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90718



NEW ZEALAND QUALIFICATIONS AUTHORITY
MANA TOHU MĀTAURANGA O AOTEAROA



National Certificate of Educational Achievement
TAUMATA MĀTAURANGA Ā-MOTU KUA TAEA

Level 3 Biology, 2005

90718 Describe applications of biotechnological techniques

Credits: Three

9.30 am Tuesday 15 November 2005

Check that the National Student Number (NSN) on your admission slip is the same as the number at the top of this page.

You should answer ALL the questions in this booklet.

If you need more space for any answer, use the page(s) provided at the back of this booklet and clearly number the question.

Check that this booklet has pages 2–6 in the correct order and that none of these pages is blank.

YOU MUST HAND THIS BOOKLET TO THE SUPERVISOR AT THE END OF THE EXAMINATION.

<i>For Assessor's use only</i>			
Achievement Criteria			
Achievement		Achievement with Merit	
			Achievement with Excellence
Describe applications of biotechnological techniques to meet human needs and demands.	<input type="checkbox"/>	Explain applications of biotechnological techniques to meet human needs and demands.	<input type="checkbox"/>
			Discuss applications of biotechnological techniques to meet human needs and demands.
Overall Level of Performance			<input type="checkbox"/>

You are advised to spend 30 minutes answering the questions in this booklet.

QUESTION ONE

DNA profiling is one of the most useful applications of a biotechnology.

- (a) Describe the purpose of DNA profiling.

- (b) Fathers who contest paternity often have DNA profiles done to support their case. Explain how DNA profiling can be used to prove paternity.

- (c) Crimes are often solved using very small samples of DNA from the crime scene.

Discuss why the purity of the sources of material for DNA profiling is critical, especially when it is used to solve a crime.

QUESTION TWO

Muscles grow in response to use. Growth and anti-growth factors combine to regulate the development of muscles. Insulin-like growth factor or IGF-1 is a protein that is one of the muscle growth factors. Scientists are investigating the possibility of helping patients with muscle-wasting conditions by inserting the gene that produces IGF-1 directly into affected muscles – a form of gene therapy. Simply inserting the protein, IGF-1 itself, is ineffective as IGF-1 breaks down too rapidly to be an effective ongoing muscle builder.



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Resource material based on *Scientific American* July 2004, 'Gene Doping', Lee Sweeney, Chair of Physiology, University of Pennsylvania.

- (a) Describe the sequence of biotechnological processes to produce a vector to carry the gene that makes the IGF-1 protein for gene therapy purposes.

Scientists have designed a synthetic gene for IGF-1 that is only switched on in muscle tissue.

- (b) Explain how the synthetic gene would be better than using the unmodified gene to meet a human need.

QUESTION THREE

Fish oils, known to protect against heart attacks, can now be made by land animals thanks to work by genetic engineers.

Using a virus, researchers have inserted a gene called *fat-1*, from a nematode worm, into the fat-storing cells of mice. This gene enabled the mammals to convert omega-6 fatty acids into omega-3 fatty acids. The oils produced by these fatty acids, as well as protecting the heart and blood circulation, are thought to reduce inflammation and may even combat cancer.

Fish such as mackerel, salmon and herring contain omega-3 oils but many people do not eat enough of these, and dietary supplements containing the oils are expensive. Genetically modified farm animals could rectify this problem.

The research team plans to modify chickens first.

Based on an article in the *New Scientist*, 2004, 'Gene Therapy Burns off Fat'.

- (a) Describe how this research would meet a human need or demand.

- (b) Describe where the gene would need to be inserted if a chicken was to be produced that could be certain to pass the *fat-1* gene onto its offspring.

- (c) Evaluate the advantages and disadvantages of using a virus for gene insertion.

**Extra paper for continuation of answers if required.
Clearly number the question.**

Question
number

