In this unit you will compare the effects of healthy and unhealthy lifestyles on your body. You will look at why organisms need energy to function effectively. Finally, you will investigate the differences that exist between organisms, and why this is important for their survival.

You already know
- The digestive system in humans is made up of different parts, each with its own special function.
- Diet, exercise, drugs, and lifestyle have an impact on the way the human body functions.
- Living things are classified into broad groups according to common characteristics.
- Fossils provide information about organisms that lived on Earth millions of years ago.
- Living things produce offspring of the same kind but normally offspring vary and are not identical to their parents.
- Animals and plants are adapted to suit their environment and adaptation may lead to evolution.
- Food chains include producers, predators, and prey.

BIG Questions
- What is a healthy diet?
- Why do organisms need food to survive?
- Why don’t we all look the same?

Making connections
In B2 you will learn about how life evolved on Earth.
In C2 you will about the origins of the Earth.
In P2 you will learn about how we use energy in our daily lives.

Can you solve this Picture Puzzler?
The first letter of each of these images spells out a science word that you will come across in this unit.

Can you tell what this zoomed-in picture is?
Clue: It’s made from flour.

Key Words
- What are the five main groups that vertebrates (animals with a backbone) are classified into?
We all know that sweets should only be eaten as a treat and you have probably heard many times that you should eat a balanced diet. But what does this mean, and why is it important?

Nutrients are important substances that your body needs to survive and stay healthy. There are different types of nutrients. We get most of them from food. The types of nutrient are:

1. carbohydrates provide energy
2. lipids (fats and oils) provide energy
3. proteins are used for growth and repair
4. vitamins keep you healthy
5. minerals keep you healthy
6. water is needed in all cells and body fluids
7. fibre provides bulk to food to keep it moving through the gut.

Fibre is not a nutrient but it is important for a healthy diet.

To remain healthy you must eat a balanced diet. This means eating food containing the right nutrients in the correct amounts.

A. State what is meant by a nutrient.

Carbohydrates

Carbohydrates are your main source of energy. They are found in sugary foods such as sugar and fruit, where they provide a quick source of energy. They are also found in starchy foods such as pasta and bread. These foods have to be broken down by the body, so the energy is released more slowly.

B. State the function of carbohydrates.

Lipids

Lipids include fats and oils. They have three important jobs. They:

- provide you with a store of energy
- keep you warm, by providing a layer of insulation under your skin
- protect organs like your kidneys and heart from damage.

C. State two functions of proteins.

Vitamins and minerals

Vitamins and minerals are essential substances for keeping you healthy but you only need tiny amounts. Vitamins are needed for you to grow, develop, and function normally. For example, vitamin A is needed for good eyesight. Vitamin D is needed with the mineral calcium to maintain healthy teeth and bones.

Fruits and vegetables are a good source of vitamins and minerals.

Water

Your cells are made up of about 70% water. To keep them healthy you need to constantly replace the water your body loses in sweat, tears, urine, feces, and exhaling. You should drink over a litre of water every day. This can come from drinking water but tea, fruit juice, and squash all count.

D. List four ways in which you lose water from the body.

Fibre

Fibre is a type of carbohydrate but it is not classed as a nutrient. However, it is an important part of your diet as it adds bulk to your food. This means it keeps food moving through the gut, and waste is pushed out of the body more easily, helping to prevent constipation.

Summary Questions

1. Match the nutrient to its role in the body.
   - carbohydrates growth and repair
   - lipids remain healthy
   - protein provide energy
   - vitamins and minerals provide bulk to food
   - water energy store and insulation
   - fibre needed in cells and bodily fluids

2. Describe the role of lipids in the body.

3. Explain in detail what is meant by a balanced diet. Provide examples of what a balanced diet should contain.

Key Words

- nutrient, carbohydrate, lipids, protein, vitamin, mineral, fibre, balanced diet
You may be able to guess by looking at some foods which nutrients they contain. For example, you may know that oily foods contain lipids. Scientists use food tests to find out which nutrients are in a food product.

How can you test foods?
A different chemical test exists for each type of nutrient. For most food tests, you will need a solution of the food. To prepare a food solution:
1. Crush the food using a pestle and mortar
2. Add a few drops of water, and mix well.
You should use a special type of water called distilled water – this is pure water that contains no other chemical substances.

How do you test for starch?
To test for starch you use iodine solution. Iodine solution is an orange-yellow liquid.
1. Add a few drops of iodine solution to the food solution.
2. If the solution turns a dark blue-black colour, the food contains starch.

A State the colour change in iodine if a food contains starch.

How do you test for lipids?
To test for lipids in a solid piece of food you use a piece of filter paper.
1. Rub some of the food onto a piece of filter paper.
2. Hold the paper up to the light.
   If the paper has gone translucent, the food contains lipids.

B State how you would test a solid piece of food for lipids.

To test for lipids in a food solution you use ethanol. Ethanol is a colourless liquid.
1. Add a few drops of ethanol to the food solution.
2. Shake the test tube and leave for one minute.
3. Pour the ethanol into a test tube of water.
4. If the solution turns cloudy, the food contains lipids.

How do you test for sugar?
To test for simple sugars such as glucose you use Benedict’s solution. Benedict’s solution is a blue liquid.
1. Add a few drops of Benedict’s solution to the food solution.
2. Heat the test tube in a water bath.
3. If the solution turns orange-red, the food contains sugar.

C State the colour change in Benedict’s solution if a food contains sugar.

How do you test for protein?
To test for protein you use copper sulfate solution and sodium hydroxide solution. Copper sulfate solution is a pale-blue liquid. Sodium hydroxide solution is a colourless liquid.
1. Add a few drops of copper sulfate solution to your food solution.
2. Add a few drops of sodium hydroxide solution.
3. If the solution turns purple, the food contains protein.

D State the colour change in a solution of copper sulfate and sodium hydroxide if a food contains protein.
You may have seen pictures of people who are either extremely overweight or underweight. Both of these conditions are caused by malnourishment. This means the people have eaten the wrong amount or the wrong types of food.

Where does your energy come from?
You need energy for everything you do, even to sleep. This energy comes from your food. The energy in food is measured in joules (J) or kilojoules (kJ). 1 kilojoule is the same as 1000 joules. If you look on a food label it will tell you how much energy is stored in that food.

A State the unit that energy in food is measured in.

Why is it unhealthy to be underweight?
Some people do not eat enough food. In extreme cases this is known as starvation. If the energy in the food you eat is less than the energy you use, you will lose body mass. This leads to you being underweight. Underweight people:
- often suffer from health problems, such as a poor immune system
- lack energy to do things, and are often tired
- are likely to suffer from a lack of vitamins or minerals.

B State three problems caused by being underweight.

Why is it unhealthy to be overweight?
Some people eat too much, or eat too many fatty foods. If the energy content in the food you eat is more than the energy you use, you gain body mass. This is stored as fat under the skin. If a person becomes extremely overweight, they are said to be obese.

Overweight people have an increased risk of:
- heart disease
- stroke
- diabetes
- some cancers.

C State three diseases that obese people are more likely to suffer from.

What are vitamin and mineral deficiencies?
If a person does not have enough of a certain vitamin or mineral they are said to have a deficiency. This can damage a person’s health. For example, a vitamin A deficiency can lead to ‘night blindness’. This makes it difficult for you to see clearly in dim light. A vitamin D deficiency can lead to a condition called rickets, where your bones become weak.

D Name the condition caused by a vitamin A deficiency.

How much energy do you need?
Your body needs energy to function properly. The amount of energy you need depends on your age (as this affects your growth rate), your body size, and how active you are. The more exercise you do, the more energy your body requires.

Energy requirements
Use the graph below to estimate the energy that a female computer programmer needs each day. How did you arrive at your answer?

A This person is suffering from rickets.

Summary Questions

1 Copy and complete the sentences below.
You gain the _____ you need to survive from food. Energy is measured in _____.
If you take in more energy than you use you _____ body mass. If you become _____ your risk of _____ disease increases. An underweight person is often _____.

2 Use the graph on this page to answer the following questions.
a Calculate the extra energy a female office worker would need each day if she became pregnant.
b A male office worker starts a new job as a construction worker. Calculate the percentage increase in his daily energy needs.

3 Compare the health problems of being underweight and the health problems of being overweight.
You may sometimes notice your stomach rumbling. This is a hint that you need to eat. You know that the food contains nutrients. But how does your body get nutrients out of food?

What is the digestive system?

The digestive system is a group of organs that work together to break down food. The nutrients in most of the food you eat are large molecules, like lipids and proteins. During digestion these large molecules are broken down into small molecules of nutrients. These nutrients can then pass into the blood where they are used by the body.

Learning objectives

After this topic you will be able to:

● describe the structure and function of the main parts of the digestive system
● describe the process of digestion.

Fantastic fact

If you unravelled your small intestine it would be roughly four times taller than you – it is not very small!

Movement of food out of the digestive system

Fibre in your food isn’t digested but adds bulk to the food. Muscles push against this, forcing food along the gut. Eating lots of fibre-rich foods such as vegetables and wholemeal bread helps prevent constipation.

Structures in the digestive system

The diagram opposite shows the main structures in your digestive system. It is often referred to as your gut.

A State what happens during digestion.

B Name the structure that food passes along to reach the stomach.

C Describe how food moves along the gut.

Passing into the blood

The small molecules of nutrients produced during digestion pass into the bloodstream through the wall of the small intestine. They are then transported around the body.

The small intestine needs to absorb the nutrients quickly, before the undigested food passes out of the body. The small intestine is specially adapted to this function. The wall of the small intestine is thin. It is also covered with tiny structures called villi. These stick out of the wall and give it a big surface area. They also contain blood capillaries to carry away the absorbed food molecules.

Villi in the small intestine increase the surface area so more nutrients can be absorbed.

Key Words

digestive system, digestion, gullet, stomach, small intestine, large intestine, rectum, anus, villi

Wordbank

Make a wordbank by listing all the scientific terms about digestion. You can refer to your wordbank as you progress through this topic.

digestive system, digestion, gullet, stomach, small intestine, large intestine, rectum, anus, villi

Summary Questions

1. Match each organ below to its role in digestion.
   - stomach: food is chewed and mixed with saliva
   - small intestine: water is absorbed back into the body
   - large intestine: food is mixed with acid and digestive juices
   - rectum: feces are stored here until they pass out of the body
   - mouth: small molecules of nutrients are absorbed into the blood stream
   (5 marks)

2. Describe the adaptations of the small intestine to its function.
   (3 marks)

3. Explain why it is important to eat a fibre-rich diet.
   (3 marks)

4. Describe in detail the passage of food through the digestive system.
   (6 marks QWC)
Learning objectives
After this topic you will be able to:
● describe the role of enzymes in digestion
● describe the role of bacteria in digestion.

Have you seen the TV adverts that say that yoghurts and yoghurt drinks are good for your digestive system? They contain bacteria, which is important for digestion.

**Bacteria in digestion**
Your large intestine contains bacteria. They live on the fibre in your diet. They make important vitamins such as vitamin K. These vitamins are then absorbed into your body and help to keep you healthy.

Some foods, called probiotic foods, like live yoghurt, contain these useful bacteria.

**A** State why bacteria are important in your digestive system.

**What’s in digestive juices?**
Your teeth begin digestion by breaking down food into smaller pieces. The digestive juices in your gut contain enzymes. These are special proteins that can break large molecules of nutrients into small molecules.

Large molecules in your food like starch, a type of carbohydrate, are made of lots of smaller molecules joined together. Enzymes chop these large molecules into the smaller molecules they are made from.

**B** State the role of enzymes in digestion.

**Different types of enzyme**
Different types of enzyme break down different nutrients. There are three main types of enzymes involved in digestion – **carbohydrase**, **protease**, and **lipase**.

**Carbohydrase**
Carbohydrase is an enzyme that breaks down carbohydrates into sugar molecules.

**Protease**
Protease is an enzyme that breaks down proteins into amino acids.

**Lipase**
Lipase is an enzyme that breaks down lipids into fatty acids and glycerol.

\[ \text{Lipids are broken down into fatty acids and glycerol.} \]

**What’s in a name?**
The enzymes **carbohydrase**, **protease**, and **lipase** are named after the type of nutrient they break down.

**Key Words**

- enzyme, catalyst, carbohydrase, protease, lipase, bile

**Summary Questions**

1. Copy the sentences below, choosing the correct bold word.

   - **Carbohydrates**/proteins are broken down into sugar by the enzyme **lipase**/carbohydrase.
   - Proteins are broken down into **amino acids**/lipase by the enzyme **carbohydrase**/protease.
   - Lipids are broken down into **fatty acids** and **glycerol** by the enzyme **lipase**/carbohydrase.

2. Explain why live yoghurt should be part of your diet.

3. Make a visual summary of the ideas on this page to compare the roles of enzymes and bacteria in digestion.