Genetics Worksheet # 1   **Answers**   name:_____

Blood type inheritance is somewhat complicated, with three forms of the gene and 4
possible phenotypes. Refer to class notes for more information.

1. Suppose that a woman with blood type AB marries a man with type o. What are
   the chances that their children will have blood type A? How about the other
   types?

   50% type A
   50% type B

2. Suppose now that a man with blood type B marries a woman with blood type A.
   What will the blood type of their first child likely be? Show how you know.

   if you assume both parents are homozygous dominant: all offspring are type AB

   if you assume both parents are heterozygous: 25% chance each of AB, A, B, and o

   other combinations are possible as well

3. How would the answer to number 2 change if you knew the blood type of the
   grandparents?

   you might know if they are heterozygous or homozygous

Cystic Fibrosis is a disease caused by a mutation in the gene for a chloride channel (a
"gate" protein". Since one "good" copy of the gene produces enough protein, the disease
is recessive – it only shows up when both copies of the gene have the mutation.

4. Suppose that a man with a family history of CF marries a woman with no history
   of the disease. The woman has no genes for CF (homozygous dominant) while
   the man is a carrier (heterozygous) and does not have the disease.

   a. Show each parent's genotype

      FF (woman)   Ff (man)

b. If these people become parents, what are the chances that their children will have CF? What about the chances they will be carriers?

no chance of having the disease; 50% chance of carriers

c. Does it make any difference if the children are male or female?

no

Huntington's disease results from a genetic error in which nervous system components degenerate (break down) with age. The disease does not show up until age 50. It is a dominant disease, since one copy of the mutation is enough to cause problems.

5. Suppose that a man with two children, aged 15 and 17, develops Huntington's disease at age 50, and that he is heterozygous. His wife does not have the disease.

a. Show the genotype of each person (man, woman, and two children)

man: Hh
woman: hh
both kids are either Hh or hh

b. What are the chances that the children have this disease?

50%

Genetics Worksheet #2   name:_____

Hemophilia is known as a sex-linked trait, since the gene is found only on the X chromosome. (no parallel gene is found on the Y chromosome). The protein made by this gene is known as clotting factor 8, one of the key components of the blood-clotting system. Without this protein, blood won't clot properly. With only one good copy of the gene, a heterozygote still makes enough clotting factor for normal functioning – thus, the disease is recessive.

1. Suppose that a man with hemophilia marries a woman whose father had hemophilia.

   a. show the genotypes of the man and the woman.

   $$man – X^hY$$
   $$woman - X^HX^h$$

   b. what are the chances that their daughters will have hemophilia?

   50%

   c. what are the chances that their sons will have hemophilia?

   50%

2. Suppose that a man with normal hemoglobin marries a woman who is a carrier.

   a. show the genotypes of each parent

   $$man – X^HY$$
   $$woman - X^HX^h$$

   b. what are the chances that their offspring will have hemophila?

   male – 50%
   female – 0%

3. Color blindness is also a sex-linked trait, since the genes that code the protein which detects colored light is found on the X chromosome. Why is color-blindness more common among males than females?

   because males only have one X chromosome, so if they have one bad copy of the gene they will have the disease.

Sickle-cell anemia is a genetic disease. The normal version of the gene produces the protein hemoglobin, which carries oxygen in the blood. The mutated version produces a

hemoglobin that has the wrong shape, so it does not function properly. A person with two normal copies of the gene has normal hemoglobin. A person with two mutated copies of the gene has the disease. A person with one normal copy (a heterozygote) has some normal and some mutated hemoglobin.

1. Suppose that a man with sickle-cell disease marries a woman who is a carrier.

    a. show the genotype of each parent.

        man – hh
        woman - Hh

    b. if the couple has children, what are the chances that they will have the disease? That they will be carriers?

        disease – 50%
        carriers – 50%

    c. why is a heterozygote less likely to contract malaria? (check your book or notes if necessary).

        heterozygotes have some sickle cells, and the malaria parasite cannot infect sickle cells.

Genetics Worksheet #3

Dihybrid crosses (2 traits at once)

In pea plants, tall is dominant to short, and yellow seeds are dominant to green. Cross a true-breeding tall yellow plant (homozygous dominant for both traits) with a short green plant.

1. Show the genotypes of both parent plants

   TTYY

   T=tall, t=short
   Y=yellow, y=green

2. Show the results of the F1 generation

   100% are TtYy

3. Cross two plants from the F1 generation. Show the possible gamete combinations and use a Punnett Square to predict the results. Indicate your answer as ratio or percentage of phenotypes. Remember that each phenotype should have a height and a color trait (for example, "tall and green").

   9 tall yellow : 3 tall green : 3 short yellow : 1 short green

   Punnett square should look like the one on p. 317

Incomplete dominance

In 4-o'clock plants, pink is an intermediate phenotype found in heterozygous individuals.

4. Cross a red plant with a white plant. Show the genotypes of the parent plants.

   Red plant: RR   White plant: WW

5. Predict the results of the cross. Indicate the percentage or ratio of phenotypes in the offspring.

25% Red (RR)   50% pink (RW)   25% White (WW)

See p. 319 in textbook

6. What are the chances of two plants in a row both being pink? Of two plants in a row being white?

Two plants in a row pink: ½ x ½ = ¼ or 25%

Two white in a row: ¼ x ¼ = 1/8 or 12.5%

Linked genes

7. Circle back to the first set of questions. How would the results you predicted in question 4 be different if the color and height genes were on the same chromosome? Predict the results for the F2 generation, assuming no crossing over.

If there is no crossover and linked genes, the pattern is like a one-factor or monohybrid cross.

Expected results are 75% tall, yellow; 25% short, green

8. How does the answer to #7 change if there is crossing over?

If there is crossover, some tall, green and short, yellow plants will appear. Probably not in the 9-3-3-1 ratio however. The closer together the genes on the chromosome, the less often they will be separated by crossover.

9. Look at the map of linked genes in chromosome 2 of fruit flies on p. 328. Identify 2 genes that are likely to be inherited together even with crossing over. Explain your answer.

One possible answer is star eye and dumpy wing.