Study Guide Chapter 23

The Evolution of Populations

Interactive Question 23.1

In a population of 200 mice, 98 are homozygous dominant for brown coat color (BB), 84 are heterozygous (Bb), and 18 are homozygous recessive (bb).

a. The allele frequencies of this population are __ B allele __ b allele.

The 98 BB mice contribute 196 B alleles, and the 84 Bb mice contribute 84 B alleles to the gene pool. These 84 Bb mice also contribute 84 b alleles, and the 18 bb mice contribute 36 b alleles. Of a total of 400 alleles, 280 are B and 120 are b. Allele frequencies are 0.7 B and 0.3 b.

b. The genotype frequencies of this population are __ BB __ Bb __ bb.

The frequencies of genotypes are 0.49 BB, 0.42 Bb, and 0.09 bb (98/200, 84/200, 18/200).

Interactive Question 23.2

Use the allele frequencies you determined in Interactive Question 23.1 to predict the genotype frequencies of the next generation.

Frequencies of

B (p) = _0.7_ b (q) = _0.3_

BB (p^2) = _0.49_ Bb (2pq) = _0.42_ bb (q^2) = _0.09_

Interactive Question 23.3

Practice using the Hardy-Weinberg equation so that you can easily determine genotype frequencies from allele frequencies and vice versa.

a. The allele frequencies in a population are A = 0.6 and a = 0.4. Predict the genotype frequencies for the next generation.

0.36; 0.48; 0.16. Plug p (0.6) and q (0.4) into the expanded binomial: $p^2 + 2pq + q^2$.

b. What would the allele frequencies be for the generation you predicted above in part a.?

0.6; 0.4. Add the frequency of the homozygous dominant genotype to ½ the frequency of the heterozygote for the frequency of p. For q, add the homozygous recessive frequency and ½ the heterozygote frequency. Alternatively, to determine q, take the square root of the homozygous recessive frequency if you are sure the population is in Hardy-Weinberg equilibrium. The frequency of p is then 1 – q.

Interactive Question 23.4

a. What is a major source of genetic variation for bacteria and viruses?

Mutation, with some recombination.

b. What is the major source of genetic variation for plants and animals?

Sexual recombination.

c. Explain why your answers to a. and b. are different.

Bacteria and viruses have very short generation times and a new beneficial mutation can increase in frequency rapidly in an asexually reproducing bacterial population. Although mutations are the source of new alleles, they are so