

Variation and evolution What causes variation within a population?	Variation and evolution Where do all variants come from, and how many affect the phenotype?
Variation and evolution Define evolution.	Variation and evolution Explain how natural selection leads to evolution.
Variation and evolution When have two populations formed two new species?	Variation and evolution When did the first simple life forms develop?
Variation and evolution What is selective breeding?	Variation and evolution Describe the steps of selective breeding.

Mutations. Most have no effect on the phenotype, some influence it, very few determine it. Rarely a new phenotype suited to an environmental change causes a relatively rapid change in the species.

Genes inherited (genetic), the conditions in which individuals developed (environmental), or both. The phenotype develops from the genome and its interaction with the environment.

Variants with phenotypes best suited to their environment survive and breed, passing on their alleles. Over generations these characteristics become more common.

A change in the inherited characteristics of a population over time through natural selection, which may result in a new species.

More than three billion years ago. All species have evolved from them.

When they become so different in phenotype that they can no longer interbreed to produce fertile offspring.

Choose parents with the desired characteristic and breed them together. Breed the best offspring together. Repeat over many generations.

The process by which humans breed plants and animals for particular genetic characteristics. It is also called artificial selection.

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Give four examples of characteristics chosen by selective breeding.

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What is inbreeding and what problem does it cause?

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Define genetic engineering.

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Give examples of genetic engineering in plants and in bacteria.

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What are GM crops and what are the concerns about them?

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Describe the main steps in genetic engineering.

Variation and evolution **Triple only**

What is tissue culture?

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What are cuttings and embryo transplants?

Breeding closely related individuals. Some breeds become prone to disease or inherited defects.

Disease resistance in crops; more meat or milk from animals; gentle nature in dogs; large or unusual flowers.

Plants: resistance to disease or bigger, better fruit. Bacteria: human insulin to treat diabetes.

Modifying the genome of an organism by introducing a gene from another organism to give a desired characteristic.

Enzymes isolate the gene. It is inserted into a vector (plasmid or virus). The vector inserts the gene into the required cells, at an early stage of development.

Crops with modified genes, for example resistant to insects or herbicides, with increased yields. Concerns: wild flowers and insects, and human health effects not fully explored.

Cuttings: a simple method gardeners use to make identical plants. Embryo transplants: splitting a developing embryo's cells before they specialise, then transplanting the identical embryos into host mothers.

Using small groups of cells from part of a plant to grow identical new plants, to preserve rare species or commercially in nurseries.

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Describe adult cell cloning.

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Give a benefit and a risk of cloning.

Benefit: many identical copies with a useful characteristic, or preserving rare species.
Risk: reduced genetic variation, and some people have ethical objections.

Remove the nucleus from an unfertilised egg cell and insert the nucleus from an adult body cell. An electric shock makes it divide into an embryo, which is inserted into the womb of an adult female.