9.3 Introducing Digestion

Food contains the nutrients we need but not in a form that our bodies can use directly. The food we eat must be broken down into nutrients that can then be absorbed into the blood and carried to the cells of the body. This process is called digestion. The collection of organs that work together to carry out digestion is called the digestive system. Food is digested in the digestive system and the nutrients are then absorbed and transported by the circulatory system to the cells of the body.

There are four main steps in digestion: ingestion (the taking in of nutrients), digestion (the physical and chemical breakdown of complex food molecules into smaller molecules), absorption (the transfer of digested nutrients from the digestive system to the bloodstream), and egestion (the removal of waste food materials from the body).

Figure 1 The mosquito's mouth structure can puncture the skin and a small artery without the host being aware of it.

gastrovascular cavity a simple, sac-like digestive cavity that has only one opening through which food is taken in and wastes are expelled

Specialized Digestive Systems

Each animal species has unique adaptations that enable it to obtain and digest food. The mosquito, for example, has specialized mouth structures and a digestive system that may be used for sucking blood to obtain nutrients (**Figure 1**). Regardless of diet, most animals have digestive systems with specialized features that enable them to break down food into usable nutrients.

Some simple animals, such as flatworms or jellyfish, have a digestive sac with a single opening into a **gastrovascular cavity**. This opening serves both as an entrance for food and as an exit for waste materials. In some cases, the opening to the gastrovascular cavity is surrounded by tentacles that are used to capture prey (**Figure 2**). Food is taken directly into the gastrovascular cavity and is broken down by chemicals that are released into the cavity. The nutrients are then absorbed by the cells that line the gastrovascular cavity, and digestion continues inside the cells. Nutrients diffuse from these cells to all other cells of the body.

More complex animals digest food along a digestive tract that has two openings—one for food intake and another for waste elimination. The digestive tract is organized into specialized regions that enable the breakdown and absorption of food as food moves along the tract in one direction. This design is often referred to as a complete digestive system.

One example of an animal with a complete digestive system is the earthworm (**Figure 3**). In the earthworm, food ingested through the mouth travels through the muscular pharynx and into the esophagus. The esophagus then pushes the food into the crop for temporary storage. From there, physical breakdown of the food is carried out by a muscular organ called the gizzard. The food particles then pass into the intestine where they are further broken down into smaller molecules. These small molecules can then be absorbed by the cells lining the intestine and any undigested wastes eliminated through the anus.

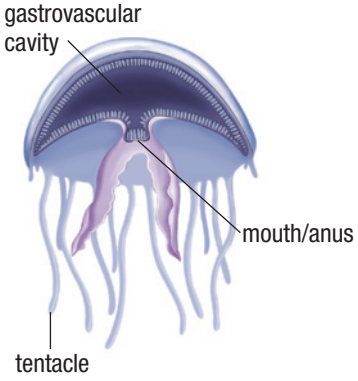

Figure 2 Jellyfish have a single opening through which food is taken in and waste is expelled.

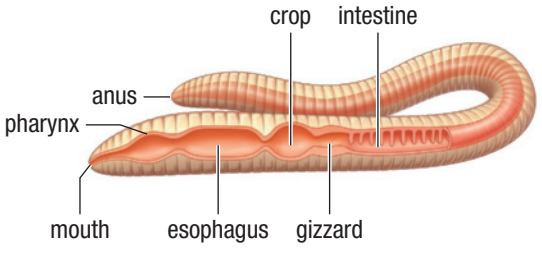

Figure 3 An earthworm's digestive system consists of a mouth, a pharynx, an esophagus, a crop, a gizzard, and an intestine.

The Structure of the Human Digestive System

The human digestive system is also a complete digestive system. Unlike that of the earthworm, the digestive tract of humans is much longer than the body (**Figure 4**). Often referred to as the **gastrointestinal tract (GI tract)**, the human digestive tract is approximately 7 m to 9 m long, depending on the age and size of the individual.

gastrointestinal tract (GI tract) the passageway or tube that extends from the mouth to the anus and in which the process of digestion takes place

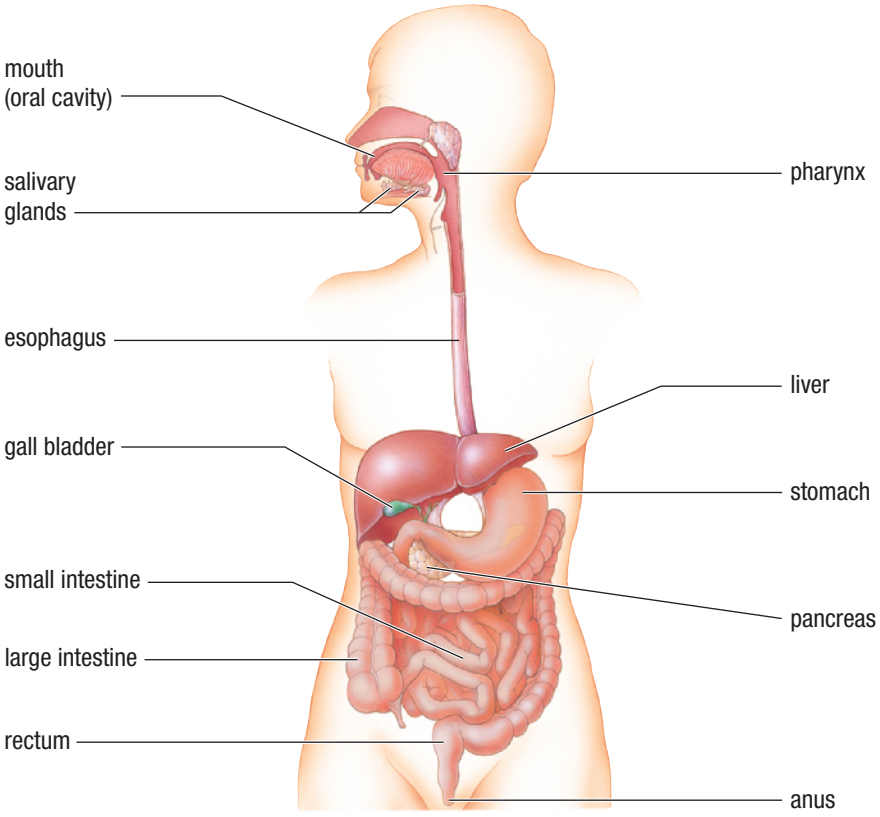

Figure 4 The human digestive system and accessory organs

Every organ system in the human body depends on the digestive system for nutrients, but the digestive system also depends on other organ systems. Muscle and bones, for example, enable animals to catch and ingest food. The circulatory system transports oxygen and other materials to the digestive organs, and carries digested foods from the digestive system to the tissues of the body. The nervous system and endocrine system regulate the actions of the digestive organs. Digestion involves interaction among several body systems.

Investigation **11.1.1**

Fetal Pig Dissection (p. 510)
Make note of the location of the various organs in the human digestive system. At the end of this unit, you will have an opportunity to dissect a fetal pig and examine the structure of the digestive system.

9.3 Summary

- The digestive systems of animals vary depending on several factors, including the size, complexity, and diet of the organism.
- The human digestive system is a complete digestive system and has four major functions: ingestion, digestion, absorption, and egestion.

9.3 Questions

1. Explain the basic functions of the digestive system. K/U
2. Use a T-chart or diagrams to compare the differences between a gastrovascular cavity and a complete digestive system. K/U T/I C
3. Suggest possible advantages of a digestive system with two openings over a system with only one opening. K/U T/I A
4. Explain how the digestive system depends on other organ systems, such as the circulatory system. K/U A
5. Research the digestive system of an organism of your choosing. How is the digestive system for your chosen organism similar to and different from the human digestive system? K/U T/I A

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