# Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_Period:\_\_\_\_\_\_Date\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Sex-Linked Traits Worksheet**

**Background Information:**

Sex-linked traits are those whose genes are found on the X chromosome but not on the Y chromosome. In humans the X chromosomes are much larger than the Y chromosome and contain thousands of more genes than the Y chromosome. For each of the genes that are exclusively on the X chromosomes, females, who are XX, would obviously have two alleles. Males, who are XY, would have only one allele. Thus females with one recessive allele and one dominant allele, for a gene that is unique to the X chromosome, will always display the dominant phenotype. However, a male with a recessive allele for a gene unique to the X chromosome will always exhibit that recessive trait because there is no other corresponding allele on the Y chromosome.

In humans, each of two different sex-linked genes has a defective recessive allele that causes a disease. The diseases are hemophilia and colorblindness. In hemophilia, the defective allele prevents the synthesis of a factor needed for blood clotting. In colorblindness, the defective allele prevents a person from seeing certain colors.

**Use the information below to answer the following questions.**

XH- X chromosome with normal dominant allele (no hemophilia)

Xh - X chromosome with recessive hemophilia allele

Y - Y chromosome (does not contain comparable gene)

XB - X chromosome with normal dominant allele (not colorblind)

Xb - X chromosome with recessive colorblind allele

Y -Y chromosome (does not contain comparable gene)

1. Write the genotypes for the following phenotypes of red-green color blindness.

1. normal male \_\_\_\_\_\_\_\_\_\_\_\_\_
2. normal female carrying no colorblind alleles (Homozygous) \_\_\_\_\_\_\_\_
3. colorblind male \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
4. normal female carrying the colorblind allele (Heterozygous) \_\_\_\_\_\_\_\_\_
5. colorblind female \_\_\_\_\_\_\_\_\_\_\_\_\_\_

**XB XB**

2. **XBXB  x XbY**

|  |  |
| --- | --- |
|  |  |
|  |  |

a. What proportion/percent of the male children

**Xb Y**

 are colorblind? \_\_\_\_\_\_\_\_\_\_\_\_

b. What proportion/percent of the female children

 are colorblind?\_\_\_\_\_\_\_\_\_\_\_\_

**XB Xb**

3. **XBXb  x XBY**

|  |  |
| --- | --- |
|  |  |
|  |  |

a. What proportion of the male children are

**XB Y**

 colorblind? \_\_\_\_\_\_\_\_\_\_\_\_\_

b. What proportion of the female children are

 colorblind?\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

4. What is the probability that a colorblind woman who marries a man with normal

 vision will have a colorblind child? \_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Xb Xb**

|  |  |
| --- | --- |
|  |  |
|  |  |

5. A normal-sighted woman (whose father was colorblind)

 marries a colorblind man. **XBXb x XbY**

**XB Xb**

|  |  |
| --- | --- |
|  |  |
|  |  |

a. What is the probability that they will have a **son**

 who is colorblind? \_\_\_\_\_\_\_\_\_

**Xb Y**

b. What is the probability that they will have a

 colorblind **daughter**? \_\_\_\_\_\_\_\_

For the following Sex-Linked Punnett Squares:

H= normal blood clotting

h=hemophilia

6. **XHXh  x XHY**

**XH Xh**

|  |  |
| --- | --- |
|  |  |
|  |  |

 a. What is the probability that any of their offspring

 will have hemophilia? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**XH Y**

7. A woman who is a carrier for hemophilia marries a hemophiliac man.

**XHXh x XhY**

**XH Xh**

|  |  |
| --- | --- |
|  |  |
|  |  |

 a. What proportion of the male children are

 hemophiliacs?\_\_\_\_\_\_\_\_\_\_\_\_\_

**Xh Y**

 b. What proportion of the female children are

 hemophiliacs?\_\_\_\_\_\_\_\_\_\_\_\_\_

8. A phenotypically normal man marries a homozygous normal woman.

**XHXH x XHY**

**XH XH**

|  |  |
| --- | --- |
|  |  |
|  |  |

**XH Y**

a. What is the probability that any of their children

 will be hemophiliacs?\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

9. A phenotypically normal woman has phenotypically normal parents. However, she

 has a hemophiliac brother.

(Mom is carrier) (Dad) Brother

**XHXh x XHY XhY (got Xh from Mom)**

**XH Xh**

|  |  |
| --- | --- |
| **XH Y** |  |
|  |  |

a. What are her chances of being a carrier for

 hemophilia?\_\_\_\_\_\_\_\_\_\_\_\_\_\_

ANSWER THE FOLLOWING QUESTIONS USING YOUR KNOWLEDGE OF SEX-LINKED TRAITS, THE BACKGROUND INFORMATION AND YOUR NOTES.

10. What is a sex-linked trait?

11. Why must males inherit colorblindness or hemophilia from their mothers?

12. Why is colorblindness or hemophilia more common in males than in females?