Differences between individuals of the same species

The term **variation** is used to describe the differences shown between individuals. No two individuals are exactly alike, even identical twins develop into separate beings. Whilst identical twins begin as one cell that divides, the subsequent replication of their DNA and future divisions introduce certain changes between them. There is always variation between one species. There are two different types: **continuous variation** and **discontinuous variation**.

CONTINUOUS VARIATION

Simply, continuous variation involves two extremes and a full range of intermediate values between those extremes. Most individuals lay near to the average value, for example, *height* in humans. There are two extremes: you can be really tall, over seven feet, or really short, less than three feet, but most adults are around five foot tall.

DISCONTINUOUS VARIATION

This form of variation occurs where there are two or more distinct groups, and no intermediate values in between them, such as gender in humans: you are either male or female. The members of a species may be evenly distributed between the groups, or there may be more dominant categories than others.

GENES OR ENVIRONMENT

Individuals of a species can differ in a variety of ways. Their variations can be **physical** (**anatomical**), **behavioural**, **physiological** or **biochemical**. They can be caused by two separate factors: there is **genetic variation** (also known as **inherited variation**) and there is also **environmental variation**.

Genetic variation is all to do with the genes we inherit from our parents, which define our characteristics. The differences occur due to the combination of different versions of genes – **alleles**. Every individual has a different combination of these alleles (even though you may share a number with another member of the species, the entire set is never the same – unless there are identical twins).

Genes can be separated into two groups. A **dominant gene** is one which will always lead to a certain characteristic in offspring. For example, having brown eyes is a dominant allele. It only takes one parent to have that allele and to pass it on in order for their child to share the allele. A **recessive gene** is one which has to be present in both chromosomes in a pair in order to have the characteristic. For example, having blue eyes is a recessive allele. A child will need to inherit that very allele from both parents in order to have blue eyes.

	B	b
b	Bb	bb
b	bb	bb

We can use a **Punnett square** to help show this. The brown eyes allele (dominant) is shown with a capital letter using its initial, so **B**. The recessive allele takes the same letter of the lower case, in this example **b**. The Punnett square below shows the two parents which have the alleles **Bb** and **bb** respectively. The parent with **Bb** will have brown eyes, as although it has both the brown and blue eyes alleles, the brown eyed one is dominant so that is the result. The parent with **bb** will therefore have blue eyes – there is no brown eyed allele present. As the two produce an offspring, 50% of the genes from each parent are inherited by that child. Therefore there are four possible outcomes for the child's alleles for eye colour as shown (only one allele from each of the parents' pairs is inherited). There is a 75% chance of the child having **bb** (blue eyes) and a 25% chance of the child having **Bb** (brown eyes).

Environmental variation occurs when external environment has an impact on the characteristics of an individual. Some characteristics are more genetic than environmental and vice versa, as many can be affected both by environment and inheritance, but some are purely one or the other. For example, skin colour is both genetic and environmental - two white parents will have a white baby, but that baby can have darker skin by becoming tanned on holiday.

An individual might also have many alleles which are triggered (or *switched on*) by an external environmental factor, which had that environmental influence not been present, would not have been triggered.