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AP Biology

Chapter 21-The Evolution of Populations

This chapter begins with the idea that we focused on as we closed chapter 19: Individuals do not evolve! Populations evolve. The Overview looks at the work of Peter and Rosemary Grant with Galápagos finches to illustrate this point, and the rest of the chapter examines the change in populations over time.

1) What is *microevolution*?

21.1 Genetic variation makes evolution possible

2) *Mutations* are any change in the nucleotide sequence of an organism's DNA. These mutations provide the raw material from which new traits may arise and be selected.

a) What occurs in a *point mutation*?

b) What are chromosomal mutations? How could they be beneficial?

c) How does *gene duplication* occur? How might it play a role in evolution?

3) What are the three main mechanisms that can cause shuffling of alleles?

21.2 The Hardy-Weinberg equation can be used to test whether a population is evolving

4) Population genetics puts a mathematical approach to the study of microevolution. Define each of the terms commonly used in population genetics.

a. population:

b. gene pool:

c. gene frequency:

5) The greater the number of *fixed* alleles, the lower the species' diversity. What does it mean to say that an allele is *fixed*?

6) If the frequency of alleles in a population remains constant, the population is at *Hardy- Weinberg equilibrium (**No Evolution**)*. There are five conditions for *Hardy-Weinberg equilibrium*. It is very important for you to know these conditions, so write the five conditions below:

a.

b.

c.

d.

e.

It is not very likely that all five of these conditions will occur, is it? Allelic frequencies change. Populations evolve. This data can be tested by applying the *Hardy Weinberg equation*. Let's look at how to do this.

Equation for Hardy-Weinberg Equilibrium

$$p2 + 2pq + q2 = 1$$

7) Define the following:

a. p^2 = ____

b. 2pq = ____

c. q^2 = ____

If we know the frequency of one of the alleles, we can calculate the frequency of the other allele:

$$p + q = 1$$

8) Work out these practice problems. Assuming H-W equilibrium, find both the allele and genotype frequencies.
a. In *Drosophilia*, the allele for normal length wings is dominant over the allele for vestigial wings. In a population of 1,000 individuals, 160 show the recessive phenotype. SHOW ALL WORK!!!

a. allele frequencies: dominant allele (**W**) = _______; recessive allele (***w***) = _______

b. genotype frequencies: **WW** = ________; **W*w*** = ________; ***ww*** = ________

21.3 Natural selection genetic drifts, and gene flow can alter allele frequencies

9) First, let's try to summarize the big idea from this section. Scan through the entire concept to pull out this information. Three major factors alter allelic frequency and bring about evolutionary change. List each factor, and give an explanation.

Factor	Explanation

10) Which of the factors above results in a random, non adaptive change in allelic frequencies?

a. Which of the factors above tends to reduce the genetic differences between populations and make populations more similar?

b. Of the three factors you listed above, only one results in individuals that are better suited to their environment. Which is it?

11) Explain what happens in each of these examples of *genetic drift*:

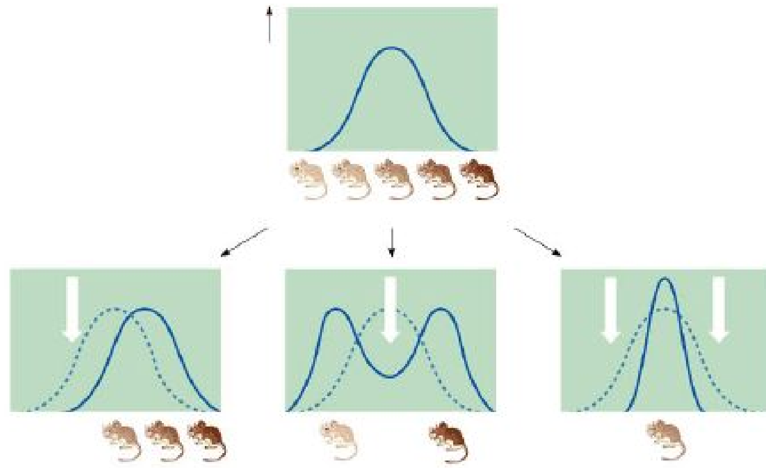
founder effect:

bottleneck effect:

21.4 Natural selection is the only mechanism that consistently causes adaptive evolution

12) In evolutionary terms, *fitness* refers only to the ability to leave offspring and contribute to the gene pool of the next generation. It may have nothing to do with being big, or strong, or aggressive. Define *relative fitness*.

13) Label the following graphs of variation with the type of selection.



14)

Type of Selection	How It Works
Stabilizing	
Directional	
Disruptive	

15) What is often the result of *sexual selection*?

16) Explain two ways in which genetic variation is preserved in a population.

17) Discuss what is meant by *heterozygote advantage*, and use sickle-cell anemia as an example.

18) Finally, give four reasons why natural selection cannot produce perfect organisms