See back cover for an English translation of this cover

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91159M

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NEW ZEALAND QUALIFICATIONS AUTHORITY
MANA TOHU MĀTAURANGA O AOTEAROA

Koiora, Kaupae 2, 2014

91159M Te whakaatu māramatanga ki te whakatinana ira

9.30 i te ata Rāhina 17 Whiringa-ā-rangi 2014
Whiwhinga: Whā

Paetae	Kaiaka	Kairangi
Te whakaatu māramatanga ki te whakatinana ira.	Te whakaatu māramatanga hōhonu ki te whakatinana ira.	Te whakaatu māramatanga matawhānui ki te whakatinana ira.

Tirohia mehemea e ōrite ana te Tau Ākonga ā-Motu (NSN) kei tō pepa whakauru ki te tau kei runga ake nei.

Me whakautu e koe ngā pātai KATOA kei roto i te pukapuka nei.

Ki te hiahia koe ki ētahi atu wāhi hei tuhituhi whakautu, whakamahia te (ngā) whārangi kei muri i te pukapuka nei, ka āta tohu ai i ngā tau pātai.

Tirohia mehemea kei roto nei ngā whārangi 2–21 e raupapa tika ana, ā, kāore hoki he whārangi wātea.

HOATU TE PUKAPUKA NEI KI TE KAIWHAKAHAERE HEI TE MUTUNGA O TE WHAKAMĀTAUTAU.

TAPEKE

MĀ TE KAIMĀKA ANAKE

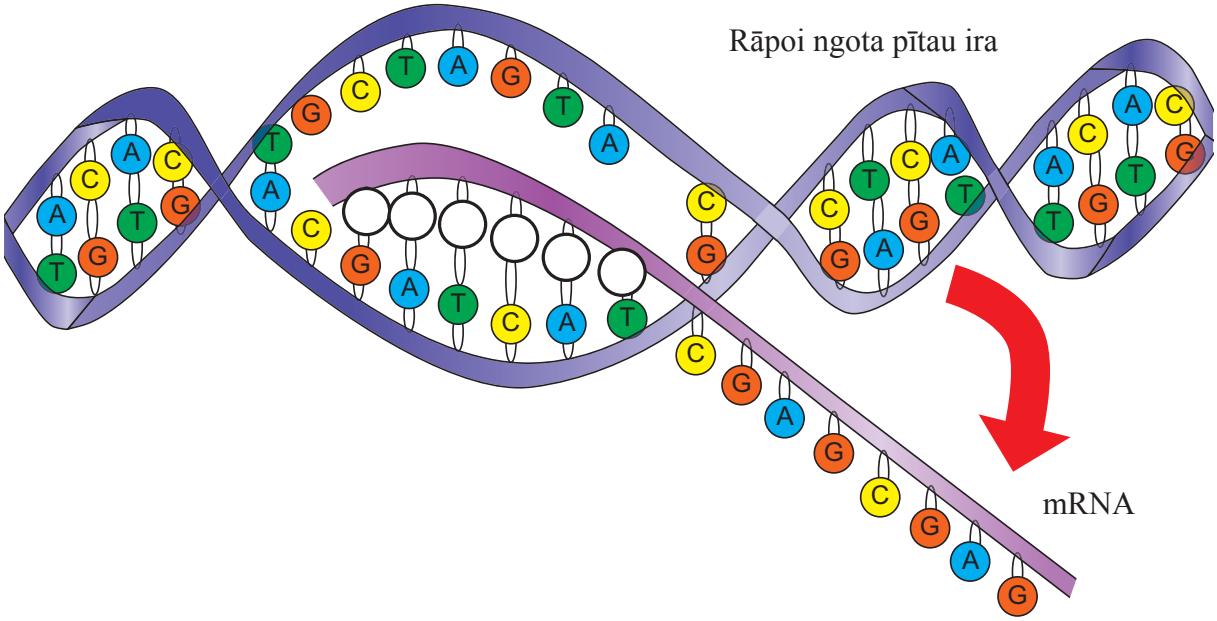
© Mana Tohu Mātauranga o Aotearoa, 2014. Pūmau te mana.
Kia kaua rawa he wāhi o tēnei tuhinga e tāruatia ki te kore te whakaaetanga a te Mana Tohu Mātauranga o Aotearoa.

MĀ TE KAIMĀKA ANAKE

PĀTAI TUATAHI: TE MAHI PŪMUA

(a) E whakaatu ana te hoahoa i raro i te tukanga pūtau, te tauwhaituhi.

Ki te hoahoa, whakakīhia ngā pāpāhua kei te ngaro i te aho mRNA.



He mea urutau mai i http://www.scientificpsychic.com/fitness/aminoacids1.html

(b) E rua ngā wāhanga o te kōtuitanga pūmua: te tauwhaituhi me te tahuringa.

Whakatauritea, ka whakatauaro i ēnei tukanga pūtau e rua me ā rāua mahi i roto i te kōtuitanga pūmua.

Ki tō whakautu:

- whakamāramahia te kaupapa me ngā tukanga o te tauwhaituhi ME te tahuringa
- matapakitia ngā ōritenga me ngā rerekētanga i waenga i te tauwhaituhi me te tahuringa.

Ka whakaaetia te whakamahi hoahoa hei tautoko i tō whakautu.

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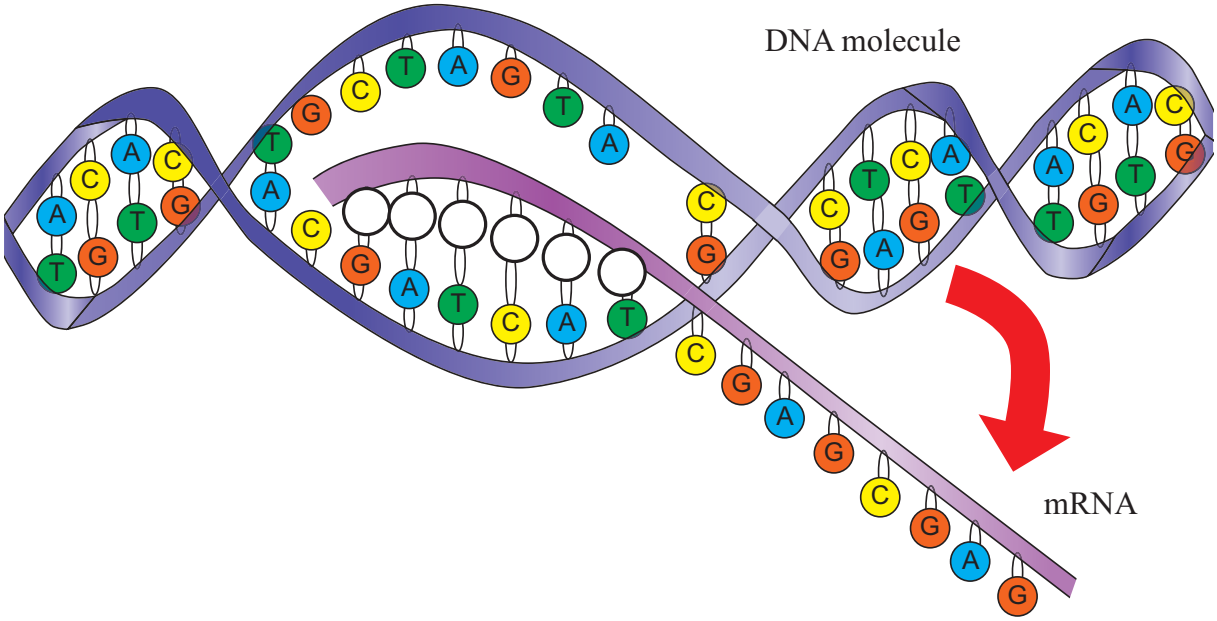
QUESTION ONE: MAKING PROTEINS

(a) The diagram below shows the cell process, transcription.

On the diagram, fill in the missing bases on the mRNA strand.



Adapted from http://www.scientificpsychic.com/fitness/aminoacids1.html

(b) Protein synthesis involves two stages: transcription and translation.

Compare and contrast these two cell processes and their role in protein synthesis.

In your answer:

- explain the purpose and processes of transcription AND translation
- discuss the similarities and differences between transcription and translation.

You may use diagrams to support your answer.

MĀ TE KAIMĀKA ANAKE

He wāhi anō mō tō whakautu ki tēnei pātai kei te whārangi 6.

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There is more space for your answer to this question on page 7.

MĀ TE KAIMĀKA ANAKE

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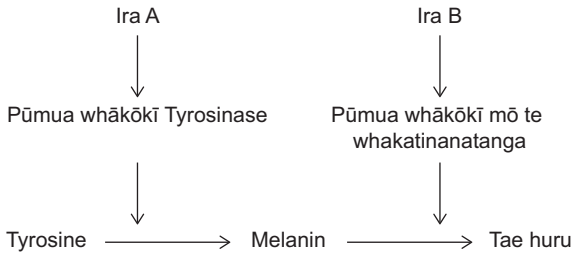
MĀ TE KAIMĀKA ANAKE

PĀTAI TUARUA: TAE HURU

He tapu tēnei rauemi. E kore taea te tuku atu. Aata tirohia ki ngā kupu kei raro iho i te pouaka nei.

Ara Matūriaka Tyrosine



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

E whakaawehia ana te tae kiri me te makawe e te ngakutae melanin. He pūmua te melanin i takea mai i te ara tyrosine, ā, e rua ngā ira kei roto i tēnei ara, e puta ai tōna whakatinanatanga.

Kāore he ngakutae melanin o ngā kararehe kirikōtea, nō reira kāore he tae o ō rātau kiri, makawe, karu hoki. He momo kirikōtea tō ngā ngeru Siamese, pērā i tērā i roto i te pikitia i runga ake. Engari he ira irakētanga tō ngā ngeru Siamese e tohu ana i te pūmua whākōkī tyrosinase, arā, he pūmua whākōkī i roto i te ara whakatinanatanga melanin. He rongorongo tēnei pūmua whākōkī i te pāmahana, nō reira ka puta i ngā ngeru Siamese te ngakutae melanin ki ngā wāhi o te tinana, pēnei i ngā waewae, whiore, mata, e kaha ake ai tō rātau tae.

Matapakitia he pēhea te pāhekoheko a te ara matūriaka mō te melanin me te taiao ki te whakaawe i te tae huru i roto i ngā ngeru Siamese.

Ki tō whakautu:

- whakaahuahia he aha te ara matūriaka
- whakamāramahia te take he kaha ake te tae o ngā ngeru Siamese i ngā wāhi o ō rātau tinana pēnei i te ihu, waewae me te whiore, engari **karekau** i tō rātau uma
- mā te whakamahi i te hoahoa i runga, matapakitia he pēhea te whakahaere a ngā ira me ngā pūmua whākōkī i te ara matūriaka mō te melanin, ā, he pēhea te puta o te kirikōtea i ngā ngeru Siamese i tēnei.

QUESTION TWO: COAT COLOUR

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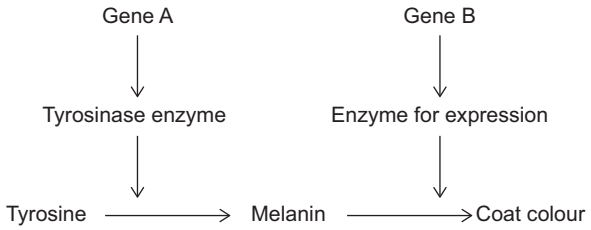
For copyright reasons, this resource cannot be reproduced here.

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

Tyrosine Metabolic Pathway



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.

MĀ TE KAIMĀKA ANAKE

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MĀ TE KAIMĀKA ANAKE

PĀTAI TUATORU: TE WAEHERE IRANGA

mRNA (codon) : Tūtohi o ngā Waikawa Amino

Pūwāhi Tuatahi	Pūwāhi Tuarua: U	Pūwāhi Tuarua: C	Pūwāhi Tuarua: A	Pūwāhi Tuarua: G	Pūwāhi Tuatoru
U	**UUU** Phe	**UCU** Ser	**UAU** Tyr	**UGU** Cys	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*, (Kirikiriroa: Biozone, 2003), wh. 287.

(a) E whakaaturia ana ki te tūtohi i raro ko te raupapa codon mRNA mō tētahi wāhanga o tētahi pūmua kawehā pūnoa.

- Whakaotihia te raupapa pītauira tauira pūnoa i roto i te tūtohi i raro.
- Whakaotihia te raupapa waikawa amino pūnoa mā te whakamahi i te tūtohi mRNA: Waikawa Amino i runga ake.

Tauira pītauira pūnoa								
mRNA pūnoa	AUG	GUG	CAC	CUG	ACU	CCU	GAG	UUG
Waikawa amino pūnoa								

QUESTION THREE: THE GENETIC CODE

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mRNA (codon) : Amino Acid Table

First Position	Second Position: U	Second Position: C	Second Position: A	Second Position: G	Third Position
U	**UUU** Phe	**UCU** Ser	**UAU** Tyr	**UGU** Cys	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								

MĀ TE KAIMĀKA ANAKE

He tahumaero tukunga iho te tahumaero pūtau āhua piko (e mōhiotia ana i mua ko te mate apa kawehā āhua piko) ka pā mai nā tētahi irakētanga ki te ira kawehā (pūtau toto whero). Kei roto i te pūiokarihi (nucleotide) 20 i roto i te raupapa pītauira, tētahi pūiokarihi T ka whakakapihia ki te pāpāhua pūiokarihi A ki te aho pītauira.

(b) Mā te whakamahi i te tūtohi i raro, whakaahuahia mai te raupapa waikawa amino irakē ka hua i te whakakapitanga o T i te pūwāhi pūiokarihi 20.

Pūiokarihi rua tekau

Pītauira irakē	_ _ _	_ _ _	_ _ _	_ _ _	_ _ _	_ _ _	_ _ _	_ _ _
mRNA irakē								
Waikawa amino irakē								

(c) Matapakitia ka ahatia te pūmua whakamutunga nā runga i tēnei irakētanga.

Ki tō whakautu:

- whakamāramahia he pēhea te pānga o te irakētanga whakakapitanga ki te raupapa o ngā pāpāhua me te pūmua whakamutunga
- matapakitia ka ahatia te raupapa pāpāhua pītauira me te pūmua whakamutunga mēnā ka whakaurua atu he pūiokarihi tāpiri ki te raupapa hei āpitihanga, kaua hei whakakapitanga mō tētahi atu, ā,
- tūhonoa tēnei ki te tipuhekenga o te waehere iranga.

He wāhi anō mō tō whakautu ki tēnei pātai kei te whārangi 16.

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Sickle cell disease (previously known as sickle cell anaemia) is an inherited disorder caused by a mutation on the haemoglobin (red blood cell) gene. The 20th nucleotide in the DNA sequence, has a T nucleotide substituted with an A nucleotide base on the DNA strand.

(b) Using the table below, describe the mutated amino acid sequence resulting from T being replaced at the 20th nucleotide position.

20th nucleotide

Mutated DNA	– – –	– – –	– – –	– – –	– – –	– – –	– ☐ –	– – –
Mutated mRNA								
Mutated amino acid								

(c) Discuss what happens to the final protein as a result of this mutation.

In your answer:

- explain how the substitution mutation affects the sequence of bases and the final protein
- discuss what would happen to the DNA base sequence and final protein if an additional nucleotide was inserted into the sequence as an extra, rather than being substituted for another, and
- link this to the degeneracy of the genetic code.

There is more space for your answer to this question on page 17.

MĀ TE KAIMĀKA ANAKE

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He puka anō mēnā ka hiahiatia.
Tuhia te (ngā) tāu pātai mēnā e hāngai ana.

TAU PĀTAI

MĀ TE KAIMĀKA ANAKE

Extra paper if required.
Write the question number(s) if applicable.

QUESTION NUMBER

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He puka anō mēnā ka hiahiatia.
Tuhia te (ngā) tāu pātai mēnā e hāngai ana.

TAU PĀTAI

MĀ TE KAIMĀKA ANAKE

Extra paper if required.
Write the question number(s) if applicable.

QUESTION NUMBER

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English translation of the wording on the front cover

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.

91159M

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 2–21 in the correct order and that none of these pages is blank.

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