

## WEEK 4 PROBLEMS

### Problems From Chapter 3

3.1 A recessive mutation of an X-linked gene in human beings results in hemophilia, marked by a prolonged increase in the time needed for blood clotting. Suppose that a phenotypically normal couple produces two normal daughters and a son affected with hemophilia.

- (a) What is the probability that both of the daughters are heterozygous carriers?
- (b) If one of the daughters and a normal man produce a son, what is the probability that the son will be affected?

3.2 Mendel studied the inheritance of phenotypic characters determined by seven pairs of alleles. It is an interesting coincidence that the pea plant also has seven pairs of chromosomes. What is the probability that no two of the traits studied by Mendel were determined by genes located on the same pair of chromosomes?

3.3 Duchenne-type muscular dystrophy is an inherited disease of muscle due to a mutant form of a protein called dystrophin. The pattern of inheritance of the disease has these characteristics: (1) affected males have unaffected children, (2) the unaffected sisters of affected males often have affected sons, and (3) the unaffected brothers of affected males have unaffected children. What type of inheritance do these findings suggest? Explain your reasoning.

3.4 Tall, red-flowered hibiscus is mated with short white-flowered hibiscus. Both varieties are true-breeding. All the F<sub>1</sub> plants are backcrossed with the short, whiteflowered variety. This backcross yields 188 tall red, 203 tall white, 175 short red, and 178 short white plants. Does the observed result fit the genetic hypothesis of 1 : 1 : 1 : 1 segregation as assessed by a chi-square test?

3.5 In *D. melanogaster*, the alleles *dp+* and *dp* determine long versus short wings, and *e+* and *e* determine gray versus ebony body. A dihybrid cross was carried out to produce flies homozygous for both *dp* and *e*. The following phenotypes were obtained in the F<sub>2</sub> generation:

long wing, gray body 462  
long wing, ebony body 167  
short wing, gray body 127  
short wing, ebony body 44

Test these data for agreement with the 9 : 3 : 3 : 1 ratio expected if the two pairs of alleles undergo independent assortment.

3.6 The accompanying pedigree and gel diagram show the molecular phenotypes obtained from genomic DNA samples. The bands are characteristic DNA fragments that distinguish two alleles of a single gene. What mode of inheritance does the pedigree suggest? On the basis of this hypothesis, and using *A1* to represent the allele associated with the 4-kb band and *A2* to represent that associated with the 9-kb band, deduce the genotype of each individual in the pedigree.

