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Level 2 Biology 2022

91159 Demonstrate understanding of gene expression

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 room for any answer, use the extra space provided at the back of this booklet.

Check that this booklet has pages 2 – 12 in the correct order and that none of these pages is blank.

Do not write in any cross-hatched area (). This area may be cut off when the booklet is marked.

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QUESTION ONE: PROTEIN SYNTHESIS

Translation is an important step in protein synthesis.

Source: https://www.thinglink.com/scene/750792545688092673

Discuss the importance of translation, and why the DNA strand is not directly translated into a polypeptide chain.

In your answer:

- describe protein synthesis
- explain translation
- discuss the relationship between codons, anticodons, tRNA, mRNA, and amino acids
- justify with TWO reasons why DNA is not directly translated into a polypeptide chain.

QUESTION TWO: THE GENETIC CODE

A mutation in the gene coding for the enzyme tyrosine causes albinism, a condition that results in a decrease in the production of the pigment melanin. These individuals have albino phenotypes, because melanin gives pigment to their skin, hair, and eyes.

Source: https://www.quora.com/Can-animals-have-albinism

(a) Describe what a mutation is.

(b) Different point mutations can cause albinism.

Discuss the effect of point mutations on final proteins.

In your answer:

- describe an insertion, deletion, and substitution mutation
- name the type of point mutation that is unlikely to change the protein, and explain why
- name the type of point mutation that would change the protein the most, and explain why
- discuss how these mutations affect the length and expression of the DNA base sequence
- discuss the degeneracy in the genetic code.

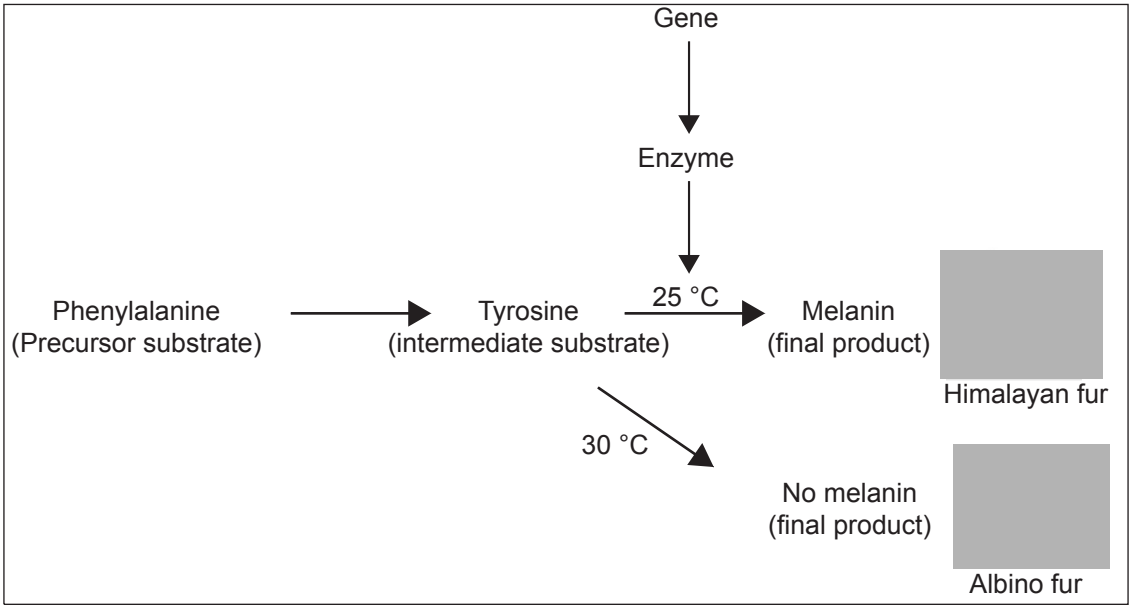
There is more space for your answer to this question on the following page.

QUESTION THREE: GENE EXPRESSION AND ENVIRONMENT

Himalayan rabbits show a mutant form of albinism that is temperature sensitive.

At lower temperatures (below 25 °C), the gene produces melanin (black) in fur. The enzyme is inactive at higher temperatures (above 30 °C) and produces no melanin (white) in fur. The average body temperature of a Himalayan rabbit is 37 °C.

Simplified metabolic pathway



Adapted from: https://arba.net/recognized-breeds/ and https://animalcorner.org/rabbit-breeds/himalayan-rabbit-breed/

Discuss how genes, enzymes, and the environment control the expression of melanin in Himalayan rabbits.

In your answer:

- describe what a metabolic pathway is
- explain a metabolic pathway using the terms precursor, substrate, intermediate, enzyme, gene, and final product
- discuss why Himalayan rabbits have dark melanin expression in their body extremities such as nose, ears, feet, and tail, and not in their core body
- discuss the environmental conditions necessary for Himalayan rabbits to express melanin (all black) AND no melanin (all white) fur colour for their entire life span.

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

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

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