

91159



NEW ZEALAND QUALIFICATIONS AUTHORITY
MANA TOHU MĀTAURANGA O AOTEAROA

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Level 2 Biology, 2014

91159 Demonstrate understanding of gene expression

9.30 am Monday 17 November 2014

Credits: Four

Achievement	Achievement with Merit	Achievement with Excellence
Demonstrate understanding of gene expression.	Demonstrate in-depth understanding of gene expression.	Demonstrate comprehensive understanding of gene expression.

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 attempt 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 2–12 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.

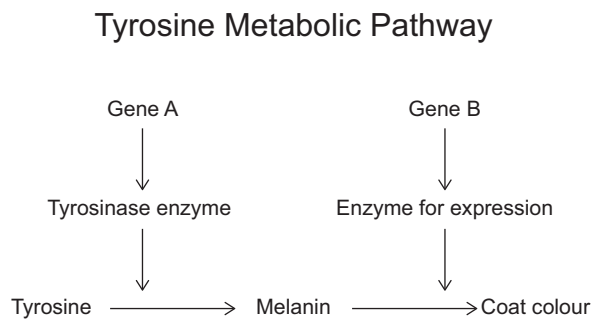
TOTAL

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The examination continues on the following page.**

QUESTION TWO: COAT COLOUR

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[http://en.wikipedia.org/wiki/Siamese_\(cat\)](http://en.wikipedia.org/wiki/Siamese_(cat))

Skin and hair colouring are influenced by the pigment melanin. Melanin is a protein that is made via the tyrosine pathway, and there are two genes involved in the pathway, which lead to its expression.

Albino animals lack the pigment melanin, and so have no colouring of their skin, hair, and eyes. Siamese cats, like the one in the picture above, show a form of albinism. However, Siamese cats possess a mutated gene that codes for the enzyme tyrosinase, which is an enzyme in the melanin expression pathway. This enzyme is temperature sensitive, and so Siamese cats can produce the pigment melanin in body extremities, such as the feet, tail, and face, which gives them darker colouring.

Discuss how the metabolic pathway for melanin and the environment interact to influence the coat colour in Siamese cats.

In your answer:

- describe what a metabolic pathway is
- explain why Siamese cats have darker colouration around their body extremities such as the nose, feet and tail, and **not** around their chest area
- using the diagram above, discuss how genes and enzymes control the metabolic pathway for melanin, and how this causes Siamese cats to be albino.

QUESTION THREE: THE GENETIC CODE

mRNA (codon) : Amino Acid Table

		Second Position					
		U	C	A	G		
First Position	U	UUU Phe	UCU Ser	UAU Tyr	UGU Cys	Third Position	U
		UUC Phe	UCC Ser	UAC Tyr	UGC Cys		C
		UUA Leu	UCA Ser	UAA STOP	UGA STOP		A
		UUG Leu	UCG Ser	UAG STOP	UGG Trp		G
	C	CUU Leu	CCU Pro	CAU His	CGU Arg		U
		CUC Leu	CCC Pro	CAC His	CGC Arg		C
		CUA Leu	CCA Pro	CAA Gln	CGA Arg		A
		CUG Leu	CCG Pro	CAG Gln	CGG Arg		G
	A	AUU Ile	ACU Thr	AAU Asn	AGU Ser		U
		AUC Ile	ACC Thr	AAC Asn	AGC Ser		C
		AUA Ile	ACA Thr	AAA Lys	AGA Arg		A
		AUG Met	ACG Thr	AAG Lys	AGG Arg		G
G	GUU Val	GCU Ala	GAU Asp	GGU Gly	U		
	GUC Val	GCC Ala	GAC Asp	GGC Gly	C		
	GUA Val	GCA Ala	GAA Glu	GGA Gly	A		
	GUG Val	GCG Ala	GAG Glu	GGG Gly	G		

Tracey Greenwood, Richard Allan, *Year 12 Biology 2003*, (Hamilton: Biozone, 2003), p 287.

(a) The mRNA codon sequence for part of a normal haemoglobin protein is shown in the table below.

- Complete the normal template DNA sequence in the table below.
- Complete the normal amino acid sequence using the mRNA : Amino Acid table above

Normal template DNA								
Normal mRNA	AUG	GUG	CAC	CUG	ACU	CCU	GAG	UUG
Normal amino acid								

