

Edexcel Biology GCSE

Topics 4.8 to 4.14 - Changing genes

Flashcards

What is selective breeding?

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The process by which humans artificially select organisms with desirable characteristics and breed them to produce offspring with similar phenotypes

Outline the main steps involved in selective breeding

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1. Identify a desired characteristic e.g. disease resistance
2. Select parent organisms that show the desired traits and breed them together
3. Select offspring with the desired traits and breed them together
4. Process repeated until all offspring have the desired traits

What is the main advantage of selective breeding?

What is the main advantage of selective breeding?

Creates organisms with desirable features:

- Crops produce a higher yield of grain
- Cows produce a greater supply of milk
- Plants produce larger fruit
- Domesticated animals

Other than in agriculture, where else is selective breeding useful?

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- In medical research
- In sports e.g. horse racing

Outline the disadvantages of selective breeding (4)

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- Reduction in the gene pool (which becomes especially harmful if sudden environmental change occurs)
- Inbreeding results in genetic disorders
- Development of other physical problems e.g. respiratory problems in bulldogs
- Potential to unknowingly select harmful recessive alleles

How can plants be cloned? (2)

(biology only)

How can plants be cloned? (2) (biology only)

- Taking plant cuttings
- Tissue culture

What is tissue culture? (biology only)

What is tissue culture? (biology only)

A method of growing living tissue in a suitable medium.

Describe how plants are grown using
tissue culture (biology only)

Describe how plants are grown using tissue culture (biology only)

1. Select a plant that shows desired characteristics
2. Cut multiple small sample pieces from meristem tissue
3. Grow in a petri dish containing growth medium
4. Transfer to compost for further growth

What must be ensured when preparing
tissue cultures? (biology only)

What must be ensured when preparing tissue cultures? (biology only)

Ensure aseptic conditions to prevent contamination by microorganisms

What does the growth medium contain?
(biology only)

What does the growth medium contain?
(biology only)

Nutrients and growth hormones

What are the advantages of growing
plants by tissue culture? (4)
(biology only)

What are the advantages of growing plants by tissue culture? (4) (biology only)

- Fast and simple process
- Requires little space
- Enables the growth of many plant clones with the same desirable characteristics
- Useful in the preservation of endangered plant species

What are the disadvantages of growing
plants by tissue culture? (4)
(biology only)

What are the disadvantages of growing plants by tissue culture? (2) (biology only)

- Reduction in the gene pool
- Plant clones often have a low survival rate
- Could unknowingly increase the presence of harmful recessive alleles

Why is animal tissue culturing useful? (biology only)

Why is animal tissue culturing useful? (biology only)

- Useful in the preparation of tissue samples for medical research
- Enables the investigation of how different factors may affect a specific animal tissue, without harming the animal itself

Describe how animal tissue cultures are prepared (biology only)

Describe how animal tissue cultures are prepared (biology only)

1. Extract a sample of tissue from an animal
2. Use enzymes to separate cells within the sample
3. Grow in a culture vessel containing growth medium
4. Once grown, store the sample

What is genetic engineering?

What is genetic engineering?

- The modification of the genome of an organism by the insertion of a desired gene from another organism
- Enables the formation of an organism with beneficial characteristics

Describe the process of genetic engineering (higher)

Describe the process of genetic engineering (**higher**)

1. DNA is cut at specific base sequences by **restriction enzymes** to create **sticky ends**
2. **Vector DNA** cut using the same restriction enzymes to create complementary sticky ends
3. **Ligase enzymes** join the sticky ends of the DNA and vector DNA forming **recombinant DNA**
4. Recombinant DNA mixed with and 'taken up' by target cells

What is a vector? (higher)

What is a vector? (higher)

A structure that delivers the desired gene into the recipient cell e.g. plasmids, viruses

Describe the benefits of genetic engineering (3)

Describe the benefits of genetic engineering (3)

- Increased crop yields for growing population e.g. herbicide-resistance, disease-resistance
- Useful in medicine e.g. insulin-producing bacteria, anti-thrombin in goat milk
- GM crops produce scarce resources e.g. GM golden rice produces beta-carotene (source of vitamin A in the body)

Describe the risks of genetic engineering (4)

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- Long-term effects of consumption of GM crops unknown
- Negative environmental impacts e.g. reduction in biodiversity, impact on food chain, contamination of non-GM crops forming 'superweeds'
- Late-onset health problems in GM animals
- GM seeds are expensive. LEDCs may be unable to afford them or may become dependent on businesses that sell them.

What is *Bacillus thuringiensis* (Bt)? (biology only)

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- Insect larvae are harmful to crops
- Bt is a bacterium which secretes a toxin that kills insect larvae

How is genetic engineering used to protect crops against insects? (biology only)

How is genetic engineering used to protect crops against insects? (biology only)

- The gene for toxin production in Bt can be isolated and inserted into the DNA of crops
- Bt crops now secrete the toxin which kills any insect larvae that feed on it

What are the benefits of Bt crops? (3)

(biology only)

What are the benefits of Bt crops? (3) (biology only)

- Increased crop yields (fewer crops damaged)
- Lessens the need for artificial insecticides
- Bt toxin is specific to certain insect larvae so is not harmful to other organisms that ingest it

What are the risks of Bt crops? (3)

(biology only)

What are the risks of Bt crops? (3) (biology only)

- Long term effects of consumption of Bt crops unknown
- Insect larvae may become resistant to the Bt toxin
- Killing insect larvae reduces biodiversity

Outline the agricultural methods of increasing food production (2) (biology only)

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- Intensive farming methods e.g. ‘battery’ farming and the use of fertilisers and pesticides
- Biological control

What is the main advantage of intensive farming? (biology only)

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(biology only)

Increases crop yields

What are the disadvantages of intensive farming methods? (3) (biology only)

What are the disadvantages of intensive farming methods? (3) (biology only)

- Fertilisers can wash into nearby water sources and cause **eutrophication**
- The use of herbicides and insecticides **reduces biodiversity**
- ‘Battery’ farming is often seen as **unethical**

What is biological control? (biology only)

What is biological control? (biology only)

When a new organism (often a predator) is introduced into an ecosystem to control a pest or pathogen

What are the advantages of using biological control to increase food production? (biology only)

What are the advantages of using biological control to increase food production? **(biology only)**

- The results of biological control generally last for a long period of time
- The effects on wildlife are less severe

What is the risk of using biological control? (biology only)

What is the risk of using biological control?
(biology only)

Risk of the control organism becoming a
pest itself