

Outline 5: The Evolution of Populations

I. Population Genetics

A. Populations evolve, not individuals

B. What is a population?

C. What is a gene pool?

D. What is population genetics?

E. Micro-evolution

II. Describing a Population Genetically

A. Genotypic Frequencies

B. Allele Frequencies

C. p and q , $p + q = ?$

III. Hardy-Weinberg Equilibrium

A. Suppose a gene pool of a population is composed of one gene with 2 alleles: A and a. If the frequency of the “A” allele = p and the frequency of the “a” allele = q :

1. What is the probability of a sperm carrying the “A” allele fertilizing an egg carrying the “A” allele? What would the resulting genotype be?
2. What is the probability of a sperm carrying the “A” allele fertilizing an egg carrying the “a” allele? What would the resulting genotype be?
3. What is the probability of a sperm carrying the “a” allele fertilizing an egg carrying the “A” allele? What would the resulting genotype be?
4. What is the probability of a sperm carrying the “a” allele fertilizing an egg carrying the “a” allele? What would the resulting genotype be?
5. What would the total of all 4 of the above be?
6. What would the allelic and genotypic frequencies be in the next generation?
7. What does it mean for a population to be in Hardy-Weinberg Equilibrium?

B. The 5 Conditions Necessary for a Population to be in Hardy-Weinberg Equilibrium

1.

2.

3.

4.

5.

C. What happens if any of the above conditions is not met?

IV. Mechanisms of Evolution

1. Mutation =

What are some different types of mutations?

How would a mutation that causes an "A" allele to change to an "a" allele affect p and q?

2. Gene Flow

3. Genetic Drift

a. Bottleneck Effect

b. Founder Effect

4. Natural Selection

V. Natural Selection and Adaptive Evolution

A. Natural Selection Requires **Genetic Variation** to Work:

Sources of Genetic Variation:

1. Mutation:
2. Independent Assortment in Meiosis:
3. Recombination (Crossing-over) in Meiosis
4. Random fusion of gametes

B. Types of Variation

1. Discrete vs. Quantitative (continuous)

2. Polymorphisms

3. Heterozygosity

VI. How Natural Selection Works

- A. Fitness

- B. Directional Selection

- C. Disruptive Selection

D. Stabilizing Selection

E. Balancing Selection

1. Heterozygote Advantage

2. Frequency-Dependent Selection

VII. Sexual selection

A. Intrasexual Selection

B. Intersexual Selection

VIII. Why aren't organisms perfect?

1. Historical Constraints
2. Trade-offs and compromises
3. Chance
4. Existing Variations