Module 12: Gene Expression (DNA to Protein)

Keys to Success & Study Guide

Learning Objectives

By the end of this module, you should be able to: 1. **Describe** the chemical structure of DNA and specific base-pairing rules. 2. **Explain** the semi-conservative model of DNA replication. 3. **Transcribe** a DNA sequence into mRNA and **Translate** it into a polypeptide. 4. **Differentiate** between the functions of mRNA, tRNA, and rRNA.

Key Terminology Checklist

Define these terms in your own words to ensure mastery. - [ ] **Nucleotide**: Sugar + Phosphate + Nitrogen Base. - [ ] **Purine vs. Pyrimidine**: Double ring (A, G) vs Single ring (C, T, U). - [ ] **Codon**: A 3-letter "word" in mRNA that codes for one amino acid. - [ ] **Anticodon**: The matching 3-letter sequence on tRNA. - [ ] **Promoter**: The "Start Here" signal on DNA for transcription. - [ ] **Helicase**: The enzyme that "unzips" the genes.

Concept Check

1. The Blueprint

- **Question**: DNA is antiparallel. What does this mean?
- **Deep Dive**: One strand runs 5' -> 3', the other runs 3' -> 5'. It's like a two-way street. Enzymes can usually only drive in one direction (5' -> 3'), which makes replication complicated on the backward strand.

2. Reading the Code

- **Question**: How many codons are there?
- **Deep Dive**: There are 64 possible codons (4x4x4), but only 20 amino acids. This means the code is **Redundant** (multiple codons mean the same thing). Why is this a safety feature against mutation?

3. The Editors

- **Question**: How are transcripts processed in eukaryotes?
- **Deep Dive**: Pre-mRNA has junk in it (**Introns**). The cell splices them out and keeps the good parts (**Exons**). It's like editing raw film footage to make the final movie.

Study Tips

- **A-T / G-C**:
  - ◦ **A**pples in the **T**ree.
  - ◦ **C**ars in the **G**arage.
  - ◦ *(Remember: In RNA, Apple goes Under (Uracil) the tree).*
- **3 Types of RNA**:
  - ◦ **mRNA** (Messenger): The script/recipe.
  - ◦ **tRNA** (Transfer): The truck bringing ingredients (amino acids).
  - ◦ **rRNA** (Ribosomal): The kitchen/factory where it happens.