KNOWLEDGE

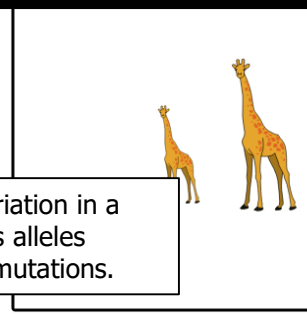
Biology Topic B14 Variation and Evolution

ORGANISER

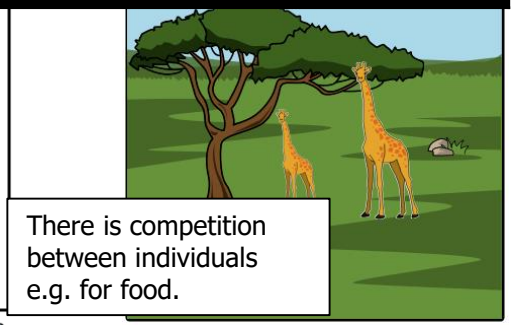
Section 1: Variation and Evolution Key Terms

Variation	The **differences** between organisms. Can be caused by **genes** (e.g. eye colour), the **environment** (e.g. scars) or **both the environment and genes** (e.g. weight). All variation in genes is **caused by mutations**.
Mutation	Mutations are **changes in genes**. **Most have no effect** on the phenotype. Occasionally mutations have a positive effect on phenotype and organisms with these mutations are more likely to survive.
Evolution	The **change in the genes of a population over time**. Occurs through natural selection.
Natural selection	The process by which the **individuals best adapted to the environment survive** and **pass on their genes**.
Speciation	Occurs when **two populations are so different** that they can **no longer breed to produce fertile offspring**. **Two new species** are formed.

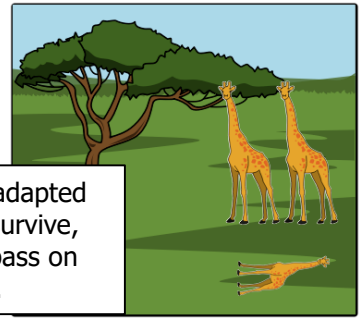
Section 2: Natural Selection



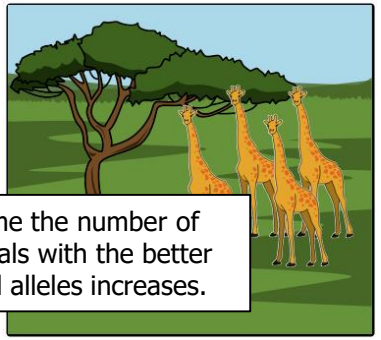
There is variation in a population's alleles caused by mutations.



There is competition between individuals e.g. for food.



The better adapted organisms survive, breed and pass on their alleles.



Over time the number of individuals with the better adapted alleles increases.

Section 3: Selective Breeding

Selective Breeding (Artificial Selection)	The process by which **humans breed plants and animals for particular genetic characteristics.**
Inbreeding	Selective breeding can lead to 'inbreeding' where some breeds are particularly **prone to disease or inherited defects**.

Process of selective breeding:

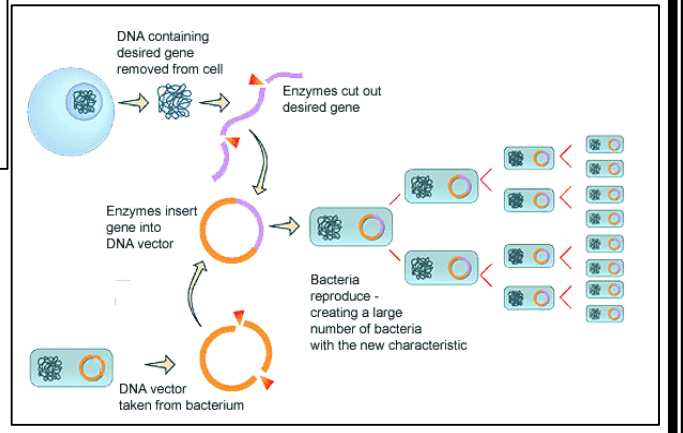
1. Choose parents with correct characteristics from the population.
2. Breed them together.
3. Choose the offspring with the desired characteristics and breed them together.
4. Continue over many generations.

Examples of desired characteristics:

- Disease resistance in food crops.
- Animals which produce more meat or milk.
- Domestic dogs with a gentle nature.
- Large or unusual flowers.

Examples of genetic engineering:

- Bacterial cells have human **insulin gene** inserted into them so that they produce insulin for diabetics.
- Plants that have had genes inserted that make them **resistant to disease, insects** or **herbicides**.



Section 4: Genetic Engineering

Genetic Engineering	A process which involves **modifying the genome** of an organism by **introducing a gene** from another organism to give a desired characteristic.
GM Crop	Crops that have been produced by genetic engineering.
Vector	Something that can **carry a gene into another organism** e.g. **bacterial plasmid** or **virus.**

Process of genetic engineering:

1. Genes are cut out by enzymes.
2. The gene is inserted into a vector (either a bacterial plasmid or virus).
3. The vector is used to insert the gene into the required cells
4. Genes are transferred to the cells of animals, plants or microorganisms at an early stage in their development so that they develop with desired characteristics.

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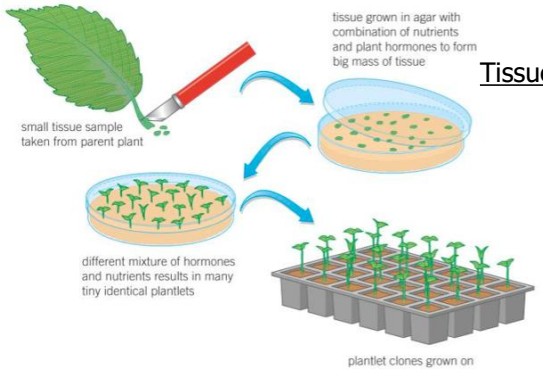
Section 1: Cloning plants and animals

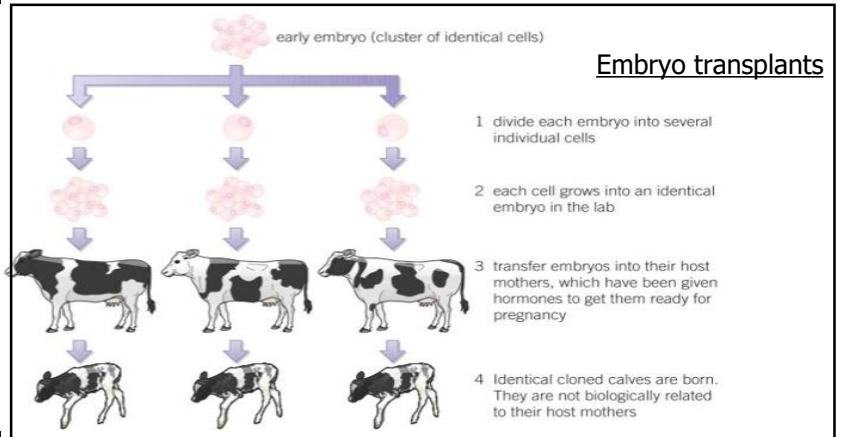
Clone	A genetically identical (to the parent) organism
Cuttings	Gardeners take cuttings to clone plants. **Quick**, **cheap** but **only one** clone at a time
Tissue culture	Scientists clone plants by taking a few plant cells and growing them in a growth medium with hormones. **Mass production** of clones but quite **expensive** compared to cuttings
Embryo transplants	Sperm taken from a 'champion' male animal, used to fertilise a 'champion' egg. An embryo develops and is split many times before any cells become specialised. Cloned embryos are implanted into host mothers resulting in cloned baby animals
Adult cell cloning	Take an unfertilised egg cell and remove its nucleus. A nucleus from an adult body cell is removed and inserted into this empty egg cell. An electric shock fused the two together and stimulates division. An embryo forms and is implanted into he uterus of a female host. A clone of the original adult cell is produced as it has the same genetic information

Issues	**Negatives**	**Positives**
	• Reduces the gene pool • Animal clones might not be as healthy as the normal ones • Worry of human cloning in the future	• Preserve endangered species • Studying animal clones can lead to better understanding of embryo development

Tissue culture



Embryo transplants



Adult cell cloning