

MODULE 4

AIM-

The aim of this module is to provide students with an introduction to digestive system.

CONTENTS AND OBJECTIVES

- Introduction to digestion and absorption
- Human digestive system
- Functions of alimentary canal
- Components of alimentary canal:
 - ✓ Mouth and Teeth
 - ✓ Pharynx
 - ✓ Oesophagus
 - ✓ Stomach
 - ✓ Small Intestine
 - ✓ Large Intestine
- Accessory organs
 - ✓ Salivary glands
 - ✓ Pancreas
 - ✓ Liver and gall bladder
 - ✓ Brunner's gland and crypt of Lieberkuhn

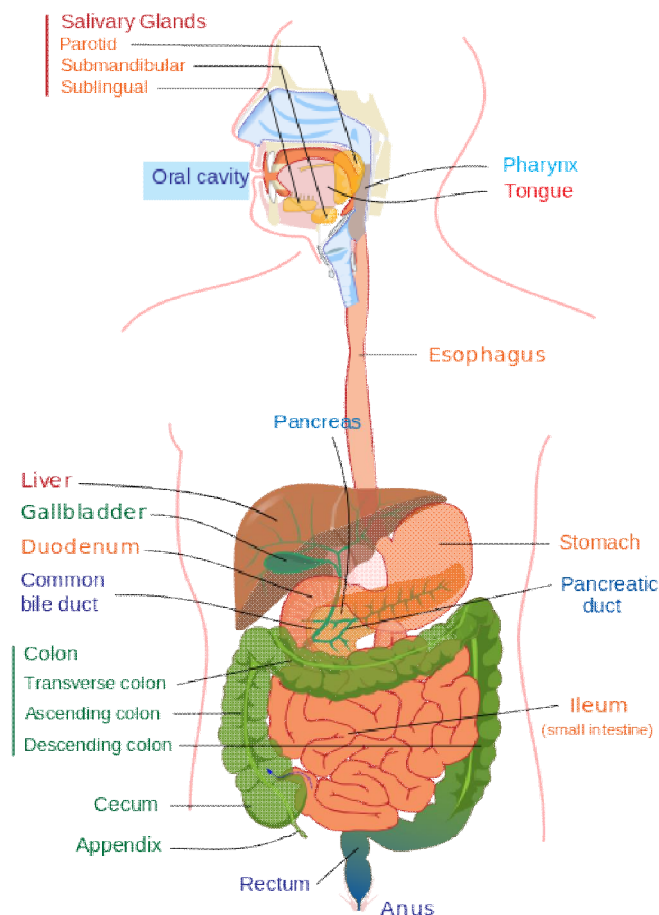
DIGESTION AND ABSORPTION

INTRODUCTION

- Food is required by all living organisms for their survival.
- Animals are heterotrophs. The food that they take in must be digested into smaller molecules in order to be absorbed by their body.
- The food that is absorbed is used to generate energy.
- We can broadly divide heterotrophs into three groups based on their food sources-
 1. Herbivores- Animals which feed exclusively on plants. Eg- Horse, cow, rabbit, etc.
 2. Carnivores- Animals that feed on meat of other animals. Eg- Dog, tiger, cat, lion etc.
 3. Omnivores- Those animals that feed on both plants and animals. Eg- Humans, pigs, bears, etc.
- Single-celled organisms and sponges digest their food intra-cellularly whereas, other organisms have a digestive cavity and thus digestion in such animals is extracellular.

HUMAN DIGESTIVE SYSTEM

Digestive system of human beings consists of a tubular alimentary canal and accessory organs.



Alimentary Canal

Mouth and the pharynx are the initial components of the alimentary canal. These two are also considered as the common passage both the oral and nasal cavities.

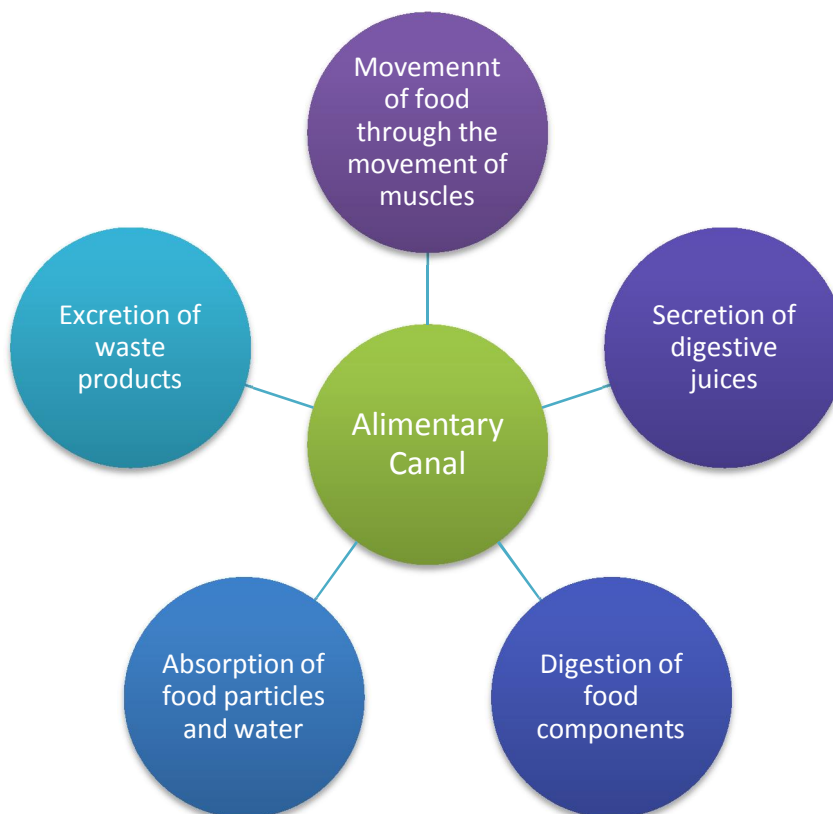
The next part of the alimentary canal is oesophagus which leads to stomach where some amount of digestion of food occurs.

The food then passes into the small intestine and finally into the large intestine.

In animals, except humans, waste product passes down into a single cavity called cloaca.

In humans, large intestine separates the faecal matter from urinogenital material. The faecal matter is then expelled into the rectum and moved out through anus.

FUNCTIONS OF ALIMENTARY CANAL



The Mouth and Teeth

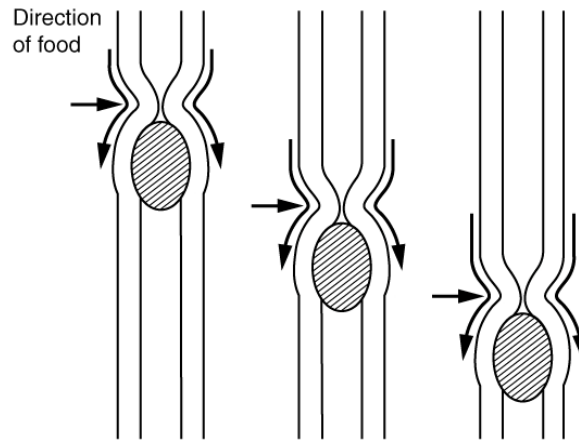
- The mouth leads to the oral (or buccal) cavity.
- Some amount of digestion of food occurs here.
- Inside the mouth, there are three pairs of salivary glands which secrete saliva.
- Saliva is necessary for making the food soft and easy to swallow.
- The oral cavity has teeth and a muscular tongue which help in mechanical digestion.
- Teeth are supported by a socket of jaw bone. This attachment is known as thecodont.
- A normal human adult has 32 teeth- Incisors (8), canines (4), premolars (8) and molars (8).
- Dental formula of humans- 2123/2123.

Pharynx

- Pharynx forms the common passage for food and air.
- It has openings for both the oesophagus as well as trachea (wind pipe).
- Glottis (opening from larynx into trachea) prevents the passage of food into the respiratory tract.

Oesophagus

- Oesophagus is a muscular tube which connects the pharynx to stomach.
- Its size is about 25 cm in a human adult.
- The muscles of oesophagus generate waves of contraction that help in the movement of food along the oesophagus.
- This rhythmic wave of contraction of oesophagus muscles is known as peristalsis.
- Entry of food from oesophagus into stomach is regulated by a muscular structure called sphincter.



Peristaltic movement of food in oesophagus

Stomach

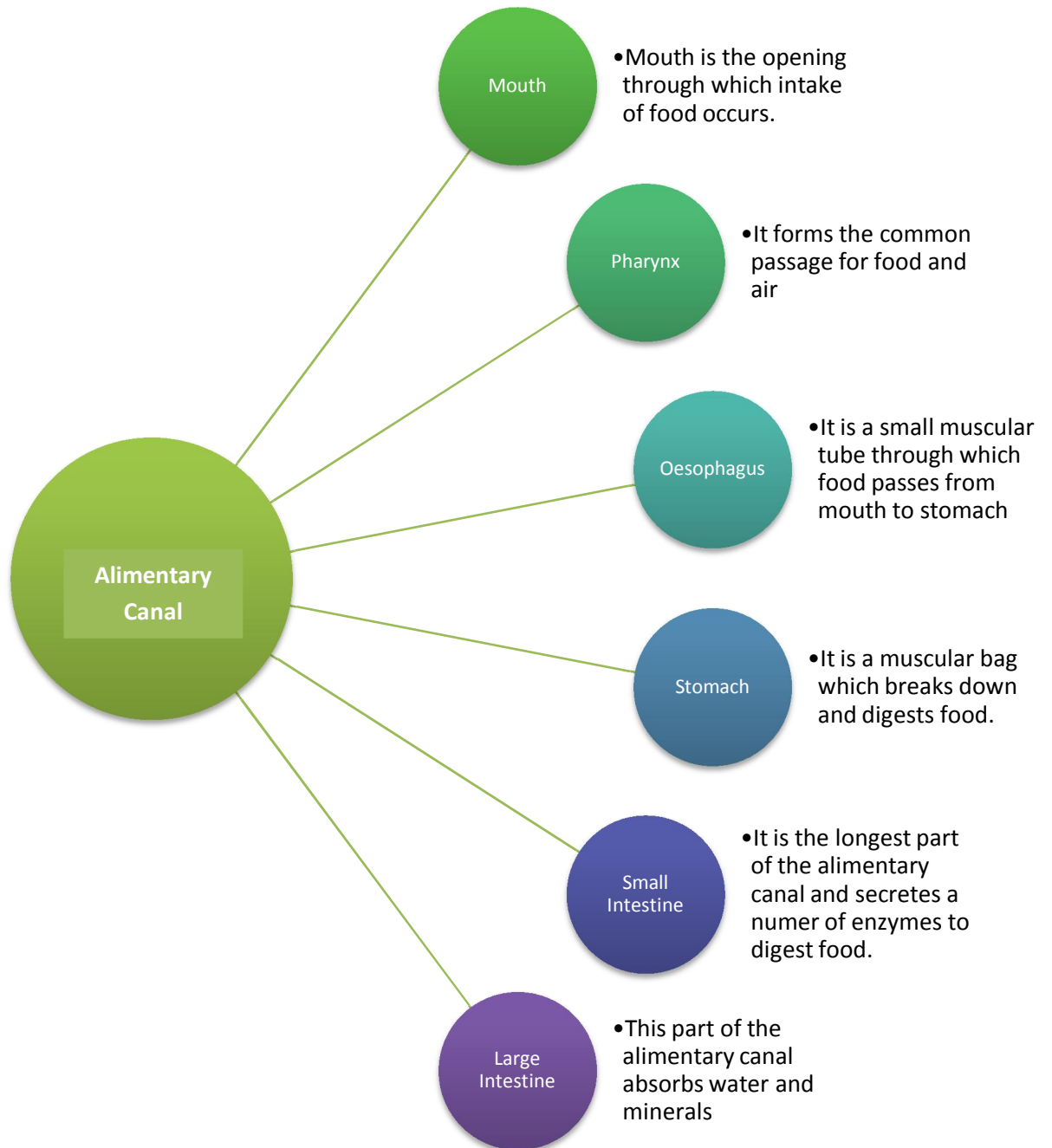
- Stomach is a sac-like organ located in the upper-left part of abdominal cavity.
- It has 3 portions-
 1. Cardiac- Uppermost part of stomach into which oesophagus opens.
 2. Fundic- Middle portion.
 3. Pyloric- Opens into duodenum (Upper most part of the small intestine).

Small Intestine

- Small intestine is the longest part of the small intestine.
- It is named so because of its small diameter.
- It has three parts:
 1. Duodenum- C-shaped portion attached to the pyloric part of the stomach.
 2. Jejunum- Coiled middle portion.
 3. Ileum- Highly coiled structure which opens into large intestine.

Large Intestine

- Diameter of small intestine is more than small intestine.
- It has three parts:
 1. Cecum- It is a small blind sac like structure which hosts some symbiotic micro-organisms.
 2. Colon- Helps in the absorption of electrolytes and water. Has three parts- an ascending, a transverse and a descending part.
 3. Rectum- The lower portion of descending colon is sigmoidal in shape and opens into rectum.



ACCESSORY GALNDS

- The accessory glands are not part of the alimentary tract but have a prominent role in digestion.
- Their function is to secrete juices needed for the proper lubrication and digestion of food.

Salivary glands

- There are three major saliva secreting glands- Parotid, submandibular and sublingual.
- A normal adult secretes 0.1-1.5 litres of saliva in a day.
- Two main components of saliva are:
 1. Ptyalin [an -amylase]- It is required for the digestion of starch.
 2. Mucin- Protects the surface of oral cavity from pathogens.
- Parotid gland secretes only ptyalin, whereas submandibular and sublingual glands secrete both ptyalin and mucin.

Pancreas

- Pancreas is located near the junction of stomach and small intestine.
- It secretes digestive juices into duodenum through a small tube called as pancreatic duct. Thus, pancreas also has exocrine function.
- Pancreas is responsible for the digestion of proteins, fat and starch.

Substrate	Pancreatic enzyme
Protein	Trypsin Chymotrypsin Carboxy peptidase
Starch	Pancreatic amylase
Fat	Pancreatic lipase Phospholipase

List of pancreatic enzymes and their substrates

Liver and gall bladder

- Liver is the largest gland of the body.
- It mainly secretes bile. Bile is delivered into the duodenum during the process of digestion.
- Bile serves as two functions:
 1. It digests and absorbs fat.
 2. Excretes waste products from blood.

Intestinal glands

- These are considered as modification of the epithelial layer of the small intestine.
 1. Brunner's gland- Secretes alkaline mucus in order to protect wall of duodenum from acidic juices and neutralizes them.
 2. Crypt of Lieberkuhn- These are small pits spread all over the surface of small intestine, located between the intestinal villi. They are responsible for secreting mucous and absorbing water and electrolytes.

