Hardy-Weinberg Equilibrium Problems

1. The frequency of two alleles in a gene pool is 0.19 (*A*) and 0.81(*a*). Assume that the population is in Hardy-Weinberg equilibrium.

   (a) Calculate the percentage of heterozygous individuals in the population.

   (b) Calculate the percentage of homozygous recessives in the population.

2. An allele *W,* for white wool, is dominant over allele *w*, for black wool. In a sample of 900 sheep, 891 are white and 9 are black. Calculate the allelic frequencies within this population, assuming that the population is in H-W equilibrium.

3. In a population that is in Hardy-Weinberg equilibrium, the frequency of the recessive homozygote genotype of a certain trait is 0.09. Calculate the percentage of individuals homozygous for the dominant allele.

4. In a population that is in Hardy-Weinberg equilibrium, 38 % of the individuals are recessive homozygotes for a certain trait. In a population of 14,500, calculate the percentage of homozygous dominant individuals and heterozygous individuals.

5. Allele *T*, for the ability to taste a particular chemical, is dominant over allele *t*, for the inability to taste the chemical. Four hundred university students were surveyed and 64 were found to be nontasters. Calculate the percentage of heterozygous students. Assume that the population is in H-W equilibrium.

6. In humans, the *Rh* factor genetic information is inherited from our parents, but it is inherited independently of the ABO blood type alleles. In humans, *Rh*+ individuals have the *Rh* antigen on their red blood cells, while *Rh*− individuals do not. There are two different alleles for the *Rh* factor known as *Rh*+ and *rh*. Assume that a dominant gene *Rh* produces the *Rh*+ phenotype, and that the recessive *rh* allele produces the *Rh*− phenotype.

   In a population that is in Hardy-Weinberg equilibrium, if 160 out of 200 individuals are *Rh*+, calculate the frequencies of both alleles.

7. In corn, kernel color is governed by a dominant allele for white color *(W)* and by a recessive allele (*w*). A random sample of 100 kernels from a population that is in H-W equilibrium reveals that 9 kernels are yellow (*ww*) and 91 kernels are white.

   (a) Calculate the frequencies of the yellow and white alleles in this population.

   (b) Calculate the percentage of this population that is heterozygous.

8. A rare disease which is due to a recessive allele (*a*) that is lethal when homozygous, occurs within a specific population at a frequency of one in a million. How many individuals in a town with a population of 14,000 can be expected to carry this allele?

Questions 9 & 10 refer to the following situation:

Two Siamese and three Persian cats survive a shipwreck and are carried on driftwood to a previously uninhabited tropical island. All five cats have normal ears, but one carries the recessive allele *f* or folded ears (his genotype is *Ff*).

9. Calculate the frequencies of alleles *F* and *f* in the cat population of this island.

10. If you assume Hardy-Weinberg equilibrium for these alleles (admittedly very improbable), about how many cats would you expect to have folded ears when the island population reaches 20,000?

11. In a certain African population, 4 % of the population is born with sickle cell anemia (*aa*). Calculate the percentage of individuals who enjoy the selective advantage of the sickle-cell gene (increased resistance to malaria)?

12. In the United States, approximately one child in 10,000 is born with PKU (phenylketonuria), a syndrome that affects individuals homozygous for the recessive allele (*aa*).

    (a) Calculate the frequency of this allele in the population.

    (b) Calculate the frequency of the normal allele.

    (c) Calculate the percentage of carriers of the trait within the population.