QUICK REVISION NOTES
For NEET
BIOLOGY CLASS 11

Digestion and Absorption

What are Digestion and Absorption?

Digestion is the process of breaking large, insoluble food molecules into smaller molecules for absorption into the bloodstream. Digestion begins in the mouth and continues as food travels through the small intestine.

Absorption is the process of assimilating substances into the cells or across the tissues and organs through the process of diffusion or osmosis. Absorption occurs in the small intestine.

Structure of the Alimentary canal

The alimentary canal has the following parts:

1. **Mouth:** Teeth have **the codont** attachment, i.e. embedded in a jaw bone socket.
    - **Diphyodont:** Two sets of teeth during a lifetime. The deciduous or milk teeth (20) are replaced by permanent adult teeth (32)
    - **Heterodont:** There are four different types of teeth. Incisors (8, for biting), Canines (4, for tearing), Premolars (8, for crushing and grinding), molars (12, for making smaller pieces)
    - The dental formula is 2123/2123, it represents the upper and lower half of the jaw
    - Taste buds are present on the upper surface of the tongue in **papillae**
    - The tongue is attached to the oral cavity by the **frenulum**
2. **Pharynx:** Gives passage to food and air. The **epiglottis (**a cartilaginous flap**)** blocks the entry of food into glottis, the opening of trachea (windpipe)
3. **Oesophagus:** It is a long tube that opens into the stomach, which is regulated by a muscular gastro-oesophageal **sphincter**
4. **Stomach:** It is divided into four parts:
    0. Cardiac – where oesophagus opens
    1. Fundic
    2. Body- central region
    3. Pyloric- opens in the small intestine
5. **Small Intestine:** It is the longest part of the alimentary canal. Pyloric sphincter connects the stomach to the small intestine. It has three parts:
    0. Duodenum
    1. Jejunum
    2. Ileum
6. **Large Intestine:** It also has three parts:
    0. Caecum- it is a blind sac, which hosts microbes and has vermiform appendix (a vestigial organ) attached to it
    1. Colon- it consists of four parts; ascending, transverse, sigmoid and descending
    2. Rectum- opens out of the body through the anus

Histology of Human Alimentary Canal

From oesophagus to rectum there are four layers present in the wall of the alimentary canal:

1. **Serosa** is the outermost layer, which is made up of mesothelium and connective tissues.
2. **Muscularis** is made up of smooth muscles, outer longitudinal and inner circular.
3. **Submucosa** is made up of loose connective tissues and contains lymph, blood and nerves. It contains glands in the duodenum part.
4. **Mucosa** is the innermost layer and contains irregular folds and gastric glands in the stomach area. Villi and microvilli and crypts of Lieberkuhn are present in the small intestine, which greatly increase the surface area of absorption. Mucus is secreted from the goblets cells of mucosal epithelium, which helps in lubrication.

Digestive Glands

Salivary glands: Saliva is secreted into the buccal cavity by three pairs of the gland; parotid- cheek, submaxillary or sub-mandibular- lower jaw and sublingual- below the tongue.

Liver: It is the largest gland (1.5 – 2 kg), present below the diaphragm. There are two lobes present in the liver. The hepatic cells secrete bile juice, which is stored in the **gallbladder.** Hepatic lobules contain hepatic cells and are the structural and functional unit of the liver. Hepatic lobules are covered by Glisson's capsule (a sheath of connective tissue).

The bile duct is formed from the cystic duct (coming from the gallbladder) and hepatic duct (from the liver).

Pancreas: It performs exocrine (enzymes) as well as endocrine (hormones insulin and glucagon) function. The pancreatic juice is alkaline.

Sphincter of Oddi is present at the opening of the hepato-pancreatic duct (bile duct + pancreatic duct) into the duodenum.

Digestion of Food

The digestion of food starts from the mouth itself. The masticated food mixed with saliva makes a small mass of food called a **bolus.** The bolus moves to pharynx and oesophagus by the process of **deglutition** (swallowing). There are various enzymes that get mixed with the food at different parts of the alimentary canal and facilitate digestion.

S.No.	Part of the Alimentary canal	Secretion	Enzymes	Action
1.	Mouth	Salivary glands- Saliva	Lysozyme	Antimicrobial
			Amylase	Hydrolysis of carbohydrates (pH-6.8) Starch → Maltose

2.	Stomach	Mucous neck cells	Mucus	Lubrication and protects from excoriation by HCl
		Peptic cells (chief)	Pepsinogen, a proenzyme converts to Pepsin in the presence of HCl Rennin in infants	Proteolytic enzyme (Protease) Protein → proteoses + Peptones (pH-1.8) Digests milk proteins
		Oxyntic cells (parietal)	HCl Intrinsic factor	HCl makes the pH acidic for the action of pepsin Intrinsic factor is required for the absorption of vitamin B_{12}
3.	Duodenum of Small Intestine	Pancreatic juice	Mucus with bicarbonates	Maintains alkaline pH (7.8) and protects intestinal mucosa from HCl
			Trypsinogen → trypsin by enterokinase	Proteins, Peptones and proteoses, converted to dipeptides
			Chymotrypsinogen	
			Procarboxypeptidase	
			Amylases	Polysaccharides into disaccharides
			Lipases	Fats to di and monoglycerides
			Nucleases	Nucleic acids to nucleotides and

			nucleosides
	Bile	Bile pigments, bile salts, cholesterol and phospholipids No enzymes	Emulsification of fat into micelles and activates lipases
	Succus entericus (Intestinal juice)	Disaccharidases (maltase)	Maltose to Glucose
		Dipeptidases	Dipeptides to amino acids
		Lipases	Di and monoglycerides to fatty acids and glycerol
		Nucleosidases	Nucleotides to nucleosides to sugar + bases

Absorption

The bio-macromolecules are broken down in the duodenum part of the intestine and get absorbed in jejunum and ileum. The undigested food moves to the large intestine, where some water and minerals get absorbed.

The absorption of food occurs by the process of diffusion due to concentration gradient or by facilitated transport by a carrier protein.

Water is transported by the osmotic gradient.

Amino acids, glucose, monosaccharides, Na^+ are absorbed in the blood by active transport against the gradient and it requires energy.

Micelles form chylomicrons (protein-coated fat globules), which are transported into lacteals (lymph vessels) in the villi and released in the bloodstream.

Some amount of absorption takes place in different parts and maximum absorption takes place in the small intestine.

Mouth- drugs

Stomach- water, simple sugars and alcohol

Small intestine- maximum absorption

Large intestine- water and some minerals

By assimilation, the absorbed nutrient reaches the different parts of the body through bloodstream and lymph for utilisation.

Disorders of the Digestive System

Many bacterial, protozoan, parasitic and viral infections cause inflammation of the intestine. Some of the common disorders are jaundice, vomiting, diarrhoea, constipation, indigestion, etc.

The diseases due to malnutrition are very common in developing and underdeveloped countries.

Protein Energy Malnutrition (PEM) causes Marasmus and Kwashiorkor in infants and children.

Marasmus- It is due to deficiency of protein and calories intake. The condition is characterised by thinning of limbs, extreme emaciation, dry and wrinkled skin and mental impairment.

Kwashiorkor- It is due to a deficiency of protein. There is wasting of muscles, but some fat is still present under the skin. The condition is characterised by swelling and extensive edema of body parts.