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Genetics Problems - Practice

I. Incomplete Dominance

1. In humans straight hair (ss) and curly hair (cc) demonstrate incomplete dominance when crossed, resulting in hybrids that have wavy hair (sc).

   Cross a curly hair female with a wavy haired male.

   a. Complete a Punnett square for this cross.

   b. What are the chances of having a curly haired child?

2. In snapdragon flowers, red flowers (rr) and white flowers (ww) demonstrate incomplete dominance when crossed. Resulting hybrids (rw) are pink.

a. Complete a Punnett square to predict the offspring of a red snapdragon crossed with a white snapdragon.

b. Complete a cross of two of the resulting offspring (F_1). What is the phenotypic ratio of the F_2 generation?

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II. Codominance

1. In cattle, RR = red, Rr = roan (spotted red/white), and rr = white. What are the predicted colour phenotypes and their frequencies for the offspring from crosses between:

a. A red bull and a white cow

b. A red bull and a roan cow

c. A roan bull and a roan cow

2. In humans, there are four types of blood; type A, type B, type AB, and type O. The alleles A and B are codominant to each other and the allele O is recessive to both A and B alleles. So a person with genotype **AA** or **AO** will have **type A** blood.

a. What possible genotypes will produce B type blood? _____
b. What is the only genotype that will produce O type blood? _____
c. What is the only genotype that will produce AB type blood? _____

d. A person with blood type O mates with a person with blood type AB.

    i. Complete a Punnett square for this cross.

    ii. List the possible blood types (phenotypes) of the offspring.

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3. Suppose a newborn baby was accidentally mixed up in the hospital. In an effort to determine the parents of the baby, the blood types of the baby and two sets of parents were determined.

Baby #1 has type O	Couple 1: Mother has type B	Father has type AB
	Couple 2: Mother has type B	Father has type B

a. Draw Punnett squares for each couple (you may need to do more than 1 square/couple)

b. To which parents does baby #1 belong? Why? *Hint: You may want to refer to your Punnett Squares.*

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III. Sex-Linked Traits

1. Haemophilia is a sex-linked trait. A person with haemophilia is lacking certain proteins that are necessary for normal blood clotting. Haemophilia is caused by a recessive allele.

a. What are the genotypes for a heterozygous female (a carrier) and a male who does not have haemophelia?

Female genotype: _____ Male genotype: _____

b. Complete a Punnett square for the cross between a female who is heterozygous for the haemophila allele, and a male who does not have haemophilia.

c. What is the probability that a male offspring will have haemophilia?

d. What is the probability of having a haemophiliac female offspring?

2. Baldness is a recessive sex-linked trait. Suppose the mother is heterozygous for the bald allele, and the father is not bald. Determine the probability of of:

i. The female offspring being bald.

ii. The male offspring being bald.

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IV. Dihybrid Crosses

1. In guinea pigs, dark fur colour is dominant (D) and light fur (d) is recessive; rough coat texture (R) is dominant and smooth coat texture ® is recessive.

   A female guinea pig is heterozygous for both fur colour and coat texture. She is crossed with a male that has light fur colour and is heterozygous for coat texture.

a. What are the genotypes for both the female and male guinea pigs?

   Female genotype: _____ Male genotype: _____

b. What possible offspring can they produce?

   Punnett Square:

c. Write out the genotypic ratio for the possible offspring:

d. Write out the phenotypic ratio for the offspring:

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2. In pea plants, the round seed allele is dominant over the wrinkled seed allele, and the yellow seed allele is dominant over the green seed allele. The genes for seed texture and those for seed colour are on different chromosomes.

   A plant heterozygous for seed texture and seed colour is crossed with a plant that is wrinkled and heterozygous for seed colour.
   R = round, r = wrinkled, Y = yellow, y = green.

   a. Construct a Punnett square for this cross.

   b. What is the expected ***phenotypic*** ratio?