

Module 12: Gene Expression (DNA to Protein)

Comprehension & Critical Thinking Questions

Part 1: Core Concepts

1. DNA Structure

- Describe the double helix. What forms the backbone? What forms the rungs?
- Explain antiparallel orientation (5' to 3').
- State Chargaff's Rules. If a DNA sample is 20% Adenine, what percent is Cytosine?

2. The Central Dogma

- Diagram the flow: DNA → RNA → Protein.
- Where does transcription occur? Where does translation occur?

3. The Machinery

- What is the role of DNA polymerase? RNA polymerase? Ribosomes?

Part 2: Application

1. Replication

- DNA replication is semi-conservative. Explain what this means.
- Why is there a leading strand (continuous synthesis) and a lagging strand (Okazaki fragments)?

2. Translation Practice

- DNA template strand: 3'-TAC GGG AAA ACT-5'.
- Transcribe to mRNA (5'→3').
- Translate to amino acids using a codon chart.

Part 3: Analysis & Evaluation

1. RNA Processing

- Explain the purpose of:
 - Introns vs. Exons
 - 5' Cap and Poly-A Tail
- Why might alternative splicing be advantageous?

2. Universal Code

- The genetic code is nearly universal. How does this support common ancestry?
How does it enable biotechnology (e.g., producing human insulin in bacteria)?