

Gene Projects - Questions by Topic

Q1.

The scientific article you have studied is adapted from several sources.

Use the information from the scientific article and your own knowledge to answer the following questions.

Tabor used enzymes to genetically modify a 'harmless species of *Escherichia coli*' (paragraph 26).

Describe the functions of the enzymes used to genetically modify bacteria.

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(Total for question = 4 marks)

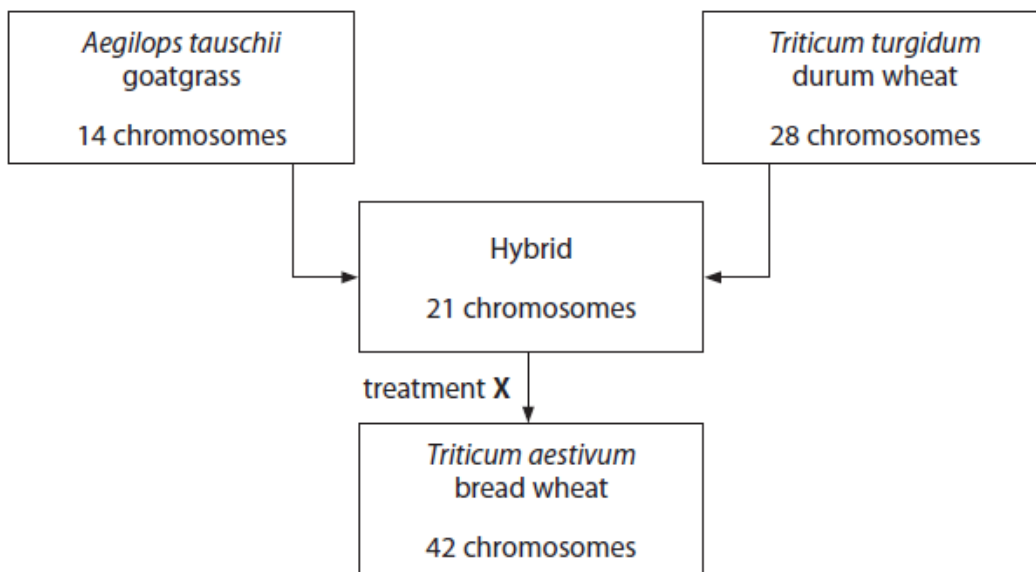
Q2.

The modern bread wheat plant (*Triticum aestivum*) has been developed from other plant species that have different genomes.

Three species of plant and their genomes are shown in the images.



The diagram shows how chromosomes from different species have combined to produce the bread wheat species used to produce flour.



* New varieties of plants with desirable combinations of characteristics can be produced using the methods shown in the table.

Method	Example
Formation of hybrids	In wheat, genome D includes genes for a tolerance of harsh conditions and genome A promotes large starch stores in seeds.
Genetic modification	Production of specific molecules in plant cells.
Selective breeding	Plants with desired characteristics can be used for breeding to produce plants with combinations of desired characteristics.

Evaluate the risks and benefits of producing varieties of plants using these methods.

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Q3.

Glucosaminoglycans (GAGs) are the by-products of chemical reactions inside cells. GAGs are broken down by enzymes inside lysosomes in cells.

Mucopolysaccharidosis type I (MPS I) is a genetic condition that results in the build-up of GAGs inside cells.

MPS I affects the production of enzyme G that breaks down GAGs inside lysosomes.

More than 50 different mutations in the gene for enzyme G have been found to result in MPS I. Most of these mutations involve changing a single base in the gene.

(i) Explain how a single base mutation can lead to an altered primary structure of enzyme G.

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(ii) Explain how human genome sequencing can be used to identify the mutations associated with MPS I.

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(Total for question = 6 marks)

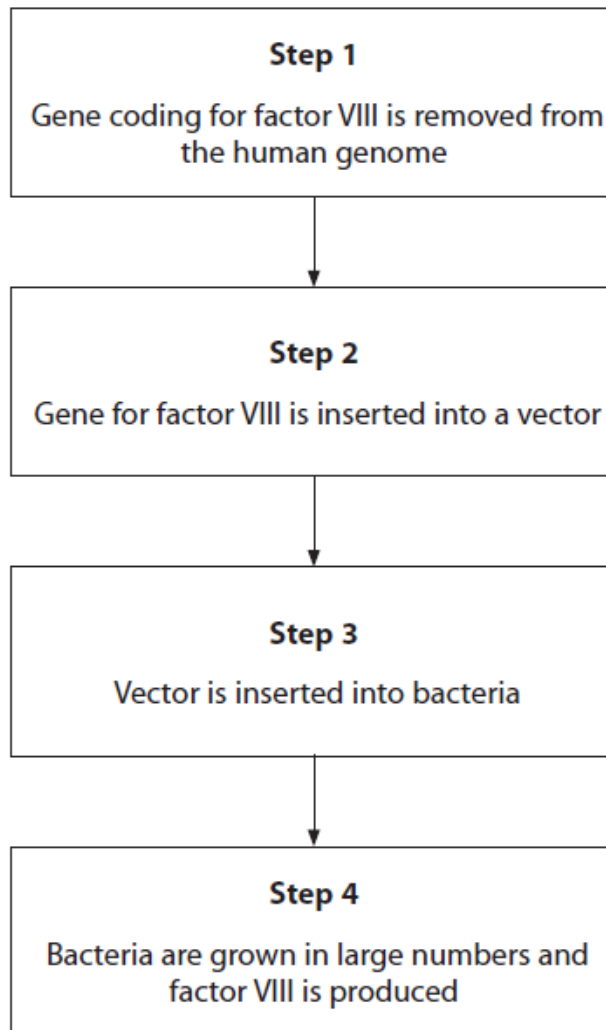
Q4.

Haemophilia is a genetic disorder where blood does not clot normally.

It can be treated by injecting factor VIII, a protein involved in the blood-clotting process that is not produced by people with haemophilia type A.

Bacteria can be genetically modified to produce factor VIII.

(a) The diagram shows some of the steps involved in genetically modifying bacteria to produce factor VIII.



(i) Describe the difference between a gene and the genome

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(ii) Give the name of the type of enzyme that would be used to insert the gene into the DNA of the vector at Step 2.

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(iii) Give an example of a suitable vector that would be used in Step 2 or 3.

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(iv) Describe how the genetically modified bacteria would use the gene from the human genome to produce factor VIII in Step 4.

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(b) Factor VIII is required for the activation of prothrombin.

Explain why the blood-clotting process does not take place normally when a person with haemophilia type A cuts their hand.

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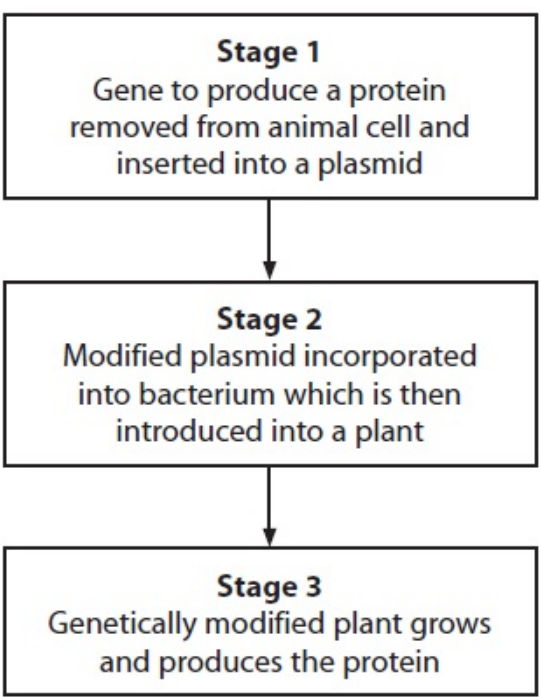
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(Total for question = 9 marks)

Q5.

Some organisms have been genetically modified to produce proteins including hormones and vaccines.

The flow diagram below shows part of a process to produce a protein, using genetically modified plants.



(a) Describe and explain the role of the enzymes involved in stage 1.

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(b) Describe the structure of the modified plasmid used in stage 2.

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(c) Suggest why plants rather than bacteria are used to produce the protein in stage 3.

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(d) Describe **two** risks associated with the use of genetically modified organisms.

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(Total for question = 11 marks)