

**Genetics Problems 2**

Warning: Be careful when you do these problems. There is a mixture of Mendelian genetics, codominance, incomplete dominance, and sex linkage.

1. In humans, the allele that codes for an ability to taste PTC is dominant (T), and the allele that codes for an inability to taste this chemical is recessive (t). A male who is heterozygous for this trait marries a female who cannot taste PTC.
  - a. What are the genotypes of the male and female?
  - b. Draw a Punnett square to show the possible genotypes of their offspring.
  - c. What is the predicted percentage of their offspring that will be able to taste PTC?
  - d. What is the predicted percentage of their offspring that will not be able to taste PTC?
  
2. Imagine that a group of sasquatches have been discovered in the mountains of British Columbia. The scientists studying them observe three pairs, each with several offspring. Phenotypes of the pairs and their offspring are given in the table for one easily observable trait: the presence or absence of hair on their toes. What do you predict are the genotypes of the parents in each of these three pairs?

Pair number	Male parent	Female parent	Offspring
1	Hairy toes	Hairy toes	$\frac{3}{4}$ hairy toes $\frac{1}{4}$ smooth toes
2	Hairy toes	Hairy toes	All hairy toes
3	Smooth toes	Hairy toes	$\frac{1}{2}$ hairy toes $\frac{1}{2}$ smooth toes

3. Imagine that you have two pure lines for each of three species of plants. For each species, one pure line produces only blue flowers and the other pure line produces only red flowers. You do a series of crossing experiments on each species. For species #1, you find that the flowers of the F<sub>1</sub> offspring are all blue. The flowers of the F<sub>1</sub> offspring of species #2 have a mottled (spotted) red and blue appearance. For species #3, the F<sub>1</sub> offspring all have purple flowers. Explain the inheritance for each species.
  
4. Can a male be a carrier of an X-linked trait, but not have the disease? Explain.
  
1. In the fruit fly, long wings (L) is dominant over short wings (l). What results would be obtained when a heterozygous fly is crossed with a short-winged fly? Show the Punnett square and report both the phenotypes and genotypes of the offspring.
  
6. Twenty-five percent of the offspring of a certain pair of white sheep are black. Which trait is dominant? What are the genotypes of the parents?
  
7. A brown mink is crossed with a silver-blue mink. All the offspring are brown. When these F<sub>1</sub> mink were crossed among themselves, they produced 47 brown animals and 15 silver-blue animals. Determine all the genotypes and determine which is the dominant trait.
  
8. Albinism in plants is a lethal trait yet many species of plants produce albinos among their offspring. If albinos always die before reproducing, why does the recessive allele not become eliminated?

9. In humans, freckles is dominant over no freckles. Sam has freckles and his mother had freckles, but his father and sister do not. What are the genotypes of all of the members of the family?
10. A cross between a white snapdragon and a red snapdragon produces pink snapdragons. Draw a Punnett square for this cross. What are the genotypes and phenotypes of the offspring? Draw a Punnett square and determine the genotypes and phenotypes of the  $F_2$  offspring.
11. A man with AB type blood and a lady with O type blood have a child. What are the possible blood types of this child? Can both parents donate blood to their child? Why or why not? Include antigens and antibodies in your explanation.
12. Colorblindness is an X-linked recessive trait. A carrier female and a normal male want to have kids. Describe the gender and vision of their possible offspring.
13. A man with type AB blood and woman with type A blood have four children. The children's blood types are A, B, AB, and O. What are the genotypes of the parents?
14. If red flowers were crossed with yellow flowers and orange flowers resulted, would it be possible to cross orange flowers to get red and yellow flowers again? Explain.
15. In pea plants, round seeds (R) are dominant over wrinkled (r) and yellow (Y) seeds are dominant over green (y) seeds. A plant heterozygous for color but homozygous dominant for seed shape is crossed with a plant that is homozygous recessive for both traits. What are the genotypic and phenotypic ratios of the offspring?
16. If the genotype is  $YySsTt$ , then what does  $ySt$  represent?
17. In humans, brown hair (B) is dominant over blonde hair (b), and brown eyes (E) are dominant over blue eyes (e). What is/are the genotype(s) of a blonde haired, brown eyed person?
18. In humans, long eyelashes are dominant over short eyelashes. If the father is homozygous with short eye lashes and the mother is heterozygous, describe their possible offspring.
19. The gene for scaly skin is X-linked. If a scaly skinned male and a carrier female have kids, what are the possible genotypes and phenotypes of the offspring?
20. There is a breed of cattle which produces good meat when a particular gene is heterozygous. The same gene is lethal when it is homozygous recessive. To produce the best beef possible without losing any cattle, what should a rancher do?