Chapter 21 Reading Guide: The Evolution of Populations

How to use this reading guide: Look over the entire reading guide—read each question to prepare yourself for reading the chapter. Read the chapter carefully and thoroughly. Make sure to look at all of the figures and pictures and read their captions. Then…answer the questions posed below.

The Smallest Unit of Evolution
1. It is a common misconception that individuals evolve. Explain why this is incorrect, but how individuals are involved in evolution. How are populations involved? Use an example and be very articulate in your response.

Population genetics provides a foundation for studying evolution
2. Define the term microevolution.

3. Darwin and Mendel were contemporaries but their theories were not synthesized until much later. When Mendel's ideas were finally applied to Darwin's mechanism it spawned population genetics.
    a. What is genetic variation? Why do some phenotypic differences occur on an "either-or" basis, while others show gradations along a continuum?

    b. Why doesn't nucleotide variability result in much phenotypic variation?

    c. Why is some phenotypic variation not heritable?

Mutation and sexual recombination produce the variation that makes evolution possible
1. How do we get new alleles and genes?
    a. How do these new genes and alleles get passed on in a population?

2. Point mutations involve a change in a single base or base pair. Why are most point mutations probably harmless? Give all potential reasons!

3. When can point mutations have potentially harmful effects? When can they potentially beneficial?

4. What events can alter a gene number or a gene sequence?

5. How can alterations in gene number or gene shuffling be harmful? How can they be beneficial?

6. Why will single-drug treatments ever be very successful against HIV?

7. What does sexual recombination refer to? What is its role in natural selection and evolution?

8. Why is sexual reproduction considered an enigma?

    a. What advantages might sexual reproduction offer?

The Hardy-Weinberg Equation

9. What is a population?
   a. How do geography and isolation relate to populations?

   b. Apply the term "gene pool" to a population.

10. To what do p and q refer?

11. What does the Hardy-Weinberg principle state?
    a. How is Mendelian inheritance "factored" into the Hardy-Weinberg principle?

12. If a population is in Hardy-Weinberg Equilibrium…
    a. The matings are…

    b. The allele frequencies are…

    c. The gene frequencies can…

    d. The equation would be…

13. Describe the conditions for Hardy-Weinberg Equilibrium. For each, describe why they are important.
    a. Extremely large populations

    b. No gene flow

    c. No mutations

    d. Random mating

    e. No natural selection

Departure from these conditions…
14. How is the Hardy-Weinberg equation used in human health studies?

Natural selection, genetic drift, and gene flow can alter a population's genetic composition

15. Explain why each of the following are not significant causes of change in a populations' allele frequencies.
    a. Mutation

    b. sexual recombination

    c. non-random mating

16. Explain why each of the following can have a significant effect on a populations' allele frequencies.
    a. Natural Selection

    b. Genetic Drift

        i. There are two situations that can increase the impact that genetic drift has on a population: the bottleneck effect and the founder effect. Explain what happens in each of these situations and why it would exacerbate the effects of genetic drift. Give examples for each. (Research Elephant Seals and see what you can find)

    c. Gene Flow

Natural Selection is the primary mechanism of adaptive evolution

17. Why can the phrases "struggle for existence" or "survival of the fittest" be misleading? Give an example.

18. What is "fitness"?
    a. How does the term "relative fitness" relate to this?

        i. Explain the statement "Survival alone does not guarantee reproductive fitness."

19. Natural selection can have three different effects on the allele frequencies in a population: directional, disruptive, or stabilizing. Describe each mode of selection, making sure to state the effects on the population, and draw a graph that represents what happens.
    a. Directional

    b. Disruptive

    c. Stabilizing

20. What is sexual selection? What does it often result in?

    a. Distinguish between intrasexual selection and intersexual selection.

        i. Explain how mate choice fits into a "Darwinian" view. What is the influence of each sex in sexual selection?

21. What is neutral variation? How is it affected by natural selection? Give an example.

22. If natural selection is happening then eventually the genetic variation within populations would/could be reduced. So there have to be mechanisms to counteract natural selection and preserve or restore variation. For each, describe how they work to counter the reduction in variety and give an example.
    a. Diploidy

    b. Balancing selection

    c. Heterozygote advantage
        i. How is this related to malaria?

    d. frequency-dependent selection

23. Why won't natural selection lead to the formation of the "perfect organism?"