

TUTORIAL 4: DNA Translation

Q1. Define translation in the context of molecular biology. (2 marks)

Q2. What are the start and stop codons in translation? (2 marks)

Q3. Name the three sites on the ribosome involved in translation. (1 mark)

Q4. Explain the significance of the Shine-Dalgarno sequence in bacterial translation. (3 marks)

Q5. Describe the role of tRNA in protein synthesis. (3 marks)

Q6. Given the mRNA sequence 5'-AUG GUC GCU AAA AGU UGA-3', determine the corresponding amino acid sequence. (3 marks)

Q7. How does tmRNA rescue stalled ribosomes? (3 marks)

Q8. Compare the roles of initiation factors and elongation factors in translation. (4 marks)

Q9. Analyze the importance of the central dogma in understanding protein synthesis. (4 marks)

Q1 Translation in molecular biology means the process of converting nucleic acid information into amino acids

Q2 start codon : AUG

Stop codon : UAA , UAG , UGA

Q3 E-site (Exit site) , A-site (Aceptor site) , P-site (Peptide site)

Q4 The Shine - Dalgarno sequence in bacterial translation is a ribosomal binding site in the mRNA of bacteria, located upstream of the start codon. It aligns the mRNA with the 16S rRNA of the ribosome, ensuring the correct positioning of the start codon in the ribosome for translation to begin.

Q5 The role of tRNA (Transfer RNA) is serves as an adaptor molecule.

- carry specific amino acids to the ribosome
- Each tRNA has an anticodon pairs with the complementary codon on mRNA
- Ensures the correct sequence of amino acids is incorporated into the growing polypeptide

Q6 AUG = Methionine (start codon)

GUC = valine

GCU = Alanine

AAA = Lysine

AGU = Serine

UGA = Stop (translation ends)

Met - Val - Ala - Lys - Serine - Stop

Q7 tmRNA rescue stalled ribosomes because it acts partly like tRNA and partly like mRNA.

- tRNA role : TmRNA binds to the stalled ribosome and adds on alanine residue to the polypeptide chain

- mRNA role : TmRNA takes over the mRNA role by providing its own short ORF for translation

- tRNA also adds a peptide tag to the nascent polypeptide chain. This tag targets the tagged peptides for proteolysis.

Q8 - Initiation factor binds to the ribosome and selects the start site

- Elongation factor transports amino acids and translocates peptidyl-tRNA
- Initiation factor assembles the ribosome on mRNA with the first tRNA
- Elongation factor brings amino acids to the ribosome and links them together

Q9 - Describes the flow of genetic information

The central dogma shows how genetic information flows from DNA to RNA to proteins

- Explain how DNA works

The central dogma explains how DNA works to create an organism's protein

- Introduces the roles of RNA

RNA has many jobs in the cell, including carrying hereditary information, acting as enzymes

- Highlight the fundamental principle of no reverse translation

No way to transfer information from protein back to nucleic acid