The Digestive System | Topic Notes

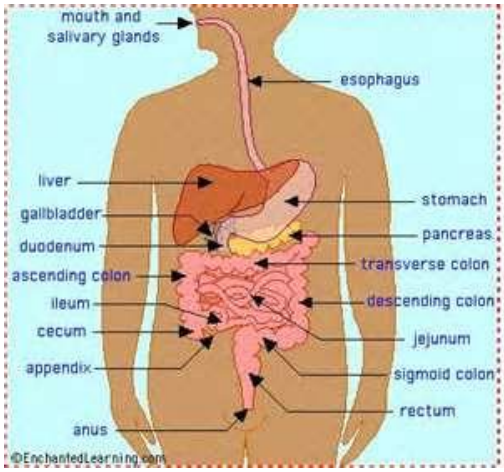
- **Nutrition** is the way in which living organisms obtain and use food.
- The 6 constituents of food are: ***carbohydrates, proteins, lipids, vitamins, minerals and water***.
- The 6 common non-metal elements present in food are C, H, O, N, P& S.
- Na, Mg, Cl, K and Ca are all present in our body as dissolved salts. They are necessary for things like bone structure, water retention and muscle contractions.
- **Trace elements** are needed by organisms in extremely small amounts. 3 examples are ***Fe*** *(haemoglobin),* ***Cu*** *(enzymes)and* ***Zn*** *(enzymes).*
- **Biomolecules**are organic chemicals produced and found only within living organisms. The 4 major ones found in food are carbohydrates, lipids, proteins and vitamins.
- **Carbohydrates**are made up of the elements C, H and O. in the ratio $C_x(H_20)_y$. they may be divided into 3 groups of saccharides(meaning sugars):
    1. ***Monosaccharide's*** are 1 sugar unit such as glucose, fructose and galactose, $C_6H_{12}O_6$(fruits)
    2. ***Disaccharides*** are 2 sugars such as maltose,sucrose and lactose, $C_{12}H_{22}O_{11}$ (sugar beet)
    3. ***Polysaccharides*** are many sugars such as starch,glycogen and cellulose, $(C_6H_{10}O_5)_x$ (potatoes)
- ***Animals cannot digest cellulose*** because they lack the enzyme needed to break it down. Cellulose therefore acts as ***fibre in the digestive system***, preventing ***constipation*** and helping lower blood ***cholesterol***.
- **Lipids**are also made of the elements C, H and O, but in no particular ratio. Fats are solid at room temperature whereas oils are liquid. Two groups of lipids are:
    1. ***Triglycerides*** are composed of 1 glycerol molecule and 3 fatty acids. They're important for storing excess energy and providing insulation.
    2. ***Phospholipids*** are composed of 1 glycerol molecule, 2 fatty acids and a phosphate molecule. They're an essential component of the cell membrane.
- **Proteins**are made of the elements **C, H, O, N** (and usually P or S). These elements combine to form **amino acids**. There are **20 different amino acids** that bond together via **peptide bonds** forming proteins.Good sources include **meat, eggs and beans**. Proteins have structural and metabolic functions:
    1. ***Structural functions-*** **collagen** is a fibrous protein responsible for holding tissues and organs together, **keratin** makes up a large part of our skin hair and nails.

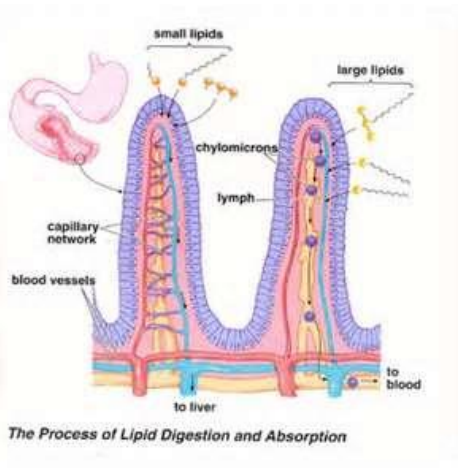
2. ***Metabolic functions*- enzymes** speed up metabolism, **hormones** (e.g. insulin) regulate metabolism, **haemoglobin** and **antibodies.**

- **Vitamins** are required by humans in v. small amounts as it's mostly plants that make them from elements they obtain from the soil. They may be ***fat-soluble*** e.g. vitamin D (found in sunlight and milk that provides strong bones and teeth and prevents rickets) or ***water-soluble***e.g. vitamin C (found in citrus fruits that provides healthy gums and skin and prevents scurvy).
- **Minerals** are metallic elements required by organisms in s. quantities daily. ***Plants*** need ***Mg*** (chlorophyll), ***NO3*** (make protein) and ***Ca*** (middle lamella). ***Animals*** need ***Ca*** (bones, teeth), ***Fe*** (haemoglobin) and ***Na*** (balance H20 in blood)
- **Water(80%)** provides a medium for metabolism and steady °C for reactions.

Herbivores are animals that eat only plant material.

- **Carnivores** are animals that eat only animal material.
- **Omnivores** are animals that eat both plant and animal material.
- **The 4 stages of nutrition are:**
  1. ***Ingestion*** (taking in food)
  2. ***Digestion*** (breaking down food into its constituent molecules)
  3. ***Absorption*** (passing of single biomolecules from gut into cells lining gut)
  4. ***Egestion*** (getting rid of undigested material "**faeces**" from the body)





- Mechanical digestion involves the ***mouth, teeth, tongue, stomach***and ***bile salts***.
- Chemical digestion involves the use of ***enzymes, acid*** and ***water.***

- **Saliva** is stimulated whenever food enters the mouth. It consists of ***water, salts, amylase*** (starch → maltose) and ***lysozyme*** (kills bacteria by opening their cell walls)**.**
- **Teeth:** $2(I_{2/2}C_{1/1}PM_{2/2}M_{3/3})$ *Incisors* (cutting), *Canines* (tearing), *Premolars & Molars* (crush).
- **Peristalsis** is rhythmical waves of contraction pushing food along the alimentary canal in one direction only. When slow or ineffective ***constipation*** may result.
- Food enters the stomach through the ***cardiac sphincter*** (prevents heartburn) as a ***bolus*** and is mixed with ***gastric juices*** (H_2O, HCL, mucous and pepsin) produced by the ***mucosa*** of the stomach for 1-2 hours, ***chyme*** then leaves the stomach through the ***pyloric sphincter.*** Stomach ulcers may form from too much HCL or alcohol.
- The liver ***stores glycogen***, ***iron*** and ***fat soluble vitamins*** (A, D, E and K). It ***breaks down red blood cells***. It ***deaminates excess amino acids*** → ***urea***. It ***produces bile*** (stored in gall bladder, contains *water, mucous, salts, cholesterol, and bilirubin and biliverdin* pigments. It *neutralises HCL from the stomach and emulsifies lipids*) ***and cholesterol*** and it ***detoxifies alcohol***.
- **Emulsification of lipids** is the breaking up of large fat droplets into smaller droplets.
- **The pancreas** produces ***pancreatic juice*** which contains ***$NaHCO_3$*** (neutralises chyme), ***lipase*** (lipids → fatty acids and glycerol) and ***amylase*** (starch → maltose). The pancreatic and bile ducts join at the duodenum.
- **The ileum** is 6m long and responsible for the absorption of nutrients by its villi.
- **Villi** are verry *numerous* in the small intestine, they've *one cell thick walls*, good *blood supply*, *lacteals* (lymph supply) and *microvilli* to further increase surface area.
- The large intestine is composed of the ***caecum, appendix and colon*** (ascending, transverse, descending and sigmoid) which then lead to the ***rectum and anus***.
- A ***balanced diet*** is one that contains all 7 of the major nutrients in the correct proportions. (carbohydrates, lipids, protein, vitamins, minerals, fiber and water).