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90715



NEW ZEALAND QUALIFICATIONS AUTHORITY
MANA TOHU MĀTAURANGA O AOTEAROA



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

Level 3 Biology, 2004

90715 Describe gene expression

Credits: Four

9.30 am Thursday 25 November 2004

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 provided at the back of this booklet and clearly number the question.

Check that this booklet has pages 2–11 in the correct order and that none of these pages is blank.

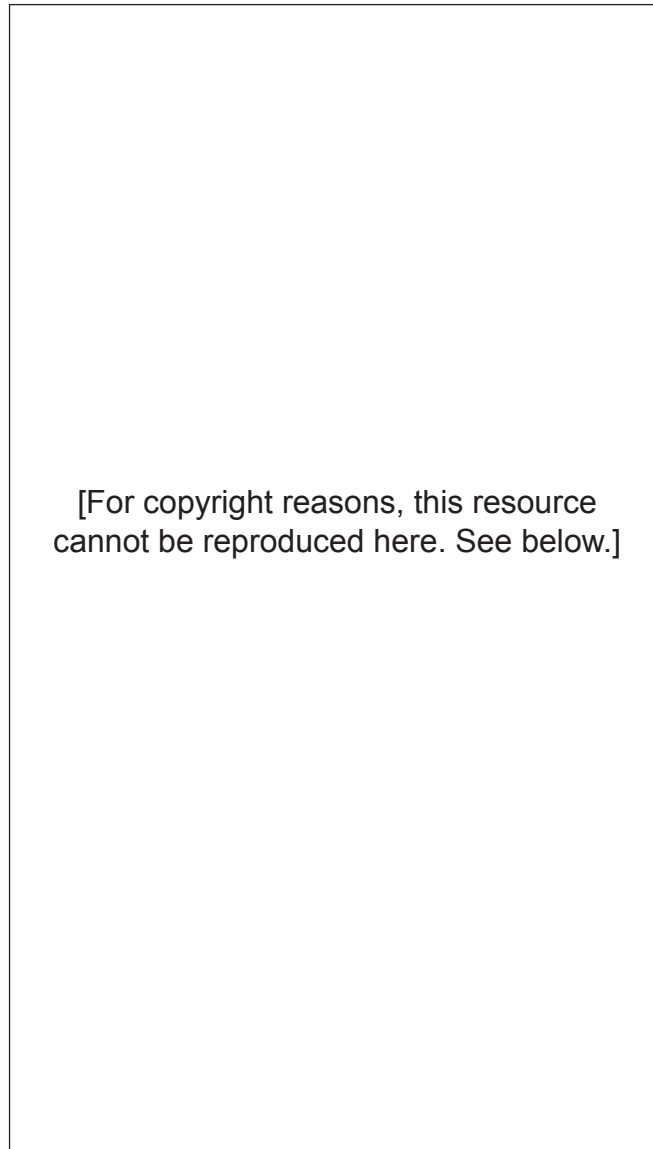
YOU MUST HAND THIS BOOKLET TO THE SUPERVISOR AT THE END OF THE EXAMINATION.

Achievement Criteria		For Assessor's use only	
Achievement		Achievement with Merit	Achievement with Excellence
Describe biological concepts and processes relating to gene expression.	<input type="checkbox"/>	Explain biological concepts and processes relating to gene expression.	<input type="checkbox"/>
Overall Level of Performance			<input type="checkbox"/>

You are advised to spend 40 minutes answering the questions in this booklet.

QUESTION ONE: MOLECULAR GENETICS

One form of leukaemia is associated with a recognisable change in the genetic material of the cell where parts of chromosomes 9 and 22 of the person with the disease are exchanged, as shown in the following diagram.



[For copyright reasons, this resource cannot be reproduced here. See below.]

adapted from <http://www.hosprract.com/genetics/9909mmc.htm>

The break point on each chromosome interrupts an existing gene. Remarkably, the new gene sequence formed on the new chromosome 22 functions to form a protein. This new protein interacts with other cell chemicals, producing more than one effect. It stops normal cell death and activates genes involved with cell reproduction, so that cells do not recognise their surroundings and constantly divide.

- (a) Identify and explain the process where one gene can have more than one effect on an organism.

- (b) Explain why the phenotypic effect of mutations such as the one outlined on page 2 are not often seen.

- (c) Explain how **transcription factors** might be involved with the formation of the new protein.

- (d) Discuss why it is remarkable that the new gene sequence formed on the small chromosome codes for a functional protein.

- Triplex drugs, which are made from DNA nucleotides and bind to DNA forming a triple helix.
- Antisense drugs that are made of RNA nucleotides and block the function of mRNA that has been made.

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- [illegible]

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(a) Coat colour in mice is controlled by a single gene with two alleles, one of which is a yellow fur allele and the other a grey fur allele. The gene is not sex linked. A large number of crosses between two yellow mice were carried out, resulting in the following numbers of offspring:

Litters were unusually small.

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QUESTION THREE: ENVIRONMENT AND GENE EXPRESSIONAssessor's
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Like many other reptiles, the incubation temperature of tuatara eggs has been found to be quite critical in sex determination. If tuatara eggs are incubated at 21° Celsius or below, they hatch into females. If they are incubated at 22° Celsius or above, they hatch into males.

- (a) There is a tendency for tuatara on their island sanctuaries to lay eggs on south facing slopes under a thin covering of soil. Explain why this benefits their conservation.

- (b) Describe another example of the effect of the environment on gene expression in a species other than humans.

[illegible]