Sex Linked Problems

1. In fruit flies, red eyes are dominant, and X-linked. A white-eyed female fruit fly (X'X') is crossed with a red-eyed male (XRY). 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 4th child will also be a girl?
   b) What are the odds that the 5th 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^C^C X^c^Y
   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. Father's Father.
   C. Father's Father.
   D. Father's Father.
   E. Father's Mother.

8. Women have sex chromosomes of XX, and men have sex chromosomes of XY.
   Which of a woman'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 Father.
   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 4th child will also be a girl? 1/2
   b) What are the odds that the 5th 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^H^Y 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