

Variation

Revision notes · Continuous and discontinuous variation, what causes them, and how mutation and other processes create genetic variation.

For Cambridge IGCSE Biology 0610 (and 0970, which has the same content). **Supplement** is Extended content, only examined on Papers 2 and 4.

Variation Spec 18.1.1-18.1.10

Continuous and discontinuous variation Spec 18.1.1, 18.1.2, 18.1.3, 18.1.4, 18.1.5

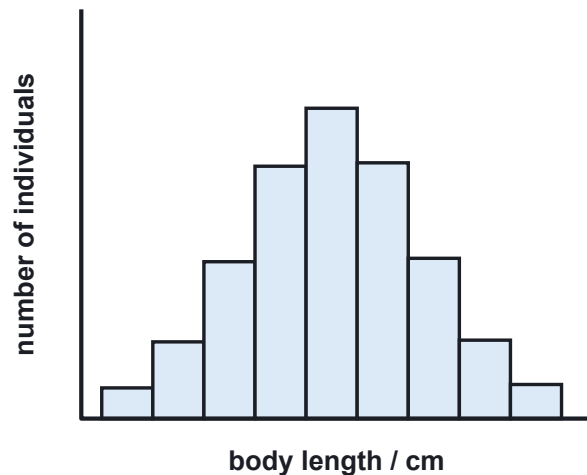
Variation is the differences between individuals of the same species. Two humans, two dogs or two pea plants are never exactly the same.

There are two types of variation: **continuous variation** and **discontinuous variation**.

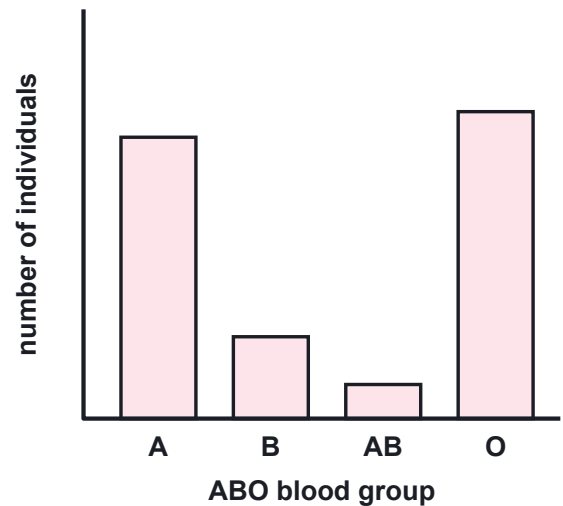
Continuous and discontinuous variation		
	Continuous variation	Discontinuous variation
Phenotypes	A range of phenotypes between two extremes	A limited number of phenotypes with no intermediates
Examples	Body length, body mass	ABO blood groups, seed shape in peas, seed colour in peas
Caused by	Both genes and the environment	Usually genes only
Graph	Histogram (bars touching), often bell-shaped	Bar chart (bars separate)

Think of height. People can be any height between very short and very tall, so there is a whole range. Blood group is different. You are A, B, AB or O. Nobody is half way between A and B.

The environment affects continuous variation. A plant with the genes to grow tall will still be short if it has too little light or water. Your blood group cannot be changed by diet or exercise.



continuous variation
a range of phenotypes
between two extremes



discontinuous variation
a limited number of phenotypes
with no intermediates

Continuous variation gives a range between two extremes (histogram); **discontinuous variation** gives a few distinct groups (bar chart).

Practical skill: Measure or observe one feature in a large sample (at least 30 individuals of the same species and similar age), for example leaf length to the nearest mm with a ruler, or seed colour. Record the results in a tally table, then plot a histogram for a measured (continuous) feature or a bar chart for categories (discontinuous).

Exam tip: Do not just say 'genes and environment'. Say discontinuous variation is usually caused by genes only, and continuous variation is caused by both genes and the environment.

Mutation and sources of genetic variation Spec 18.1.6, 18.1.7, 18.1.8, 18.1.9, 18.1.10

Mutation is genetic change. It is the way in which new alleles are formed. Most mutations have no effect or are harmful, but a few can be useful if the environment changes.

Some things make mutations happen more often. **Ionising radiation** (such as X-rays and gamma rays) and some chemicals (such as chemicals in tobacco smoke) increase the rate of mutation.

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Gene mutation is a random change in the base sequence of DNA. It is random because it cannot be predicted which gene will change, or when. A change in the base sequence can change the amino acids in a protein, so the protein may work differently.

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Sources of genetic variation in a population

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Four processes produce genetic variation in populations:

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- mutation: forms new alleles
- meiosis: makes genetically different gametes with different combinations of alleles
- random mating: any individual can mate with any other of the opposite sex, so different combinations of alleles come together
- random fertilisation: any male gamete can fuse with any female gamete

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Exam tip: Learn the four sources as a list: mutation, meiosis, random mating, random fertilisation. Do not give the environment: it affects phenotype but is not a source of genetic variation.

Quick check

1. Define variation.
2. Give two examples of continuous variation.
3. Give an example of discontinuous variation in humans.
4. What is mutation?
5. **Supplement** State four sources of genetic variation in populations.

Quick check answers

Variation

1. Differences between individuals of the same species.
2. Body length and body mass.
3. ABO blood groups.
4. Genetic change; it is the way new alleles are formed.
5. Mutation, meiosis, random mating and random fertilisation.