WEEK 8 PROBLEMS

Problems From Chapter 14

14.1 A trait due to a harmful recessive X-linked allele in a large, randomly mating population affects 1 in 50 males. What is the frequency of carrier females? What is the expected frequency of affected females?

14.2 How many *A* and *a* alleles are present in a sample of organisms consisting of 10 *AA,* 15 *Aa,* and 4 *aa* genotypes? What are the allele frequencies in this sample?

14.3 Which of the following genotype frequencies of *AA, Aa,* and *aa,* respectively, satisfy the Hardy-Weinberg principle?

(a) 0.25, 0.50, 0.25
(b) 0.36,0.55,0.09
(c) 0.49, 0.42, 0.09
(d) 0.64, 0.27, 0.09
(e) 0.29,0.42,0.29

14. 4 Galactosemia is an autosomal recessive condition associated with liver enlargement, cataracts, and mental retardation. Among the offspring of unrelated individuals, the frequency of galactosemia is 8.5×10^{-6} . What is the expected frequency among the offspring of first cousins *(F = 1/16)* and among the offspring of second cousins *(F = 1/64)*?

14.5 A man with normal parents whose brother has phenylketonuria marries a phenotypically normal woman. In the general population, the incidence of phenylketonuria at birth is approximately 1 in 10,000. Assume Hardy-Weinberg proportions.

(a) What is the probability that the man is a carrier?
(b) What is the probability that the wife is also a carrier?
(c) What is the probability that their first child will be affected?

14.6 A population of maple trees contains a lethal allele that allows homozygous recessive seeds to germinate, but the plants produce no chlorophyll and die shortly after germination. The allele frequency of the recessive allele for this condition in the population is 0.01.

(a) If a randomly mating population produces one million seeds, how many plants will lack chlorophyll?
(b) Will natural selection eliminate the allele after one generation? Why or why not?

14.7 Hartnup disease is an autosomal recessive disorder of intestinal and renal transport of amino acids. The frequency of affected newborn infants is about 1 in 14,000. Assuming random mating, what is the frequency of heterozygotes?

14.8 An allele A undergoes mutation to the allele a at the rate of 10-5 per generation. If a very large population is fixed for A (generation 0), what is the expected frequency of A in the following generation (generation 1)? What is the expected frequency of A in generation 2? Deduce the rule for the frequency of A in generation n.