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90459

NEW ZEALAND QUALIFICATIONS AUTHORITY
MANA TOHU MĀTAURANGA O AOTEAROA

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

Level 2 Biology, 2003

90459 Describe concepts and processes that relate to genetic variation and change

Credits: Three
2.00 pm Monday 17 November 2003

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

Check that this booklet has pages 2–10 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.

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Achievement Criteria		
Achievement	**Achievement with Merit**	**Achievement with Excellence**
Describe biological concepts and processes that relate to genetic variation and change. ☐	Explain biological concepts and processes that relate to genetic variation and change. ☐	Discuss biological concepts and processes that relate to genetic variation and change. ☐
Overall Level of Performance ☐		

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

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QUESTION ONE: Woolly Lambs

Use the information below to answer questions (a) and (b).

The characteristics of fecundity and wool fibre diameter in sheep are controlled by two separate genes. The alleles of these two genes are incompletely dominant. This means a sheep that is heterozygous for one of these characteristics has a phenotype that is in-between the homozygous dominant phenotype and the homozygous recessive phenotype.

The fecundity gene causes the ewes to produce multiple lambs:

- BB produces triplets (3 lambs)
- Bb produces twins (2 lambs)
- bb produces singles (1 lamb).

For wool fibre diameter:

- NN produces a sheep with thick wool fibre
- Nn produces a sheep with mixed wool fibre
- nn produces a sheep with normal wool fibre.

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Drysdale ewe with twin lambs

[Source: http://www.nzsheep.co.nz/drysdale/index.htm]

(a) Complete the Punnett square to show the possible genotypes of the offspring produced by crossing a ewe (female) and a ram (male) that are both heterozygous for **both** fecundity and wool fibre diameter.

Ewe's gametes

Ram's gametes				

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(b) Complete the table below to summarise the information about the possible offspring of the mating in (a). List the expected genotypes, the expected proportion of offspring for EACH genotype, and describe the phenotype of EACH of the expected genotypes.

Expected genotypes	Expected proportion of offspring	Description of phenotype that would be shown by this genotype

(c) The allele for higher fecundity in sheep was produced by a mutation. This process, that creates a new allele of a gene, is often referred to as the 'ultimate source of genetic variation'.

Explain why a mutation can be called the 'ultimate source of genetic variation' when other sources of variation cannot.

QUESTION TWO: Arapawa Sheep

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Sheep have been known on Arapawa Island in the Marlborough Sounds for at least 130 years. A few sheep most probably escaped from a flock of merino sheep introduced to New Zealand in 1867.

Arapawa sheep survive on very steep land, in bad weather conditions and with poor quality food. They survive in conditions that are more difficult than the conditions on most sheep farms in New Zealand. As a result, these sheep are now small, light, lean, long-legged and very active. Their most common colouring is all black but they often have white noses.

Arapawa sheep shed their wool. Most types of wild sheep shed their wool but this characteristic has been bred out of farmed sheep. Arapawa sheep are also more resistant than farmed sheep to attack by flies.

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Arapawa sheep

[Source: http://www.rarebreeds.co.nz/ferals.html]

Identify and discuss the **processes** that cause genetic change and are likely to have led to the distinct characteristics of Arapawa sheep.

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QUESTION THREE: Variation and Change

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(a) Sexual reproduction produces genetic variation within a population through the processes of recombination, independent assortment and fertilisation.

(i) Describe how **fertilisation** produces genetic variation. You may use diagrams in your answer.

(ii) Discuss how **recombination** and **independent assortment** during meiosis affect the genetic variation between individuals in a population. You may use diagrams in your answer.

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(b) Describe how the gene pool of a population is affected by the migration of individuals into the population.

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(c) New males, or semen, are often brought into populations of farmed or zoo animals for breeding purposes. Explain how this practice benefits these populations.

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

Assessor's use only

Question Number

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