

Exercises on protein synthesis

Grade 10 Biology

19 February 2026

Targeted outcomes

- Outline the process of a gene producing a polypeptide
- Distinguish between DNA and RNA
- Outline transcription and translation
- Outline the role of mRNA and tRNA

Exercise 1

An adequate understanding of protein synthesis requires our understanding of the following concepts. Please state:

- a. Your definition for the term **'gene'**.

- b. How the meaning of **'gene'** is distinct from the meaning of **'DNA'**.

c. Why a **gene** is composed of **two strands**.

d. Why one strand of a **gene** can be referred to as the '**coding strand**', whilst the other can be referred to as the '**template strand**'.

e. The difference between the **function/purpose** of **DNA** code and **RNA** code.

f. The difference between the **function** of a **gene's coding sequence** (composed of DNA), and the same gene's equivalent **mRNA sequence** (composed of RNA).

g. Your definition for the term '**amino acid**'.

h. Your definitions for the terms '**codon**' and '**anticodon**' and understanding about where (i.e. within what biological structures) each can be found.

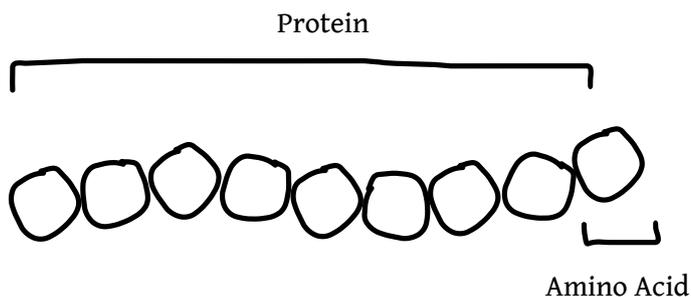
- i. Your interpretations as to what it means to **'transcribe'** something, and also what it means to **'translate'** something, given that the two stages of protein synthesis are termed **'transcription'** and **'translation'**.

Exercise 2

We have established previously that,

1. Proteins are a type of **molecule**¹ composed of a chain of **amino acids**, and a protein performs various bodily functions.

¹ a **molecule** is a group of atoms held together by chemical bonds. An amino acid is a molecule. Since a protein is a chain of amino acids, we can also call a protein a chain of molecules, and further also simply call a protein a molecule.



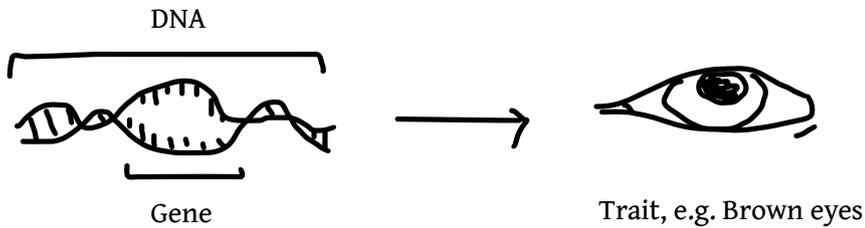
2. To **'synthesize'** means **'to make'**.

Hence, when we refer to the process of **'protein synthesis'**, we refer to the process of **'making proteins.'**

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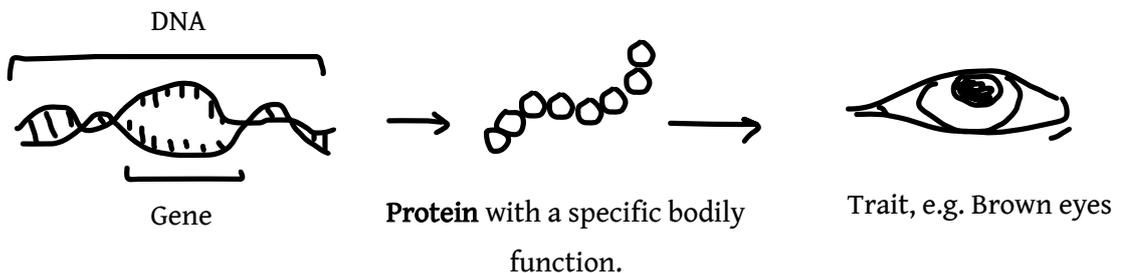
3. The process of **protein synthesis** begins with a **gene**, which we have defined previously as,

A section of DNA that **codes** for a particular trait.



Whilst this is correct, when attempting to understand the process of protein synthesis, it is best to add specificity to our 'gene' definition – through the adjustment,

A section of DNA that **codes** for a **protein**.



e.g. to aid the process of melanin pigment production in the eyes, which determines eye colour

Arguably, this definition of 'gene' allows us to better understand **why protein synthesis occurs** and **why genes are involved**.

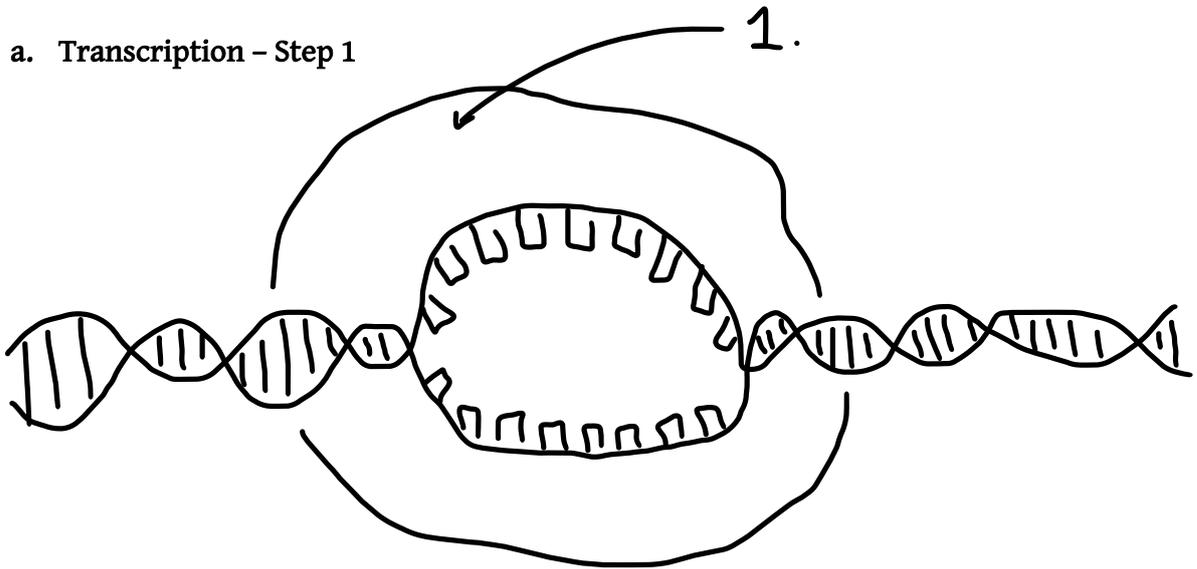
4. So far, we have said that to make a **protein** from a **gene**, we need to undergo **protein synthesis**, which can be divided into **two steps** as we previously mentioned.

This exercise concerns the first of these two steps – which we call **transcription**.

Transcription is the first stage of **protein synthesis**, and since we said that protein synthesis begins with a **gene**, **transcription** begins with a **gene**.

Please attempt to identify the events occurring during and elements of transcription:

a. Transcription – Step 1

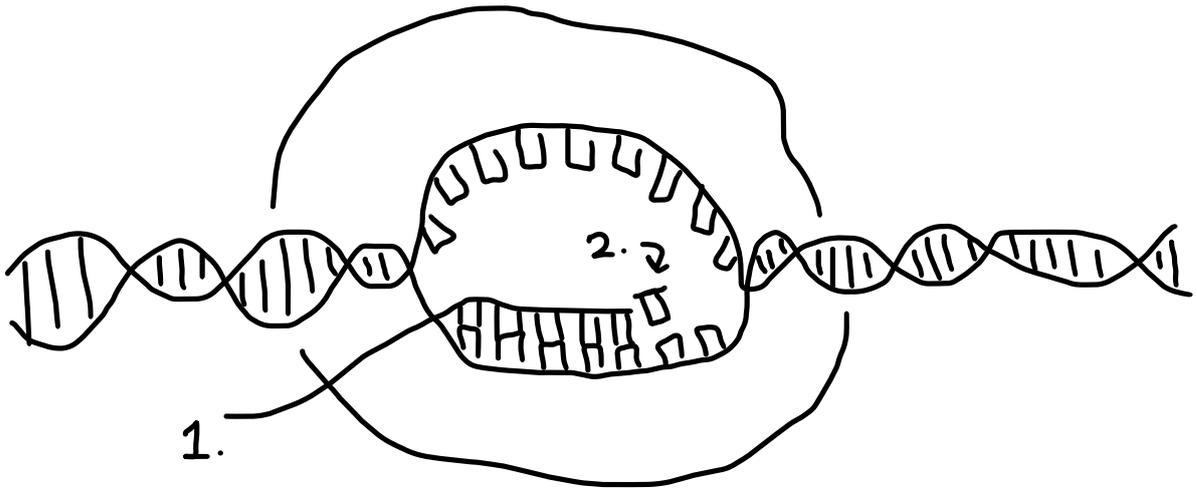


Please:

1. Indicate the positions of a **nucleotide**, the **gene**, and the **DNA** on the diagram.
2. State the name of structure 1, specifying what kind of structure it is, what it has just done within this first step of Transcription, and why it has done so.

3. State where within the cell Transcription is occurs.

b. Transcription – Step 2



Please:

1. State the name of structure 1 and indicate on the diagram which structure has been responsible for forming structure 1.

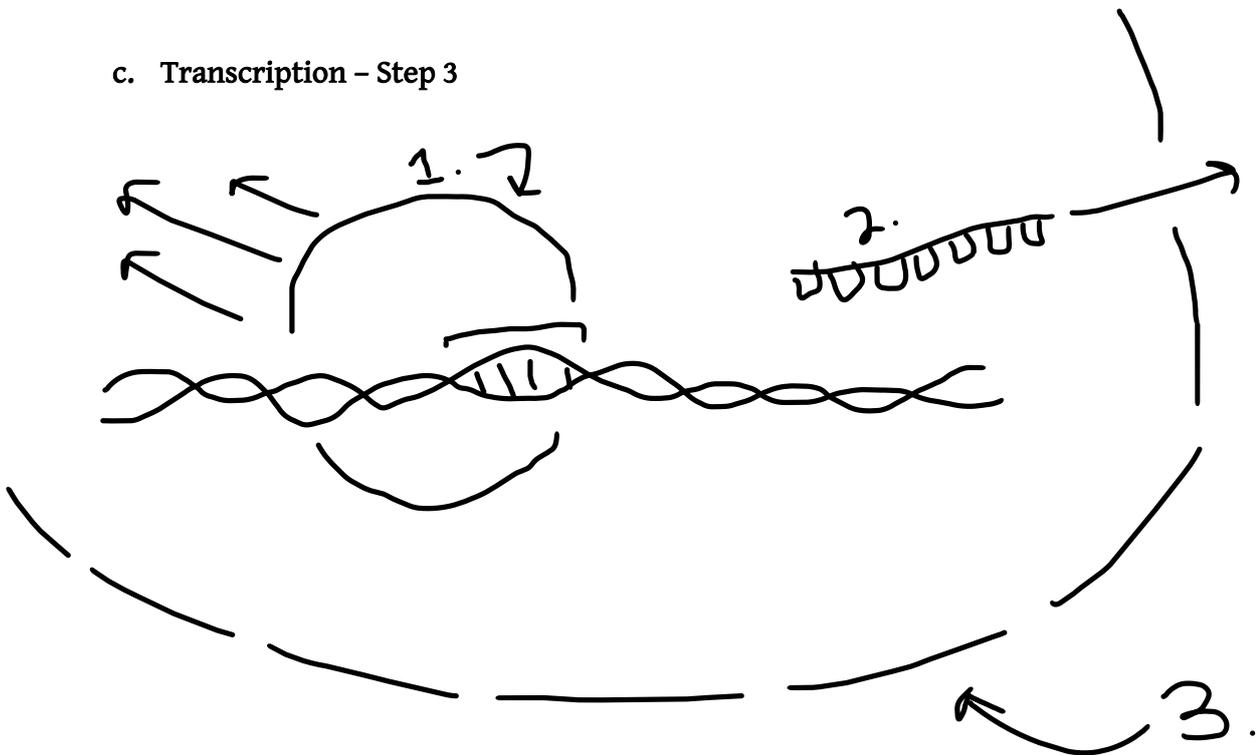
2. State the name of structure 2.

3. Indicate the location of the coding strand and template strand of the gene in the diagram and explain why you have indicated as such.

Exercise continues on next page.

4. Explain the relationship between structure 1 and the coding strand of the gene, and the relationship between structure 1 and the template strand of the gene.

c. Transcription - Step 3



Please:

1. State the name of structure 1 and observe that it is now moving away from the DNA. Can you explain what it has just done to the DNA and the gene, and why?

Exercise continues on next page

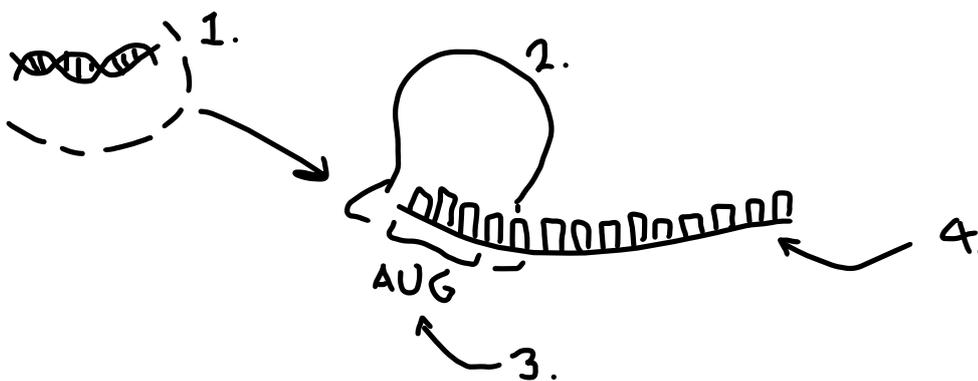
2. State the name of structure 2 and explain what it is doing.

3. State the name of structure 3.

Exercise 4

With the aid of your answers from **Exercise 3**, please attempt to identify the events occurring during and the elements of the second stage of protein synthesis – which we call **Translation**.

a. Translation – Step 1

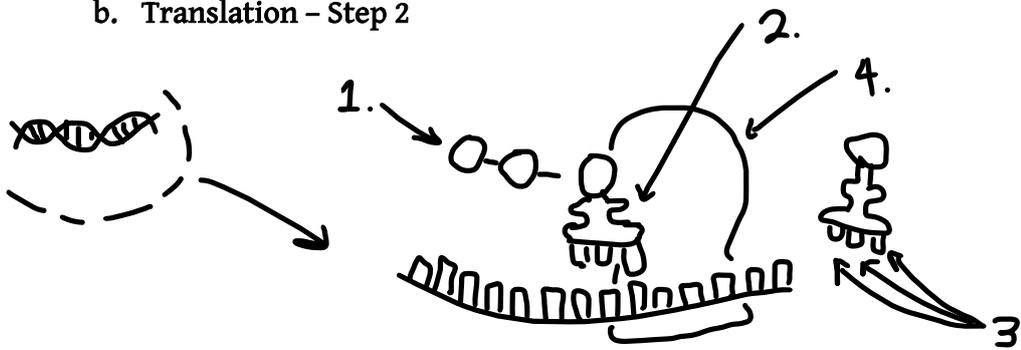


Please:

1. State the name of structure 1, which structure 4 has just come out of. Also, can you state where structure 4 is now located? (i.e. where within the cell does Translation occur?)

2. State the name of structure 2 and explain what it is doing with structure 4 in relation to structure 3.

b. Translation - Step 2



Please:

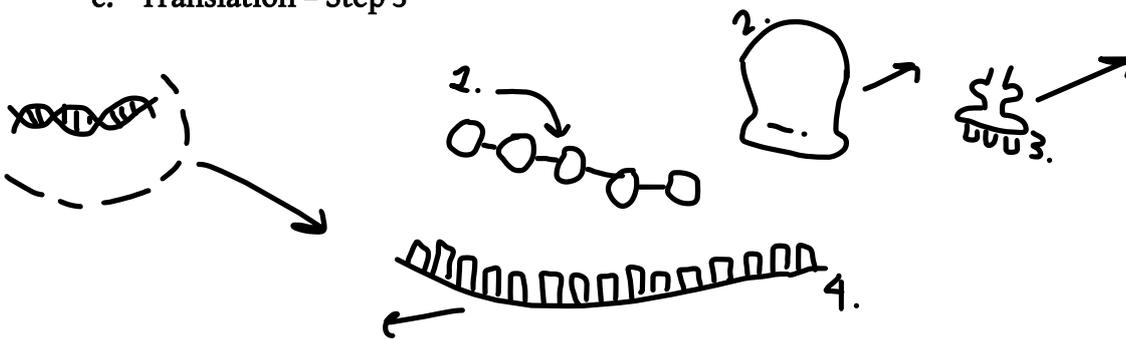
1. State the name of structure 1.

2. State the name of structure 2 and explain its relationship to structure 1 and structure 4.

Exercise continues on next page.

3. State the name of structure 3 and explain its relevance to the formation of structure 1.

c. Translation – Step 3



Please:

1. Structures 2, 3 and 4 have fulfilled their functions and are moving away, leaving structure 1. Can you state the name of structure 1?

2. State what structure 1 composed of.

3. State the general function of structure 1 and give a specific example of structure 1 within the human body.
