Solving Genetics Problems

Questions and assumptions

- Are the genes linked? - assume that they are not linked unless specifically stated they are linked or on the same chromosome

Questions and assumptions

- Are the genes sex-linked? - assume that they are on autosomes unless it is specifically stated they are on a X or Y sex chromosome or are sex-linked.

Questions and assumptions

- Are the alleles dominant, recessive, or neither? - assume capital letters (e.g. DD) designate dominance over lower case letters (e.g. dd) unless it is codominance or incomplete dominance is stated. The exception is blood types where I^AI^B codominance is implied.

How many different kinds of gametes can individuals with each of the following genotypes produce?

1. AA
2. aa
3. Aa
4. AaBB
5. AaBb
6. AaBbCC
7. AaBbCc
8. AaBbCcDdEeFf

The ability to taste the chemical PTC is determined by a single gene in humans with the ability to taste given by the dominant allele T and inability to taste by the recessive allele t. Suppose two heterozygous tasters (Tt) have a large family.

a. Predict the proportion of their children who will be tasters and nontasters. Use a Punnett square to illustrate how you make these predictions.

b. What is the likelihood that their first child will be a taster? What is the likelihood that their fourth child will be a taster?

c. What is the likelihood that the first three children of this couple will be nontasters?

A boy, whose parents and grandparents had normal vision, is color-blind. What are the genotypes for his mother and his maternal grandparents. Use X^B for the dominant normal condition and X^b for the recessive, color-blind phenotype.

Mother

Grandmother

Grandfather

A farmer who wants to get into the milk business has bought a small beginning herd of 12 cows all of which produce high quantities of milk (M, dominant over low quantities) and have high fertility (F, also dominant over low fertility). However, she knows that all of her cows are heterozygous for both these traits and that the genes are linked. In her cows, one homolog of the pair contains the dominant alleles for each trait and one contains the recessive allele of each of the traits. Two of the farmer's nearby neighbors own bulls that are also heterozygous for these traits. The first neighbor's bull has the same alleles linked as her cows but the second neighbor's bull has one dominant and one recessive allele from each trait on each homolog. Baring in mind that the farmer would like to obtain the maximum number of calves with high milk production and high fertility, which of the two available bulls should she choose to introduce her cows to?

The lubber grasshopper is a very large grasshopper, and is black with red and yellow stripes. Assume that red stripes are expressed from the homozygous RR genotype, yellow stripes from the homozygous rr genotype, and both from the heterozygous genotype.

a. What will be the phenotypic ratio of the F_1 generation resulting from a cross of two grasshoppers, both with red and yellow stripes

b. What would be the genotypic ratio of the F1 generation?

c. What genotypes would be produced by crossing a grasshopper with both color stripes and one with yellow stripes?

d. What phenotypes would be produced by crossing a grasshopper with both color stripes and one with yellow stripes?