

Module 12: Gene Expression (DNA to Protein)

Comprehension & Critical Thinking Questions

Part 1: Understanding 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 Rule**. If a DNA sample is 20% Adenine, what % is Cytosine?

2. The Central Dogma

- Draw the flow of information: **DNA -> RNA -> Protein**.
- Where does **Transcription** happen in a eukaryotic cell? Where does **Translation** happen?

3. The Machinery

- What is the role of **DNA Polymerase**?
- What is the role of **RNA Polymerase**?
- What is the role of the **Ribosome**?

Part 2: Applying Biological Principles

1. Replication

- DNA Replication is **Semi-Conservative**. Explain what this means.
- Why is there a **Leading Strand** (continuous) and a **Lagging Strand** (Okazaki fragments)? (Hint: Directionality of the enzyme).

2. Translation Practice

- **Scenario**: You have a DNA template strand: **3' - TAC GGG AAA ACT - 5'**.

- **Apply:**
 - Transcribe it to mRNA (Remember U replaces T, and 5'/3' flip).
 - Translate it to Amino Acids (using a codon chart).

Part 3: Analyzing & Evaluating

1. RNA Processing

- In eukaryotes, the mRNA is "edited" before leaving the nucleus. Explain the purpose of:
 - **Introns vs Exons.**
 - **The 5' Cap and Poly-A Tail.**
- **Critique:** Why might "Alternative Splicing" be useful? (Can one gene make more than one protein?).

2. Universal Code

- The Genetic Code is universal (bacteria use the same codons as humans).
Analyze: How does this fact support the theory of evolution? How does it make biotechnology (like making insulin in bacteria) possible?