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 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**: Small circular DNA ring in bacteria; often used as a vector. - [ ] **DNA Ligase**: The "glue" enzyme that seals DNA backbone breaks. - [ ] **STR (Short Tandem Repeat)**: Highly variable DNA sections used for fingerprinting. - [ ] **Bioinformatics**: Using computers to analyze biological data.

Concept Check

1. Cut and Paste

- **Question**: What two enzymes are needed to create recombinant vectors?
- **Deep Dive**:
    - **Scissors**: Restriction Enzymes (Cut specific sequences).
    - **Glue**: DNA Ligase (SEals the backbone).

2. The Electric Race

- **Question**: How does gel electrophoresis work?
- **Deep Dive**: DNA is Negatively charged (Phosphate groups). When you turn on the power, DNA runs toward the Positive pole.
    - Small pieces -> Run fast/far.

    - Big pieces -> Get stuck/slow.

3. New Life Forms

- **Question**: What are some beneficial uses of transgenic organisms?
- **Deep Dive**:
    - **Bacteria**: Making Insulin or Human Growth Hormone.
    - **Plants**: Golden Rice (Vitamin A), Pest-resistant corn.
    - **Animals**: Goats making medicine in milk.

Study Tips

- **PCR Song**: Think of it like cooking.
    - **Heat it up** (95C) -> Separate strands.
    - **Cool it down** (50C) -> Primers stick.
    - **Warm it up** (72C) -> Build new DNA.
    - *Repeat*.
- **Crime Scene Logic**: In a DNA fingerprint, every single band in the child MUST come from either Mom or Dad. If a band matches neither, it's not their kid.