

9B1 - Genetics and Inheritance



Variation is the differences between individuals within a species. This can be caused by inherited or environmental factors.

Some variation within a species is inherited (genetic), and some variation is due to the environment and many are a mix of both.

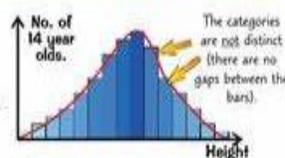


Continuous and discontinuous variation

Some of the features of the different organisms in a species show continuous variation, and some features show discontinuous variation.

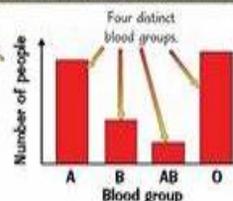
Continuous Variation — the feature can vary over a range of values

- Examples of this are things like **height, weight, skin colour, intelligence, leaf area**, etc. where the feature can have **any value at all** — within a certain **range**. If you did a survey of kids' heights you could plot the results on a chart like the one opposite (the heights would be collected into groups to give the bars).
- The smooth **distribution curve** drawn on afterwards (the red line) shows much better the **continuous** way that values for height actually vary.



Discontinuous Variation — the feature can only take certain values

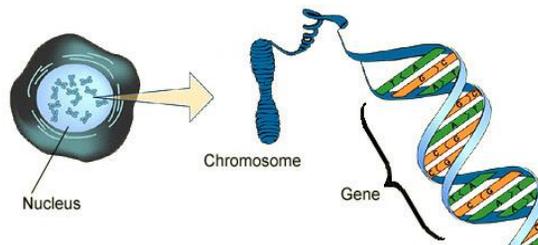
- An example of this is a person's **blood group**, where there are just **four distinct options**, **NOT** a whole **continuous range**.
- Another example is the **colour of a courgette**. A courgette is either **yellow, light green or dark green** — there's **no range** of values.



DNA

DNA is a chemical made up of two long molecules. The molecules are arranged in a spiral, like a twisted ladder. We call this the **double helix** structure.

There is DNA in the **nucleus** of every cell. DNA carries genetic information. It has all the instructions that a living organism needs to grow, reproduce and function.



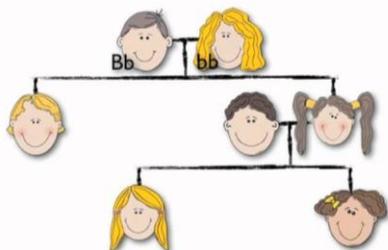
Genes

Genes are short sections of DNA. Genes carry information for particular characteristics, such as ear shape or eye colour. Different sets of genes carry information for different characteristics. There are many genes in a chromosome.

Chromosomes

In a cell nucleus, DNA is organised into coiled strands called **chromosomes**. Humans have 46 chromosomes in each cell. The fruit fly has only 8 chromosomes and is often used to study patterns of inheritance while red king crabs have a whopping 208

Species	Chromosome number (2n)	Species	Chromosome number (2n)
human being	46	tobacco	48
fruit fly	8	barley	14
rat	42	watermelon	22
fen duck	80	bean	22

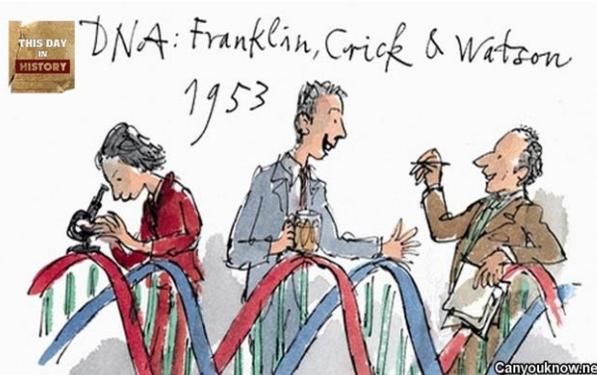


Half the chromosomes are inherited from one parent and half from the other. As humans, therefore, we have **23 chromosomes** from each parent.

This explains why organisms can share characteristics from both parents. A child, for example, might have red hair like their dad and long fingers like their mum.

In 1952 Maurice Wilkins and Rosalind Franklin image DNA crystals via X-ray. These images are the basis for the conclusions of Watson and Crick.

In 1953 James Watson and Francis Crick publish their description of DNA. They describe it as a double-helix -two spirals held together by complementary base pairs.



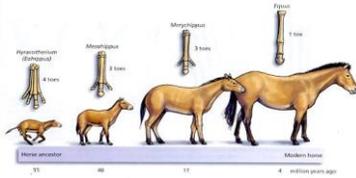
A **species** is a group of similar organisms that can breed with one another to produce **fertile** offspring. For example, daisy's are one species and monkeys are another species.



Two individuals belonging to different species cannot normally reproduce together. If they do, their offspring is often infertile and unable to reproduce. A zorse is a male zebra and a female horse's offspring; it is infertile.

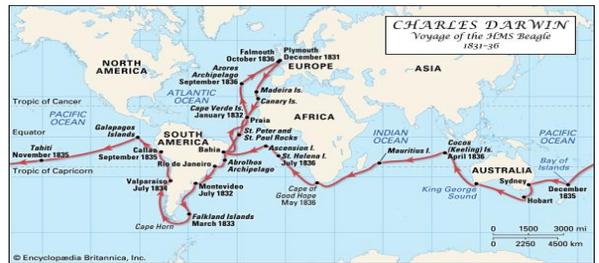


Scientific analysis of fossils shows that species have changed over long periods of time. This change is evolution.

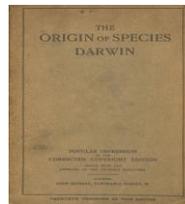


There are different theories of evolution. The most accepted one is 'natural selection' this was proposed by Charles Darwin. He was on the £10 note until 2018.

Charles Darwin was an English naturalist. He studied variation in plants and animals during a five-year voyage around the world in the 19th century. Darwin later studied hundreds more animal and plant species. In 1858, after nearly 30 years of research, he proposed his theory of evolution by natural selection. He explained his ideas about evolution in a book *On the Origin of Species*, published in 1859.



Darwin's ideas caused a lot of controversy at the time. Today, some religious views about the creation of the world and the organisms in it conflict with the scientific consensus about evolution.



Natural Selection

- Each species shows variation:
 - Shut it - shorty
 - Get off my land, you lanky git
- There is competition within each species for food, living space, water, mates etc.
 - Gutted!
 - Yum
- The "better adapted" members of these species are more likely to survive - "Survival of the Fittest"
 - Survival of the fittest
- These survivors will pass on their better genes to their offspring who will also show this beneficial variation.

A species becomes extinct when there are no more individuals of that species left.

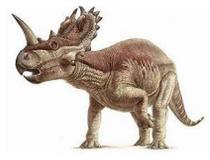
Changes in the environment may leave individuals less well adapted to compete successfully for resources such as food, water and mates. Sometimes an entire species may become unable to compete successfully and reproduce. These problems can lead to extinction. Examples of changes include:

- a new disease
- a new predator
- a change in the physical environment e.g. climate change
- competition from another species that is better adapted, including competition from humans

Endangered species

An **endangered species** is at risk of becoming extinct. E.g. the panda and gorilla. A species can become endangered for several reasons, including:

- the number of available habitats falls below a critical level
- the population of the species falls below critical level



For example, dinosaurs became extinct millions of years ago. This was probably due to changes in the environment, but many species have become extinct more recently because of competition from humans e.g. the Dodo.

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.



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.

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