

Selective breeding and tissue culture

Revision notes · How selective breeding changes food plants and domesticated animals, and how tissue culture makes identical plants and cells.

For Edexcel GCSE Biology 1BI0 and Combined Science 1SC0. **Triple only** is not in Combined Science. **Higher tier** is only on the Higher paper.

Selective breeding and tissue culture Spec 4.8–4.9B

Selective breeding Spec 4.8

Selective breeding is when humans choose which organisms to breed so that the desired characteristics are passed on to the next generation. It has been used for thousands of years.

1. Decide which characteristic is wanted, for example high milk yield or disease resistance.
2. Choose parents that show the characteristic most strongly and breed them together.
3. From the offspring, select those with the characteristic and breed them together.
4. Repeat over many **generations** until the desired characteristic is strongly shown.

Examples of selective breeding

Organism type	Characteristics selected for
Food plants (crops)	Disease resistance, larger fruit or grains, better taste, higher yield
Domesticated animals	More milk, more meat, more eggs, a gentle nature, wool quality

Impact of selective breeding

- Food plants and animals give **higher yields**, so more food can be produced from the same land.
- Crops can be bred to resist disease, so less is lost.
- Breeding from only a few individuals reduces **genetic variation** in the population. If a new disease or a change in the environment appears, all individuals may be affected, and the population could die out.
- Closely related individuals are bred together (inbreeding), which can make harmful inherited conditions more common in domesticated animals.

Probability in a selective breeding cross

In a plant, disease resistance is controlled by a dominant allele R, and susceptibility by the recessive allele r. Two resistant plants with the genotype Rr are crossed. What is the probability that an offspring is susceptible to the disease?

1. Gametes from each parent: R or r
2. Possible offspring: RR, Rr, Rr, rr
3. Only rr is susceptible: 1 out of 4

Answer: The probability is 1/4 (25%). The ratio of resistant to susceptible offspring is 3 : 1.

Exam tip: Always say that selection is repeated over many generations. Mark schemes award a mark for this.

Tissue culture Spec 4.9B Triple only

Tissue culture is growing new cells or tissues from small pieces of tissue, using sterile conditions and a growth medium.

1. Take a small piece of tissue or a few cells from the parent plant.
2. Use **aseptic technique** so that bacteria and fungi do not contaminate the culture.
3. Place the tissue on a sterile **nutrient medium** (such as agar) containing nutrients and growth hormones.
4. The cells divide, forming a mass of cells that grow into small plants, which are genetically identical to the parent.

Advantages in plant breeding programmes

- Many identical plants can be produced **quickly**, from a very small amount of tissue.
- Plants with desirable characteristics, such as those produced by selective breeding or genetic engineering, can be copied exactly.
- Plants can be produced all year round, in a small space.
- Rare plants can be reproduced to help save them.

Advantages in medical research

- Large numbers of identical cells can be grown for research, so results are reliable.
- New drugs can be tested on cultured cells, reducing the need to test on animals or people.
- Cells can be used to study how diseases develop.

Exam tip: 'Identical' is the key word for plant breeding: tissue culture produces genetically identical offspring, so useful characteristics are kept.

Quick check

1. What is selective breeding?
2. Name two characteristics selected for in food plants.
3. Why can selective breeding be a risk to a population?

Quick check answers

Selective breeding and tissue culture

- 1 . Choosing parents with desired characteristics to breed together, and repeating this over many generations.
- 2 . Any two of: disease resistance, larger fruit or grains, better taste, higher yield.
- 3 . It reduces genetic variation, so a new disease or change could affect all individuals.