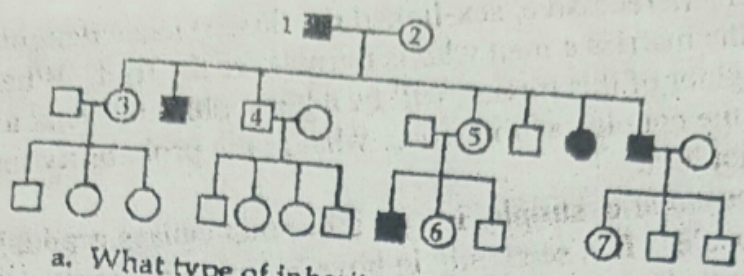
Chapter 15

GENETICS PROBLEMS

1. The following pedigree traces the inheritance of a genetic trait.



a. What type of inheritance does this trait show?
b. Give the predicted genotype for the following individuals:

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____

c. What is the probability that a child of individual #6 and a phenotypically normal male will have this trait?

2. The following recombination frequencies were found. Determine the order of these genes on the chromosome.

a, c 10%	b, c 4%	c, d 20%
a, d 30%	b, d 16%	
a, e 6%	b, e 20%	

3. In guinea pigs, black (*B*) is dominant to brown (*b*), and solid color (*S*) is dominant to spotted (*s*). A heterozygous black, solid-colored pig is mated with a brown, spotted pig. The total offspring for several litters are black solid = 16, black spotted = 5, brown solid = 5, and brown spotted = 14. Are these genes linked or nonlinked? If they are linked, how many map units are they apart?

4. A woman is a carrier for a sex-linked lethal gene that causes spontaneous abortions. She has nine children. How many of these children do you expect to be boys?

5. A dominant sex-linked gene *B* produces white bars on black chickens, as seen in the Barred Plymouth Rock breed. A clutch of chicks has equal numbers of black and barred chicks. (Remember that sex is determined by the *Z-W* system in birds: *ZZ* are males, *ZW* are females.)
   a. If only the females are found to be black, what were the genotypes of the parents?
   b. If males and females are evenly represented in the black and barred chicks, what were the genotypes of the parents?

6. A man with hemophilia (a recessive, sex-linked condition) has a daughter with a normal phenotype. She marries a man who is normal for the trait. What is the probability that a daughter of this mating will be a hemophiliac? That a son will be a hemophiliac? If the couple has four sons, what is the probability that all four will be born with hemophilia?
7. Pseudohypertrophic muscular dystrophy is a disorder that causes gradual deterioration of the muscles. It is seen only in boys born to apparently normal parents and usually results in death in the early teens. Is this disorder caused by a dominant or a recessive allele? Is its inheritance sex-linked or autosomal? How do you know? Explain why this disorder is seen only in boys and never in girls.
8. Red-green color blindness is caused by a sex-linked recessive allele. A color-blind man marries a woman with normal vision whose father was color-blind. What is the probability that they will have a color-blind daughter? What is the probability that their first son will be color-blind? (Note: The two questions are worded a bit differently.)
9. A wild-type fruit fly (heterozygous for gray body color and normal wings) was mated with a black fly with vestigial wings. The offspring had the following phenotypic distribution: wild type, 778; black-vestigial, 785; black-normal, 158; gray-vestigial, 162. What is the recombination frequency between these genes for body color and wing type?
10. In another cross, a wild-type fruit fly (heterozygous for gray body color and red eyes) was mated with a black fruit fly with purple eyes. The offspring were as follows: wild type, 721; black-purple, 751; gray-purple, 49; black-red, 45. What is the recombination frequency between these genes for body color and eye color? Using information from problem 9, what fruit flies (genotypes and phenotypes) would you mate to determine the sequence of the body-color, wing-shape and eye-color genes on the chromosome?
11. A space probe discovers a planet inhabited by creatures who reproduce with the same hereditary patterns as those in humans. Three phenotypic characters are height (T = tall, t = dwarf), head appendages (A = antennae, a = no antennae) and nose morphology (S = upturned snout, s = downturned snout). Since the creatures were not "intelligent," Earth scientists were able to do some controlled breeding experiments, using various heterozygotes in testcrosses. For a tall heterozygote with antennae, the offspring were: tall-antennae, 46; dwarf-antennae, 7; dwarf-no antennae, 42; tall-no antennae, 5. For a heterozygote with antennae and an upturned snout, the offspring were: antennae-upturned snout, 47; antennae-downturned snout, 2; no antennae-downturned snout, 48; no antennae-upturned snout, 3. Calculate the recombination frequencies for both experiments.
12. Using the information from problem 11, a further testcross was done using a heterozygote for height and nose morphology. The offspring were: tall-upturned snout, 40; dwarf-upturned snout, 9; dwarf-downturned snout, 42; tall-downturned snout, 9. Calculate the recombination frequency from these data; then use your answer from problem 11 to determine the correct sequence of the three linked genes.