

**BIOLOGY 122
GENETIC PROBLEMS**

Monohybrid crosses:

1. For Labrador retrievers, black fur color is dominant to yellow. Explain how the homozygous black dog can have a different genotype than a heterozygous black dog. Could the heterozygous black dog have the same genotype as a yellow-haired dog?
2. A pea plant with round seeds is crossed pollinated with a pea plant that has wrinkled seeds.
 - (a) What is the genotype of the parents if the round seed parent is heterozygous?
 - (b) What are the genotypes and phenotypes of the F1 generation?
 - (c) What is the F2 generation if two round plants of the F1 generation are crossed?
3. For Dalmatian dogs, the spotted condition is dominant to non-spotted
 - (a) Using a Punnett square, show the cross between two heterozygous parents.
 - (b) A spotted female Dalmatian dog mates with an unknown father. From the appearance of the pups, the owner concluded that the male was Dalmatian. The owner notes that the female has six pups, three spotted and three non-spotted. What is the genotype and phenotype of the unknown male?
4. For Mexican hairless dogs, the hairless condition is dominant to hairy. A litter of eight pups is found: six are hairless and two are hairy. What is the genotype of their parents?

Test Crosses/Multiple Alleles/Incomplete Dominance:

5. Multiple alleles control the intensity of pigment in mice. The gene D^1 designates full color, D^2 designates dilute color and D^3 designates is deadly when homozygous. The order of dominance is $D^1 > D^2 > D^3$. When a full-color male is mated to a dilute-color female, the offspring are produced in the following ratio: two full color to one dilute to one dead. Indicate the genotypes of the parents.

6. Multiple alleles control the coat color of rabbits

Phenotypes	Genotypes
Full color	CC, CC^{ch}, CC^h, CC^a
Chinchilla	$C^{ch}C^{ch}$
Light gray	$C^{ch}C^h, C^hC^a$
Himalaya	C^hC^h, C^hC^a
Albino	C^aC^a

****The dominance hierarchy is $C > C^{ch} > C^h > C^a$

- (a) Indicate the genotypes and phenotypes of the F1 generation from the mating of a heterozygous Himalayan-coat rabbit with an albino-coat rabbit.
- (b) The mating of a full color rabbit with a light-gray rabbit produces two full color offspring, one light-gray offspring and one albino offspring. Indicate the genotype of the parents.
- (c) A chinchilla-color rabbit is mated with a light-gray rabbit. The breeder knows that the light-gray rabbit had an albino mother. Indicate the genotypes and phenotypes of the F1 generation from this mating.
- (d) A test cross is performed with a light-gray rabbit, and the following offspring are noted: five Himalayan-color rabbits and five light-gray rabbits. Indicate the genotype of the light-gray rabbit.