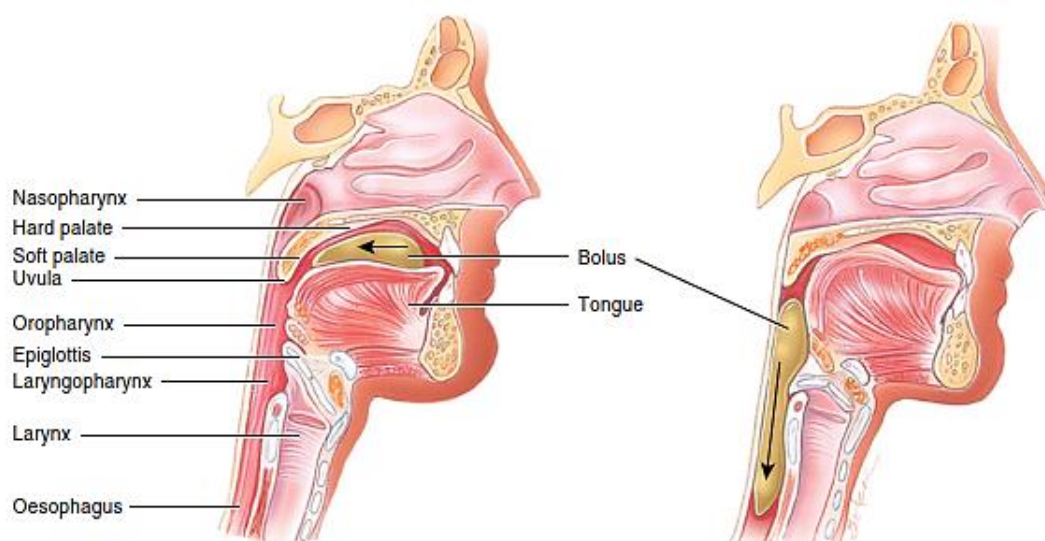
There are three pairs of salivary glands. The **parotid glands** are the largest and they are located anterior to the ears. The submandibular glands are located below the jaw on each side of the face. The sublingual glands are the smallest. They are located in the floor of the mouth.

In health, approximately 1–1.5 L of saliva are secreted daily. Saliva consists of: water, salivary amylase, and mucus.



Pharynx

The pharynx consists of three parts: the **oropharynx**, the **nasopharynx** and the **laryngopharynx**. The nasopharynx is considered a structure of the respiratory system. The oropharynx and the laryngopharynx are passages for both food and respiratory gases. The **epiglottis** is responsible for closing the entrance to the larynx during swallowing, and this essential action prevents food from entering the larynx and obstructing the respiratory passages.



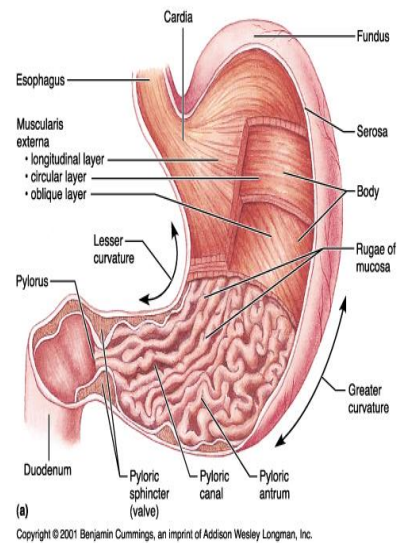
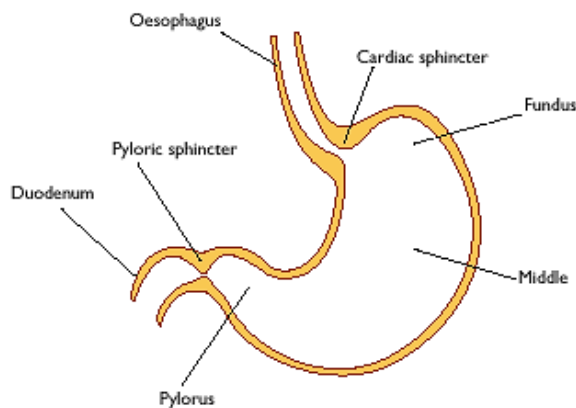
Oesophagus

The food bolus leaves the oropharynx and enters the oesophagus. The oesophagus extends from the laryngopharynx to the stomach. It is a thick-walled structure, measuring about 25 cm in length and lies in the thoracic cavity, posterior to the trachea. The function of the oesophagus is to transport substances (the food bolus) from the mouth to the stomach. The upper oesophageal sphincter regulates the movement of substances into the oesophagus, and the lower oesophageal sphincter (also known as the cardiac sphincter) regulates the movement of substances from the oesophagus to the stomach. No digestion in the oesophagus.

Stomach

The stomach lies in the abdominal cavity. It lies between the oesophagus superiorly and the duodenum of the small intestine inferiorly. It is divided into regions. The entrance to the stomach from the oesophagus is via the lower oesophageal sphincter or cardiac sphincter. This leads to a small area within the stomach called the **cardiac region** or **cardia**. The **fundus** is the dome-shaped region in the superior part of the stomach. The **body region** occupies the space between the lesser and greater curvature of the stomach, and the **pyloric region** narrows into the **pyloric canal**. The **pyloric sphincter** controls the exit of **chyme** from the stomach into the small intestine. Chyme is the name given to the food bolus as it leaves the stomach.

Anatomy of the Stomach

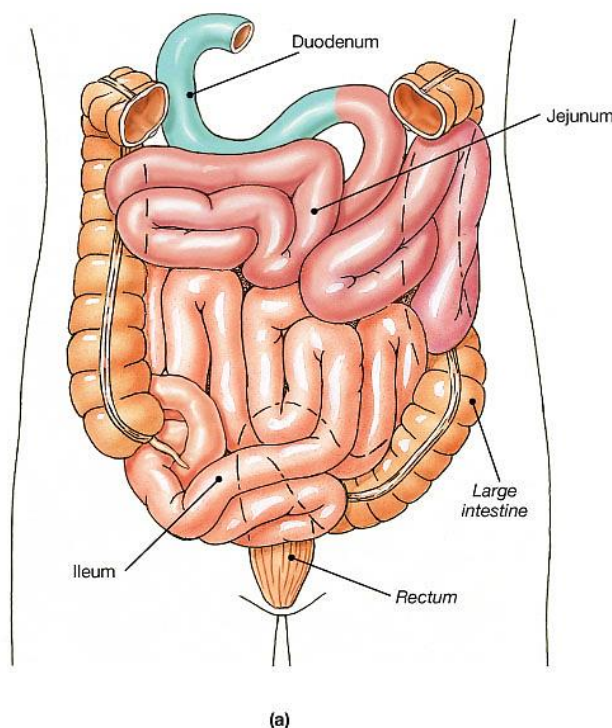


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Small intestine

The small intestine is approximately 6 m long. In the small intestine food is further broken down by mechanical and chemical digestion, and absorption of the products of digestion takes place. The small intestine is divided into three parts:

1. The **duodenum** is approximately 25 cm long. It is the entrance to the small intestine.
2. The **jejunum** measures 2.5 m and is the middle part of the small intestine.
3. The **ileum** measures 3.5 m. It meets the large intestine at the **ileocaecal valve**. This valve prevents the backflow of the products of digestion from the large intestine back into the small intestine.

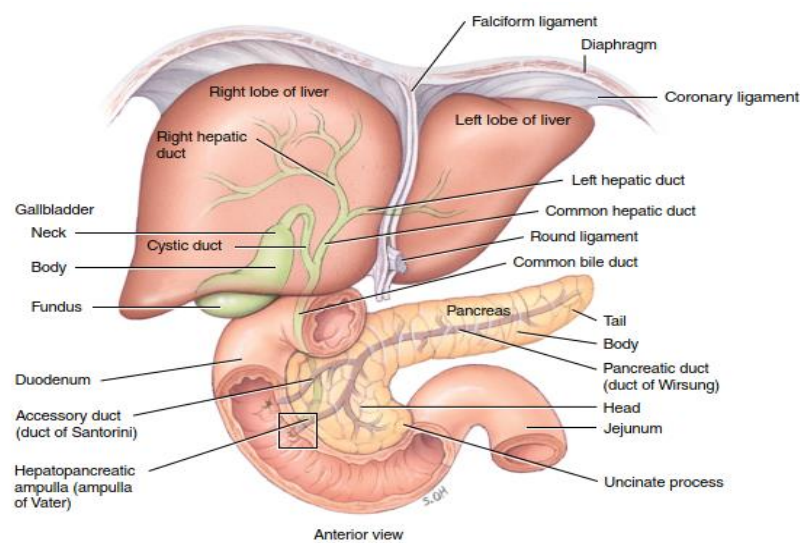


The pancreas is composed of exocrine and endocrine tissue. It consists of a head, body and tail. The cells of the pancreas are responsible for making the endocrine and exocrine products. The islet cells of the **islets of Langerhans** produce the endocrine hormones **insulin** and **glucagon**.

These hormones control carbohydrate metabolism.

The liver is the body's largest gland. It weighs between 1 and 2 kg. It lies under the diaphragm protected by the ribs. The liver occupies most of the right hypochondriac region and extends through part of the epigastric

region into the left hypochondriac region. The right lobe is the largest of the four liver lobes. On the posterior surface of the liver there is an entry and exit to the organ called the portal fissure. Blood, lymph vessels, nerves and bile ducts enter and leave the liver through the portal fissure. The liver produces and secretes up to 1 L of yellow/green alkaline bile per day.



The gallbladder

The gallbladder is a small, green, muscular sac that lies posterior to the liver. It functions as a reservoir for bile. It also concentrates bile by absorbing water.

The large intestine

The contents of the small intestine move slowly through it by a process called segmentation. This allows time to complete digestion and absorption. Entry to the large intestine is controlled by the ileocaecal sphincter. The sphincter opens in response to the increased activity of the stomach and the action of the hormone gastrin. Once food residue has reached the large intestine it cannot backflow into the ileum. The large intestine measures 1.5 m in length and 7 cm in diameter. It is continuous

with the small intestine from the ileocaecal valve and ends at the anus. Food residue enters the caecum and has to pass up the ascending colon along the transverse colon, down the descending colon and out of the body via the rectum, anal canal and anus. The caecum is a descending, sac-like opening into the large intestine. The vermiform appendix is a narrow, tube-like structure that leaves the caecum but is closed at its distal end. It is composed of lymphoid tissue and has a role in immunity. Two sphincter muscles control exit from the anus. The internal anal sphincter is smooth muscle and is under the control of the parasympathetic nervous system, whereas the external anal sphincter is composed of skeletal muscle and is under voluntary control.

