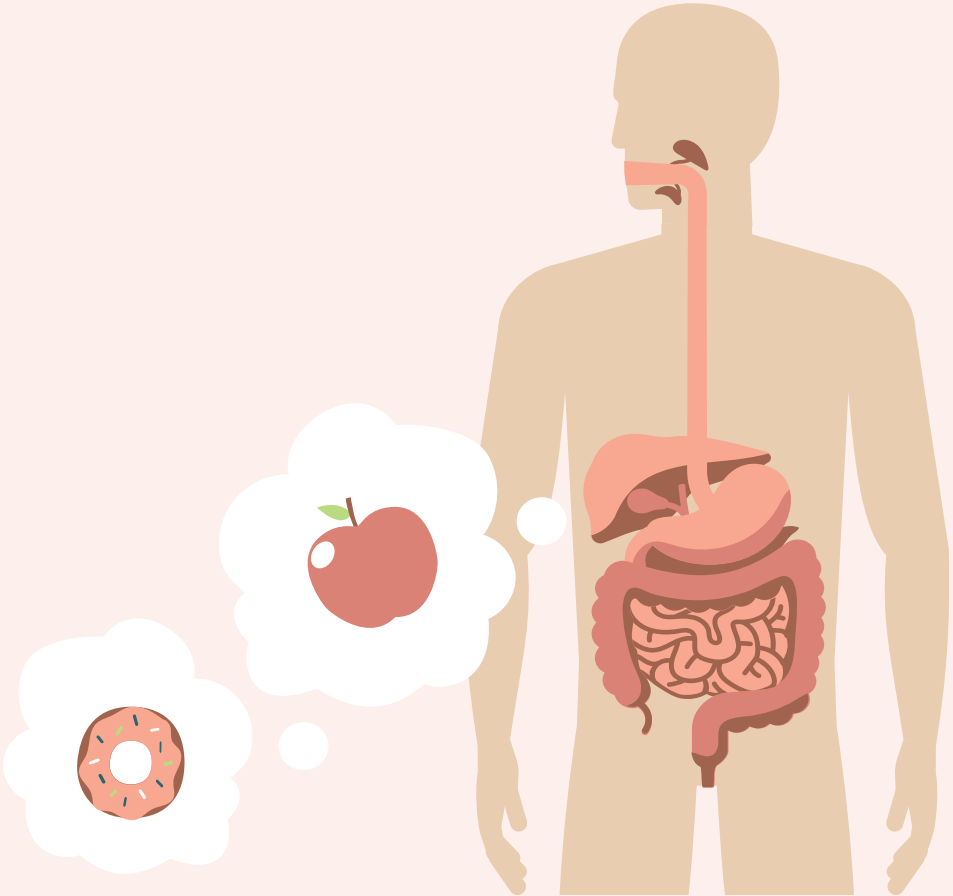
# UNIT 3
# LESSON 2

TOPIC: Human Nutrition – The Alimentary Canal



# OBJECTIVES

By the end of the lesson, the students will be able to;

1. **Identify** the parts of the alimentary canal and **state their functions**.
2. **Describe** mechanical and chemical digestion using correct scientific terms.
3. **Explain** how digestion and absorption are linked to the structure of the small intestine.

# Key Definitions

**Ingestion:** taking food and drink into the body through the mouth

**Mechanical digestion:** physical breakdown of food into smaller pieces

**Chemical digestion:** breakdown of large insoluble molecules into small soluble molecules

- **Absorption:** movement of digested food molecules into the blood
- **Assimilation:** use of absorbed food by body cells
- **Egestion:** removal of undigested food as faeces through the anus

# Human Nutrition – The Alimentary Canal

- The alimentary canal is a long tube running through the body
- Food is digested, absorbed, and waste is removed
- Five main processes occur during digestion

# Regions of the alimentary canal.

- The alimentary canal is a tube that runs through the body.
- Food is digested in the gastrointestinal tract, also known as the alimentary canal.
- The soluble products are absorbed, and

the indigestible residues are expelled (egested).

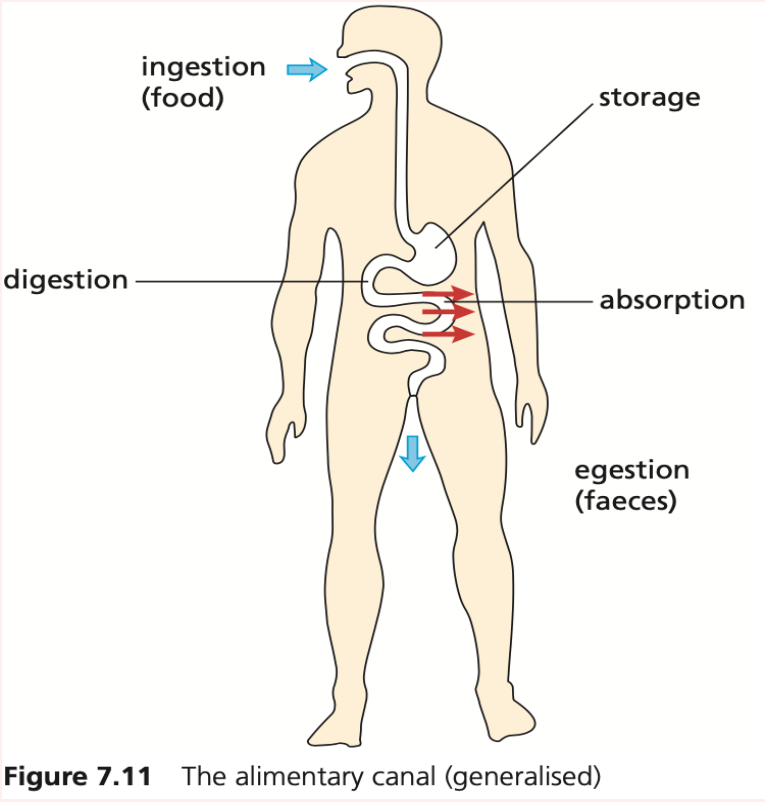



**Figure 7.11** The alimentary canal (generalised)

# Regions of the alimentary canal.

- The inside of the alimentary canal is lined with layers of cells forming what is called an **epithelium.**
- New cells in the epithelium are being produced all the time to replace the cells worn away by the movement of the food.
- There are also cells in the lining that produce **mucus**.
- Mucus is a slimy liquid that lubricates the lining of the canal and protects it from wear and tear.
- Mucus may also protect the lining from attack by the **digestive enzymes**, which are released into the alimentary canal.

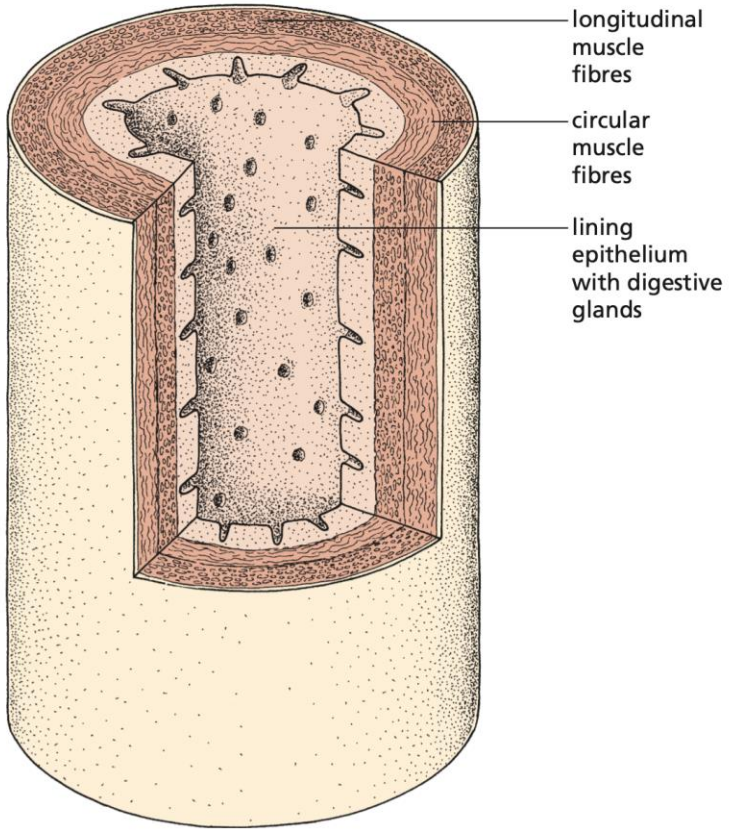



**Figure 7.12** The general structure of the alimentary canal

# Regions of the alimentary canal.

- Some of the digestive enzymes are produced by cells in the lining of the alimentary canal, as in the stomach lining.
- Others are produced by **glands** that are outside the alimentary canal but pour their enzymes through tubes (called **ducts)** into the alimentary canal.
- The **salivary glands** and the **pancreas** are examples of such digestive glands.

The alimentary canal has a great many blood vessels in its walls, close to the lining.

These bring oxygen needed by the cells and take away the carbon dioxide they produce.

They also absorb the digested food from the alimentary canal.

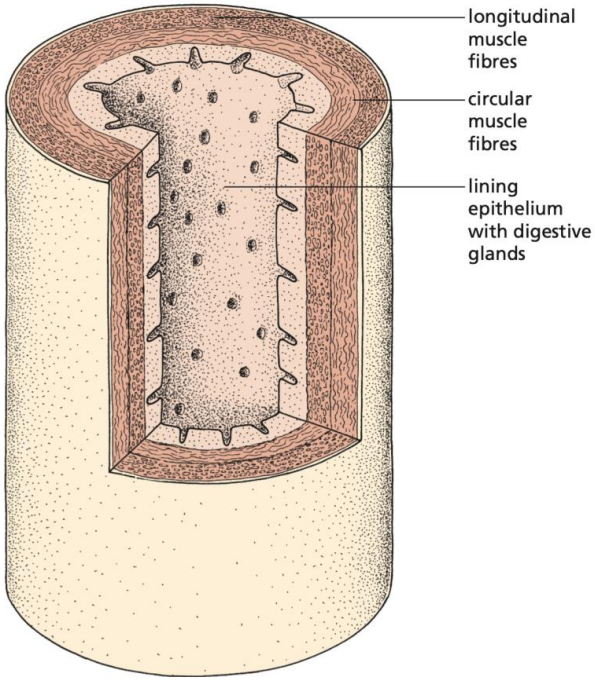



**Figure 7.12** The general structure of the alimentary canal

# Regions of the Alimentary Canal

Five main processes associated with digestion occur in the alimentary canal. These are

1. ingestion,
2. digestion,
3. absorption,
4. assimilation, and
5. egestion.

The regions of the alimentary canal are;

- Mouth
- Oesophagus (gullet)
- Stomach
- Duodenum
- Ileum
- Colon
- Rectum
- Anus

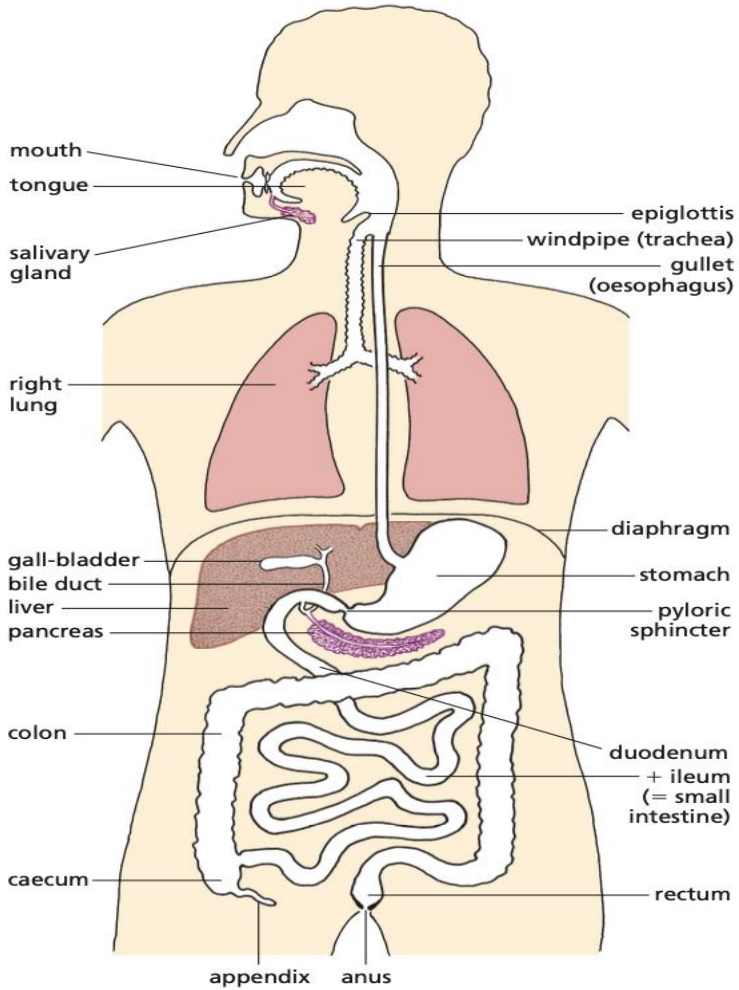
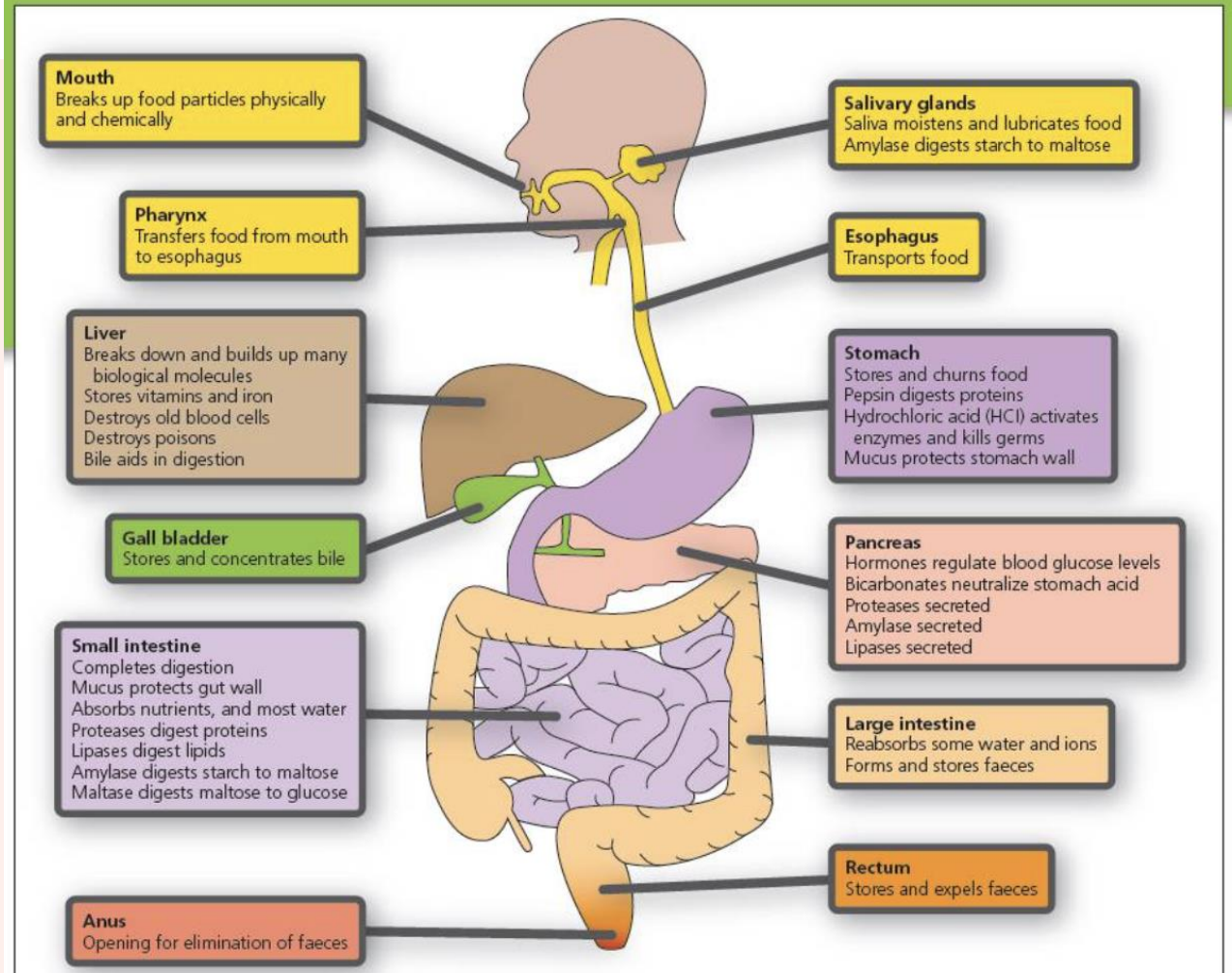



**Figure 7.13** The alimentary canal

**Table 7.5** Functions of main parts of the alimentary canal

| Region of alimentary canal | Function |
|---|---|
| mouth | **ingestion** of food; **mechanical digestion** by teeth; **chemical digestion** of starch by amylase; formation of a bolus for swallowing |
| salivary glands | saliva contains amylase for **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 pepsin, 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 form of **physical digestion**) |
| ileum | second part of the small intestine; enzymes in the epithelial lining carry out **chemical digestion** of maltose and peptides; very long and has villi (see Figures 7.22 and 7.23) to increase surface area for **absorption** of digested food molecules |
| pancreas | secretes pancreatic juice into the duodenum via pancreatic duct (see Figure 7.21) for **chemical digestion** of proteins, fats and starch |
| liver | makes bile, containing salts to emulsify fats (**physical digestion**); **assimilation** of digested food such as glucose; **deamination** of excess amino acids (see Chapter 13) |
| gall bladder | stores bile, made in the liver, to be secreted into the duodenum via the bile duct (see Figure 7.21) |
| 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 |




■ **Figure 3.12** What happens where in the digestive system

# Peristalsis

- The alimentary canal has layers of muscle in its walls.
- The fibres of one layer of muscles run
- around the canal, called **the circular muscle**,
- and the others run along its length, called the **longitudinal muscle**.
- Circular muscles contract around food
- Longitudinal muscles shorten the canal
- When the circular muscles in one region contract, they

make the alimentary canal narrow in that region.

A contraction in one region of the alimentary canal is followed by another contraction just below it, so that a wave of contraction passes along the canal, pushing food in front of it.

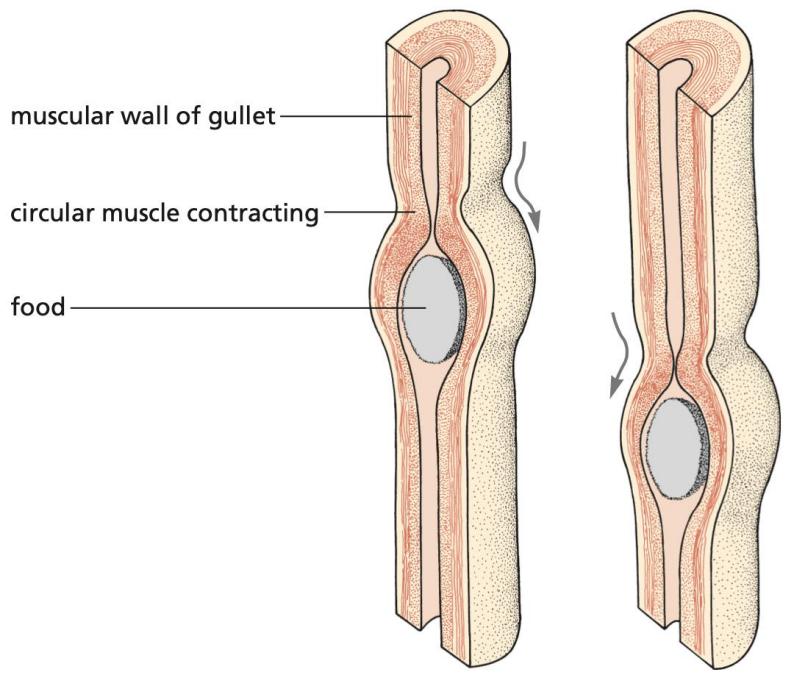



**Figure 7.14** Diagram to illustrate peristalsis

# Diarrhoea

Diarrhoea is the loss of **watery faeces.**

- It is sometimes caused by **bacterial or viral infection**, for example, from food or water.
- Once infected, the lining of the digestive system is damaged by the pathogens, resulting in the intestines being unable to absorb fluid from the contents of the colon or too much fluid being secreted into the colon.
- Undigested food then moves through the large intestine too quickly, resulting in insufficient time to absorb water from it. Unless the condition is treated, **dehydration can occur.**

Treatment is known as **oral hydration therapy(rehydration).**

*NB: Other possible causes of diarrhoea include anxiety, food allergies, lactose intolerance, a side-effect of antibiotics, and bowel cancer.*

# Cholera

- This disease is caused by the bacterium ***Vibrio cholera***, which causes acute diarrhoea.
- Treatment involves **rehydration and restoration of the salts lost** (administered by injecting a carefully controlled solution into the bloodstream)

and use of an **antibiotic** such as **tetracycline** to kill the bacteria.

- The bacteria thrive in **dirty water** (often that contaminated by sewage) and are transmitted when the water is drunk or used to wash food.
- Long- term methods of control are to dispose of human sewage safely, ensuring that drinking water is free from bacteria, and preventing food from being contaminated.

# How cholera causes diarrhoea

- When the ***Vibrio cholera*** bacteria are ingested, they multiply in the **small intestine** and invade its **epithelial cells**.
- As the bacteria become embedded, they release **toxins (poisons)** which irritate the **intestinal lining** and lead to the **secretion of large amounts of water and salts**, including **chloride ions.**
- The salts decrease the **osmotic potential** of the **gut contents**, drawing more water from surrounding tissues and blood by osmosis.
- This makes the undigested food much more watery, leading to **acute diarrhoea,** and the loss of body fluids and salt leads to **dehydration and kidney failure.**

# Mechanical/Physical Digestion

- The process of mechanical/physical digestion mainly occurs in the mouth by means of the teeth, through a process called **mastication**.

- Other examples of physical digestion include the action of muscles in the stomach and the emulsification of fats by bile.

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

# Mechanical/Physical Digestion

- Humans are **omnivores**, meaning they eat both **animal and plant material**.
- Broadly, humans have the **same types of teeth as carnivores**.
- However, human teeth are **not used for catching, holding, killing, or tearing prey**.

- Humans **cannot cope with bones.**
- Humans have **incisors, canines, premolars, and molars**.
- These teeth **do not show large differences in size and shape**.
- For example, human teeth show **less variation** compared to those of animals like a **wolf**.

# Mechanical/Physical Digestion

- Our **top incisors pass in front of our bottom incisors**.
- They **cut pieces of food**.

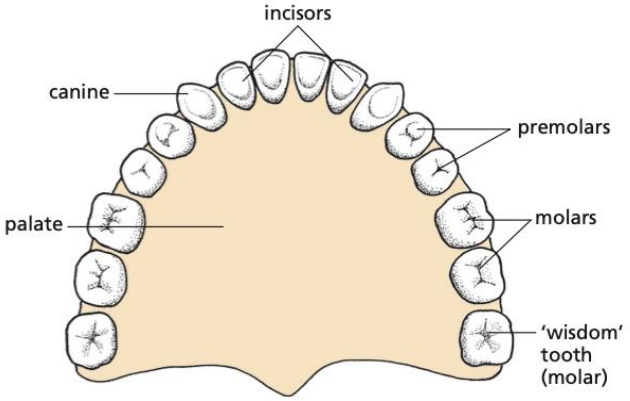



**Figure 7.15** Teeth in human upper jaw

- This happens when **biting into an apple** or
- **taking a bite out of a piece of toast**.

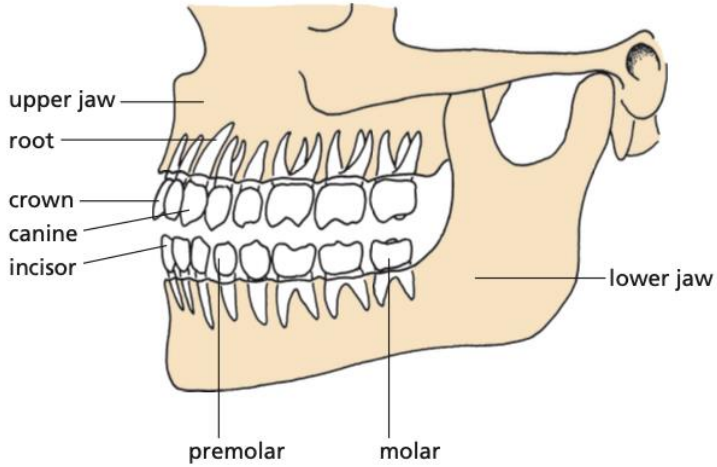
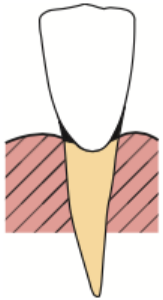
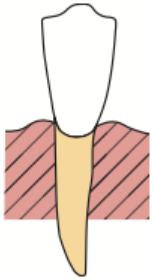
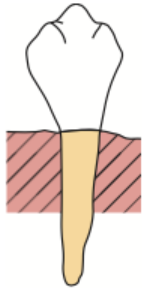
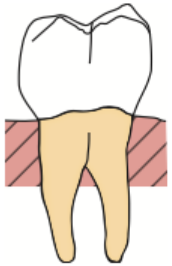



**Figure 7.16** Human jaws and teeth

**Table 7.6** Summary of types of human teeth and their functions

| Type | Incisor | Canine | Premolar | Molar |
|---|---|---|---|---|
| Diagram |  |  |  |  |
| Position in mouth | front | either side of incisors | behind canines | back |
| Description | chisel-shaped (sharp edge) | slightly more pointed than incisors | have two points (cusps); have one or two roots | have four or five cusps; have two or three roots |
| Function | biting off pieces of food | similar function to incisors | tearing and grinding food | chewing and grinding food |

# Tooth Structure

- The part of a tooth visible above the gum line is called the **crown**.
- The **gum** is tissue that overlays the jaw.
- The part of the tooth embedded in the jawbone is called the **root.**
- The surface of the crown is covered by a very hard layer called **enamel**.
- In the root, enamel is replaced by **cement**, which helps the tooth grip its bony socket in the jaw.

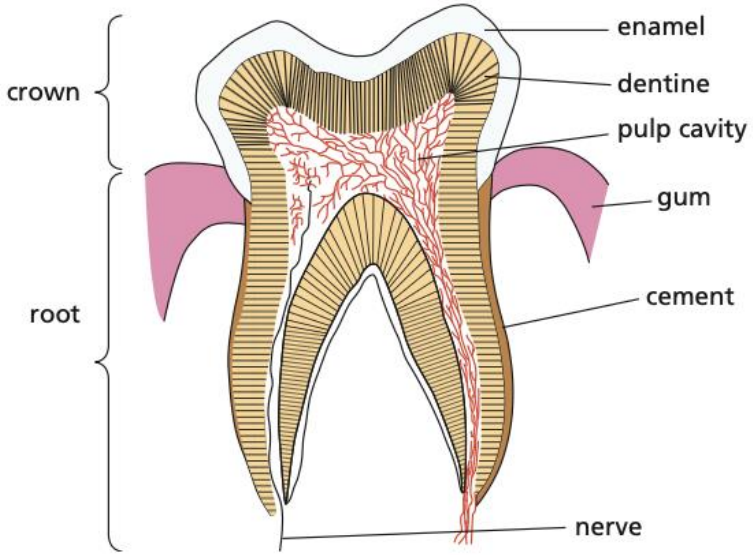



**Figure 7.17** Section through a molar tooth

# Tooth Structure

- Below the enamel is a layer of **dentine**.
- **Dentine** is softer than enamel.
- Inside the dentine is the **pulp cavity**, which contains **nerves and blood vessels**.
- These nerves and blood vessels enter the tooth through a **small hole at the base of the root**.

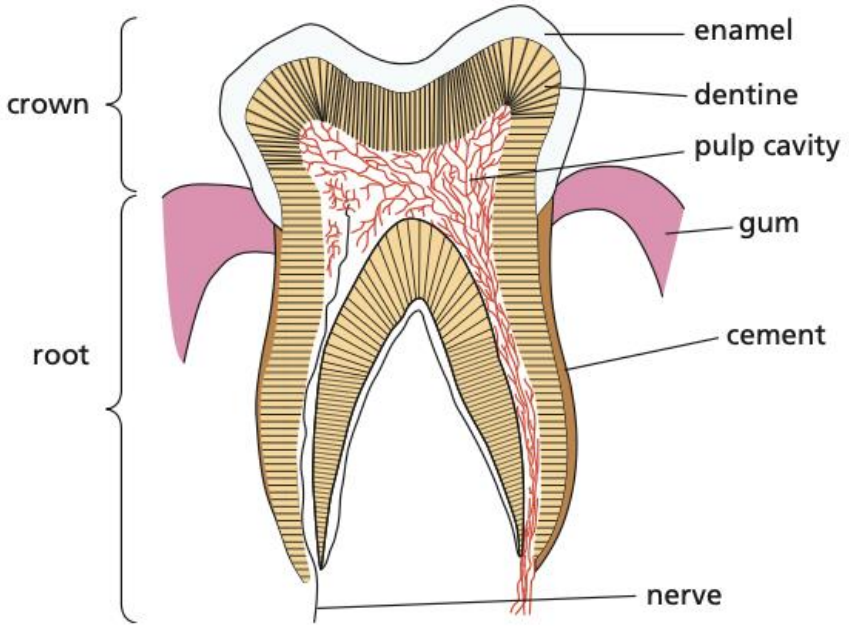



**Figure 7.17** Section through a molar tooth

# Dental Decay (Dental Caries)

- Dental decay begins when **small holes (cavities)** form in the **enamel**.
- Cavities are caused by **bacteria on the tooth surface**.
- Bacteria feed on **sugars on the teeth** and respire, producing **acid**.
- The acid **dissolves calcium salts in the enamel**.
- Enamel wears away during **chewing and grinding**, exposing the **dentine**.

# Dental Decay (Dental Caries)

- **Dentine is softer than enamel**, so it dissolves more quickly, and cavities form.
- Cavities reduce the distance between the tooth surface and **nerve endings**.
- Acids irritate the nerves, causing **a toothache.**
- If untreated, bacteria enter the **pulp cavity**, causing a painful **abscess**.
- In severe cases, the tooth may need to be **pulled out**.

# Role of Sugar and pH

- Refined sugar (**sucrose**) in the diet greatly increases tooth decay.
- Western diets contain **high amounts of refined sugar**.
- Sucking sweets between meals keeps sugar in the mouth for long periods.
- When sugar is consumed, **the mouth pH falls** and becomes more acidic.
- The **critical pH** for enamel attack is between **5.5 and 6**.
- After one sweet, enamel is under acid attack for about **10 minutes**.
- Frequent sweets (e.g., **four per hour**) cause **continuous acid attack**.

# Prevention of Dental Decay

- Avoid eating **sugary foods and drinks frequently**.
- Limit sweets, orange squash, and **fizzy drinks**.
- Visit the **dentist every 6 months** for early treatment.
- **Fluoride toothpaste** helps reduce bacteria and increases enamel resistance.

# Gum Disease (Periodontal Disease)

- Bacteria form a coating on teeth called **plaque**.
- If plaque is not removed, it hardens into **tartar (calculus)**.
- Plaque causes **gingivitis** (red, bleeding gums and bad breath).
- Untreated gingivitis can develop into **periodontitis**.
- Periodontitis destroys fibres holding teeth in the jaw, causing **loose teeth**.

# Prevention

- Brush teeth **twice daily**.
- Clean the area between gums and teeth thoroughly.
- Use **mouthwash** to reduce bacteria.
- Use **dental floss or interdental brushes** to remove plaque between teeth.

# Function of the Stomach in Physical Digestion

- The stomach has **elastic walls** that stretch as food collects in it.
- The main function of the stomach is to **store food** from a meal and **turn it into a liquid**.
- Physical digestion occurs when the **muscles in the stomach wall** work.
- The muscles **contract and relax alternately**, churning and squeezing the food.
- Food is mixed with **gastric juice**.
- This action turns the food into a **creamy liquid**.
- Churning increases the **surface area of the food**, allowing digestion to occur **more efficiently**.

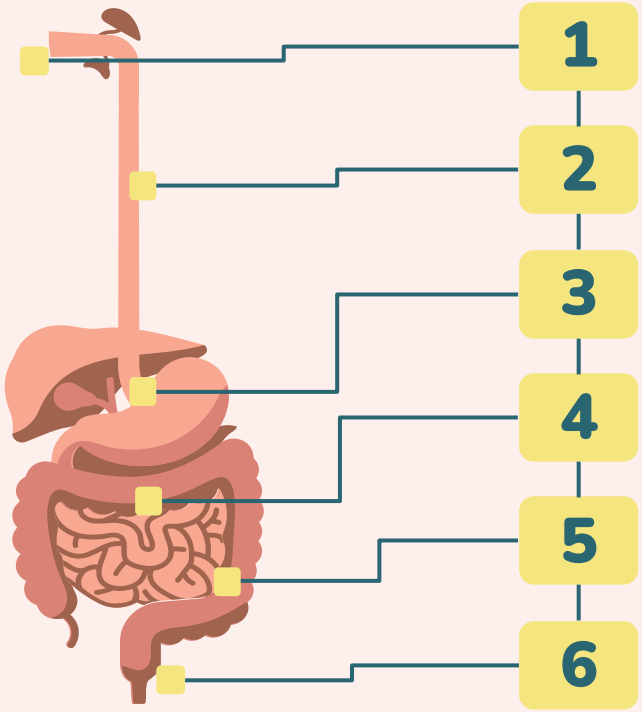
# Time Food Spends in the Stomach

- The length of time food remains in the stomach depends on its **contents**.
- **Water** passes through the stomach quickly.
- A **carbohydrate meal** (e.g., porridge) may stay in the stomach for **less than one hour**.
- A **mixed meal** containing protein and fat may remain for **1–2 hours**.

# Movement of Food Out of the Stomach

- A **valve** is located at the base of the stomach.
- The valve **prevents solid food** from passing through.
- It allows **liquid products of digestion** to pass out slowly.
- Digested food enters the **duodenum**, the first part of the **small intestine**.

# Activity 1 Digestion process



# Chemical Digestion

- Digestion is mainly a **chemical process**.
- It involves breaking down **large molecules** into **small molecules**.
- Large molecules are usually **not soluble in water**.
- Small molecules are **soluble in water**.
- Small molecules can be **absorbed through the epithelium** of the alimentary canal.
- They then pass through **blood vessel walls** and into the **blood**.

# Why Digestion Is Needed

- Some food can be absorbed **without digestion**.
- For example, **glucose in fruit juice** can enter the blood directly.
- Most food is **solid** and cannot enter the blood vessels.
- Digestion **dissolves solid food**, forming a **solution** that can be absorbed.

# Role of Enzymes

- The chemicals that dissolve food are **enzymes**.
- Enzymes speed up digestion.
- A protein would take **about 50 years** to dissolve in water alone.
- With enzymes, digestion is completed in **a few hours**.

# End Products of Chemical Digestion

- **Starch** (bread, potatoes) → **glucose** (soluble)
- **Proteins** (meat, eggs, beans) → **amino acids** (soluble)
- **Fats** → **glycerol and fatty acids** (soluble)

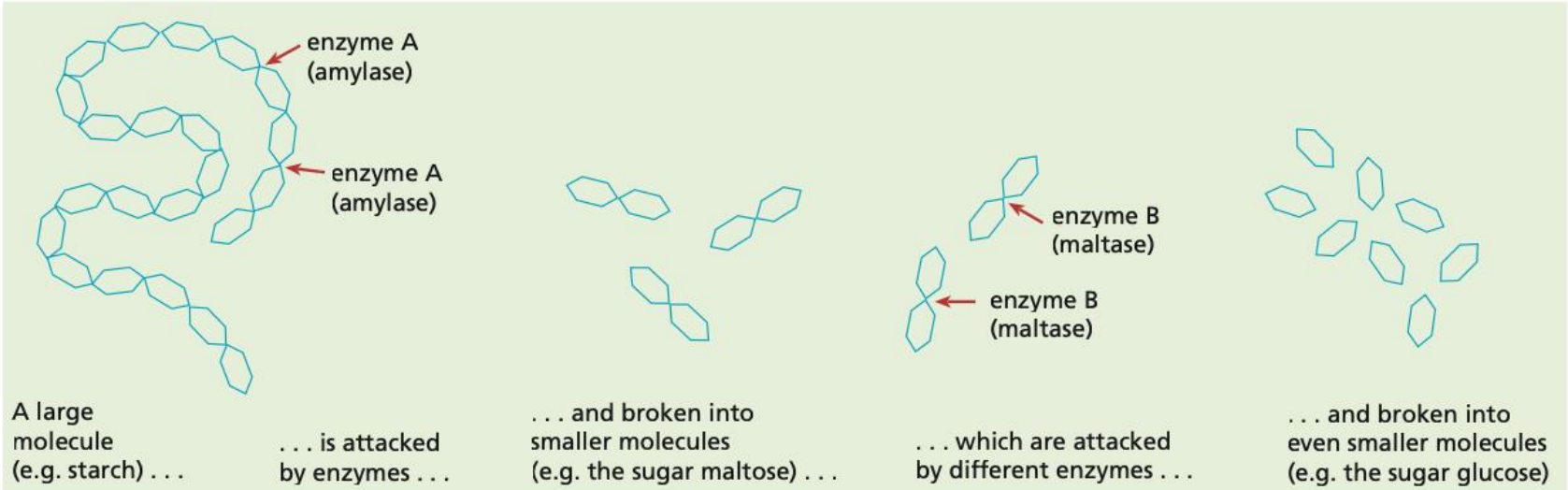



**Figure 7.19** Enzymes acting on starch

# Stages of Chemical Digestion

Chemical digestion usually takes place in **stages**.
**Digestion of Starch** molecules is made of **hundreds of carbon, hydrogen, and oxygen atoms**.
**First stage**:

Starch is broken down into **maltose** (a **12-carbon sugar**).

**Final stage**:

Maltose is broken down into **two glucose molecules** (each a **6-carbon sugar**).

**Summary:**
**Starch → Maltose → Glucose**
**Digestion of Protein**
Protein molecules are first broken down into **peptides**.
Peptides are then digested into **amino acids**.
**Summary:**
**Protein → Peptide → Amino acid**
**Where Digestion Occurs**
These stages take place in **different parts of the alimentary canal**.
The movement of food through the canal and the stages of digestion will be described next.

# The Mouth

- The act of taking food into the mouth is called **ingestion**.
- In the mouth, food is **chewed** and mixed with **saliva**.
- Chewing:
  - Breaks food into pieces that can be swallowed
  - Increases the **surface area** for enzymes to work on later
- **Saliva** is a digestive juice produced by **three pairs of glands**.
- Saliva:
  - Lubricates food
  - Helps food particles stick together
- Saliva contains the enzyme **salivary amylase (ptyalin)**.
- Salivary amylase begins digestion by breaking **cooked starch into maltose**.
- The mouth opening is the **aperture between the lips**.
- The space containing the tongue and teeth is the **buccal cavity**.
- Beyond the buccal cavity is the **pharynx (throat)**.

# Swallowing

- Food must pass over the **windpipe** to enter the **gullet (oesophagus)**.
- The **epiglottis** (a flap of cartilage):

•Prevents food from entering the windpipe

•Guides food into the gullet

- Swallowing starts as a **voluntary action**.
- Once food reaches the back of the mouth, swallowing becomes a **reflex action**.
- Food is pushed down the gullet by **peristalsis**.
- Solid food takes about **6 seconds** to reach the stomach.
- Liquids move **more quickly**.

# The Stomach – Structure and Physical Digestion

- The stomach has **elastic walls** that stretch as food collects.
- The **pyloric sphincter** is a circular muscle at the lower end of the stomach.
- It prevents **solid food** from passing through.
- Main functions of the stomach: Store food, Turn food into a liquid
- Release food slowly into the alimentary canal
- Physical digestion occurs by **peristaltic movements** of the stomach muscles.
- Muscles contract and relax, **churning and squeezing** food.
- Food mixes with **gastric juice** to form a creamy liquid called **chyme**.
- Churning increases **surface area**, making digestion more efficient.

# The Stomach – Chemical Digestion and Movement of Food

- Glands in the stomach lining produce **gastric juice**.
- Gastric juice contains a **protease enzyme**.
- Protease helps break down **proteins into amino acids**.
- The stomach also produces **hydrochloric acid**.
- Hydrochloric acid:

•Provides the correct pH for protease activity

•Kills many bacteria in food

# The Stomach – Chemical Digestion and Movement of Food

- Peristaltic movements occur about **every 20 seconds**.
- Time food stays in the stomach depends on its type:

•Water: a few minutes

•Carbohydrates (e.g. porridge): less than 1 hour

•Protein and fat: **1–2 hours**

- The pyloric sphincter releases digested liquid slowly into the **duodenum**, the first part of the **small intestine**.

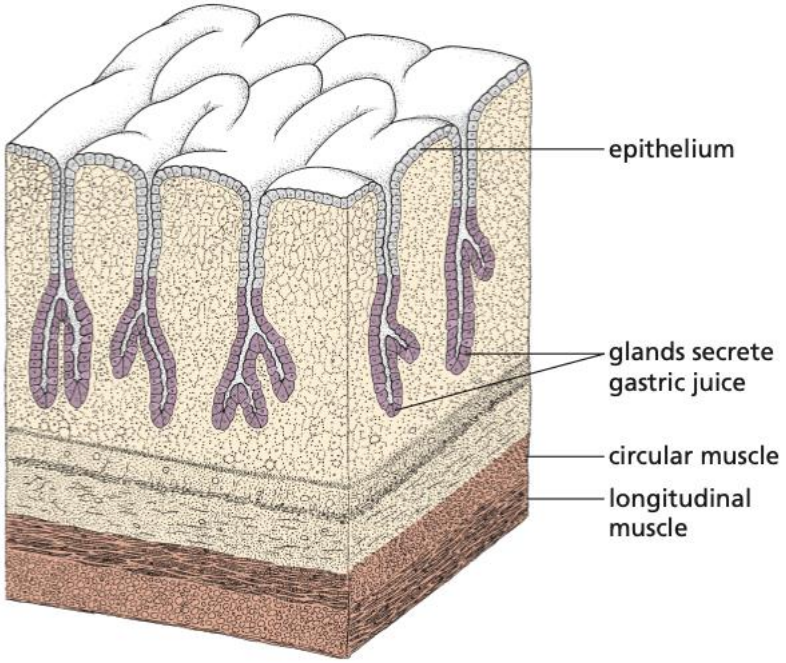



**Figure 7.20** Diagram of section through stomach wall

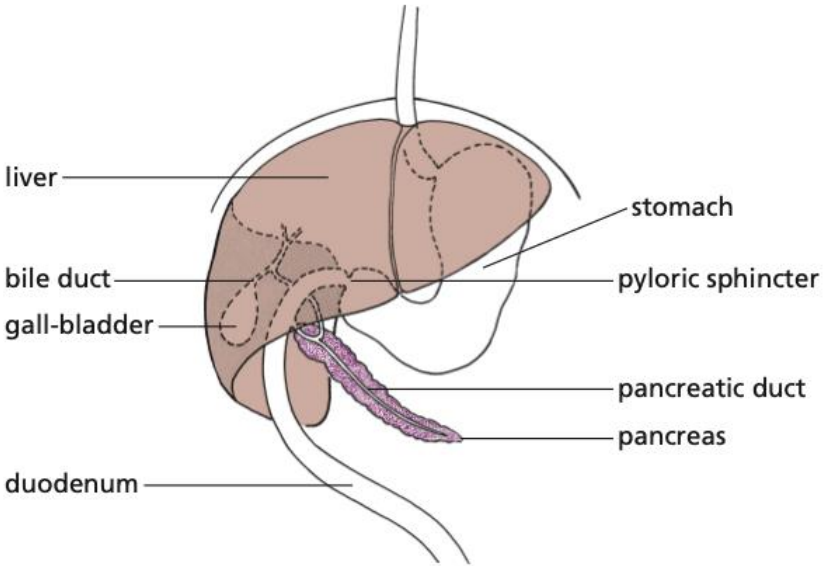



**Figure 7.21** Relationship between stomach, liver and pancreas

# The Small Intestine (Duodenum)

- **Pancreatic juice** from the pancreas and **bile** from the liver enter the **duodenum**.
- The **pancreas** is a digestive gland located below the stomach.
- Pancreatic juice contains **enzymes that act on all classes of food**.
- It also contains **sodium hydrogencarbonate**, which:

•Partly neutralises acidic chyme from the stomach

•Creates suitable conditions for pancreatic enzymes

# Pancreatic Enzymes and Their Functions

- **Protease** → proteins → **amino acids**
- **Pancreatic amylase** → starch → **maltose**
- **Lipase** → fats (lipids) → **fatty acids and glycerol**
- Pancreatic enzymes **do not work well in acidic conditions**, neutralisation is necessary.

# Final Products of Digestion

- All digestible food is converted into **soluble compounds**.
- These pass through the **intestinal lining** into the **bloodstream**.

- Starch → **Glucose**
- Proteins → **Amino acids**
- Fats (lipids) → **Fatty acids and glycerol**

# Bile

- Bile is a **green, watery fluid** made in the **liver**.
- Stored in the **gall bladder**.
- Transported to the duodenum by the **bile duct**.
- Bile contains **no enzymes**.
- Green colour is due to **bile pigments** formed from the breakdown of **haemoglobin**.

# Functions of Bile

- Contains **bile salts**, which act like a **detergent**.
- Bile salts **emulsify fats**:
  - Break fats into **small droplets**
  - Increase **surface area** for lipase action
- Bile is **slightly alkaline** (contains sodium hydrogencarbonate).
- Along with pancreatic juice, bile **neutralises acidic chyme**.
- This provides **optimum alkaline conditions** for enzymes in the duodenum.

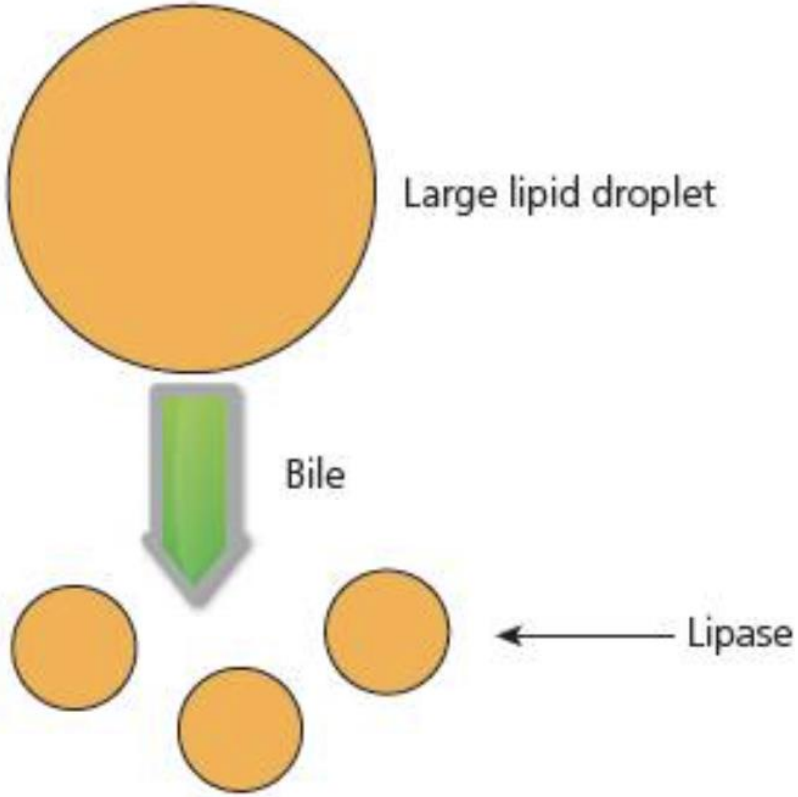



**Figure 3.13** Bile emulsifies fats, creating a larger surface area for lipase to act on

# Digestion of Protein

Several **proteases** digest proteins.

**Pepsin** (stomach):

•Proteins → **peptides**

**Trypsin** (pancreas):

•Secreted in an **inactive form**

•Activated in the **duodenum**

•Peptides → smaller peptides

**Peptidase** (villi cell membranes):

•Peptides → **amino acids**

# Role of the Small Intestine Wall

- The small intestine **does not produce digestive enzymes** directly.
- **Crypts** are not digestive glands:
  - They produce **new epithelial cells**
- Enzymes in **villi cell membranes** complete digestion before absorption.

# Digestion of Starch

- Occurs in **two places**:
  - Mouth → **salivary amylase**
  - Duodenum → **pancreatic amylase**
- Amylase:
  - Works best at **neutral or alkaline pH**
  - Starch → **maltose**
- **Maltase** (villi membranes):
  - Maltose → **glucose**
- Glucose is **small and soluble**, so it can be absorbed.

# Functions of Hydrochloric Acid (Stomach)

- Creates a very **acidic pH (≈2)**.
- Kills **harmful bacteria** in food.
- **Denatures enzymes** in microorganisms.
- Provides the **optimum pH for pepsin** to digest proteins.

**Table 7.7** Principal substances produced by digestion

| Region of alimentary canal | Digestive gland | Digestive juice produced | Enzymes in the juice/ cells | Class of food acted upon | Substances produced |
|---|---|---|---|---|---|
| mouth | salivary glands | saliva | salivary amylase | starch | maltose |
| stomach | glands in stomach lining | gastric juice | pepsin | proteins | peptides |
| duodenum | pancreas | pancreatic juice | proteases, such as trypsin<br>amylase<br>lipase | proteins and peptides<br>starch<br>fats | peptides and amino acids<br>maltose<br>fatty acids and glycerol |
| ileum | epithelial cells | (none) | maltase<br>peptidase | maltose<br>peptides | glucose<br>amino acids |

(Note: details of peptidase and peptides are **not** a syllabus requirement)

# Prevention of Self-Digestion

- Cells of the **stomach and pancreas** produce **protein-digesting enzymes (proteases)**.
- However, the cells themselves are **not digested**.
- One reason is that proteases are released in an **inactive form**.

**Examples:**

- **Pepsin** is secreted as **pepsinogen**.
    - It becomes active only in the presence of **hydrochloric acid** in the stomach.
- The stomach lining is protected by a layer of **mucus**, which prevents damage by pepsin.
- **Trypsin** (from the pancreas) is secreted as **trypsinogen**.
    - It is activated by **enterokinase**, an enzyme secreted by the lining of the **duodenum**.

# Activity 2

Write the **function(s)** for each **organ.**

**Mouth**



**Esophagus**

**Stomach**

**Small intestine**

**Large intestine**

# Absorption

The small intestine consists of:

- **Duodenum**
- **Ileum**

**Nearly all absorption of digested food** occurs in the **ileum**.

Most **water** is also absorbed in the ileum.

Only **small, soluble molecules** can be absorbed.

# Why the Ileum Is Efficient at Absorption

- The ileum is **long**, providing a large absorbing surface.
- Its inner surface has **circular folds**.
- The folds bear thousands of tiny projections called **villi**.
- Each villus is about **0.5 mm long** and may be finger-like or flattened.
- The epithelial lining is **very thin**, allowing rapid diffusion.
- Each epithelial cell has **microvilli**, increasing surface area by about **20 times**.
- Each villus contains a **dense network of blood capillaries**.

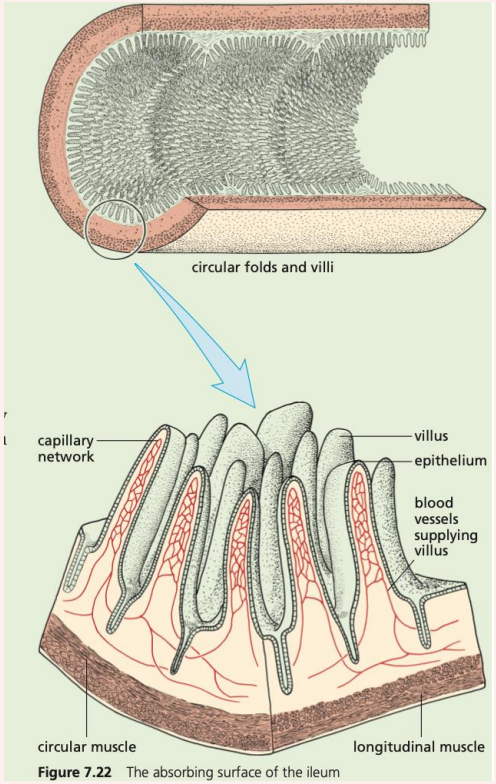


**Figure 7.22** The absorbing surface of the ileum

# Absorption into the Blood

**Glucose and amino acids**:

•Enter epithelial cells

•Pass into the blood capillaries

•Are carried away in veins

These veins join to form the **hepatic portal vein**.

The hepatic portal vein carries blood to the **liver**.

The liver may:

•Store digestion products

•Modify them

After release from the liver, nutrients enter the **general circulation**.

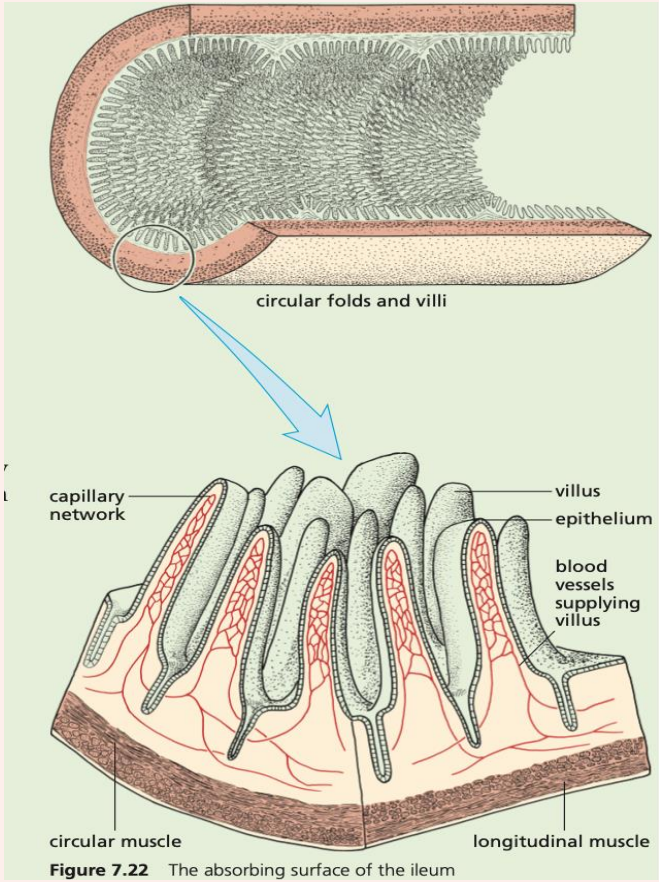


**Figure 7.22** The absorbing surface of the ileum

# Absorption of Fats, Vitamins, and Minerals

- Some **fatty acids and glycerol** enter blood capillaries directly.
- Many are recombined into **fats** in the intestinal epithelium.
- These fats enter **lacteals** (lymph vessels in the villi).
- Lacteals drain into the **lymphatic system**, which later empties into the bloodstream.

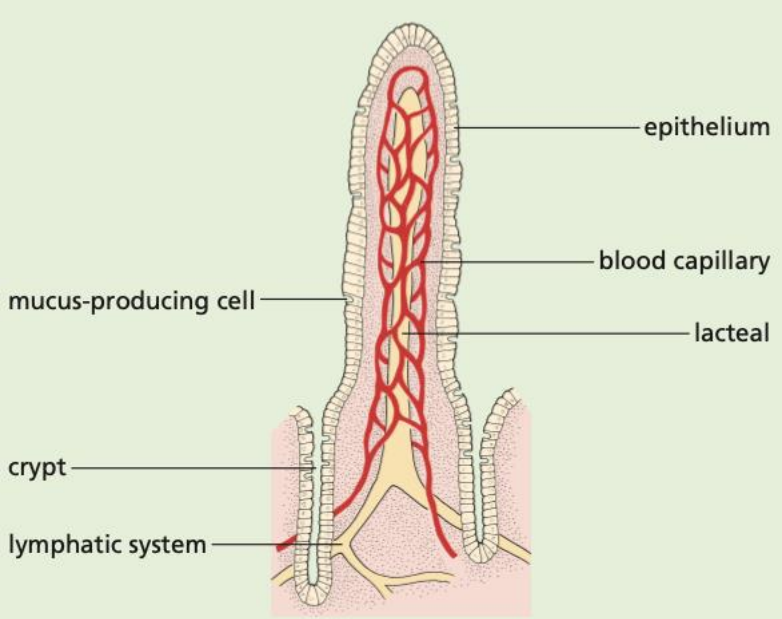



**Figure 7.23** Structure of a single villus

# Absorption of Fats, Vitamins, and Minerals

- **Water-soluble vitamins** diffuse into epithelial cells.
- **Fat-soluble vitamins** are carried in microscopic fat droplets.
- **Mineral ions** are absorbed mainly by **active transport**.
- **Calcium ions** require **vitamin D** for effective absorption.

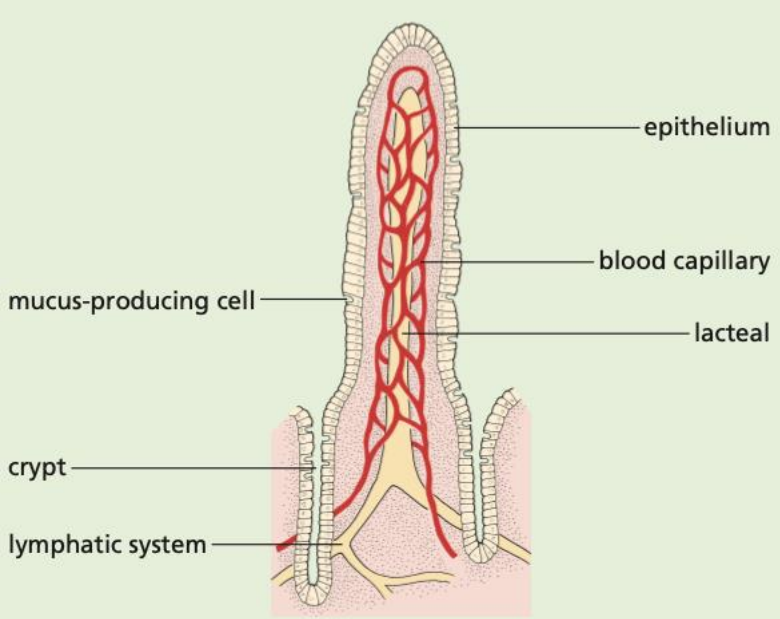



**Figure 7.23** Structure of a single villus

# Absorption: How Digested Food Enters the Body

- Absorption is **not only by simple diffusion**.
- Only **alcohol** and sometimes **water** are absorbed mainly by diffusion.
- Most substances cross the intestinal epithelium by **active transport**.
- Even **water** can move against an **osmotic gradient**.

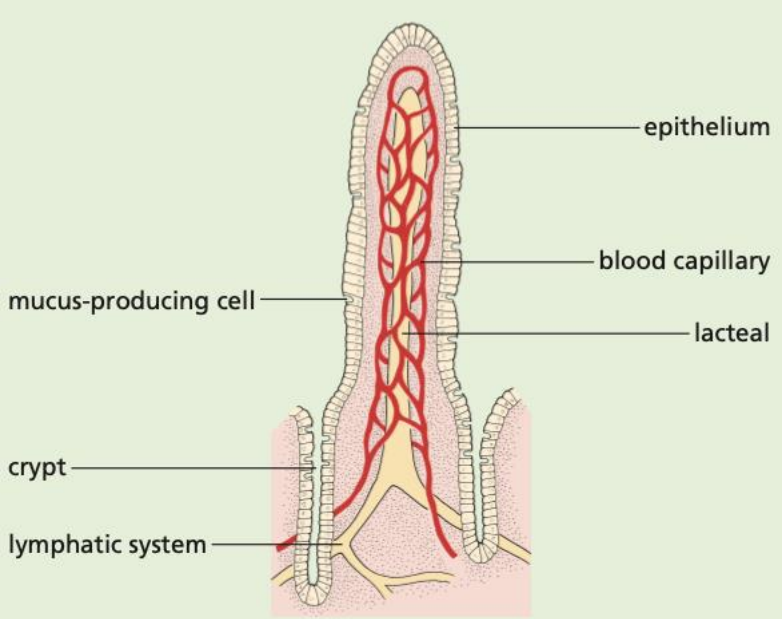



**Figure 7.23** Structure of a single villus

# Absorption: How Digested Food Enters the Body

- **Amino acids, sugars, and mineral salts** are almost certainly absorbed by active transport.
- **Glucose** is absorbed faster than **fructose**, showing that diffusion alone is not responsible.

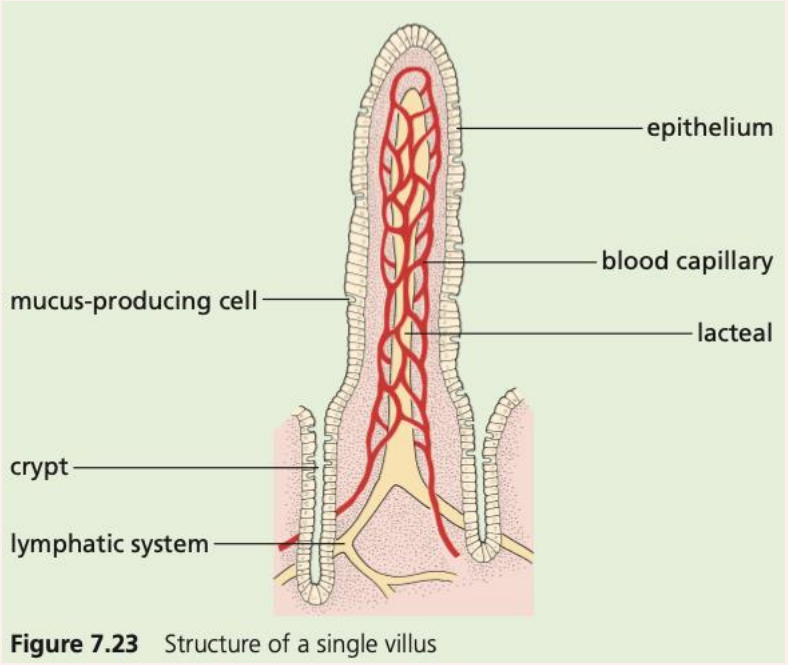



**Figure 7.23** Structure of a single villus

# Renewal of the Intestinal Epithelium

- Epithelial cells of the **villi** are constantly **shed** into the intestine.
- New cells are produced by **rapid cell division** in the **crypts**.
- There is a continuous movement of cells from the **crypts to the villi**.
- This maintains an efficient surface for absorption.

# Use of Digested Food (Assimilation)

- Products of digestion are transported around the body in the **blood**.
- Cells absorb and use **glucose, fats, and amino acids**.
- This uptake and use of digested food is called **assimilation**.

# Uses of Different Nutrients

**Glucose**

- Used in **respiration**.
- Oxidized to **carbon dioxide and water**.
- Releases **energy** for:
  - Muscle contraction
  - Protein synthesis
  - Electrical activity in nerves

**Fats**

- Used to build **cell membranes and structures**.
- Serve as an **energy source** for metabolism.
- Fatty acids are oxidized to release energy.
- Fats provide **about twice as much energy as carbohydrates, such as sugars.**

# Uses of Different Nutrients

**Amino Acids**

•Used to build **proteins** with the help of enzymes.

•Proteins may become:

- **Plasma proteins** in the blood
- **Cell structures**
- **Enzymes**

•Excess amino acids are converted by the **liver** into **glycogen** for energy use.

# Activity 3

Please answer **the questions** briefly

**01** What is the first stage of digestion?

**02** What are the gastric juices?

**03** How many meters is the small intestine?

# Try questions

- What is assimilation, and how is it different from digestion?
- Why is active transport important in the absorption of nutrients in the ileum?
- State one reason why glucose is absorbed faster than fructose.
- Give one use of fats and one use of amino acids in the body.
- Why must the epithelial lining of the small intestine be replaced regularly?

# END!

# Resources


- **Hodder Education (MYP):**
  Hodder Education. *MYP Biology by Concept*. Hodder Education, 2018, pp. 60–62.
- **Cambridge IGCSE Biology:**
  Jones, Mary, and Geoff Jones. *Cambridge IGCSE™ Biology*. 3rd ed., Cambridge University Press, 2014, pp. 96–105.
- **Slide Template:**
  Slidego. *Biology Presentation Template*. Slidego, www.slidego.com.