Module 16: Evolution of Populations (Microevolution)

Keys to Success & Study Guide

Learning Objectives

By the end of this module, you should be able to: 1. **Calculate** allele and genotype frequencies using the Hardy-Weinberg equations. 2. **Differentiate** between the effects of Genetic Drift, Gene Flow, and Natural Selection. 3. **Identify** patterns of selection (Stabilizing, Directional, Disruptive) from data. 4. **Explain** how Heterozygote Advantage maintains deadly alleles in a population.

Key Terminology Checklist

Define these terms in your own words to ensure mastery. - [ ] **Gene Pool**: All the alleles in a population. - [ ] **Microevolution**: Small-scale changes in allele frequencies generation to generation. - [ ] **Sexual Dimorphism**: Differences in appearance between males and females. - [ ] **Gene Flow**: Movement of alleles between populations (Migration). - [ ] **Bottleneck Effect**: Loss of genetic diversity due to a drastic reduction in population size.

Concept Check

1. The Null Hypothesis

- **Question**: What are the 5 criteria for stable allele frequencies (Hardy-Weinberg)?
- **Deep Dive**:
    1. No Mutation.
    2. No Gene Flow.
    3. No Natural Selection.
    4. Random Mating.
    5. Extremely Large Population.
    6. *Real Talk*: This basically never happens. Evolution is inevitable.

2. The Math

- **Question**: What are the two equations?
- **Deep Dive**:
  - $p + q = 1$ (Allele Frequency: Dominant + Recessive = 100%).
  - $p^2 + 2pq + q^2 = 1$ (Genotype Frequency: AA + Aa + aa = 100%).
  - *Tip*: Always find **q** (recessive frequency) first. You can "see" recessive phenotypes. You can't see carriers.

3. Luck of the Draw

- **Question**: What is genetic drift?
- **Deep Dive**: Random chance. If you flip a coin 1000 times, it's 50/50. If you flip it 4 times, you might get 100% heads. Small populations (4 flips) are subject to wild random swings (Drift). Large populations are stable.

Study Tips

- **Graphs**: Memorize the shapes of selection graphs.
  - **Directional**: Bell curve moves Left/Right.
  - **Stabilizing**: Bell curve gets skinny/tall (Variance decreases).
  - **Disruptive**: Bell curve gets two humps (M shape).
- **Peacock Logic**: Sexual Selection is powerful. If females prefer long tails, males get long tails, even if it kills them. Copulation > Survival.