

## 1.2 Where organisms live

How are organisms adapted to the place they live? A polar bear could not live in a hot desert because it would get too hot. A fish cannot live out of water because it cannot get oxygen from the air. Each type of organism is able to live in one kind of environment.

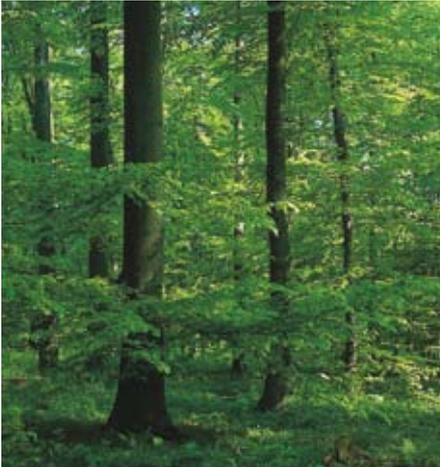


Figure 2.1 A deciduous woodland habitat.

### Habitats

To us the earth is a very special place. Life may have started about 3500 million years ago and organisms are now able to live in most areas of the sea, land or air. Very few areas are entirely free of life. The surface of the earth where living things can survive is called the **biosphere**.

Organisms live in specific places in the biosphere. The place where each organism can live is called its **habitat**. This is a local **environment** which usually describes the main type of plant or the structure of the environment e.g. a woodland, a pond, the seashore. The organism must be adapted to the special conditions existing in that area. Different species (types of organisms) will each be **adapted** to that particular habitat and form an interacting group – a **community** of organisms.

The organisms interact with the non-living environment. The combination of the community of organisms and the non-living (physical) environment is called the **ecosystem**. Ecosystems are often grouped together on a global scale to give **biomes** (Figure 2.2). These are large areas where similar types of plants can grow.

**?** 1 Suggest what makes up the non-living environment. [2]

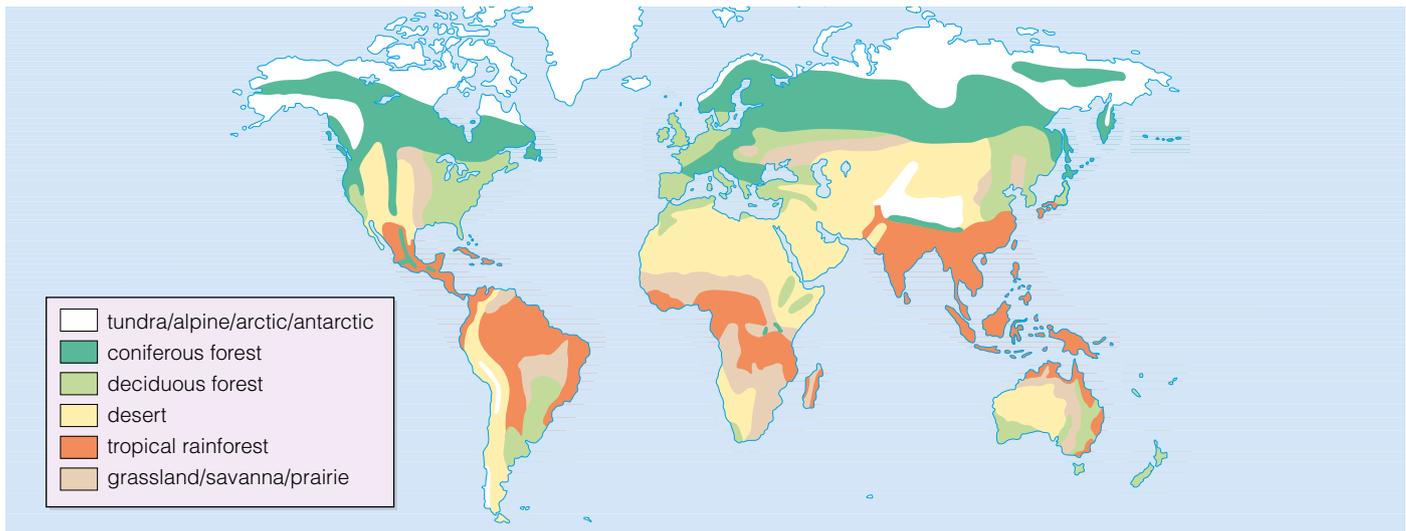


Figure 2.2 The major biomes of the world.

## Adaptations

Each organism is adapted to live in the habitat where it is found. The adaptations often appear strange to us but are essential to the organism. In the sea, a blue whale has tail flukes to help it move through the oceans, with small arms (seen as flippers) to help direct the whale in the water. It feeds by filtering the sea water for small organisms which it swallows using its strong tongue. Its nostril (blowhole) is on the top of its head to allow breathing when swimming at the surface. It also has a special blood circulation system to ensure that the brain and heart muscle have the best oxygen supply to conserve 'air' during a long dive.



Figure 2.3 *Blue whale.*

Some cactus plants look like spiky balls instead of a 'normal' plant, but this helps them to survive in the desert. Leaves have been reduced to spines which are present to protect the cactus from animals eating it. Only the green ribbed stem is used to capture sunlight.

The ribs create some areas of shade so that carbon dioxide can enter for photosynthesis without the cactus losing too much water. The stem has a small surface area which cuts down water loss. The roots are usually long and spread over a wide area so that if it rains water can be absorbed quickly and stored within the stem.

These are just two examples of the ways organisms can be adapted to the physical environment. Some organisms need to change during the day and throughout the year to take advantage of the different conditions.

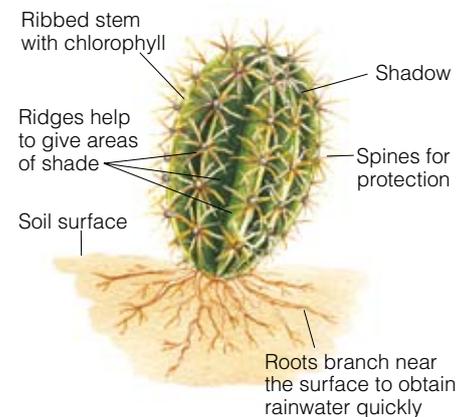


Figure 2.4 *Sea urchin cactus.*

## Daily changes

Organisms respond to the daily changes in physical factors to maximise their survival in the habitat. A crocus plant will open its flower in bright sunshine when it is most likely to be warm enough for insects to fly so that they can pollinate the flower. In sunlight, leaves will also open small pores (holes) on the surface so that carbon dioxide can be taken in for photosynthesis. Later in the day, when the light is less bright, the pores close to stop water loss.

Different organisms are active at different times of the day so that they can protect themselves from predators and gather enough food. For example, a bat has a better chance of catching insects at night when it can sense them but it cannot be seen. During the day the bat must hide in its roost to avoid its own predators.



Zoos help to breed endangered species so that they do not become extinct. Sometimes they can release the individuals back into the wild. For example, red kites have been released in North Wales and red-crowned cranes in Japan and north-east China.

### Seasonal changes

In an oak wood you can see how the organisms have adapted to the seasons. The oak trees burst into leaf in late spring so that they gain the maximum amount of sunshine in the warmest conditions. Underneath the oak trees, holly trees have very thick dark green leaves to absorb as much light as possible in the shade of the bigger trees above.

Squirrels are active during the day as they need light to collect their food. At night they defend themselves by resting and hiding from the nocturnal predators in the wood. The squirrels remain active all summer and find enough food to raise a family.

As autumn approaches wood mice store more of their food energy as fat to last them through the winter. When the air temperature falls the wood mouse's respiration slows down and its body temperature decreases. It **hibernates** to save energy during the cold months.

The oak tree loses its leaves to make sure that the branches are not damaged by stronger winds and so that the delicate leaves are not damaged by frost. Another advantage to the oak tree is that waste chemicals can also be lost from the tree in the falling leaves. The smaller holly tree can now receive more light and so continues to grow slowly using its better-protected leaves.

In spring, as the temperature increases again but before the oak leaves open, bluebells grow using food stored in their bulbs. They flower early so that the insects and wind can get to the flowers without hindrance from the oak tree leaves. The leaves of the bluebell use the light energy getting to the woodland floor to create a new bulb for the next year ... and so on for many years.

The flowers of the bluebell are adapted to attract insects. They are colourful and perfumed. Insects arrive to get food as a reward but they also carry the pollen from one flower to the next. Each flower must only give the insect a small amount of food so that it will fly to another flower instead of going to the hive or nest. The flower and the insect developed together millions of years ago. The insect cannot live without the flowers and the flowers cannot reproduce without the insects. This is an example of co-evolution and the beneficial way organisms can interact within a community.



2 How do humans adapt to the seasons? [3]



Spiders and insects are among the oldest types of animals on the earth – about 300 million years old.

# 1 Transplants

## A matter of life or death



In 1967 the first human heart transplant was performed. Simpler transplants date back much earlier. The first successful cornea transplant dates back to 1905. A doctor called Eduard Zirm used corneas from the eyes of an 11-year old boy to restore the sight of a labourer who had been blinded by slaked lime (calcium hydroxide).

Sometimes organs can stop working properly, either as a result of disease or injury. An organ transplant is one solution to this problem. It involves replacing the malfunctioning organ with a healthier one from another person's body. The replacement organ (**donor organ**) may come from someone who has recently died, or in some cases it may come from a living donor.



Figure 1 A human kidney being transplanted.

When a person dies in an accident, many of their organs may still be in good condition and could be used to save someone else's life. This can only happen if they had previously expressed a wish to donate their organs after death. This can be done by joining the organ donor register. There are currently over 16 million people in the UK on this register – over a quarter of the population.

The biggest problem doctors face with transplantation is the lack of suitable organs. This means that many people may die while waiting for a suitable organ to become available. When an organ does become available, a decision has to be made as to who should receive it; this can be a very hard decision to make.

Once an organ has been transplanted, the **recipient** has to take drugs to stop their body from rejecting the donated organ. Rejection occurs when the immune system recognises the donated organ as being 'foreign', and then attacks it and destroys it. The drugs taken are called **immunosuppressants**, and they work by weakening the immune system. A side effect of taking these drugs is that a person will be more likely to fall ill from disease.



- 1 What might be considered when deciding who should receive a donor organ? [2]
- 2 Explain what an organ transplant is, using the term 'donor organ' in your answer. [2]



In 2005 a French woman called Isabelle Dinoire became the first person in the world to undergo a partial facial transplant. Her pet Labrador had mauled her face, leaving her disfigured. Isabelle received a triangle of tissue containing a new nose and mouth from a female donor.

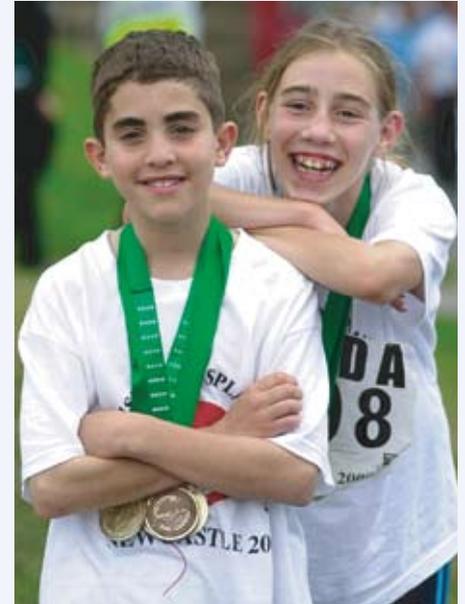


Figure 2 Isabelle Dinoire after her partial face transplant.

## Difficult decisions

When an organ becomes available for transplantation, several different organisations work together to decide who should receive the organ. Factors that are considered include the blood group, age, and size of potential recipients. When considering heart and liver transplants, the health of the potential recipients also needs to be considered; it may be more urgent for one person than another.

Some people argue that factors such as social worth should be taken into consideration; for example, should a donated organ be used to save the life of a young working man or an old retired man? Others point out that maybe someone who has caused damage to themselves through their own actions is not deserving of a transplant. An example of this would be an alcoholic receiving a new liver to replace their own diseased organ, caused by their own drinking.



**Figure 3** *These children have just finished the Transplant Games. The athletes in these Games have had organ transplants.*

## Questions

- 1** Kidney transplants are much more common than heart transplants. Suggest reasons why this may be so. [Total 2]
- 2** In 1954, the first kidney transplant between identical twins was performed in America. Richard Herrick received one of his brother Ronald's kidneys, and was soon back to good health. Despite not taking any immunosuppressant drugs, Richard's body did not reject the donated kidney. Suggest why not. [Total 1]
- 3** John is 18 years old and currently serving a five-year prison sentence for manslaughter while drink driving. Susan is 56 years old, has no close family, and works part-time in a garden centre. Both John and Susan are waiting for a liver transplant, without which they will probably die within the next year. A donor liver becomes available, and can be used to save the life of either John or Susan.
  - a) Suggest some reasons why John should receive the new liver and Susan should not. [3]
  - a) Suggest some reasons why Susan should receive the new liver and John should not. [3][Total 6]