12. The Muscular System and Digestive System in Human Beings

- Muscles are one of the contractile organs of our body.
- They are the fleshy parts of our body, which help in the movement of different body parts.
- Alternate contraction and relaxation of muscles helps in the movement of bones.
- The muscles work in pairs to move a bone.
- Muscles are of of three types: voluntary muscles, that can be controlled by our will, involuntary muscles, that cannot be controlled by us, and cardiac muscles, that are special kind of involuntary muscles and are found only in heart.
- Lever Mechanisms in Human Skeleton
    - First Order Lever: Fulcrum (F) is in between Power (P) and Weight (W). Example, extension of arm at the elbow by the action of triceps muscles, and resting of skull on first and second neck vertebrae.
    - Second Order Lever: Fulcrum and power are at the two ends with the weight in between. Example, gastrocnemius muscle raising weight of the body on the toes.
    - Third Order Lever: Fulcrum and weight are at the two ends with the power in between. Example, biceps muscles flexing the arms.
- When some muscles undergoes contraction, at the some time there are some muscles of the same group that relax which helps in performing various operations.
- **Biceps** are present on the front part of our upper arm while **triceps** are at the back.
- **Abdominal muscles** (abs) are pair of muscles present in the front of abdomen.

Nutrition in humans

- Mouth includes teeth, salivary glands, and tongue. Teeth break down the food. They are of four types – molars (6), premolars (4), canines (2), and incisors (4) in each jaw.
    - Molars and premolars are for chewing and grinding food.
    - Canines are for piercing and tearing food.
    - Incisors are for cutting and biting food.
- In total life span of humans, two sets of teeth grow – milk teeth and permanent teeth.
- Saliva is secreted by salivary glands located under the tongue. It contains a digestive enzyme salivary amylase, which breaks down starch into sugar.
- Tongue helps in chewing and swallowing of food.
- The food from mouth passes down the oesophagus to the stomach, through the movement of walls of oesophagus (peristalsis)
- **Stomach** mixes the food received from oesophagus with digestive juices.
- Inner lining of stomach secretes:
    - Mucus – protects the lining of stomach against the action of the acid.
    - Hydrochloric acid – creates an acidic medium and helps in digestion of proteins.
    - Digestive juices – break down protein into simple substance.
        - Pepsin breaks proteins into polypeptides
        - Rennin changes soluble milk proteins into curd which is insoluble.
- The food from stomach moves into the small intestine.
- **Digestion in small intestine**
    - It is the longest part (about 7.5 m long) of the alimentary canal.
    - It is the site where complete digestion of carbohydrates, proteins, and fats takes place.
    - All the digested food is absorbed by the walls of intestine. This process is known as **absorption**.
    - Inner lining of small intestine has tiny finger-like projections called **villi.**

- **Villi** increase the surface area for more efficient food absorption.
- The absorbed food is delivered to each and every cell of the body where they are used to produce complex substances such as proteins, etc. This process is known as **assimilation**.
- It receives intestinal juice from two glands – liver and pancreas that help in further digestion of food.
- **Liver -** It is the largest gland of the body and secretes bile juice. Bile juice is stored in gall bladder and plays an important role in the digestion of fats.
- **Pancreas -** Pancreas contains enzymes that help in complete digestion of all food components.
  - Amylase breaks starch into maltose
  - Lipase breaks complex fats into simple fats.
- The functions of enzymes secreted in small intestine are :
  - Maltase changes maltose to glucose
  - Sucrase changes sucrose to glucose
  - Lactase changes lactose to glucose
  - Peptidase changes polypeptides to amino acids

- **Digestion in large intestine**
  - The digested food from small intestine goes into blood stream and the undigested and unabsorbed material and water enters the large intestine.
  - The function of large intestine is absorption of water and some salts from undigested food.
  - From large intestine, the waste material is stored in rectum in the form of semi-solid faeces.
  - The undigested, stored waste is excreted out from the body as faeces via anus. This process is known as egestion.

Digestive glands

- Three pairs of salivary glands are the parotids, the sub maxillary or sub mandibular, and the sub lingual.
- **Liver** is the largest gland.
- **Cystic duct** (duct of gall bladder) and **hepatic duct** (duct of liver) form a common **bile duct**.
- **Bile duct** and **pancreatic duct** opens together into duodenum as **hepato-pancreatic duct.**
- **Sphincter of Oddi** is located at the surface of duodenum and controls the secretions from liver, pancreas, and gall bladder into the duodenum of small intestine.
- **Crypts of lieberkuhn** are intestinal glands found in epithelial lining of small intestine and colon. These glands secrete maltase, sucrase, etc.
- **Pancreas** act as both exocrine and endocrine gland.
  i. **Exocrine part** secretes pancreatic juice.
  ii. **Endocrine part** secretes hormones - insulin and glucagon.
- Glands present in the mucosa of stomach are called gastric glands. Gastric glands have three major types of cells.
  - Mucus cells – Secrete mucus
  - Peptic or chief cells – Secrete pepsinogen
  - Parietal or oxyntic cells – Secrete HCl