Module 14: Biotechnology and Genomics

Keys to Success & Study Guide

Learning Objectives

By the end of this module, you should be able to:

1. **Explain** the function of restriction enzymes and DNA ligase in creating recombinant DNA.
2. **Describe** the steps and purpose of PCR and gel electrophoresis.
3. **Evaluate** the benefits and risks of transgenic organisms (GMOs).
4. **Discuss** the goals and methods of gene therapy.

Key Terminology Checklist

Define these terms in your own words to ensure mastery.

- [ ] **Recombinant DNA**: DNA containing genetic material from two different sources.
- [ ] **Plasmid**: A small circular DNA molecule in bacteria, often used as a cloning vector.
- [ ] **DNA Ligase**: An enzyme that seals breaks in the DNA backbone.
- [ ] **STR (Short Tandem Repeat)**: Highly variable DNA sequences used in genetic fingerprinting.
- [ ] **Bioinformatics**: The use of computational tools to analyze biological data.

Concept Check

1. Molecular Cloning

- **Question**: What enzymes are used to create recombinant DNA?
- **Key Answer**:
    - **Restriction enzymes**: Cut DNA at specific recognition sequences, generating sticky or blunt ends.
    - **DNA ligase**: Joins DNA fragments together.

2. Gel Electrophoresis

- **Question**: How does gel electrophoresis separate DNA?
- **Key Answer**: DNA is negatively charged (phosphate groups). In an electric field, DNA migrates toward the positive electrode. Smaller fragments move faster/farther through the gel matrix.

3. Transgenic Organisms

- **Question**: What are applications of transgenic technology?
- **Key Answer**:
    - **Bacteria**: Production of insulin, human growth hormone.
    - **Plants**: Golden Rice (Vitamin A), pest-resistant crops.
    - **Animals**: Pharmaceutical production in milk.