Sex-Linked Traits

MS.B

GENETICS

TARGETS

13. I can explain the differences between autosomes and sex chromosomes
14. I can predict the possible genotypes and phenotypes of a sex-linked cross between X^BX^b and X^BY
15. I can explain why females are carriers and not males
16. I can explain why recessive traits whose gene is on the X chromosome are more likely to appear in males than females

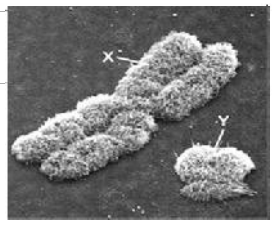
What is a sex-linked trait?

- Traits determined by a gene found only on sex chromosomes (pair #23)
  - Chromosome pairs 1-22 are autosomes
  - Females have 2 X chromosomes - **XX**
  - Males have one X and one Y - **XY**

- **Females can pass on only an X chromosome but males can pass on an X or a Y**

Also note: there is a 50/50 chance of having a boy or a girl

	X	Y
X	XX	XY
X	XX	XY



- **In humans, the X chromosome is much larger than the Y chromosome so it can hold more genes than the Y chromosome**

Carriers

Women can be carriers since they have 2 alleles for trait.

- they *carry* the recessive gene but the dominant (normal) gene will be expressed

X^NX^n

MEN CAN NOT **BE CARRIERS OF SEX-LINKED TRAITS**

- **Since they are XY, any trait on the X will be expressed because there is no second allele to dominate or cover it up.**
- **They either have the disorder or they don't**

Colorblindness is sex-linked

Normal Vision- Dominant (N)
Colorblind- Recessive (n)

Female who is homozygous Normal Vision:

X^NX^N

Male who is Normal Vision:

X^NY ⟸ **No second allele for vision**

GENOTYPE OF COLORBLIND MALE?

X^nY

Colorblind female? $X^n X^n$

Female Carrier? $X^N X^n$

Example:

- **What is the probability of a woman that is a carrier for colorblind and a man that has normal vision having a child with the disorder?**
- Step 1: Dominant = normal vision
  Recessive = color blind
- Step 2: Phonotype woman = carrier
  man = normal vision
- Step 3: Genotype woman = $X^N X^n$
  man = $X^N Y$

STEP 3: GENOTYPE WOMAN = $X^N X^n$ MAN = $X^N Y$

Step 4: Punnett Square

		Male X^N	Male Y
Female	X^N	$X^N X^N$	$X^N Y$
	X^n	$X^N X^n$	$X^n Y$

WHAT IS THE PROBABILITY OF A WOMAN THAT IS A CARRIER FOR COLORBLIND AND A MAN THAT HAS NORMAL VISION HAVING A CHILD WITH THE DISORDER?

$X^N X^N$	$X^N Y$
$X^N X^n$	$X^n Y$

Step 5: Phenotypes

Female babies: 100% normal vision

Male babies: 50% normal 50% color blind

Answer: 1 in 4 or 25% chance of having a child that is colorblind

REFLECTION #3

- **<u>Hypothesis:</u> If I cross a woman who is homozygous dominant for the trait of colorblindness, with a man who is colorblind, then _____% of the offspring will be colorblind because**

  _____

- Complete the cross **showing all 6 steps** in your notes.
- **Was your hypothesis correct?**