Sex Linked Problems

1. In fruit flies, red eyes are dominant, and **X**-linked. A white-eyed female fruit fly (X^rX^r) is crossed with a red-eyed male (X^RY). What are the expected phenotypes of the offspring?
2. In a cross between a pure bred, red-eyed female fruit fly and a white-eyed male, what percent of the **male** offspring will have white eyes? (white eyes are **X**-linked, recessive)
3. Hemophilia is a sex-linked trait where X^H gives normal blood clotting and is dominant to the hemophilia allele X^h. What will be the results of mating between a normal (non-carrier) female and a hemophilac male?
4. Red-green color blindness (c) is inherited as a sex-linked recessive. If a color-blind woman marries a man who has normal vision (C), what would be the expected genotypes and phenotypes of their children with reference to this character?
5. A human female "carrier" who is heterozygous for the recessive, sex-linked trait causing red-green color blindness, marries a normal male. What proportion of their **male** progeny will have red-green color blindness?
6. A man and his wife both have normal color vision, but a daughter has red-green color blindness, a sex-linked recessive trait. The man sues his wife for divorce on grounds of infidelity. Can genetics provide evidence supporting his case?
7. Women have sex chromosomes of **XX**, and men have sex chromosomes of **XY**.
Which of a man's grandparents could be the source of any of the genes on his **Y**-chromosome?
A. Father's Mother.
B. Mother's Father.
C. Father's Father.
D. Mother's Mother, Mother's Father, and Father's Mother.
E. Mother's Mother.
8. Women have sex chromosomes of **XX**, and men have sex chromosomes of **XY**.
Which of a women's grandparents could **not** be the source of any of the genes on either of her **X**-chromosomes?
A. Mother's Father.
B. Father's Mother.
C. Mother's Mother.
D. Father's Father.
E. Mother's Mother and Mother's Father.
9. A couple has three girls in a row.
a) What are the odds that the 4^{th} child will also be a girl?
b) What are the odds that the 5^{th} child will also be a girl?
c) What are the odds of a couple having 5 girls in a row? (God help that father)
10. Hemophilia is a sex-linked trait where X^H gives normal blood clotting and is dominant to the hemophilia allele X^h.
a. Give the genotypes of 1) a woman with normal blood clotting whose father had hemophilia and 2) a normal man whose father had hemophilia.
b. What is the probability that a mating between these two individuals will produce a child, regardless of sex, that has hemophilia?
c. If this couple has a daughter, what is the probability that the daughter will be a carrier of the hemophilia trait? What is the probability a daughter would have hemophilia?
d. If this couple has a son, what is the probability he will have hemophilia?

Sex Linked Problems KEY

1. A white-eyed female fruit fly is crossed with a red-eyed male. Red eyes are dominant, and **X**-linked. What are the expected phenotypes of the offspring?
All of the females are red-eyed and heterozygous. All of the males are white-eyed.

2. In a cross between a pure bred, red-eyed female fruit fly and a white-eyed male, what percent of the **male** offspring will have white eyes? (white eyes are **X**-linked, recessive)
0%
All of the males and all of the females are red-eyed.

3. Hemophilia in humans is due to an **X**-chromosome mutation. What will be the results of mating between a normal (non-carrier) female and a hemophilac male?
all sons are normal and all daughters are carriers.

Daughters inherit a normal allele from their mother and the hemophilia allele from their father. Sons inherit the normal allele from their mother.

4. Red-green color blindness (c) is inherited as a sex-linked recessive. If a color-blind woman marries a man who has normal vision (C), what would be the expected genotypes and phenotypes of their children with reference to this character?
genotypes: 1 X^CX^c : 1 X^cY phenotype: all sons are color blind, all daughters are carriers but have normal vision.

5. A human female "carrier" who is heterozygous for the recessive, sex-linked trait causing red-green color blindness, marries a normal male. What proportion of their **male** progeny will have red-green color blindness?
50%
Half the sons would be expected to inherit the allele from their mother and be afflicted because they are hemizygous. Half the daughters would be carriers like their mothers.

6. A man and his wife both have normal color vision, but a daughter has red-green color blindness, a sex-linked recessive trait. The man sues his wife for divorce on grounds of infidelity. Can genetics provide evidence supporting his case?
Yes it can.

7. Women have sex chromosomes of **XX**, and men have sex chromosomes of **XY**.
Which of a man's grandparents could be the source of any of the genes on his **Y**-chromosome?
A. Father's Mother.
B. Mother's Father.
C. Father's Father.
D. Mother's Mother, Mother's Father, and Father's Mother.
E. Mother's Mother.

8. Women have sex chromosomes of **XX**, and men have sex chromosomes of **XY**.
Which of a women's grandparents could **not** be the source of any of the genes on either of her **X**-chromosomes?
A. Mother's Father.
B. Father's Mother.
C. Mother's Mother.
D. Father's Father.
E. Mother's Mother and Mother's Father.

9. A couple has three girls in a row.
a) What are the odds that the 4^{th} child will also be a girl? **1/2**
b) What are the odds that the 5^{th} child will also be a girl? **1/2**
c) What are the odds of a couple having 5 girls in a row? (God help that father) **1/32**

10. Hemophilia is a sex-linked trait where X^H gives normal blood clotting and is dominant to the hemophilia allele X^h.
a. Give the genotypes of 1) a woman with normal blood clotting whose father had hemophilia and 2) a normal man whose father had hemophilia.
1) the woman has normal clotting so she has one X^H but she got X^h from her father
2) the man is X^HY since he got the Y from his father and he is normal so must be X^H
b. What is the probability that a mating between these two individuals will produce a child, regardless of sex, that has hemophilia?
each child has a 1/2 chance of being male and males have a 1/2 chance of being affected; so 1/4 chance of a child with hemophilia
c. If this couple has a daughter, what is the probability that the daughter will be a carrier of the hemophilia trait?
1/2 chance of being a carrier
What is the probability a daughter would have hemophilia?
0 chance that a daughter would have hemophilia
d. If this couple has a son, what is the probability he will have hemophilia?
1/2 chance