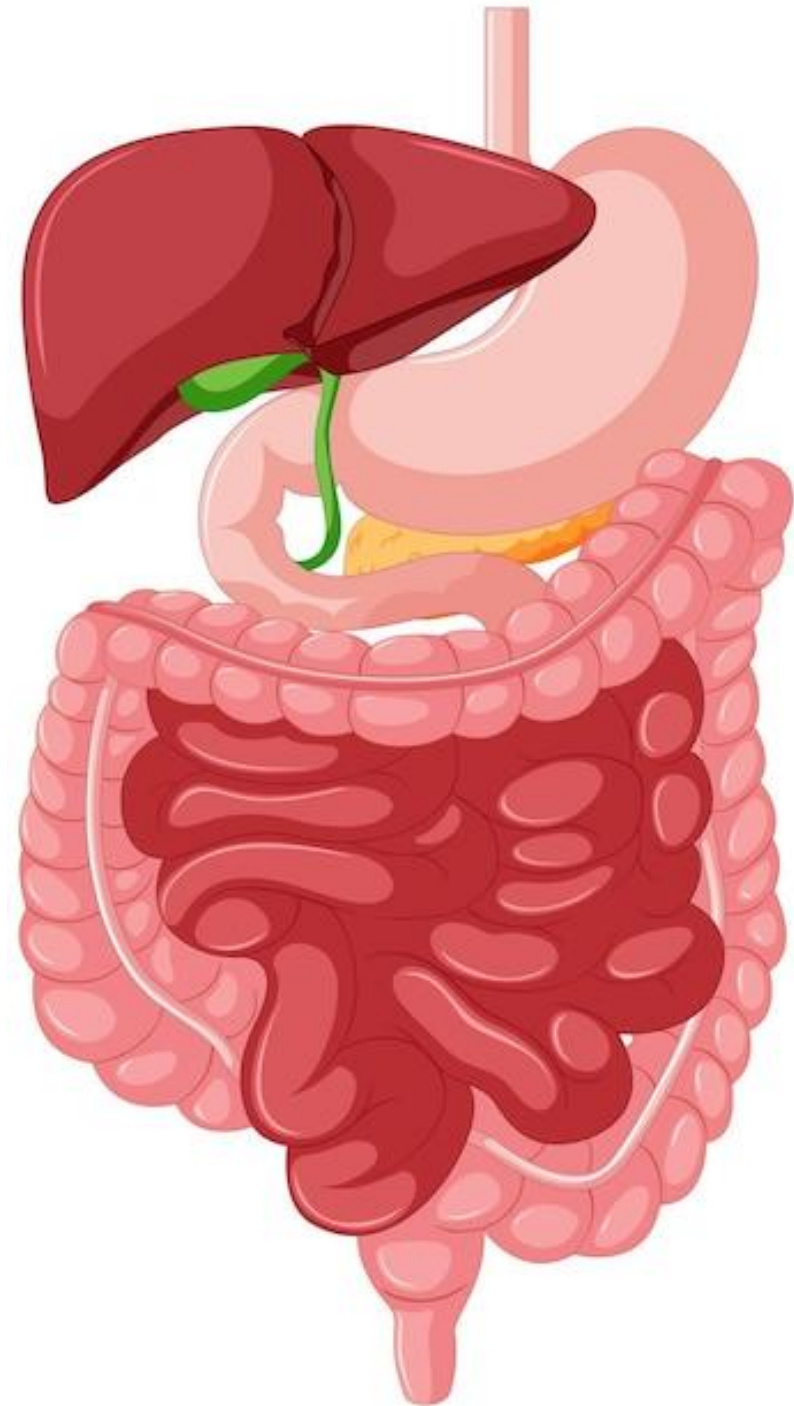


MYP 4 UNIT 3 LESSON 2

TOPIC: DIGESTION

*UNIT TITLE: HOW DO ORGANISMS SUSTAIN
THEMSELVES*



Objectives.

- **Explain** the process of digestion and the role of the alimentary canal.
- **Identify** the major organs involved in digestion and their functions.
- **Describe** how nutrients are broken down and absorbed by the body.

Icebreaker: Digestive Detective

- **Instructions:**

1. You will work in **pairs**.
 2. Each pair will receive cards with the names of different **foods**.
 3. Your task is to **guess which organ in the digestive system processes each food first** (e.g., mouth, stomach, small intestine).
 4. After 2 minutes, we will **share your answers** with the class.
- Tip:** Think about what happens to the food when you eat it!

Digestion in Humans

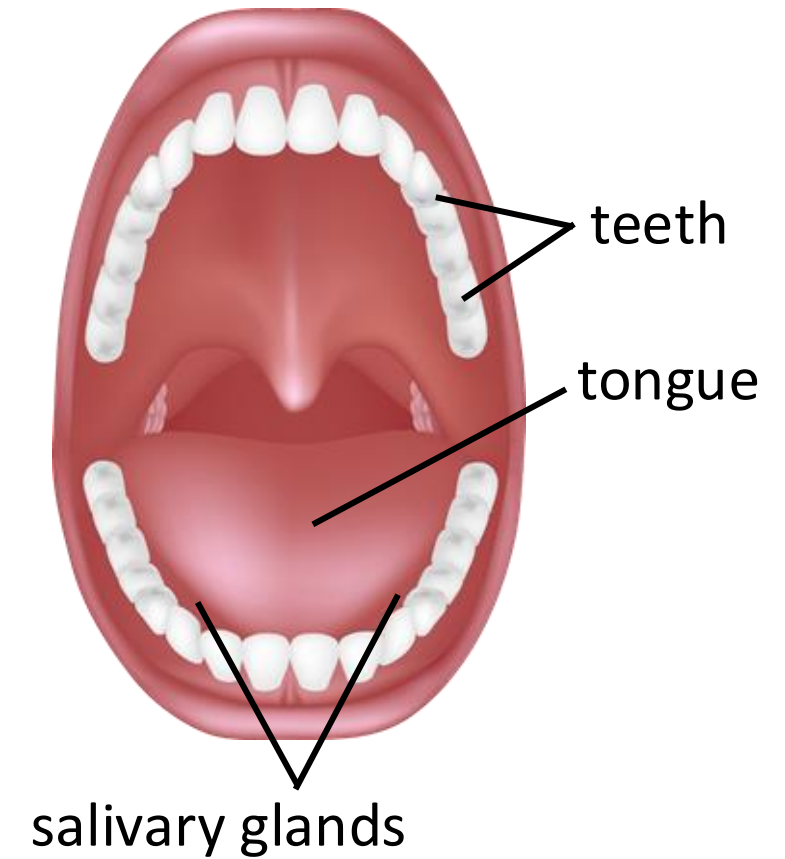
- Large, **insoluble** food molecules must be broken down into **small, soluble molecules**.
- Only then can they be **absorbed into the blood** and reach body cells.

Digestion involves **physical** and **chemical** breakdown:

- **Physical:** chewing by teeth
- **Chemical:** enzymes breaking down molecules

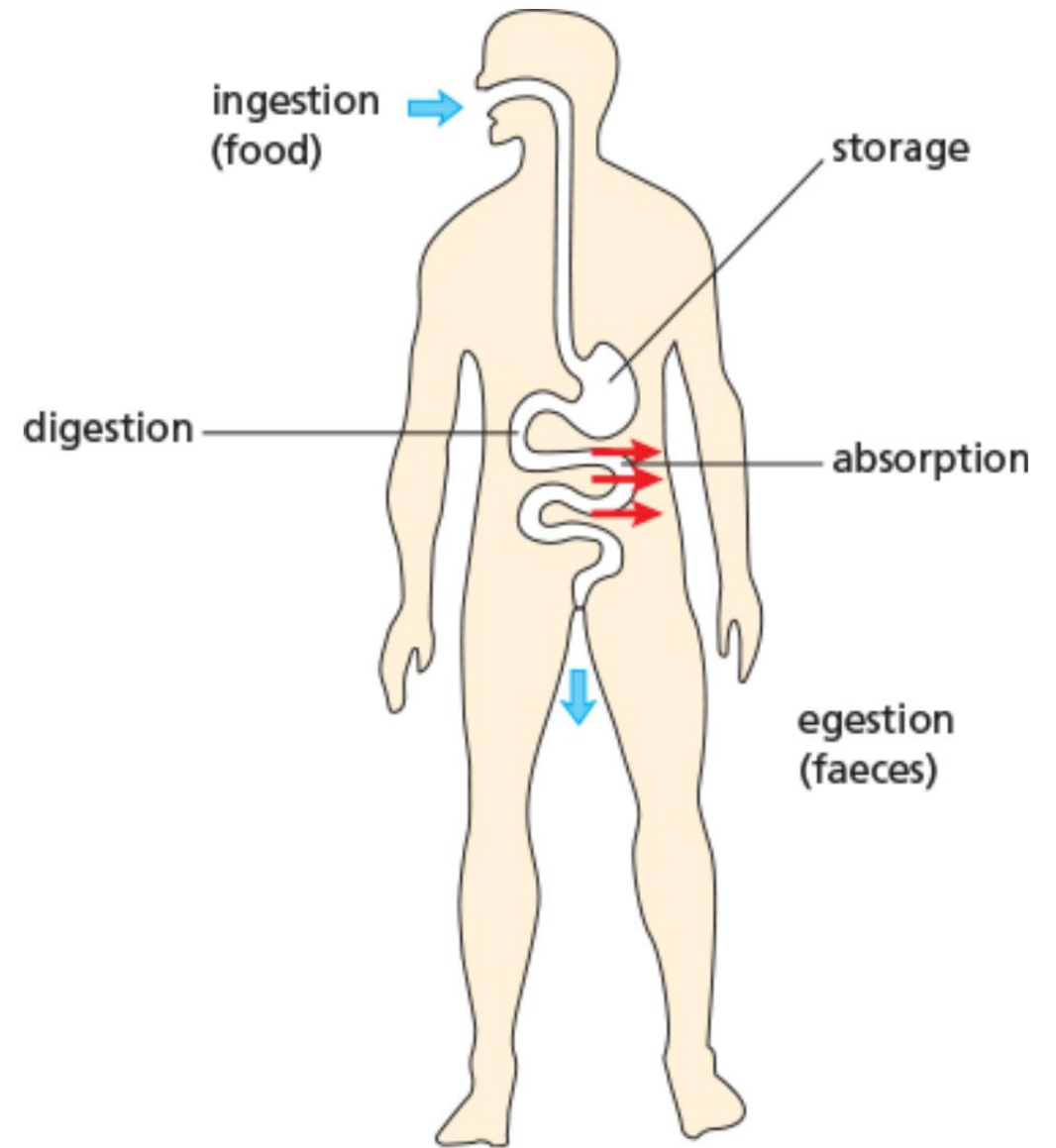
The mouth has several **adaptations**:

- the teeth cut and chew food into smaller pieces.
- the tongue rolls and mixes the food in the mouth.
- the salivary **glands** produce chemicals and add water to the food.



The Alimentary Canal

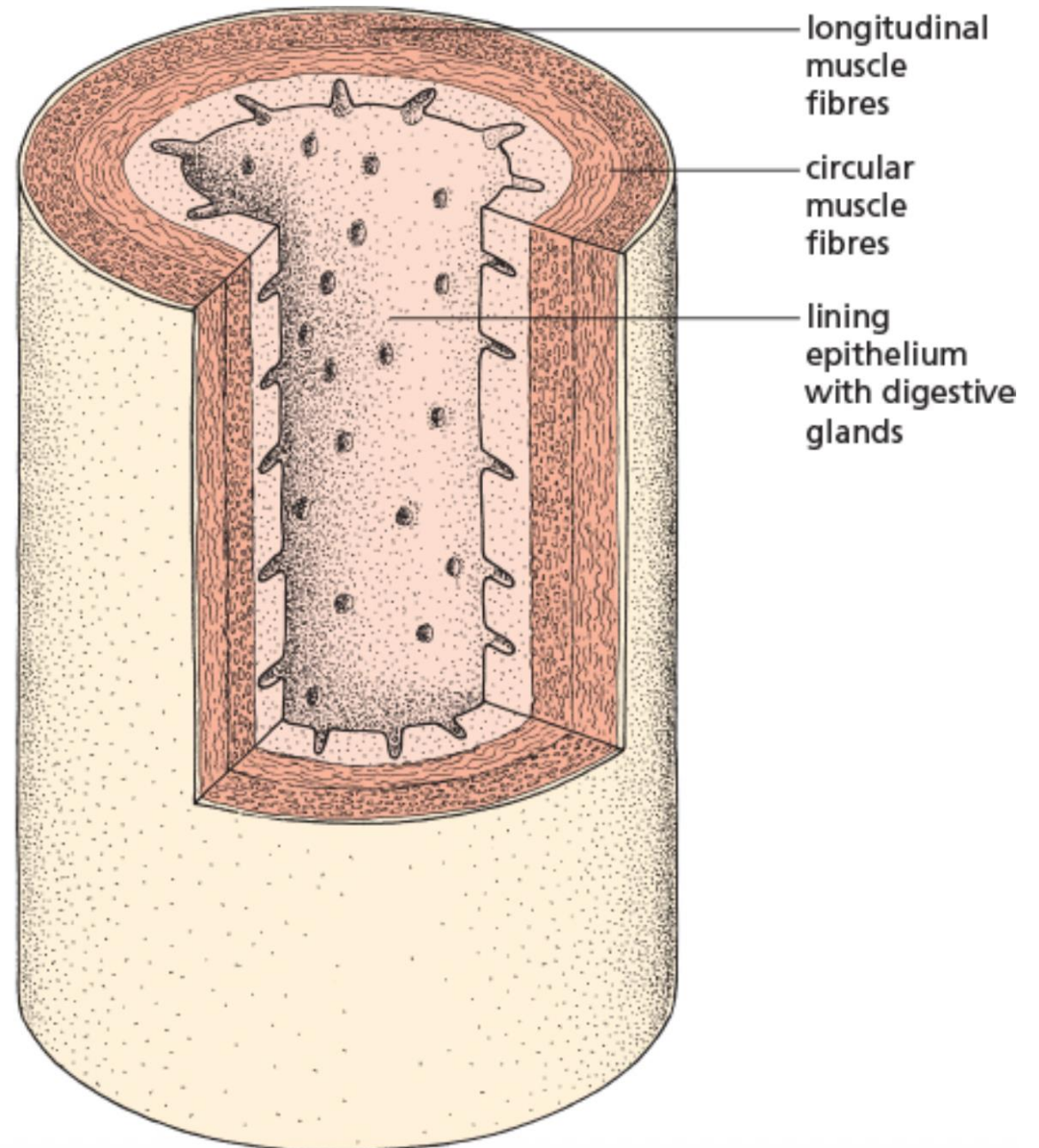
- A tube running through the body where **food is digested**.
- **Soluble products** are absorbed; **indigestible food** is expelled (egested).



The alimentary canal (generalised)

Epithelium Lining

- The canal is lined with **epithelium cells**.
- New cells are constantly **produced** to replace worn-out cells.



The general structure of the alimentary canal

Role of Mucus

- Produced by cells in the lining.
- Lubricates** the canal and **protects** it from damage.
- Prevents **digestive enzymes** from attacking the lining.

Digestive Enzymes

- Some enzymes are made by **cells in the canal lining** (e.g., stomach).
- Others are made by **glands outside the canal** (e.g., salivary glands, pancreas).
- Enzymes reach the canal through **ducts**.

Blood Vessels in the Alimentary Canal

- Blood vessels in the canal walls:
 - Bring **oxygen** to cells
 - Remove **carbon dioxide**
 - **Absorb digested food** for delivery to the body

Physical digestion



Physical digestion is the breakdown of food into smaller pieces without chemical change to the food molecules.

Physical Digestion

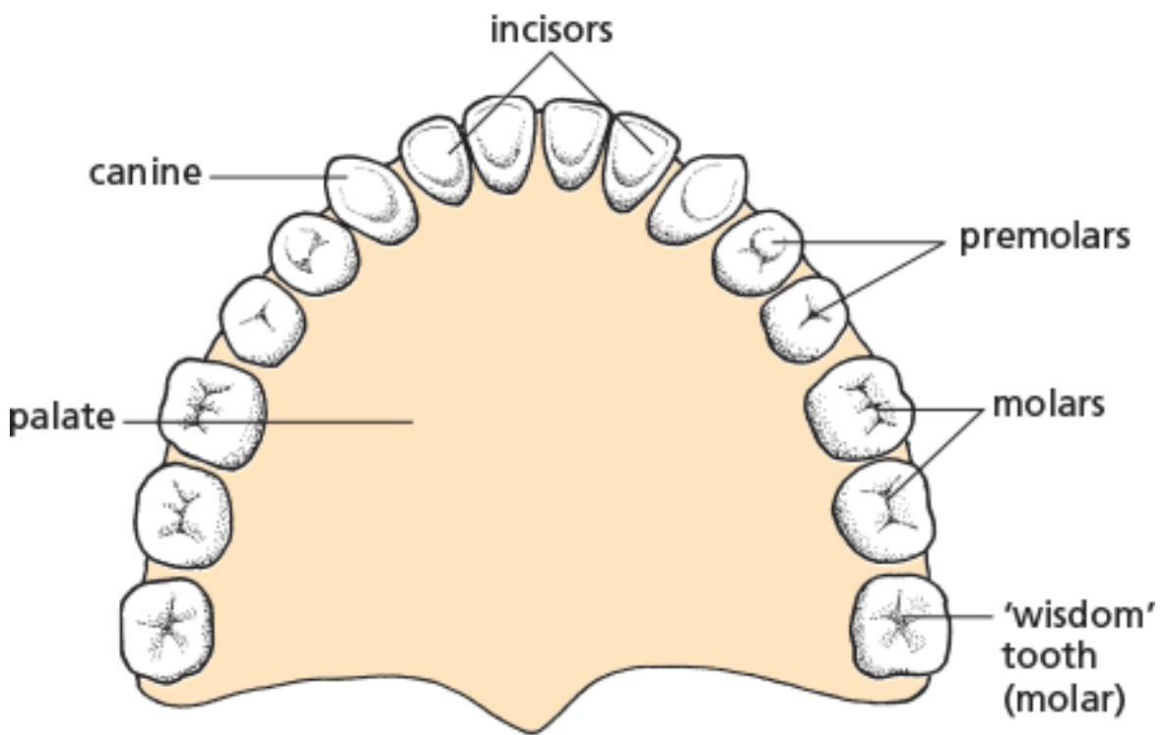
- Mainly occurs in the **mouth**.
- Teeth chew food.

Other examples:

- **Muscle action** in the stomach
- **Emulsification of fats** by bile



Human Diet and Teeth



*Humans are **omnivores** (eat plants and animals).*

*Human teeth are similar to those of carnivores, but **cannot** catch or crush prey*

- Humans have four main types of teeth—

Incisors (cutting), **Canines** (tearing),




Premolars (crushing/grinding),

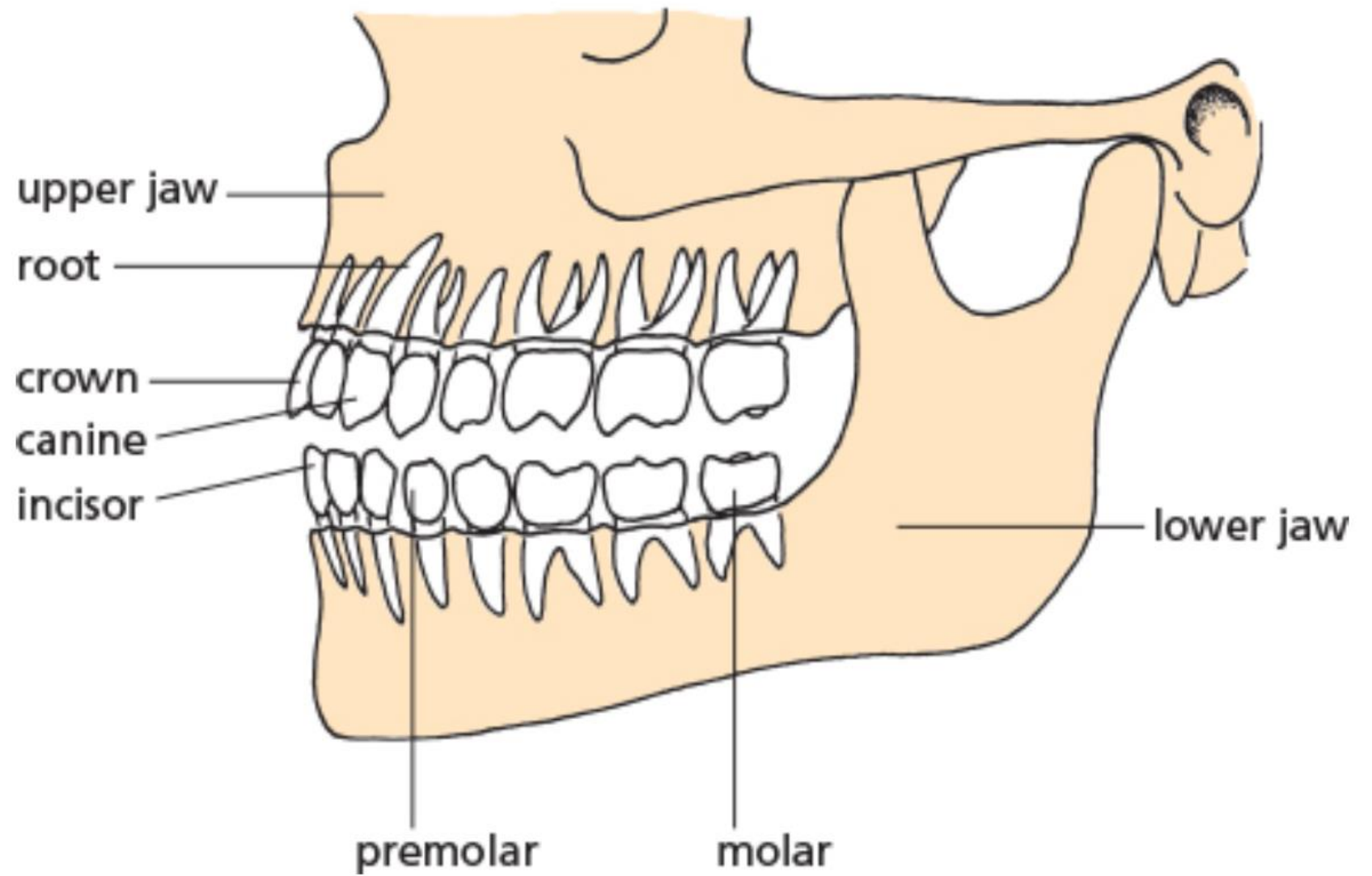
and **Molars** (heavy grinding)—all

working together to bite, tear, and

chew food for digestion.

Types of Teeth and their Function

	Incisor	Canine	Premolar	Molar
				
Position in mouth	Front	Either side of incisors	behind canine	Back
in mouth Description	Chisel-shaped (sharp edge)	of incisors Slightly more pointed than incisors	2 points (cusps), 1 or 2 roots	4 or 5 cusps 2 or 3 roots
Function	Biting of pieces of food	Similar function to incisors tearing	Tearing and drinding food	Chewing and grinding food



7.11 Human jaws and teeth

Tooth Structure

- Part of the tooth is **above the gum line**.
- The rest is **embedded in the jawbone and gum**.
- The visible part of the tooth is covered by **enamel**, a very hard substance that protects the tooth.
- The cement helps the tooth **grip the jawbone**.

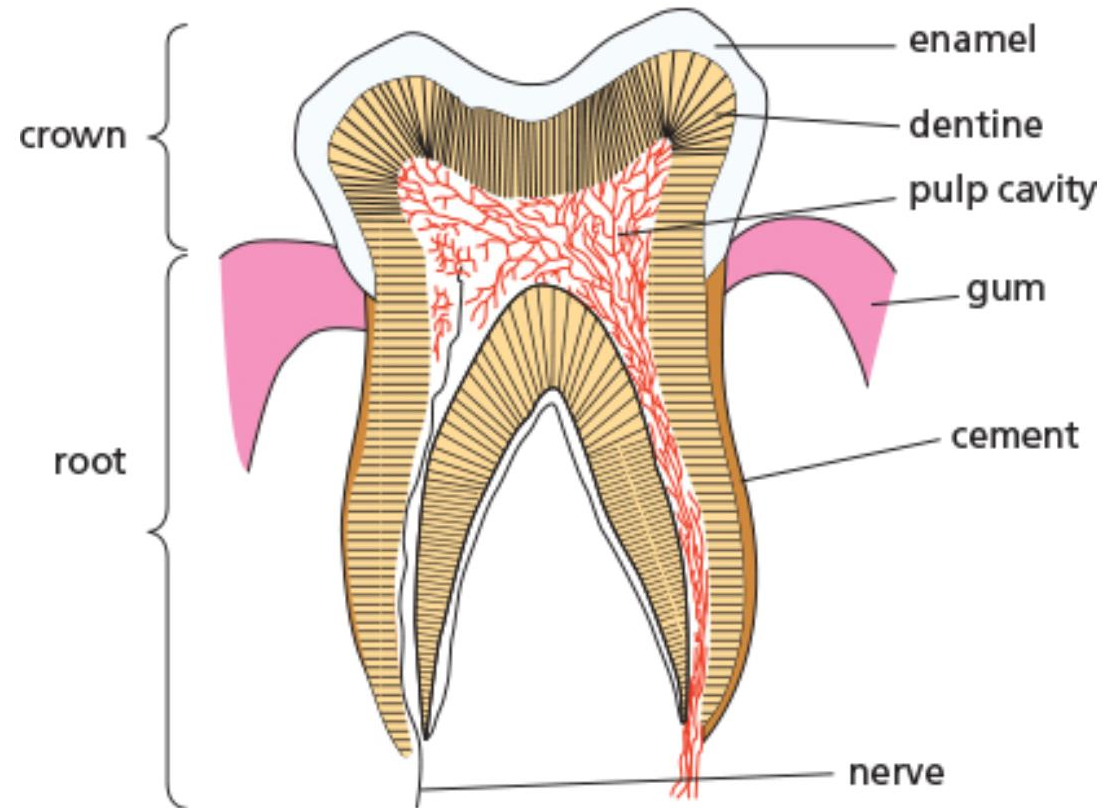


Figure 12 Section through a molar tooth

Tooth Structure

- ✓ **Dentine** is found **below the enamel**, and it's **softer than enamel**.
- ✓ **The pulp cavity** is located **inside the dentine**, which contains **nerves and blood vessels**.

These enter through a **small hole at the base of the root**.

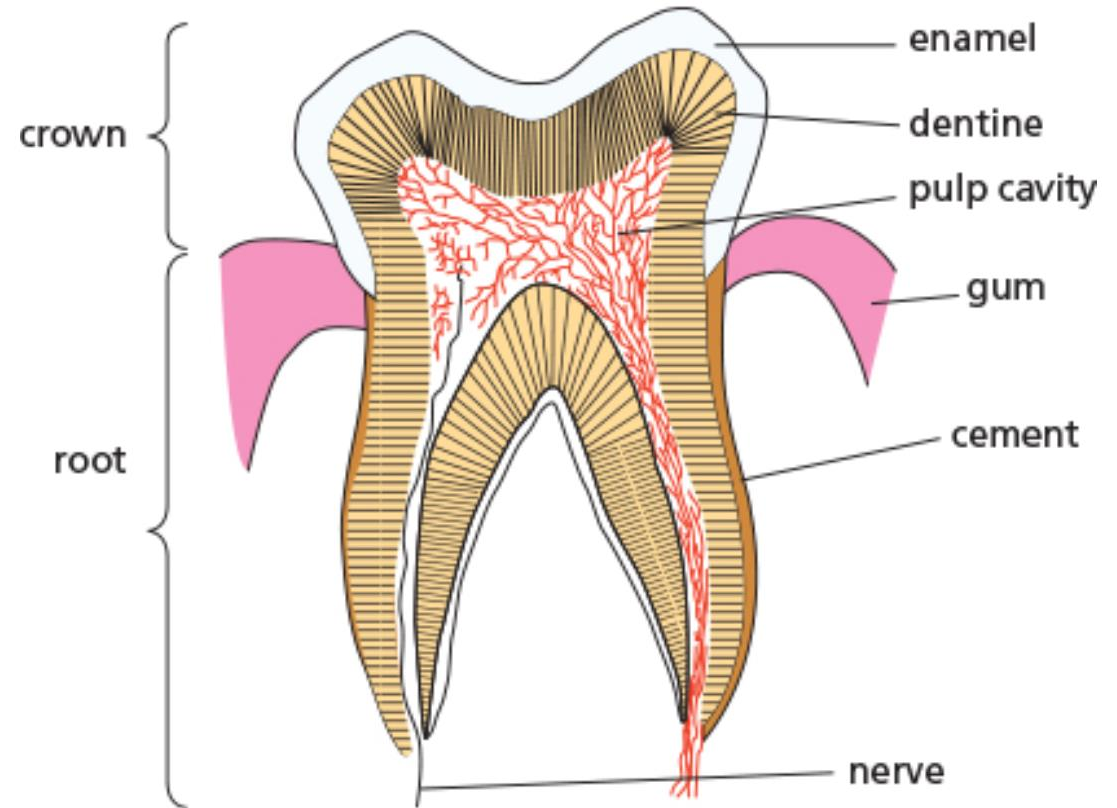


Fig. 12 Section through a molar tooth

Peristalsis

Peristalsis is the **movement of food** along the alimentary canal.

Muscles in the Alimentary Canal

- The walls contain **layers of muscle**.
- Two types of muscle:
 - **Circular muscle**(contracts to make the canal **narrow**)
 - **Longitudinal muscle**

The wave pushes food forward through the canal

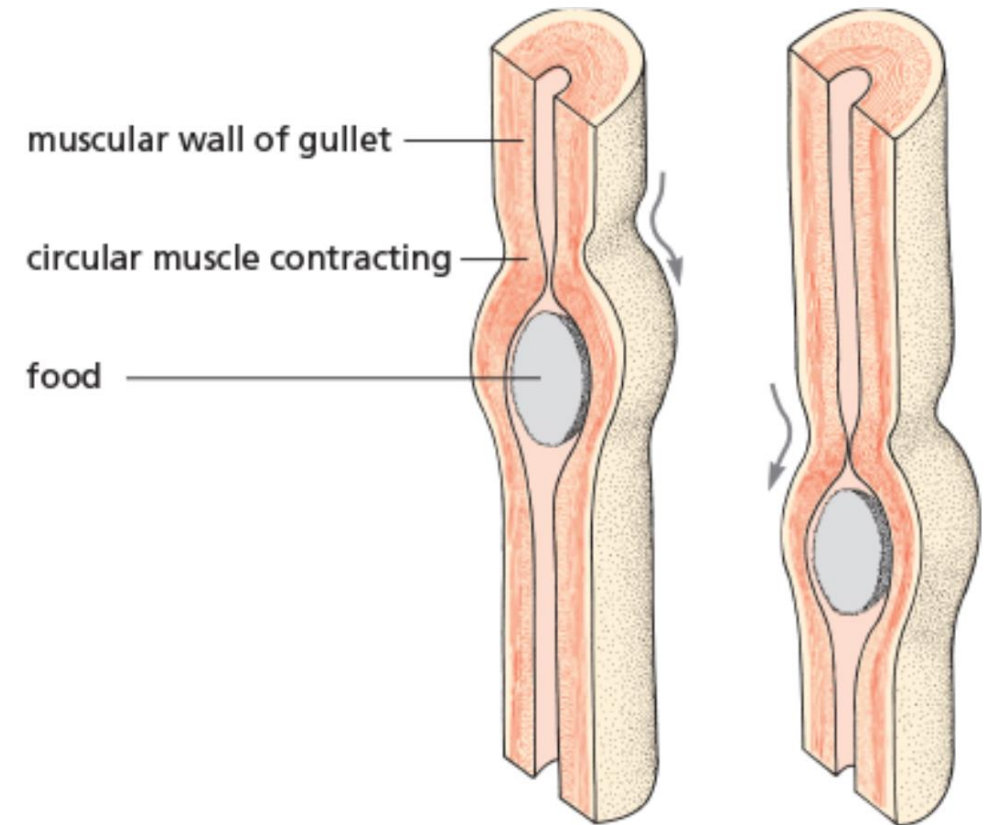
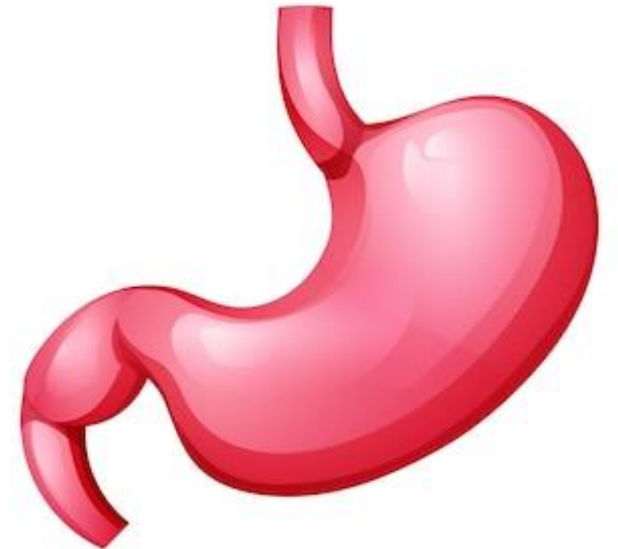


Figure 7.13 Diagram to illustrate peristalsis

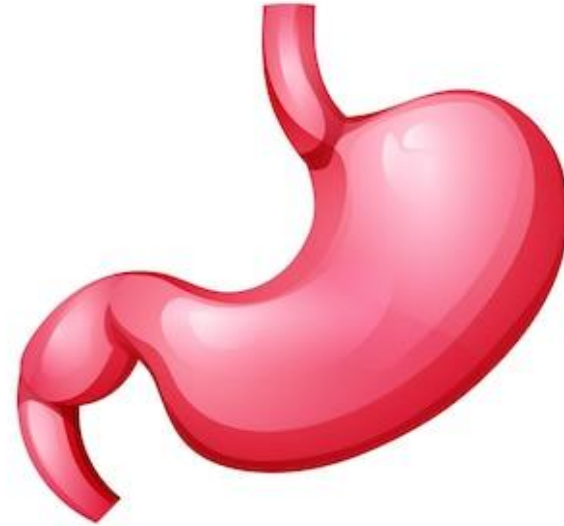
Physical Digestion in the Stomach

- The stomach has **elastic walls** that stretch as food enters.
- Its main function is to **store food** and turn it into a **liquid**.
- Muscles in the stomach wall **contract and relax**.
- This **churns and squeezes** the food.
- Food mixes with **gastric juice**.
- Food is turned into a **creamy liquid**.
- Increases **surface area** for efficient digestion.



Time Food Stays in the Stomach

- **Water:** passes through quickly.
- **Carbohydrate meal:** less than 1 hour.
- **Protein and fat meal:** 1–2 hours.



Exit from the Stomach

- A **valve** at the base of the stomach controls the movement of food.
- Only **liquid food** passes through.
- Food enters the **duodenum** (first part of the small intestine).

Bile and Physical Digestion

- Bile is involved in **physical digestion**.
- It helps break down **fats**.

Color of Bile

- Green color is due to **bile pigments**.
- Pigments are formed from the **breakdown of haemoglobin** in the liver.

Production and Storage of Bile

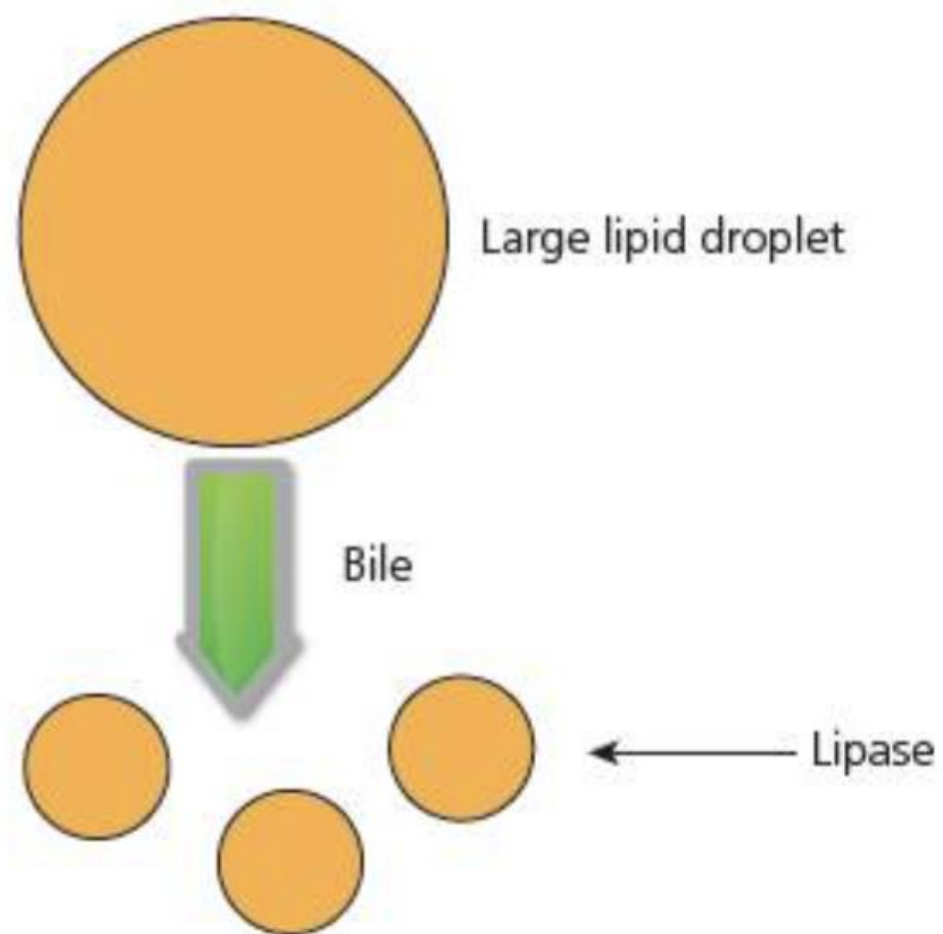
- Made in the **liver**.
- Stored in the **gall bladder**.
- Released into the **duodenum** through the **bile duct**

What Bile Contains

- A **green, watery fluid**.
- Contains **bile salts**.
- **No enzymes**.

Action of Bile Salts

- Bile salts **emulsify fats**.
- Break fats into **small droplets**.
- Increases **surface area** for digestion by **lipase**.



■ **Figure 3.13** Bile emulsifies fats, creating a larger surface area for lipase to act on

Chemical digestion

- Digestion is mainly a **chemical process**.
- Some foods can be absorbed **without digestion (e.g., glucose in fruit juice)**.
- **Enzymes** dissolve food into small molecules.

Chemical digestion is the breakdown of large, insoluble molecules into small, soluble molecules.

Processes in the Alimentary Canal

1. Ingestion is the taking of substances, e.g., food and drink, into the body through the mouth.

2. Digestion is the breakdown of food.

3. Absorption is the movement of nutrients from the intestines into the blood.

4. Assimilation is the uptake and use of nutrients by cells.

5. Egestion is the passing out of food that has not been digested or absorbed as faeces through the anus

Region of alimentary canal	Function
mouth	ingestion of food; physical digestion by teeth; chemical digestion of starch by amylase; formation of a bolus for swallowing
salivary glands	produces saliva, which contains amylase for the first stage of the chemical digestion of starch in food; also, liquid to lubricate food and make small pieces stick together
oesophagus (gullet)	transfers food from the mouth to the stomach by peristalsis
stomach	produces gastric juice containing protease, for chemical digestion of protein; also, hydrochloric acid to kill bacteria; peristalsis churns food up into a liquid
duodenum	first part of the small intestine; receives pancreatic juice for chemical digestion of proteins, fats and starch as well as neutralising the acid from the stomach; receives bile to emulsify fats (a type of physical digestion)

ileum	second part of the small intestine; enzymes in the epithelial lining carry out chemical digestion of starch into simple reducing sugars using pancreatic amylases; proteins to amino acids by proteases; and fats and oils into fatty acids and glycerol by lipases; very long and has villi <input type="text"/> to increase surface area for absorption of digested food molecules and water
pancreas	secretes pancreatic juice into the duodenum through the pancreatic duct <input type="text"/> for chemical digestion of proteins, fats and starch
liver	makes bile containing salts to emulsify fats (physical digestion); assimilation of digested food like glucose; deamination of excess amino acids <input type="text"/>
gall bladder	stores bile made in the liver, to be secreted into the duodenum through the bile duct <input type="text"/>
colon	first part of the large intestine; absorption of water from undigested food; absorption of bile salts to pass back to the liver
rectum	second part of the large intestine; stores faeces
anus	egestion of faeces

Seven Classes of Food – Digestion Summary

Food Class	Enzyme	Where Found	End Product	(Additional Notes)
Carbohydrates	Amylase	Mouth & small intestine	Glucose	
Proteins	Pepsin / Trypsin	Stomach & small intestine	Amino acids	
Lipids (Fats)	Lipase (with bile assisting)	Small intestine	Fatty acids + glycerol	
Vitamins	None	Small intestine	Absorbed	
Minerals	None	Small intestine	Absorbed	
Water	None	Small & large intestine	Absorbed	
Fibre	None	Not digested	Adds bulk to faeces	

The final products of digestion are:

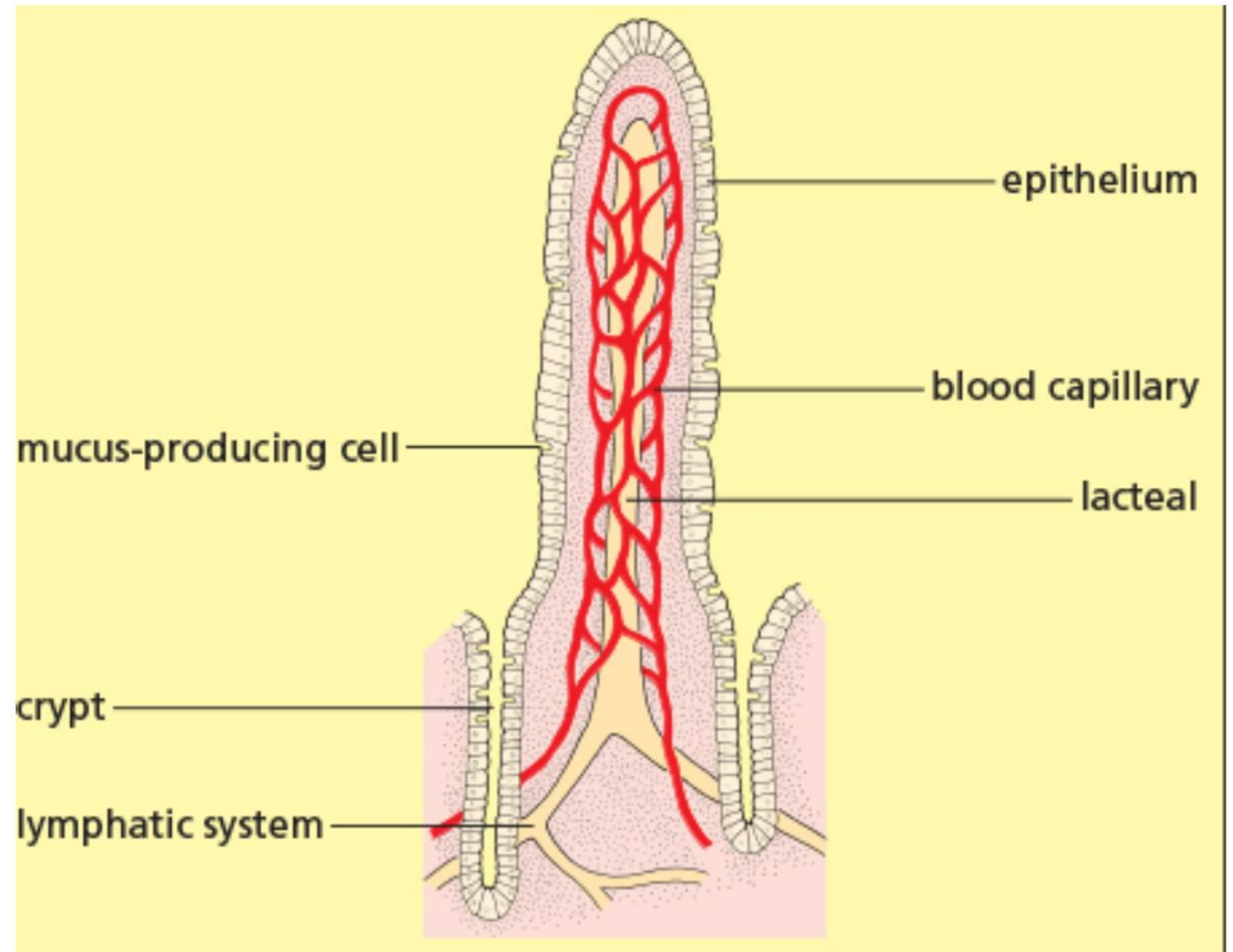
Food		Final products
starch	→	glucose (a simple sugar)
proteins	→	amino acids
fats (lipids)	→	fatty acids and glycerol

Absorption of Water

- Most water is absorbed in the **ileum**.
- Some water is absorbed in the **colon** (large intestine).

Villi and Microvilli

- Villi are **tiny projections** that increase surface area.
- Each epithelial cell has **microvilli**.
- Microvilli increase the surface area **by about 20 times**.



Structure of a single villus

Absorption into the Blood

- **Glucose and amino acids** enter epithelial cells.
- They pass into **capillaries** and then into the blood.
- Blood flows to the liver via the **hepatic portal vein**.

Role of the Liver

- The liver may **store or change** absorbed nutrients.
- Nutrients then enter **general circulation**.

Absorption of Fats

- Some fatty acids and glycerol enter **the blood capillaries**.
- Most are reformed into fats in the epithelium.
- These fats enter **the lacteals** and the **lymphatic system**.

Vitamins and Mineral Salts

- **Water-soluble vitamins** diffuse into cells.
- **Fat-soluble vitamins** move with fat droplets.
- **Mineral ions** are absorbed mainly by **active transport**.
- **Vitamin D** helps calcium absorption.

How Absorption Happens

- Absorption is **not only diffusion**.
- **Active transport** is also involved.
- Amino acids, sugars, and salts are mainly absorbed this way.

Assimilation

- Digested food is **carried in the blood**.
- Cells **absorb and use** nutrients.
- This process is called **assimilation**.

SUMMARY REFLECTION

- What have you learnt about what occurs during the process of digestion?
- What new ideas or concepts have you learnt in this section?

Reference

- **Hodder Education (MYP):**
Hodder Education. *MYP Biology by Concept*. Hodder Education, 2018, pp..
- **Cambridge IGCSE Biology:**
Jones, Mary, and Geoff Jones. *Cambridge IGCSE™ Biology*. 3rd ed., Cambridge University Press, 2014, pp.