Digestive system

The **digestive system** (figure.1) consists of the **digestive tract,** a tube extending from the mouth to the anus, and its associated **accessory organs,** primarily glands, which secrete fluids into the digestive tract. The digestive tract is also called the **alimentary tract,** or **alimentary canal.** The term **gastro intestinal** tract technically only refers to the stomach and intestines but is often used as a synonym for the digestive tract.

The regions of the digestive tract include:

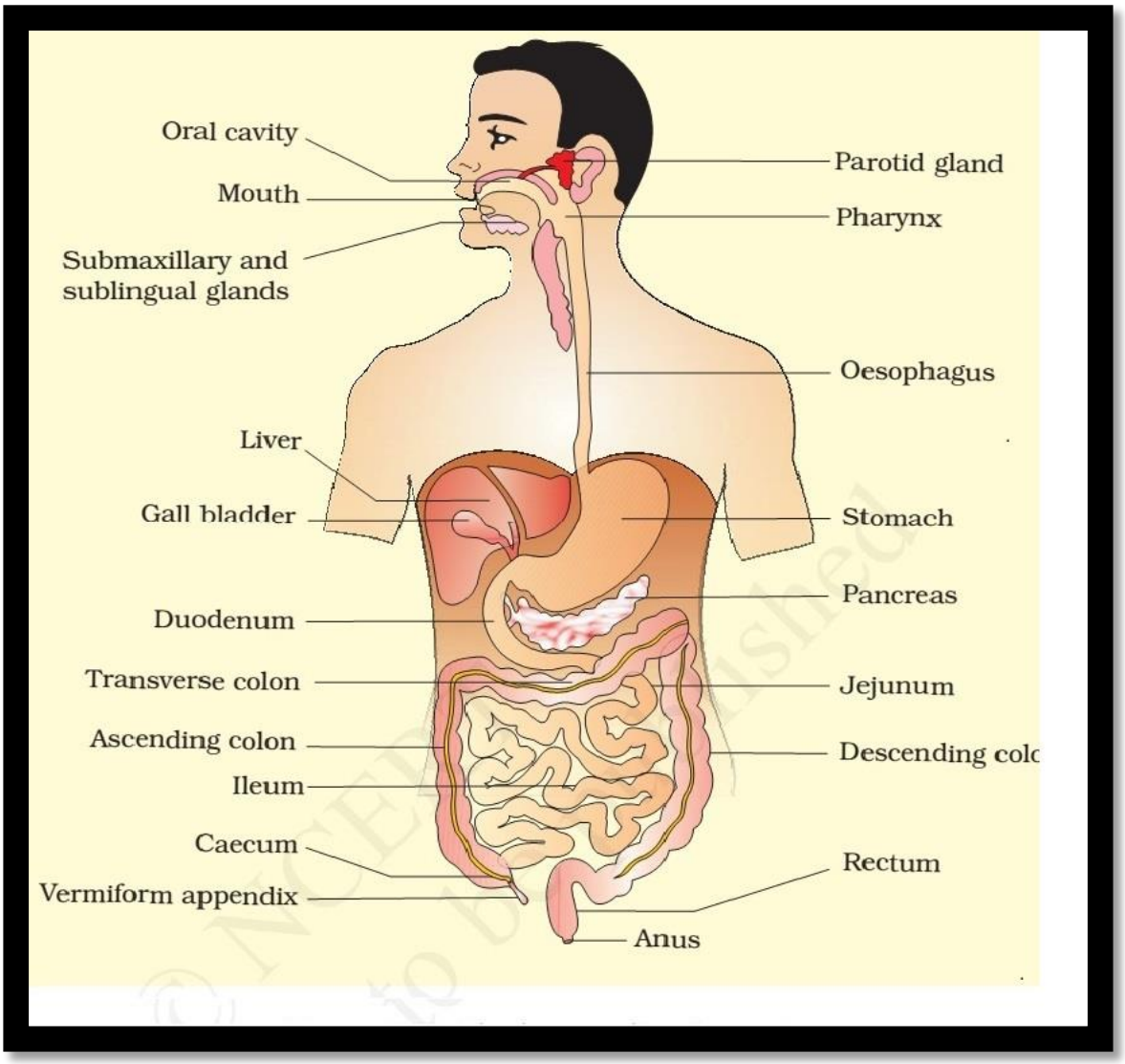
1. The mouth or oral cavity, which has salivary glands and tonsils as accessory organs.

2. The pharynx, or throat, with tubular mucous glands.

3. The esophagus, with tubular mucous glands.

4. The stomach, which contains many tube like glands.

5. The small intestine, consisting of the duodenum, jejunum, and ileum, with the liver, gallbladder, and pancreas as major accessory organs.



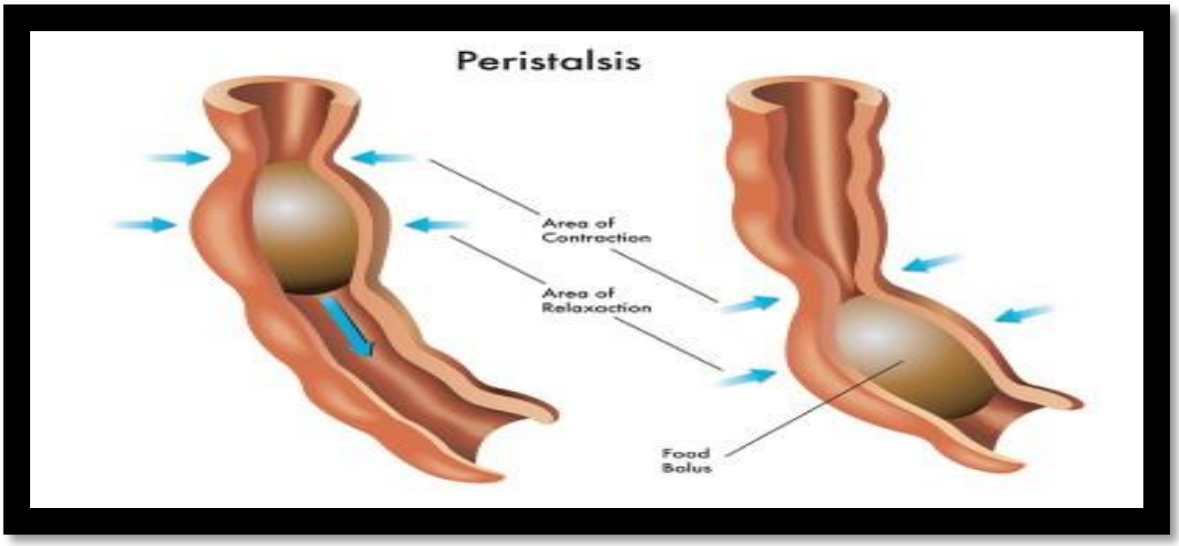
(figure.1) The Digestive System

Functions of the Digestive System

1. Ingestion is the introduction of solid or liquid food into the stomach. The normal route of ingestion is through the oral cavity, but food can be introduced directly into the stomach by a nasogastric, or stomach, tube.

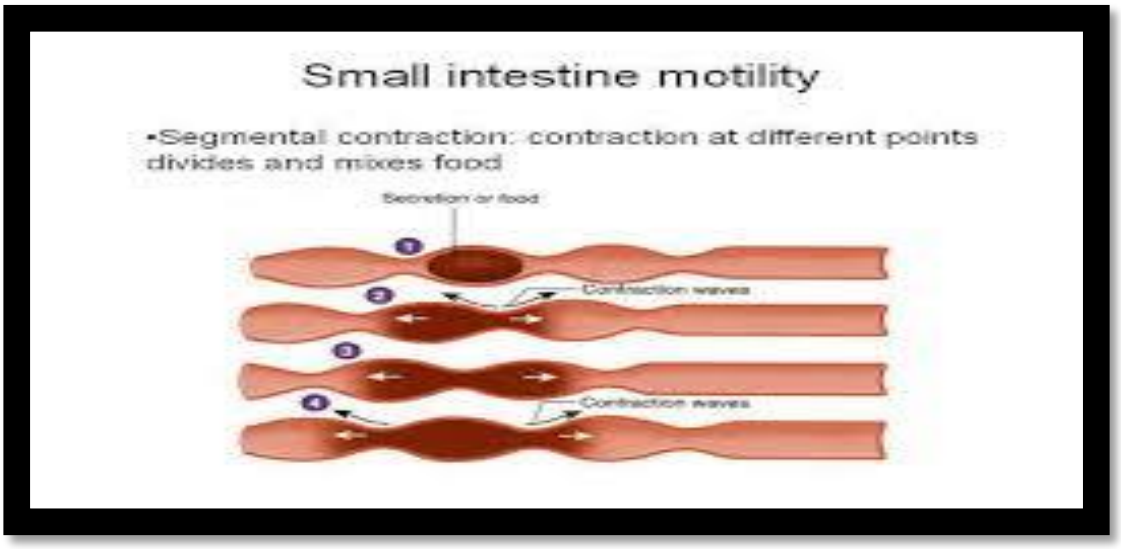
2. Mastication is the process by which food taken into the mouth is chewed by the teeth. Digestive enzymes cannot easily penetrate solid food particles and can only work effectively on the surfaces of the particles. It’ s vital, therefore, to normal digestive function that solid foods are mechanically broken down into small particles. Mastication breaks large food particles into many smaller particles, which have a much larger total surface area than do a few large particles.

3. Propulsion in the digestive tract is the movement of food from one end of the digestive tract to the other. The total time that it takes food to travel the length of the digestive tract is usually about 24–36 hours. Each segment of the digestive tract is specialized to assist in moving its contents from the oral end to the anal end. **Deglutition** or swallowing, moves food and liquids, called a **bolus,** from the oral cavity into the esophagus. **Peristalsis** (figure.2) is responsible for moving material through most of the digestive tract .Muscular contractions occur in **peristaltic waves,** consisting of a wave of relaxation of the circular muscles, which forms a leading wave of distention in front of the bolus, followed by a wave of strong contraction of the circular muscles behind the bolus, which forces the bolus along the digestive tube. Each peristaltic wave travels the length of the esophagus in about 10 seconds. Peristaltic waves in the small intestine usually only travel for short distances. In some parts of the large intestine, material is moved by **mass movements,** which are contractions that extend over much larger parts of the digestive tract than peristaltic movements.



Peristalsis (figure.2)

4. Mixing. Some contractions don't propel food (chyme) from one end of the digestive tract to the other but rather move the food back and forth within the digestive tract to mix it with digestive secretions and to help break it into smaller pieces. Segmental contractions (figure.3) are mixing contractions that occur in the small intestine.



Segmental contractions (figure.3)

5. Secretion. As food moves through the digestive tract, secretions are added to lubricate, liquefy, and digest the food. Mucus, secreted along the entire digestive tract, lubricates the food and the lining of the tract. The mucus coats and protects the epithelial cells of the digestive tract from mechanical abrasion, from the damaging effect of acid in the stomach, and from the digestive enzymes of the digestive tract. The secretions also contain large amounts of **water,** which liquefies the food, thereby making it easier to digest and absorb. Water also moves into the intestine by osmosis. Liver secretions break large fat droplets into much smaller droplets, which makes possible the digestion and absorption of fats. **Enzymes** secreted by the oral cavity, stomach, intestine, and pancreas break large food molecules down into smaller molecules that can be absorbed by the intestinal wall.

6. Digestion is the breakdown of large organic molecules into their component parts: carbohydrates into mono saccharides, proteins into amino acids, and triglycerides into fatty acids and glycerol. Digestion consists of mechanical digestion, which involves mastication and mixing of food, and chemical digestion, which is accomplished by digestive enzymes that are secreted along the digestive tract. Digestion of large molecules into their component parts must be accomplished before they can be absorbed by the digestive tract. Minerals and water are not broken down before being absorbed. Vitamins are also absorbed without digestion and lose their function if their structure is altered by digestion.

7. Absorption is the movement of molecules out of the digestive tract and into the circulation or into the lymphatic system. The mechanism by which absorption occurs depends on the type of molecule involved .Molecules pass out of the digestive tract by simple diffusion, facilitated diffusion, active transport.

8. Elimination is the process by which the waste products of digestion are removed from the body. During this process, occurring primarily in the large intestine, water and salts are absorbed and change the material in the digestive tract from a liquefied state to a semisolid state. These semisolid waste products, called **feces,** are then eliminated from the digestive tract by the process of **defecation.**

Nervous Regulation of the Digestive System

Some of the nervous control is local, occurring as the result of local reflexes within the enteric plexus, and some is more general, mediated largely by the parasympathetic division of the ANS through the vagus nerve.

Local neuronal control of the digestive tract occurs within the **enteric nervous system (ENS).** The ENS consists of the enteric plexus, made up of enteric neurons within the wall of the digestive tract.

There are three major types of enteric neurons:

1- Enteric sensory neurons detect changes in the chemical composition of the digestive tract contents or detect mechanical changes such as stretch of the digestive tract wall.

2- Enteric motor neurons stimulate or inhibit smooth muscle contraction and glandular secretion in the digestive system.

3- Enteric interneurons connect enteric sensory and motor neurons.

The ENS coordinates peristalsis and regulates **local reflexes,** which control activities within specific, short regions of the digestive tract. Although the enteric neurons are capable of controlling the activities of the digestive tract independent of the CNS, normally the two systems work together. For example, autonomic innervation from the CNS influences the activity of the ENS neurons. General control of the digestive system by the CNS occurs when reflexes are activated by stimuli originating in the digestive tract. Action potentials are carried by sensory neurons in the vagus nerves to the CNS, where the reflexes are integrated. In addition, reflexes within the CNS may be activated by the sight, smell, or taste of food, which stimulate the sensation of hunger. All of these reflexes influence parasympathetic neurons in the CNS. Parasympathetic neurons extend to the digestive tract through the vagus nerves to control responses or alter the activity of the ENS and local reflexes. Some sympathetic neurons inhibit muscle contraction and secretion in the digestive system and decrease blood flow to the digestive system.

Chemical Regulation of the Digestive System

The digestive tract produces a number of hormones, such as gastrin, secretin, and others, which are secreted by endocrine cells of the digestive system and carried through the circulation to target organs of the digestive system or to target tissues in other systems. These hormones help regulate many gastrointestinal tract function as well as the secretions of

associated glands such as the liver and pancreas. In addition to the hormones produced by the digestive system, which enter the circulation, such as histamine, are released locally within the digestive tract and influence the activity of nearby cells. These localized chemical regulators help local reflexes within the ENS control local digestive tract environments, such as pH levels.