

Variation & Evolution

Variation

There are differences between organisms of the same species (hair colour, height etc.) caused by **genetics** or the **environment**.

Genetic variation is caused by different **genotypes** (all the genes and alleles an organism has). These affect its phenotype – the characteristics it displays.

The **environment** an organism lives in affects certain characteristics. A plant placed in a sunny position would be more green than a plant grown in darkness.

Evolution by Natural Selection

Charles Darwin came up with the theory of natural selection:

- There is **variation** in a species
- The **best adapted** would be better competitors and more likely to **survive**.
- The organisms that survive **reproduce** and **pass on the genes** coding for successful characteristics to their offspring.
- Over many generations these characteristics become **more common** in the population so the species evolves.

Speciation & Extinction

Speciation is where the **phenotype** of organisms in a species **changes** so much they form a new species. When two populations of a species changes enough they become **reproductively isolated**, meaning they can't interbreed to produce **fertile offspring**.

Extinction

Species can become extinct because:

- the **environment** changes too quickly
- a new **predator** kills all of them
- another species **out competes** them for food
- a new **disease** kills all of them
- a **catastrophic event** kills all of them

Mutations

A **random** change in an organisms DNA. They are rare but happen **continuously** and are **inherited**.

When a mutation occurs it produces a genetic variant (a different form of a gene). This leads to changes in the **protein** it codes for.

Most mutations have **very little** (or no) effect on the protein so will **not affect** the **phenotype** of the organism.

Rarely, a mutation can have a big effect. Cystic fibrosis is a genetic disorder caused by the deletion of three bases in the gene that codes for a protein responsible for the movement of salt and water into and out of cells. The mutation prevents the protein working properly so excess mucus is produced in the lungs and digestive system.

A gene codes for a sequence of **amino acids**. The amino acids join together to make a protein.

Fossils

Are the remains of plants and animals and provide evidence for evolution.

- Teeth, shells and bones don't decay so last a long time. They are **replaced by minerals** to form a rock like substance.
- **Casts and impressions** may be formed when an organisms is buried in soft materials like clay. A footprint can be pressed into the clay, leaving an impression.

- Fossils can form in places where decay can't happen. In **amber** there is no oxygen, or moisture. In **glaciers** it is too cold and in **peat bogs** it is too acidic. These all prevent **decay microbes** from surviving.

Fossils do not show us where the **first** living organism came from. Hypotheses include from **swamps** on Earth or from **comets**. There is **not enough evidence** to prove or disprove these hypotheses.