

Natural selection and genetic modification

Natural selection

Darwin and Wallace **Triple only**

- Independent theories
- On the Origin of Species
- Impact on biology

Natural selection

- Variation by mutation
- Survive and reproduce
- Pass on alleles

Evolution

- Inherited change
- Many generations

Antibiotic resistance

- Resistant mutant
- Antibiotic selection pressure
- Population becomes resistant

Evidence

Fossils

- Ardi 4.4 mya
- Lucy 3.2 mya
- Leakey 1.6 mya

Stone tools

- Become more complex
- Dated from rock layers

Pentadactyl limb **Triple only**

- Same bones
- Common ancestor
- Different functions

Classification

- Five kingdoms
- Three domains
- Genetic analysis

Breeding and cloning

Selective breeding

- Choose parents
- Repeat generations
- Higher yield

Drawbacks

- Less variation
- Inbreeding

Tissue culture **Triple only**

- Aseptic technique
- Nutrient agar
- Identical clones

Uses of tissue culture **Triple only**

- Plant breeding
- Medical research

Genetic engineering

Modify the genome

- Desirable characteristic
- Gene transferred

Main stages **Higher tier**

- Restriction enzyme
- Sticky ends
- Ligase
- Vector

Bt crops **Triple only**

- Bt toxin gene
- Insect resistance

GM advantages and disadvantages **Triple only**

- Higher yield
- Health risk
- Gene spread

Agriculture and evaluation

Fertilisers **Triple only**

- Mineral ions
- Water pollution

Biological control **Triple only**

- Living organisms
- Slow
- May become pest

Benefits

- More food
- New medicines

Risks and ethics

- Unknown effects
- Practical issues
- Ethical concerns