Nutrients in Humans

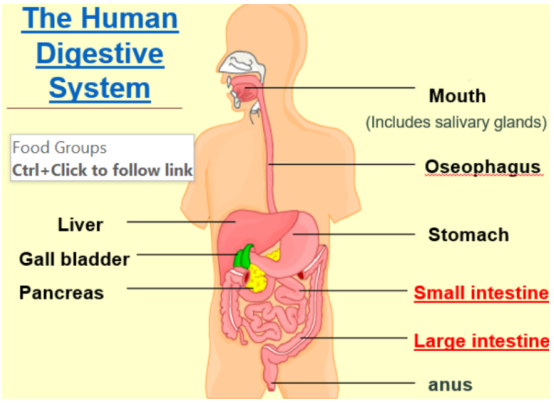
Define:

Digestion:

- breakdown of large insoluble complex food molecules to smaller soluble (simpler) molecules which will be absorbed into the bloodstream

▼ Anatomy

▼ Mouth and buccal cavity:



- teeth
  - Chewing action
  - Increases surface area to volume ratio

Salivary glands

- secretes saliva into tongue through via salivary duct

Tongue

- Rolls the food into bolus
- Starch → maltose (salivary amylase)

▼ Oseophagus

- helps move food (bolus) along the long tube with peristalsis

▼ Stomach

- churns the bolus
- secrete gastric juice to break down food into simpler substances
- Hydrochloric acid:

    - stops the action of salivary amylase.
    - changes inactive forms of enzymes to active forms (e.g pepsinogen is activated by hcl into pepsin), providing an acidic medium for action of gastric enzymes.
    - kills potentially harmful microorganisms in food.
    - proteins → polypeptides (protease)

▼ **Small intestine**

- helps to further digest proteins and starch and emulsified fats

Enzymes

- remaining proteins → amino acids
- polypeptides →amino acids
- starch → trypsin (enterokinase)
- maltase → glucose (maltose)
- sucrose → glucose and fructose (sucrase)
- lactose → glucose and galactose (lactase)
- fats → fatty acids and glycerol (lipase)

▼ **Large intestine**

- absorbs excess water and mineral salts

▼ **Pancreas**

- Secretes pancreatic juices

▼ **Rectum**

- stores undigested and unabsorbed food before its discharged as faeces through the anus

▼ Digestive Enzymes

Region in which digestive juice is secreted	Digestive Juice	Enzyme	Substrate	Product(s)	pH	Temperature
	Saliva	salivary amylase	Starch	maltose	7	37°C
Stomach	gastric juice	protease	proteins	Polypeptides	2	37°C
		rennin	Caseinogen	caesin	2	37°C
Small intestine	Pancreatic juice	maltase	starch	Maltose	8/9	37°C
		Pancreatic lipase	fats	fatty acids and glycerol	8/9	37°C
		protease	Proteins	polypeptides	8/9	37°C
	intestinal juice	sucrase	sucrose	Glucose and fructose	8/9	37°C
		trypsinogen	pepsin	trypsin	8/9	37°C
		Lactase	lactose	glucose and galactose	8/9	37°C
		lipase	fats	Fatty acids and glycerol	8/9	37°C
		Maltase	maltose	Glucose	8/9	37°C
		protease	Polypeptides	amino acids	8/9	37°C

Function of enzymes:

Salivary amylase: starch → maltose

Maltase: maltose → glucose

Protease:

- proteins → polypeptides
- polypeptides → amino acids

Lipase: fats → fatty acids and glycerol

Lactase: lactose → galactose and glucose

Sucrase: sucrose → glucose and fructose

Rennin: caesinogen → caesin

Trypsinogen: pepsin → trypsin

Liver + Gall bladder in Fat digestion

Liver

- regulates blood glucose concentration after a meal
- produces bile for emulsification
- stores iron
- synthesizes protein
- deaminate excess amino acids to form urea
- detoxification of alcohol

Gallbladder

- stores bile produced by the liver.

Role of Liver:

1. metabolism of glucose
    - Too much glucose after a meal:
        - stimulates islets of Langerhans in pancreas
        - secrete insulin
        - insulin is transported to the liver
        - excess glucose → glycogen by insulin (stored in the muscles and the liver cell)
    - Too little glucose when fasting:
        - stimulate islets of Langerhans in pancreas
        - secretes glucagon
        - Glucagon transported to the liver
        - glycogen → glucose by glucagon (goes into the bloodstream)
2. metabolism of amino acids and formation of urea
    - metabolism of amino acids
        - deaminate amino acids
    - formation of urea
        - amino group, NH_2, →ammonia
        - ammonia → urea
3. breakdown of alcohol
    - detoxifies alcohol, by converting it with alcohol dehydrogenase into acetaldehyde which is then broken down into compounds used in respiration

Adaptation of small intestine:

- finger-like structure (villi and microvilli) to increase surface area to volume ratio and absorb nutrients into the bloodstream
- Epithelium of a villi is one-cell thick
- Long to allow sufficient time for absorption
- Many capillaries in intestinal walls and villi