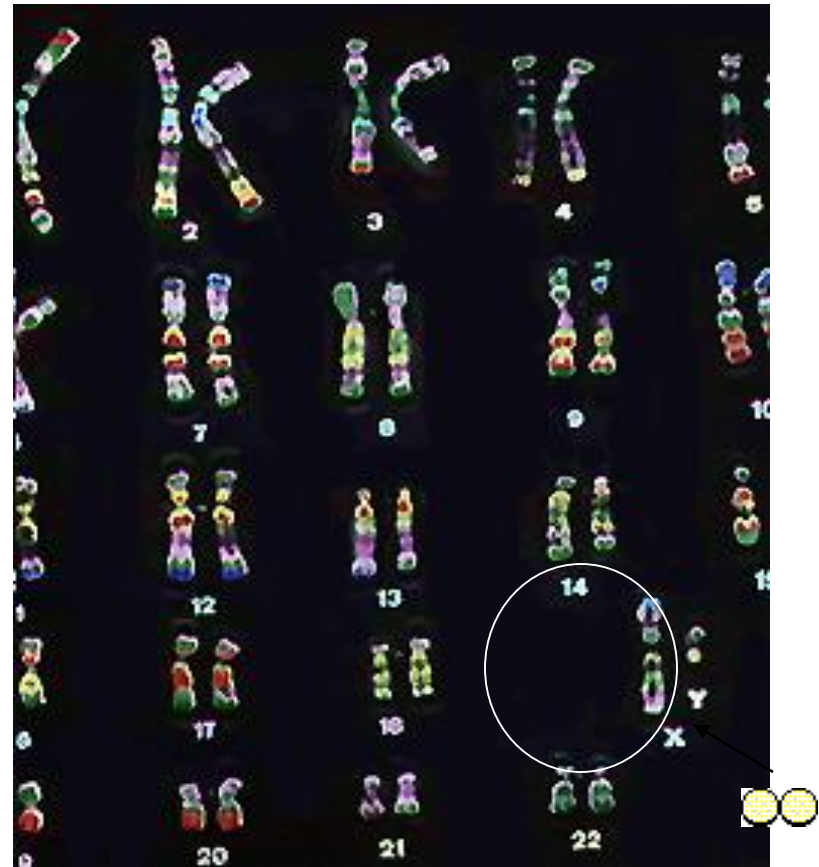


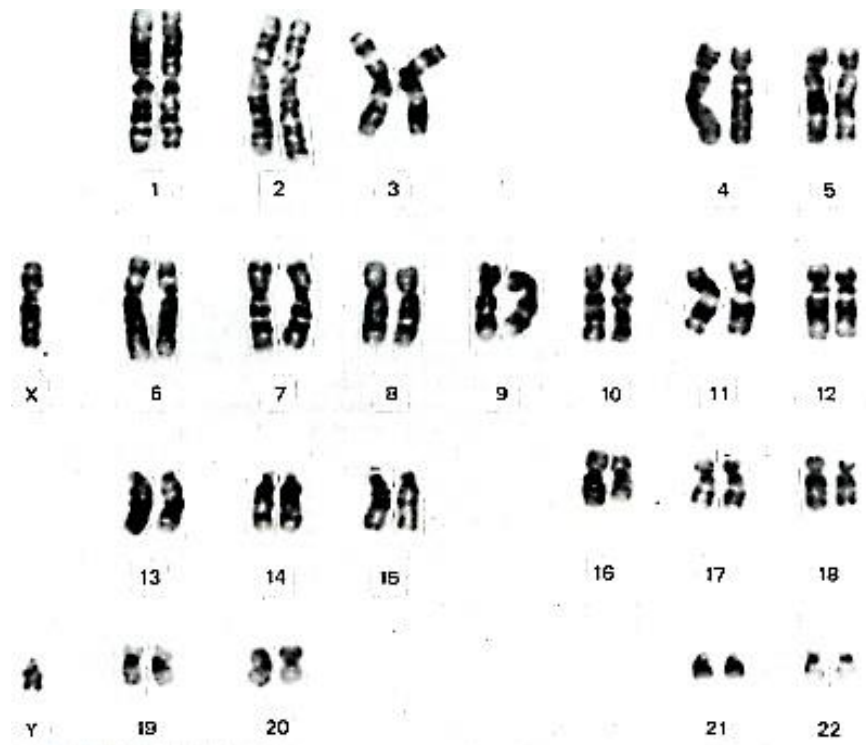
Sex Linked Traits

- Humans have 23 pairs of chromosomes.
- One pair of chromosomes is related to the sex of an individual, these chromosomes are called sex chromosomes



Sex Linked Traits

- The other 22 pairs of chromosomes are called **autosomes (1-22)**



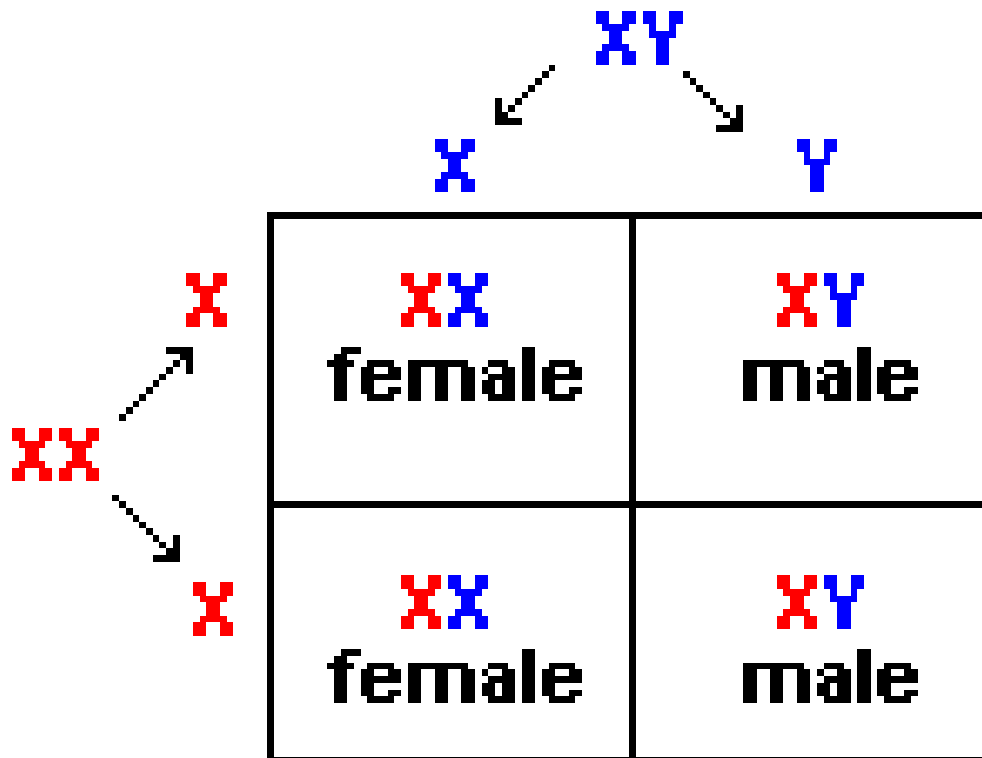
Sex Linked Traits

- In humans, the sex of an individual depends on the presence or absence of the **Y chromosome**

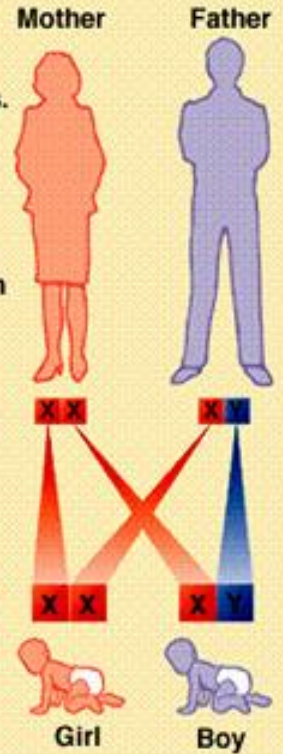
A normal human female is **XX**

A normal human male is **XY**

Determination of Sex



Father has an X chromosome and a Y chromosome. Mother has two X chromosomes. Male baby receives an X chromosome from the mother and a Y chromosome from the father. Female baby receives X chromosomes from both mother and father.



Sex Linked Traits

- Genes that are located on the X chromosome are called **sex-linked genes**.
- Traits determined by sex-linked genes are called sex-linked traits

(c = colorblind, C = normal)

Ex. Color blindness

female $X^c X^c$

male $X^c Y$

Sex Linked Traits

- Sex linked traits are **recessive**, this means both x chromosomes must have the gene in order for the trait to be expressed.

Sex Linked Traits

- If only **one x chromosome** is present (**in males**) and has the sex linked gene, then the trait will be **expressed**

Carriers

- A carrier is a person that has the trait on only one chromosome and does not express the trait. Carriers of sex linked traits are always **women**.

(C= normal, c= colorblind)

Ex. Color blind carrier $X^C X^c$

Sex Linked Punnett Squares

- A colorblind male marries a normal female. What are the offspring genotypes and phenotypes?
(C = normal, c = colorblind)

	X^c	Y
X^C		
X^C		

Sex Linked Punnett Squares

- A colorblind male marries a normal female. What are the offspring genotypes and phenotypes?

(C = normal, c = colorblind)

	X^c	Y
X^C	$X^C X^c$	$X^C Y$
X^C	$X^C X^c$	$X^C Y$

Sex Linked Punnett Squares

- A normal male (not colorblind) marries a carrier. What are the offspring genotypes and phenotypes?

	X^C	Y
X^C		
X^c		

Sex Linked Punnett Squares

- A normal male (not colorblind) marries a carrier. What are the offspring genotypes and phenotypes?

	X^C	Y
X^C	$X^C X^C$	$X^C Y$
X^c	$X^c X^c$	$X^c Y$

Sex Linked Punnett Squares

- A normal male (not colorblind) marries a colorblind female. What are the offspring genotypes and phenotypes?

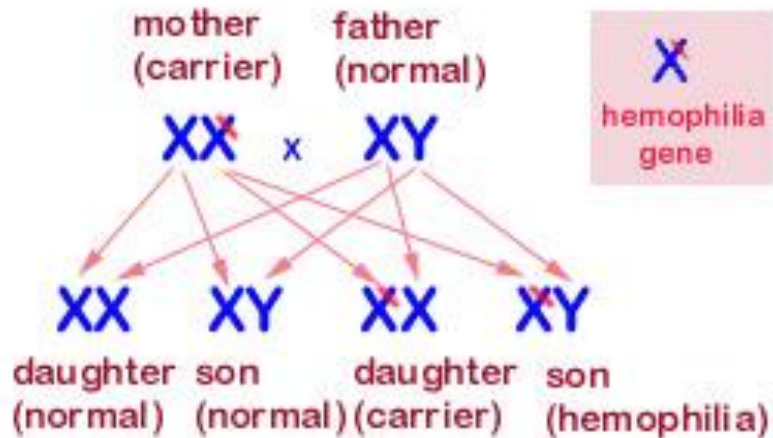
	X^C	Y
X^c		
X^c		

Sex Linked Punnett Squares

- A normal male (not colorblind) marries a colorblind female. What are the offspring genotypes and phenotypes?

	X^C	Y
X^c	$X^C X^c$	$X^c Y$
X^c	$X^C X^c$	$X^c Y$

Hemophilia



- Hemophilia is characterized by **uncontrolled bleeding**
- It is a sex linked disorder caused by **errors in the DNA** that codes for the proteins involved in clotting