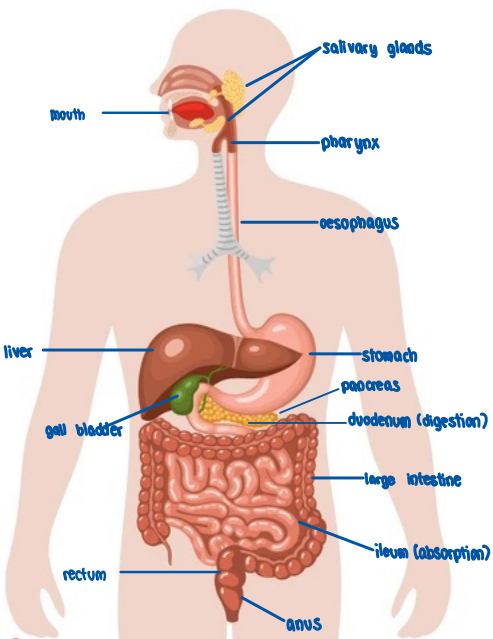


nutrition in humans



2 types of digestion.

- ① physical digestion — when large pieces of food are broken up into smaller pieces
- ② chemical digestion — when larger, more complex molecules are broken down into smaller, simpler molecules. Chemical digestion is carried out by digestive enzymes found in the alimentary canal.

carbohydrates lipids proteins

types of processes biological molecules must go through before they become part of our bodies:

- ① ingestion — process in which food is taken into the body
- ② digestion — food is broken down either physically or chemically
- ③ absorption — nutrient molecules enter the bloodstream and then the body cells
- ④ assimilation — nutrient molecules are used to make new molecules within body cells
- ⑤ egestion — undigested material is passed out of the body

PARTS OF THE ALIMENTARY SYSTEM INVOLVED IN DIGESTION

① Mouth

- ingestion occurs in the mouth
- physical digestion occurs: the chewing action of the teeth cuts food into smaller pieces
found in saliva, made by salivary glands
- chemical digestion is carried out by the enzyme, **salivary amylase**.
- works best at pH 7



② Oesophagus

- chewed up food is swallowed and it passes down the oesophagus, aka the gullet
- does not produce enzymes

HOW FOOD MOVES ALONG THE ALIMENTARY CANAL

- peristalsis is first observed at the oesophagus, but also occurs throughout the rest of the alimentary canal
- a series of rhythmic wave-like muscular contractions that occur throughout the walls of the alimentary canal
- the wall of the alimentary canal has two layers of muscles: the circular muscles form the inner layer while the longitudinal muscles form the outer layer

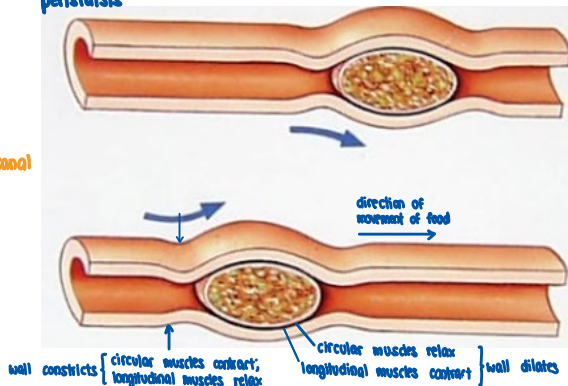
③ Stomach

- food in the oesophagus moves into the stomach
- stomach muscles contract to mix the food with gastric juice
- gastric juice is secreted in the stomach

hydrochloric acid — kills harmful pathogens in food and provides acidic environment for gastric protease

- **gastric protease** — breaks down proteins into simpler polypeptides
- partially digested food that leaves the stomach is called **chyme**

peristalsis



③ small intestine

chyme moves from the stomach to the small intestine

consists of 3 sections:

1. **duodenum** — most of the digestion takes place

2. **jejunum** — absorption of digested nutrients

3. **ileum** — further absorption of digested nutrients

the duodenum is the first part of the small intestine

↳ receives bile from the liver and pancreatic juice from the pancreas

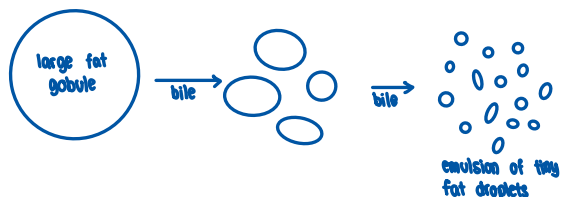
the liver produces a greenish-yellow fluid called **bile**

↳ bile is temporarily stored in the gall bladder

↳ when food enters the duodenum, bile is released into the duodenum through the **bile duct**

↳ bile emulsifies fats — it breaks up fat globules into smaller fat droplets (**physical digestion**)

↳ increases the **SA:V ratio** so that lipase can act on it more efficiently

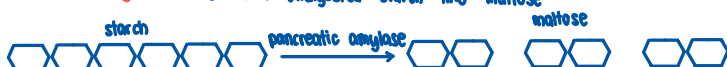


the pancreas produces **pancreatic juice**

↳ pancreatic juice travels to the duodenum via the **pancreatic duct**

↳ pancreatic juice contains digestive enzymes:

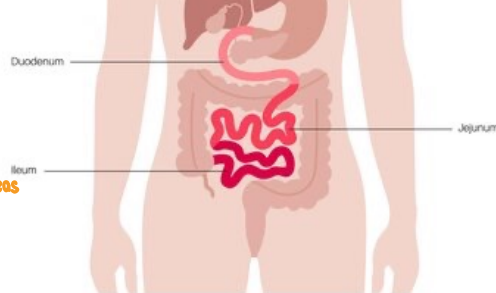
- **pancreatic amylase** breaks down undigested starch into maltose



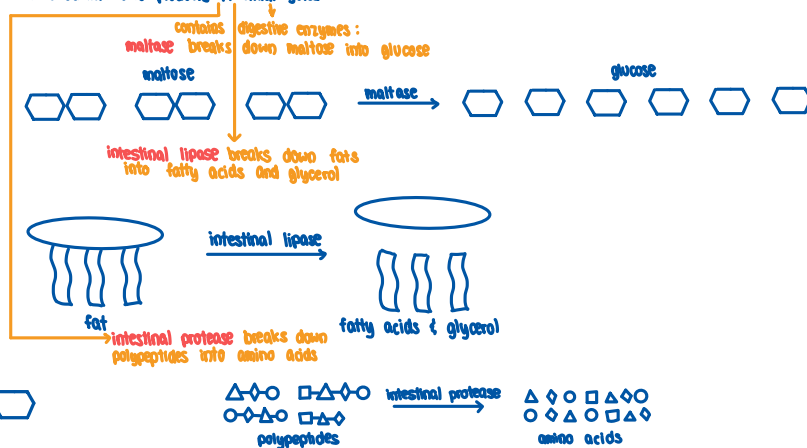
- **pancreatic lipase** breaks down fats into fatty acids and glycerol



- **pancreatic protease** breaks down proteins into simpler polypeptides



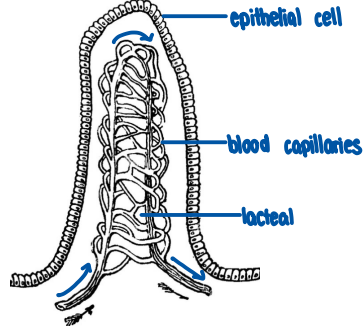
the duodenum also produces **intestinal juice**



adaptation	function
long and coiled tube	provide sufficient time for complete digestion and maximum nutrient absorption
inner wall has many folds and furrows	increase SA:V ratio for more efficient absorption of digested nutrients via diffusion and active transport
folds in inner wall is lined with finger-like protrusions called villi	
each villus containing: 1) blood capillaries absorbing glucose and amino acids 2) lacteal absorbing glycerol and fatty acids	the continuous flow of blood carries absorbed nutrients away quickly, maintaining the concentration gradient for efficient diffusion of digested nutrients

Structure and function of villus

- finger-like projections found on the wall of the small intestine
- within each villus is a network of blood capillaries and lacteal in the centre
- glucose and amino acids diffuse or are actively transported from the lumen of the small intestine, through the epithelial lining, into the blood capillaries
- the blood capillaries carry these nutrients to the liver via the hepatic portal vein
- water moves by osmosis from the small intestine lumen into the blood capillaries
- fatty acids and glycerol diffuse into the epithelial cells
- there, they recombine into lipids
- the lipids are transported into the lacteal, and carried away by the lymphatic system



⑤ absorption at the large intestine

- any undigested food and water pass into the large intestine
- water and mineral salts are absorbed at the large intestine by osmosis and diffusion respectively
- the undigested food becomes increasingly solid as water is absorbed while it moves along the large intestine
- it is stored temporarily in the rectum as faeces
- then passed out of the anus in egestion

ROLES OF THE LIVER

① regulation of blood glucose concentration

- when blood glucose concentration is higher than normal, insulin stimulates the conversion of excess glucose into glycogen
- when blood glucose concentration is lower than normal, glucagon stimulates the conversion of glycogen into glucose

↳ insulin and glucagon are produced by pancreas

② production of bile

- bile emulsifies fats into tiny fat droplets

③ deamination of excess amino acids

- unused amino acids become ammonia which is toxic to cells
- during deamination, excess amino acids turns to ammonia then urea while producing glucose
- urea is removed in urine, glucose is used by body or stored as glycogen

④ detoxification of alcohol

- the process of breaking down harmful substances into harmless ones

⑤ breakdown of hormones

- after carrying out their functions, hormones are transported in blood to the liver to be broken down

effects of alcohol consumption on the brain and body

- slows down brain function
- excessive consumption leads to slower reaction time, reduced self-control and poor judgement
- can lead to slurred speech, blurred vision and poor muscular coordination

long term effects of excessive alcohol consumption

- gastric ulcer — alcohol stimulates acid secretion in stomach, excess stomach acid increases the risk of gastric ulcer
- liver cirrhosis — leads to haemorrhage/bleeding in liver, increased pressure and then death
- brain damage

social implications

- exhibit violent behaviour
- drivers have slower reaction and slower reflexes → prone to vehicular collisions and accidents