SCIENCE FOUNDATIONS

Transcription and translation

Difficulty level: Advanced

Science Foundations

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Overview of the concept

This is how the instructions in a gene are copied into a message and then read to build a protein, the two-step process behind everything from eye colour to the enzymes that digest your food. Your DNA stays in the nucleus while a messenger copy carries the gene's instructions out to the ribosome that builds the protein. A mutation, a change in the DNA, that changes the message changes the protein, which is why a single letter change can matter. Knowing transcription and translation tells you how a gene becomes a working part of your body, in two clear steps.



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Rule

Transcription and translation: transcription copies DNA into mRNA, pairing A with U, T with A, C with G, and G with C. RNA uses U, not T.

Translation reads mRNA in codons of three bases and builds amino acids: each codon calls one amino acid, read from the codon list below.

The codons you need in this lesson are: AUG means methionine, the start codon; UUU means phenylalanine; CCC means proline; and UAA, UAG, and UGA mean stop.

Worked examples

EXAMPLE 1

Q What mRNA sequence results from transcribing the DNA sequence A T C G?

SOLUTION

Pair each DNA base with its RNA partner: A with U, T with A, C with G, G with C.

Write the partners in order: U A G C.

Check: RNA has U where DNA has T.

The result is mRNA U A G C.

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EXAMPLE 2

Q What amino acids result from translating the mRNA sequence AUG UUU?

SOLUTION

Split into codons: AUG, then UUU.

Read the codon table: AUG is methionine (start), UUU is phenylalanine.

Join them: methionine, phenylalanine.

The result is methionine, phenylalanine.

Practice questions

1 Transcribe the DNA sequence G C A T to mRNA.

- **A** C G U A
- **B** G C A U
- **C** C G T A
- **D** A U G C

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2

Which of these codons means stop?

A UAA

B AUG

C UUU

D CCC

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Translate the mRNA sequence AUG CCC to amino acids.

A Methionine, proline

B Methionine, phenylalanine

C Proline, methionine

D Methionine, leucine

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4 **A mutation changes one base in a DNA sequence. What can happen to the protein it codes for?**

- **A** It can change, because the mRNA message changes
- **B** Nothing, proteins never change
- **C** The DNA repairs itself every time
- **D** Transcription stops

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5 **What base does DNA A pair with in RNA?**

- **A** U
- **B** T
- **C** A
- **D** G

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How many bases are in a codon?

A Three

B Two

C Four

D One

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What is the start codon?

A AUG

B UAA

C UAG

D UGA

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8 What ends translation?

A A stop codon

B A start codon

C A new ribosome

D A tRNA molecule

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9 Where does transcription happen?

A In the nucleus

B At a ribosome

C In the cytoplasm

D In the mitochondria

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Where does translation happen?

A At a ribosome

B In the nucleus

C In the Golgi body

D In the vacuole

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ANSWER KEY

1. C G U A

2. UAA

3. Methionine, proline

4. It can change, because the mRNA message changes

5. U

6. Three

7. AUG

8. A stop codon

9. In the nucleus

10. At a ribosome

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