Natural Selection and Survival

Characteristics that make organisms good at surviving are likely to become more common over time. The process by which this happens is called natural selection.

Organisms Need to Compete

1) Organisms need certain resources so they can survive and reproduce. For example, food and water.
2) Often there aren't enough of these resources to go around, so organisms need to compete ('fight') for them.
3) They have to compete with: a) other members of their own species, b) organisms from other species.

EXAMPLE:

1) Red squirrels have to compete with each other (their own species) for food.

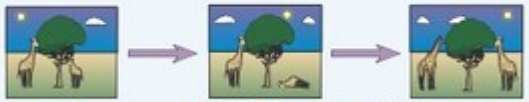
2) They also have to compete with grey squirrels (a different species).

4) Some species are better at competing than others.
5) Some organisms are also better at competing than others from their own species. This is because they show variation due to differences in their genes (see previous page).

Variation Leads to Natural Selection

1) Organisms with characteristics that make them better at competing are more likely to survive and reproduce.
2) This means they're more likely to pass on the genes for their useful characteristics to their offspring (children).
3) So, over time, lots of individuals end up with the useful characteristic.
4) When a useful characteristic gradually becomes more common like this, it's called natural selection.

EXAMPLE: Giraffes have long necks due to natural selection.



1) To start with there is variation — some giraffes have longer necks than others.
2) Giraffes with longer necks can reach leaves easily — so they're better at competing for food. They're more likely to survive and reproduce.
3) The gene for a longer neck gets passed on to the next generation. This process keeps happening until all giraffes have long necks.

Key term	Definition
Biodiversity	The variety of living things. It is measured as the differences between individuals of the same species, or the number of different species in an ecosystem.
Chromosomes	Thread-like structures containing tightly coiled DNA.
Competition	When two or more living things struggle against each other to get the same resource.
DNA	A molecule found in the nucleus of cells that contains genetic information.
Extinct	When no more individuals of a species remain.
Gene	A section of DNA that determines an inherited characteristic.
Natural selection	Process by which species change over time in response to environmental changes and competition for resources.
Species	A group of living things that have more in common with each other than with other groups.
Variation	The differences within and between species.

Extinction and Preserving Species

Organisms that can't compete don't survive for long. It's a cruel world out there.

Many Species Are at Risk of Becoming Extinct

1) If the environment changes in some way, some organisms will be badly affected. They may struggle to compete successfully for the things they need.
2) If this happens to a whole species, then that species may die out, so there are none of them left at all.
3) This means the species has become extinct (like the woolly mammoth).
4) Species at risk of becoming extinct are called endangered species.

Humans Can Suffer When Species Become Extinct

1) Humans rely on plants and animals for loads of things. For example:
2) We need to protect the organisms we already use.
3) We also need to make sure organisms we haven't discovered yet don't become extinct — they might end up being really important.
4) Organisms rely on other organisms to survive (see page 37). So if one species becomes extinct, this can have a knock-on effect for other species — including humans.
5) So it's important that we always have a variety of species on Earth — this is Earth's BIODIVERSITY.

Gene Banks May Help to Prevent Extinction

1) A gene bank is a store of the genes of different species.
2) If a species becomes endangered or extinct, we could use stored genes to create new members of that species.
3) So gene banks could be a way of maintaining biodiversity in the future.

EXAMPLE: Plants

1) Seeds can be collected from plants and stored in seed banks.

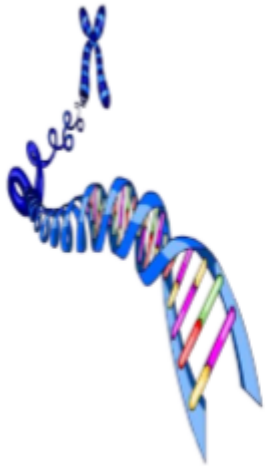
2) If the plants become extinct in the wild, new plants can be grown from the seeds kept in storage.

Biodiversity

Biodiversity means having as wide a range of different species in an ecosystem as possible. It is important to conserve the variety of living organisms on Earth. Not only do we have moral and cultural reasons for conserving endangered species, but conservation:

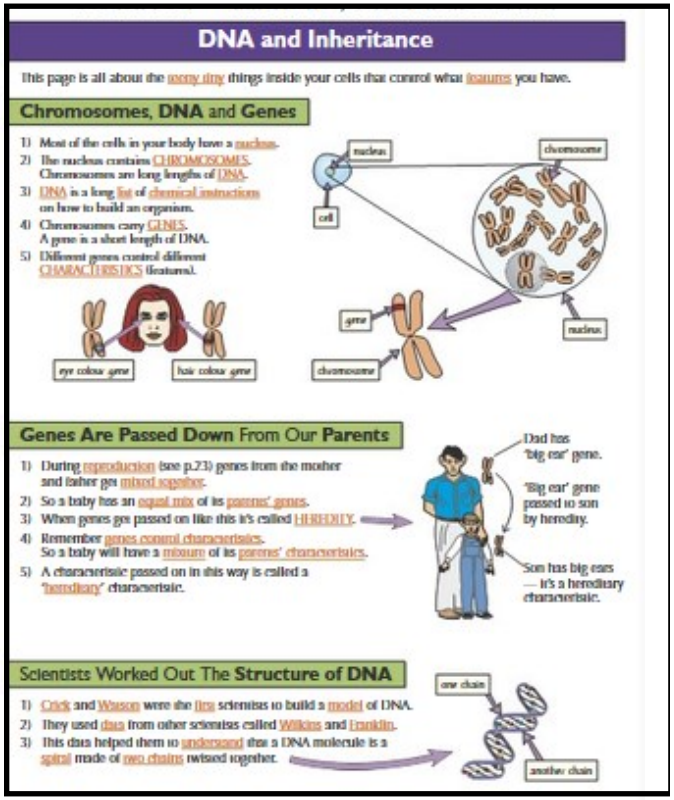
- maintains the future possibility that plant species might be identified for medicines
- keeps damage to food chains and food webs to a minimum
- protects our future food supply

Section B – Inheritance and Variation



Genetic information is passed from one generation to the next. This is called heredity and why we resemble our parents. The genetic information itself is contained in a complex molecule called DNA. Human body cells each contain 23 pairs of chromosomes, half of which are from each parent. A gene is a section of DNA that is responsible for a characteristic like eye colour or blood group.

Some variation within a species is inherited e.g. eye colour and some variation is due to the environment e.g. accent; some variation is due to a combination of both e.g. intelligence and mass.



Structure of DNA

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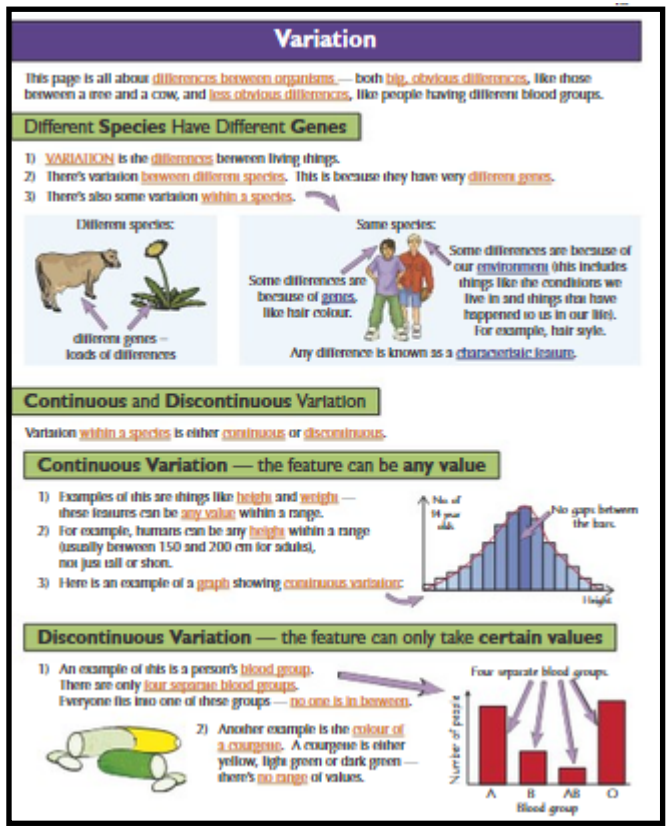
Scientists worked out the structure of DNA in the 1950s. Rosalind Franklin made 'X-ray diffraction' images of DNA. James Watson and Francis Crick used information from one of her images to work out a model for the structure of DNA. Work by Maurice Wilkins, a colleague of Franklin, supported their model.



Conservation measures

Some species in Britain are endangered, including the skylark, red squirrel and grass snake. They could be helped by conservation measures such as:

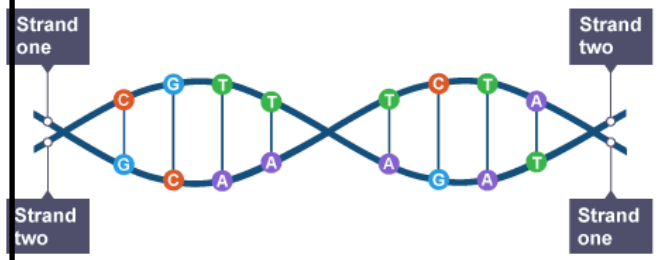
- education programmes
- captive breeding programmes
- legal protection and protection of their habitats
- making artificial ecosystems for them to live in

Plant species can also be endangered. Seed banks are a conservation measure for plants. Seeds are carefully stored so that new plants may be grown in the future.

Seed banks are an example of a **gene bank**. Gene banks are increasingly being used to preserve genetic material for use in the future. A cryobank is another type of gene bank. Embryos, sperm or eggs are stored at very low temperatures in liquid nitrogen (which is at a very chilly –196 °C). They can be thawed out later for use in breeding programmes.

Watson and Crick were able to work out how DNA was arrange and the tiny distances between its different features. They worked out that in a DNA molecule:

- there are two strands
- the strands are twisted around each other to form a **double helix**
- the strands are held together by **bonds** between **base pairs**



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Conservation

- Conservation is anything that is done to try to stop an endangered species becoming extinct
- Examples of endangered species include the Leatherback Sea Turtle, Ivory Billed Woodpecker and the Amur Leopard
- Conservation work can include:
  - Captive breeding
  - Seed banks
  - Conservation areas
  - Nature reserves