

Genetics Problems for Ch 15 - Due _____

1. A man with hemophilia (a recessive, sex-linked condition) has a daughter of 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?
2. Pseudohypertrophic muscular dystrophy is an inherited disorder that causes gradual deterioration of the muscles. It is seen almost exclusively 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 almost never seen in girls.
3. 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.)
4. A wild-type fruit fly (heterozygous for gray body color and normal wings) is mated with a black fly with vestigial wings. The offspring have 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 size?
5. In another cross, a wild-type fruit fly (heterozygous for gray body color and red eyes) is mated with a black fruit fly with purple eyes. The offspring are 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 4, what fruit flies (genotypes and phenotypes) would you mate to determine the sequence of the body-color, wing-size, and eye-color genes on the chromosome?
6. What pattern of inheritance would lead a geneticist to suspect that an inherited disorder of cell metabolism is due to a defective mitochondrial gene?
7. Women born with an extra X chromosome (XXX) are healthy and phenotypically indistinguishable from normal XX women. What is a likely explanation for this finding? How could you test this explanation?
8. Determine the sequence of genes along a chromosome based on the following recombination frequencies: A -B , 8 map units; A -C , 28 map units; A -D, 25 map units; B -C, 20 map units; B -D, 33 map units.
9. Assume that genes A and B are linked and are 50 map units apart. An animal heterozygous at both loci is crossed with one that is homozygous recessive at both loci. What percentage of the offspring will show phenotypes resulting from crossovers? If you did not know that genes A and B were linked, how would you interpret the results of this cross?

10. A space probe discovers a planet inhabited by creatures who reproduce with the same hereditary patterns seen 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 are not “intelligent,” Earth scientists are able to do some controlled breeding experiments, using various heterozygotes in testcrosses. For tall heterozygotes with antennae, the offspring are: tall–antennae, 46; dwarf–antennae, 7; dwarf–no antennae, 42; tall–no antennae, 5. For heterozygotes with antennae and an upturned snout, the offspring are: 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.

11. Using the information from problem 10, a further testcross is done using a heterozygote for height and nose morphology. The offspring are: 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 10 to determine the correct sequence of the three linked genes.

12. The ABO blood type locus has been mapped on chromosome 9. A father who has blood type AB and a mother who has blood type O have a child with trisomy 9 and blood type A. Using this information, can you tell in which parent the nondisjunction occurred? Explain your answer.

13. Two genes of a flower, one controlling blue (B) versus white (b) petals and the other controlling round (R) versus oval (r) stamens, are linked and are 10 map units apart. You cross a homozygous blue–oval plant with a homozygous white–round plant. The resulting F₁ progeny are crossed with homozygous white–oval plants, and 1,000 progeny are obtained. How many plants of each of the four phenotypes do you expect?