

CHAPTER 23

THE EVOLUTION OF POPULATIONS

Learning objectives

Genetic Variation, the Substrate for Natural Selection

1. Explain the statement “It is the population, not the individual, that evolves.”
2. Explain how Mendel’s particulate hypothesis of inheritance provided necessary support for Darwin’s theory of evolution by natural selection.
3. Explain how quantitative and discrete characters contribute to variation within a population.
4. Distinguish between average heterozygosity and nucleotide variability. Explain why average heterozygosity tends to be greater than nucleotide variability.
5. Define a cline.

Mutation and Sexual Recombination

6. Explain why the majority of point mutations are harmless.
7. Explain why mutation has little quantitative effect on allele frequencies in a large population.
8. Describe the significance of transposons in the generation of genetic variability.
9. Explain how sexual recombination generates genetic variability.

The Hardy-Weinberg Principle

10. Define the terms **population**, **species**, and **gene pool**.
11. Explain why meiosis and random fertilization alone will not alter the frequency of alleles or genotypes in a population.
12. List the five conditions that must be met for a population to remain in Hardy-Weinberg equilibrium.
13. Write the Hardy-Weinberg equation. Use the equation to calculate allele frequencies when the frequency of homozygous recessive individuals in a population is 25%.

Natural Selection, Genetic Drift, and Gene Flow

14. Explain the following statement: “Only natural selection leads to the adaptation of organisms to their environment.”
15. Explain the role of population size in genetic drift.
16. Distinguish between the bottleneck effect and the founder effect.
17. Describe how gene flow can act to reduce genetic differences between adjacent populations.
18. Define relative fitness.
19. Distinguish among directional, disruptive, and stabilizing selection. Give an example of each mode of selection.
20. Distinguish between intrasexual selection and intersexual selection.
21. Explain how female preferences for showy male traits may benefit the female.
22. Explain how diploidy can protect a rare recessive allele from elimination by natural selection.
23. Describe how heterozygote advantage and frequency dependent selection promote balanced polymorphism.
24. Define neutral variations. Explain why natural selection does not act on these alleles.

25. List four reasons why natural selection cannot produce perfect organisms.