

Name, Date, Hr/Pr _____ **KEY**

Genetics: X-Linked Genes

In fruit flies, eye color is a sex linked trait. Red is dominant to white.

1. What are the sexes and eye colors of flies with the following genotypes:

$X^R X^r$ female, red $X^R Y$ male, red
 $X^R X^R$ female, white $X^r Y$ male, white

2. What are the genotypes of these flies:

white eyed, male $X^r Y$ red eyed female (heterozygous) $X^R X^r$
 white eyed, female $X^r X^r$ red eyed, male $X^R Y$

3. Show the cross of a white eyed female $X^r X^r$ with a red-eyed male $X^R Y$.

| | X^R | Y |
|-------|-----------|---------|
| X^r | $X^R X^r$ | $X^r Y$ |
| X^r | $X^R X^r$ | $X^r Y$ |



4. Show a cross between a pure red eyed female and a white eyed male.

What are the genotypes of the parents: $X^R X^R$ & $X^r Y$

How many are:

| | X^r | Y |
|-------|-----------|---------|
| X^R | $X^R X^r$ | $X^R Y$ |
| X^R | $X^R X^r$ | $X^R Y$ |

white eyed, male none white eyed, female none
 red eyed, male 100% of males; 50% of total offspring
 red eyed, female 100% of females; 50% of total offspring

5. Show the cross of a red eyed female (heterozygous) and a red eyed male.

What are the genotypes of the parents? $X^R X^r$ & $X^R Y$

How many are:

| | X^R | Y |
|-------|-----------|---------|
| X^R | $X^R X^R$ | $X^R Y$ |
| X^r | $X^R X^r$ | $X^r Y$ |

white eyed, male 50% of males; 25% of total offspring
 white eyed, female none
 red eyed, male 50% of males; 25% of total offspring
 red eyed, female 100% of females; 50% of total offspring.

****Math**:** What if, in the cross to the left, 100 males were produced and 200 females. How many total red-eyed flies would there be? 150 flies would be red-eyed [50 males & 100 females]

6. In humans, hemophilia is a sex linked recessive trait. Females can be normal, carriers, or have the disease. Males will either have the disease or not (but they won't ever be carriers)

$X^H X^H$ = sex: fem phen. = normal

$X^H X^h$ = sex: fem phen. = carrier

$X^h X^h$ = sex: fem phen. = hemophiliac

$X^H Y$ = sex: male phen. = normal

$X^h Y$ = sex: male phen. = hemophiliac

7. Show the cross of a man who has hemophilia with a woman who is a carrier.

| | X^h | Y |
|-------|-----------|---------|
| X^H | $X^H X^h$ | $X^H Y$ |
| X^h | $X^h X^h$ | $X^h Y$ |

What is the probability that their children will have the disease? 50%

8. A woman who is a carrier marries a normal man. Show the cross.

| | X^H | Y |
|-------|-----------|---------|
| X^H | $X^H X^H$ | $X^H Y$ |
| X^h | $X^H X^h$ | $X^h Y$ |

What is the probability that their children will have hemophilia? 25%
 What sex will a child in the family with hemophilia be? male

9. A woman who has hemophilia marries a normal man.

| | X^H | Y |
|-------|-----------|---------|
| X^h | $X^H X^h$ | $X^h Y$ |
| X^h | $X^H X^h$ | $X^h Y$ |

How many of their children will have hemophilia, and what is their sex?
50% will have hemophilia – all of which will be boys

10. In cats, the gene for calico (multicolored) cats is a COdominant, sex linked trait. Females that receive an X^B [black] and a X^{B^1} [orange] gene have black and orange splotches on white coats. Males can only be black or orange, but never calico.

Show the cross of a female calico cat with a black male.

| | X^B | Y |
|-----------|---------------|-------------|
| X^B | $X^B X^B$ | $X^B Y$ |
| X^{B^1} | $X^B X^{B^1}$ | $X^{B^1} Y$ |

What percentage of the kittens will be black & male? 25%
 What percentage of the kittens will be calico & male? 0% - can't be calico
 What percentage of the kittens will be calico & female? 25%

11. Show the cross of a female black cat, with a male orange cat.

| | X^{B^1} | Y |
|-------|---------------|---------|
| X^B | $X^B X^{B^1}$ | $X^B Y$ |
| X^B | $X^B X^{B^1}$ | $X^B Y$ |

What percentage of the kittens will be calico and female? 50%
 What color will all the male cats be? black

12. Color blindness is caused by a sex-linked recessive allele. *use X^N = normal vision and X^n = color blind

Can a color blind female have a son that has normal vision? no. She donates an X chromosome to her sons – and she can only donate

- a. Genotype Female: $X^n X^n$ Xs having the color-blind allele.
 b. Genotype Male: $X^n Y$

13. Baldness is a sex-linked trait. *use X^H = normal hair, and X^h = bald
 What parental genotypes could produce a bald woman?

$X^h X^h$ crossed with $X^h Y$

$X^H X^h$ crossed with $X^h Y$