

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. |

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

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 **only** on **plants** and **animals** for loads of things. For example:
- 2) We need to **protect** the organisms we **haven't discovered** yet don't become extinct — they might end up being really important.
- 4) Organisms **only** 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.

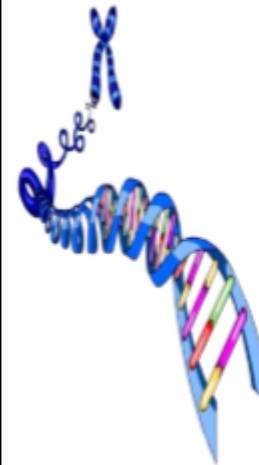
EXAMPLE: Plants

- 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.

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.

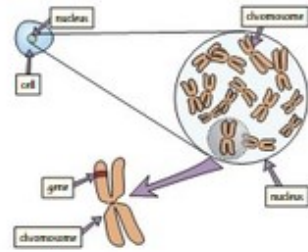
Some variation within a species is inherited e.g. eye colour and some variation is due to the environment e.g. accent; some variation is due to a combination of both e.g. intelligence and mass.

DNA and Inheritance

This page is all about the genetic things inside your cells that control what features you have.

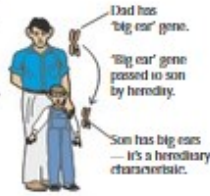
Chromosomes, DNA and Genes

- 1) Most of the cells in your body have a nucleus.
- 2) The nucleus contains CHROMOSOMES. Chromosomes are long lengths of DNA.
- 3) DNA is a long list of chemical instructions on how to build an organism.
- 4) Chromosomes carry GENES. A gene is a short length of DNA.
- 5) Different genes control different CHARACTERISTICS (features).



Genes Are Passed Down From Our Parents

- 1) During reproduction (see p.23) genes from the mother and father get mixed together.
- 2) So a baby has an equal mix of its parents' genes.
- 3) When genes get passed on like this it's called HEREDITARY.
- 4) Remember genes control characteristics. So a baby will have a mixture of its parents' characteristics.
- 5) A characteristic passed on in this way is called a 'hereditary' characteristic.



Scientists Worked Out The Structure of DNA

- 1) Crick and Watson were the two scientists to build a model of DNA.
- 2) They used data from other scientists called Wilkins and Franklin.
- 3) This data helped them to understand that a DNA molecule is a spiral made of two chains twisted together.



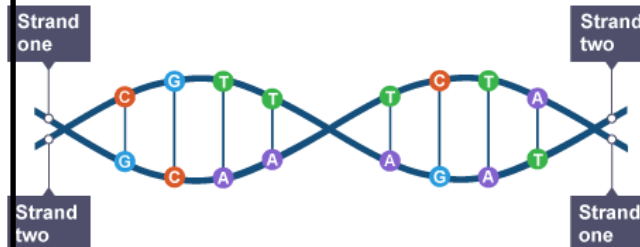
Structure of DNA

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.

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.

Watson and Crick were able to work out how DNA was arranged 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

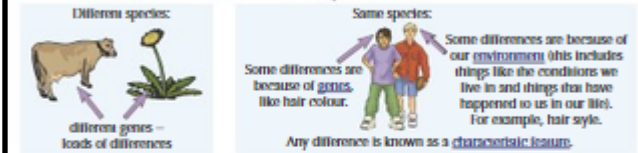


Variation

This page is all about differences between organisms — both big, obvious differences, like those between a tree and a cow, and less obvious differences, like people having different blood groups.

Different Species Have Different Genes

- 1) VARIATION is the differences between living things.
- 2) There's variation between different species. This is because they have very different genes.
- 3) There's also some variation within a species.



Continuous and Discontinuous Variation

Variation within a species is either continuous or discontinuous.

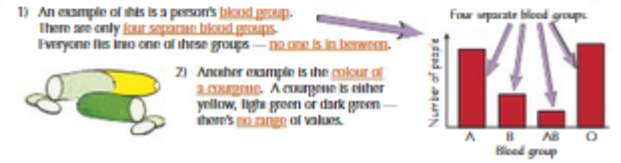
Continuous Variation — the feature can be any value

- 1) Examples of these are things like height and weight — these features can be any value within a range.
- 2) For example, humans can be any height within a range (usually between 150 and 200 cm for adults), not just tall or short.
- 3) Here is an example of a graph showing continuous variation:



Discontinuous Variation — the feature can only take certain values

- 1) An example of this is a person's blood group. There are only four separate blood groups. Everyone fits into one of these groups — no one is in between.
- 2) Another example is the colour of a cow's eye. A cow's eye is either yellow, light green or dark green — there's no range of values.



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 $-196\text{ }^{\circ}\text{C}$). They can be thawed out later for use in breeding programmes.

GENES YEAR 8 KNOWLEDGE ORGANISER

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