CONCEPT: SEX CHROMOSOMES

Sex Determination

● Different organisms determine sex differently

□ There are two types of sex's

- **Homogametic sex** is the sex that has only one type of chromosome (X)

- **Heterogametic sex** is the sex that has two types of chromosomes (X or Y)

□ There are three different sex _____ systems

- **XX/XO**: Sex's are determined by having either one or two of the same chromosome

- **XX/XY:** Sex's are determined by having either one or two types of chromosomes

- **ZZ/ZW**: The male is *homogametic* and the female is *heterogametic*

□ Organisms can be

- **Monoecious**: when an organism contains both male and female sexual organs (*hermaphrodite)*

- **Dioecious**: when an organism contains either male or female sexual organs

EXAMPLE: Sex determination systems

Humans: XX:XY

Female Gametes	X	X
X	XX	XX
Y	XY	XY

Male Gametes

Insects: XX:XO

	X	X
X	XX	XX
-	X-	X-

Male Gametes

Birds:ZW:ZZ

	Z	W
Z	ZZ	ZW
Z	ZZ	ZW

Male Gametes

Females: XX or ZW

Males: XY or XO or ZZ

Human Sex Chromosomes

● Humans follow the XX/XY model, with males determined by the XY chromosomes

□ During meiosis, the XY or XX chromosomes, separate _____ into the haploid daughter cells

- **Nondisjunction** is when chromosomes do not separate properly during meiosis

□ There are many _____ that can occur if the sex chromosomes do not segregate properly

- **Klinefelter syndrome (47 XXY)** : have male genitalia, but usually fail to produce sperm

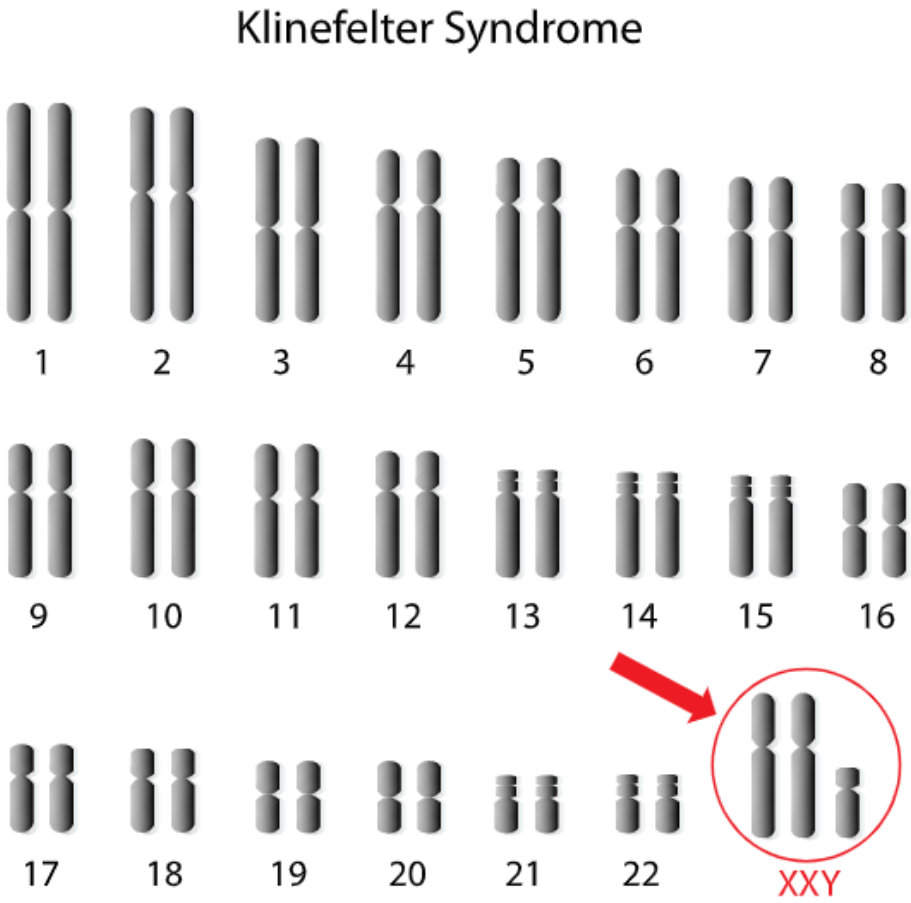
- In severe cases, klinefelters can have more Xs and display more severe phenotypes

- Turner syndrome (45 X): have female genitalia, but have cognitive and sexual impairments

- **Mosaics** can occur when somatic cells display two different numbers of sex chromosomes

- Example: 45X / 46 XY

EXAMPLE: Karyotype for Klinefelter Syndrome



● Human sex's handle their chromosomes differently

□ The Y chromosome determines _____

- **Sex determining region (SRY)** produces a **testis determining factor (TDF)** protein

□ Females get two _____ of the X chromosome

- Therefore one needs to be inactivated so females don't get double the dose of X they need

- **Barr bodies** are the name for the inactivated X chromosome

- It is inactivated by condensing the chromatin

- The **lyon hypothesis** states that X chromosome inactivation occurs randomly in somatic cells

- Occurs early in development, so it can result in a mosaic phenotype

Ex: calico cats

EXAMPLE: Calico cats and the Lyon Hypothesis