Name_____ Date_____

40 Inheritance of Sex-Linked Traits

BACKGROUND

The body cells of humans have 46 chromosomes in their nuclei. There are twenty-two pairs of *homologous* chromosomes. These chromosomes are called *autosomes*, and they determine most of the traits of the individual. The other two chromosomes are the *sex chromosomes*, which determine the sex of the individual. There are two different sex chromosomes, X and Y. A female has two X chromosomes; a male has one X and one Y chromosome.

Traits controlled by genes carried on the sex chromosomes are said to be *sex-linked*. Humans are known to have more than 40 sex-linked traits. The Y chromosome is considerably smaller and has fewer genes than the X chromosome. Almost all human sex-linked traits are carried on the X chromosome. Among the sex-linked traits in humans are color blindness and hemophilia.

OBJECTIVES

In this activity you will learn about the pattern of inheritance of two sex-linked traits in humans.

PROCEDURES AND OBSERVATIONS

In humans, red-green color blindness is the result of a recessive gene, **b**, carried on the X chromosome. Normal color vision is produced by the dominant gene, **B**, also carried on the X chromosome.

In predicting the inheritance of sex-linked traits, use the symbols X and Y to represent the sex chromosomes. Write the letter symbol for the trait as a superscript on the appropriate sex chromosome. For example, an X chromosome with the dominant gene for normal color vision would be written X^B. An X chromosome with the recessive gene for color blindness would be written X^b.

a. Determine how to write the genotypes for male and female individuals who either are color blind or have normal color vision.

1. *Write the genotype of a male with normal color vision.*

_____

2. *Write the genotype of a male who is color blind.*

_____

3. *Write the two possible genotypes of a female with normal color vision.*

_____

4. *Write the genotype of a female who has normal color vision but who carries the gene for color blindness.*

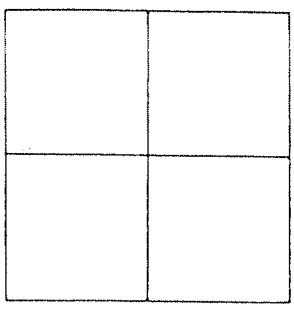
_____

5. *Write the genotype of a female who is color blind.*

_____

b. Punnett squares can be used to determine the probability of inheritance of color blindness. A pedigree chart can also be used to illustrate the information in a Punnett square. In a pedigree chart, the heterozygous genotype can be shown by shading in only half of the symbol.

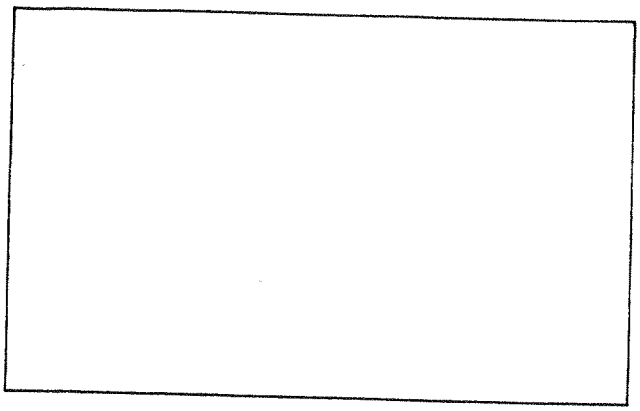
6. *Using a Punnett square, determine the possible genotypes and phenotypes of the children of a color-blind male and a female who has normal color vision but carries the recessive gene.*



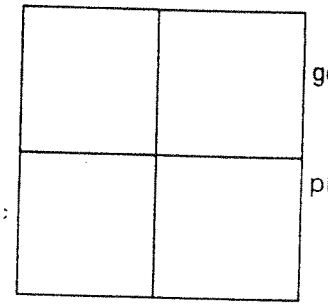
genotype: females _____ males

phenotype: females: males:

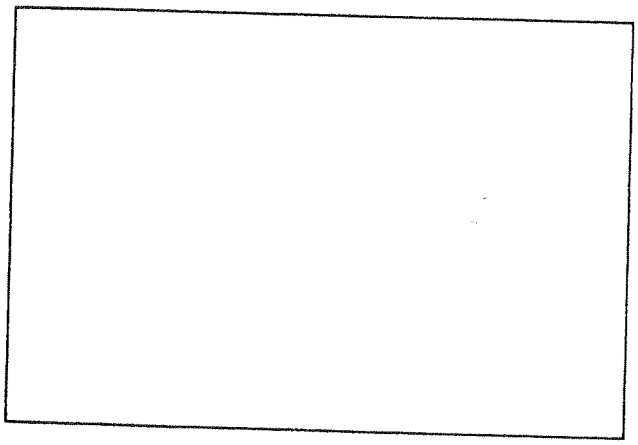
7. *Draw a pedigree chart illustrating the cross in question 6.*



8. *Using a Punnett square, determine the possible genotypes and phenotypes of the children of a color-blind female and a male with normal color vision.*



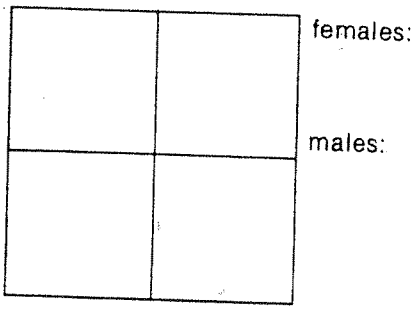
9. *Draw a pedigree chart illustrating the cross in question 8.*



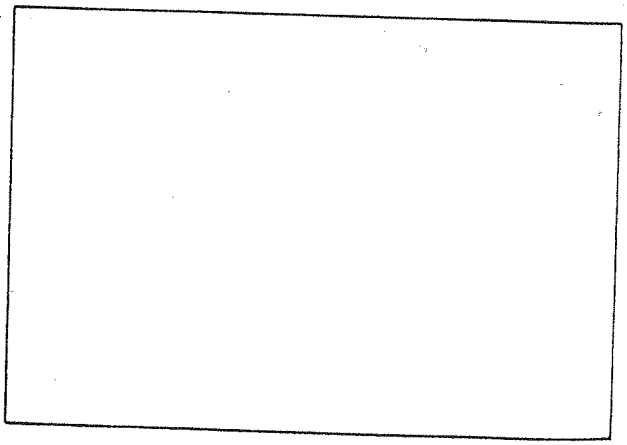
Like color blindness, the inheritance of hemophilia in humans is also controlled by sex-linked genes. The dominant gene, H, is carried on the X chromosome. It causes the production of substances that allow the blood to clot normally after an injury. An individual with the recessive gene, h, on the X chromosome lacks certain of the substances in the blood that allow it to clot normally. In extreme cases, a hemophiliac can bleed to death from a minor injury.

c. Punnett squares can be used to determine the chance of inheritance of hemophilia.

10. *Using a Punnett square, determine the possible genotypes and phenotypes of the children of a normal male and a female who carries the recessive gene for hemophilia.*



11. *Draw a pedigree chart illustrating the cross in question 10.*



INHERITANCE OF SEX-LINKED TRAITS- QUESTIONS

1. What is the probability that a daughter of a color-blind female and a male with normal color vision will be color-blind?

2. Explain why males are affected by color blindness and hemophilia much more frequently than females.

3. Is it possible for a male to have normal color vision and carry the gene for color blindness? Explain your answer.

4. A color-blind male and a female with normal color vision produce a color-blind daughter. What is the genotype of the mother?

5. Can a color-blind female and a male with normal color vision have a son with normal vision? Explain your answer.

6. Use a Punnett square to determine the possible genotypes of the children of a male with normal color vision and a female with normal color vision whose father was color-blind.

7. What genotypes in parents could produce a female with hemophilia?

8. What is the probability that a male with hemophilia and a normal female with no evidence of hemophilia in her family will produce a hemophiliac son? Explain your answer.