**Genetics Practice Problems**

Directions: Label each situation as Incomplete Dominance (**I**), Co-dominance (**C**), Multiple Allele (**M**), or Sex-linked (**S**). Then complete each cross on your own paper. Be sure to show all the necessary steps.

1. In poultry, when birds with splashed-white plumage are mated with solid black birds, the offspring are blue.
   1. Work out the results of a cross between black and splashed white. Then cross two from the F­1 generation to get the F2 generation.
   2. Cross a blue female with a splashed-white male.
2. Hemophilia is a sex-linked disorder. A woman who is a carrier for hemophilia marries a normal man. Show the possible results of this cross and answer the following questions.
   1. What is the probability that this couple could have a son with hemophilia?
   2. What is the probability that they could have a daughter who is a carrier for hemophilia?
   3. What is the probability that they could have a child that is neither a hemophiliac nor a carrier?
   4. What is the probability that they could have a daughter with hemophilia?
3. Yellow guinea pigs crossed with white guinea pigs always produce cream-colored offspring. Cross a yellow guinea pig with a cream-colored guinea pig.
4. In shorthorn cattle, roan color of coat (red and white spotted) appears as a result of a cross between red and white coat color. A breeder of short cattle has cows, which are white and roan bull. What proportion of the calves produced in his herd will be white? Red? Roan?
5. In four-o’clock flowers, the gene for red (RR) flowers is incompletely dominant to the gene for white flowers (WW). The heterozygous plant is pink (RW).
   1. What color flowers are produced by the offspring of a cross between a red-flowered plant and a pink-flowered plant?
   2. What are the results of a cross between two pink-flowered plants?
   3. What offspring does crossing a pink-flowered plant and a white-flowered plant produce?
6. In humans, red-green colorblindness is a recessive trait found on the X chromosome. Normal vision is dominant to color-blindness. Show the possible children of the following couples:
   1. A male with red-green colorblindness and a heterozygous normal woman.
   2. A woman with red-green colorblindness and a normal male
   3. A normal male and a woman who is a carrier for red-green colorblindness.
7. In humans, straight hair and curly hair are incompletely dominant. Matings between individuals with straight hair and curly hair produces heterozygous offspring with wavy hair.
   1. Cross two wavy haired persons.
   2. Cross a curly-haired male with a wavy-haired female.
   3. If a man and woman produce only straight-haired offspring, what will be their genotypes and phenotypes?
8. In human blood typing, four phenotypes are possible: Type A, Type B, Type AB, and Type O. IA and IB are dominant to i. IA and I**B** are codominant. Show the possible offspring of the following couples.
   1. A man with type AB and a woman heterozygous for type B.
   2. A woman with type O and a man homozygous for type A.
   3. A man with type AB and a woman homozygous for type B.
9. Crossing a black chicken (BB) with a white chicken (WW) results in chickens having a black and white checkered pattern.
   1. Cross two checkered chickens.
   2. Cross a black rooster with a checkered hen.

1. Clark Kent (Superman) neglects to inform his wife Lois Lane that his is homozygous for X-Ray vision (EE). Lois, being a normal human is homozygous for normal vision (NN). They have two children and Lois becomes upset when she learns that the children see wavelengths in the ultra-violet spectrum, which is the intermediate between normal and X-Ray range.
   1. What are the genotypes of the children?
   2. What would be the result of a cross between one of the children and a normal individual?

Dihybrid Problems:

1. Work out the following dihybrid cross. Round seeds are dominant over wrinkled seeds. Yellow seeds are dominant over green seeds. Yellow seeds are dominant over green seeds. A plant that is heterozygous for both traits (RrGg) is crossed with another plant that is heterozygous for both traits (RrGg).  
   Parent #1 is RrGg: List the possible gametes: \_\_\_\_\_\_\_ \_\_\_\_\_\_ \_\_\_\_\_\_ \_\_\_\_\_\_  
   Parent #2 is RrGg: List the possible gametes: \_\_\_\_\_\_\_ \_\_\_\_\_\_ \_\_\_\_\_\_ \_\_\_\_\_\_  
   Now draw and complete the Punnett Square (4x4) or short-cut (2 2X2’s) in your spiral. What is the phenotypic ratio?
2. In horses, black hair is dominant to chestnut hair. The trotting gait is dominant to pacing gait. If a homozygous black pacer is crossed with a homozygous chestnut trotter, what will the children be?
3. Two of the children from #2 are mated.
4. In humans, freckles are dominant to no freckles. Dimples are dominant to no dimples. What would be the result of a cross between a woman who is heterozygous for both traits with a homozygous freckled person that doesn’t have dimples?
5. In guinea pigs, dark fur is dominant to light fur and rough coat texture is dominant to smooth coat texture. If a female guinea pig is heterozygous for dark hair and homozygous for rough coat texture is crossed with a male guinea pig with light fur and smooth coat texture, what will be the result?

Monohybrid Questoins

1) For each of the genotypes (AA, Aa or aa) below determine what the phenotype would be.

Hairy knuckles are dominant to non-hairy knuckles in humans.

HH\_\_\_\_\_\_\_\_\_\_\_\_\_ Hh \_\_\_\_\_\_\_\_\_\_\_ hh \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Bobtails in cats are recessive**. Normal tails are dominant.

TT \_\_\_\_\_\_\_\_\_\_\_\_\_ Tt \_\_\_\_\_\_\_\_\_ tt \_\_\_\_\_\_\_\_\_\_\_\_\_

2) For each of the following write whether it is homozygous dominant, heterozygous or homozygous recessive.

AA Ff Aa gg

**Use the following information for questions 3-4:**

In dogs, the gene for fur color has two alleles. The dominant allele (F) codes for grey fur and the recessive allele (f) codes for black fur.

3) The female dog is heterozygous. The male dog is homozygous recessive. Figure out the phenotypic and genotypic ratios of their possible puppies by using a Punnett Square.

4) The female dog has black fur. The male dog has black fur. Figure out the phenotypic and genotypic ratios of their possible puppies by using a Punnett Square.

**Use the following for questions 5-6:** In dogs, there is an hereditary deafness caused by a recessive gene, “d.” A kennel owner has a male dog (Gilbert) that she wants to use for breeding purposes if possible. The dog can hear.

5) What are the two possible genotypes of Gilbert?

6) If the dog’s genotype is Dd, the owner does not wish to use him for breeding so that the deafness gene will not be passed on. This can be tested by breeding the dog to a deaf female (dd). Draw two Punnett squares to illustrate these two possible crosses. In each case, what percentage/how many of the offspring would be expected to be hearing? deaf? How could you tell the genotype of this male dog? Also, using Punnett square(s), show how two hearing dogs could produce deaf offspring.