Digestion and nutrition

Teacher review edition. Ask your teacher if anything is unclear.

How do nutrients from food reach your body's cells?

What you will learn

- Describe the route food takes through the digestive system.
- Explain the roles of enzymes and bile.
- Explain how villi help absorption.
- Distinguish digestion, absorption and egestion.

Why do we need food?

Food supplies nutrients for energy, growth and repair. A balanced diet supplies a variety of nutrients, together with water and fibre.

Nutrient or dietary component	Main role
Carbohydrates	Provide energy.
Proteins	Supply materials for growth and repair.
Fats	Store energy and form parts of cells.
Vitamins and minerals	Needed in small amounts for many body processes.
Fibre	Helps food and waste move through the gut.
Water	Needed for transport and chemical reactions.

What is digestion?

Digestion
Breaking large food molecules into smaller molecules that the body can absorb.

Mechanical digestion
Breaking food into smaller pieces, for example by chewing.

Chemical digestion
Using chemical reactions to break large food molecules into smaller ones.

- Mechanical digestion breaks food into smaller pieces, for example by chewing.
- Chemical digestion breaks large food molecules into small, soluble molecules.
- Digestive enzymes speed up chemical digestion. For example, amylase breaks starch into sugars.

The journey through the digestive system

Food travels through the mouth, oesophagus, stomach, small intestine, large intestine, rectum and anus.

Part	What happens there?
Mouth	Teeth break up food. Saliva contains amylase, which begins starch digestion.
Oesophagus	Muscular movements push food towards the stomach.
Stomach	Food is churned. Acid provides suitable conditions for a protein-digesting enzyme and kills many microbes.
Small intestine	Digestion is completed and nutrients are absorbed.
Large intestine	Water is absorbed from the remaining material.
Rectum and anus	Faeces are stored, then passed out of the body.

The route food takes

1. Mouth
↓
2. Oesophagus
↓
3. Stomach
↓
4. Small intestine
↓
5. Large intestine
↓
6. Rectum and anus

Follow the arrows in order. Food does not pass through the liver or pancreas; these organs supply substances that help digestion.

Enzymes and bile

Different enzymes act on different food molecules. The pancreas releases digestive enzymes into the small intestine.

- Amylase breaks starch into sugars.
- Proteases break proteins into amino acids.
- Lipases break fats into fatty acids and glycerol.

- The liver makes bile; the gall bladder stores it. Bile is not an enzyme.
- Bile breaks large fat droplets into smaller ones, giving enzymes more surface to work on. It also helps neutralise acid from the stomach.
- Food does not pass through the liver or pancreas. These organs send substances into the gut.

Absorption in the small intestine

> **Absorption**
> Movement of digested nutrients through the gut wall into the blood or lymph.
>
> **Villus**
> A tiny finger-like projection in the small intestine that provides surface area for absorption.

Absorption is the movement of digested nutrients through the wall of the small intestine. Many enter the blood. Most absorbed fats first enter vessels carrying lymph, then later reach the blood.

Tiny finger-like projections called villi help absorption:

- Many villi provide a large surface area.
- Their thin walls give nutrients a short distance to cross.
- Transport vessels carry absorbed nutrients away to the body's cells.

What happens to the nutrients and waste?

> **Egestion**
> Passing undigested material out of the body as faeces.

Absorbed nutrients supply cells with energy and materials.

- Glucose is used in respiration to release energy.
- Amino acids are used to make proteins for growth and repair.
- Some nutrients are stored for later use.
- Egestion removes undigested material as faeces.
- Excretion removes waste made by the body's chemical reactions, such as carbon dioxide.

Worked examples

Consider a piece of bread. Chewing breaks it into pieces, but enzymes are needed to break its starch into small sugar molecules that can be absorbed.

Work through it

1. Teeth break the bread into smaller pieces, exposing more surface.
2. Amylase and other digestive enzymes break starch down into small sugars.
3. The small sugars cross the small-intestine wall.
4. The circulation carries nutrients to cells, where they can be used.

Common mistakes

Common mistake: Digestion and absorption are the same process.

Remember: Digestion breaks food molecules down. Absorption moves digested nutrients through the gut wall.

Common mistake: Bile is an enzyme.

Remember: Bile breaks fat into smaller droplets and helps neutralise acid. Digestive enzymes carry out chemical breakdown.

Answering questions

- When explaining villi, link each feature to absorption: large area, short distance through the wall and transport away.
- When tracing food, follow the gut route. Mention the liver and pancreas as organs that add substances, not places food passes through.

Try an investigation

Follow the path of food on a digestive-system model. In a teacher-supervised enzyme investigation, compare starch samples under controlled conditions. Do not taste laboratory food samples.

Plan, record and review

- Question and prediction: What are you testing, and what do you think will happen? Give a reason.
- Change, measure, keep the same: What will you deliberately change? What will you measure, and in what units? What stays the same to make it a fair test? For an observation, say what you will record consistently instead.
- Record and look for a pattern: Use a table with headings and units. Look for a pattern or a result that does not fit.
- Conclude from evidence: Answer your question using a result or observation. Say if the evidence is unclear.
- Improve the investigation: What would you repeat or change, and how would that make the evidence better?

Do practical work with your teacher and follow the laboratory safety instructions.