

FROM GENOTYPE TO PHENOTYPE

How Genes Interact

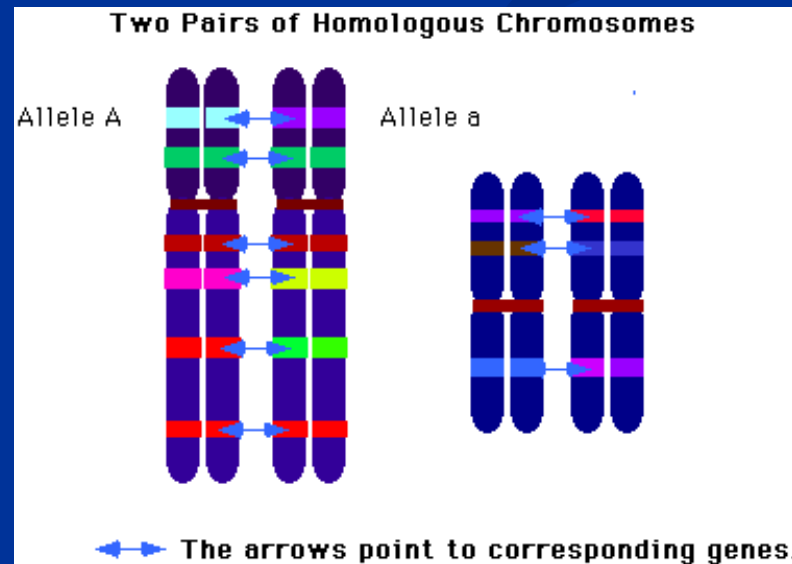
But first...

- Genotype is....
the genetic make-up of an organism

- Phenotype is....
The physical appearance of the organism determined
by the genotype

BUT...Where are the Genes?

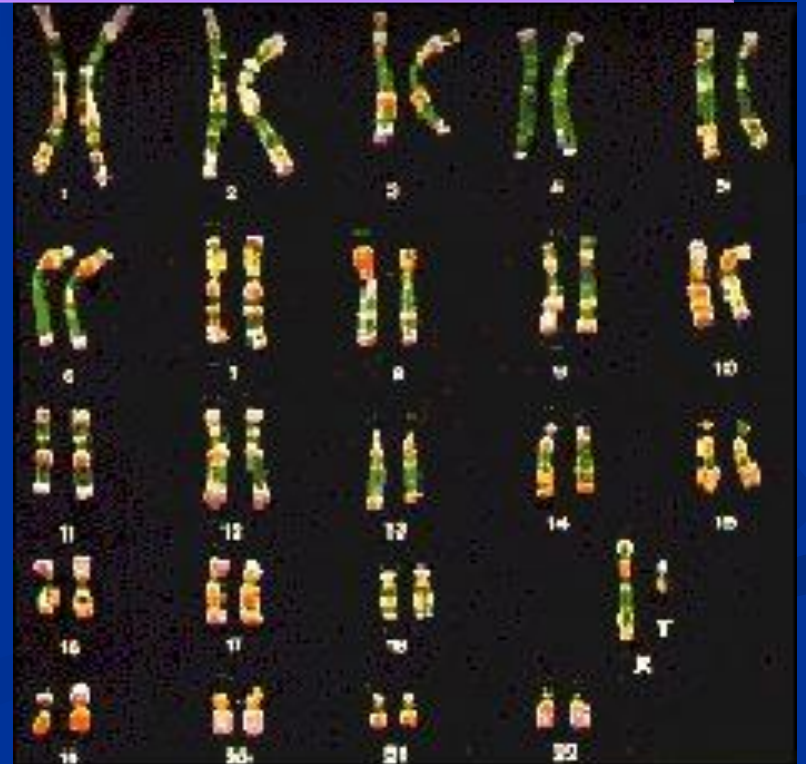
- On chromosomes
- 30,000 different genes on 46 human chromosomes
- Unlinked genes undergo Mendel's principle of independent assortment
- Genes on same chromosome are "linked" together
- Linked genes **DO NOT** undergo independent assortment



Sex Chromosomes

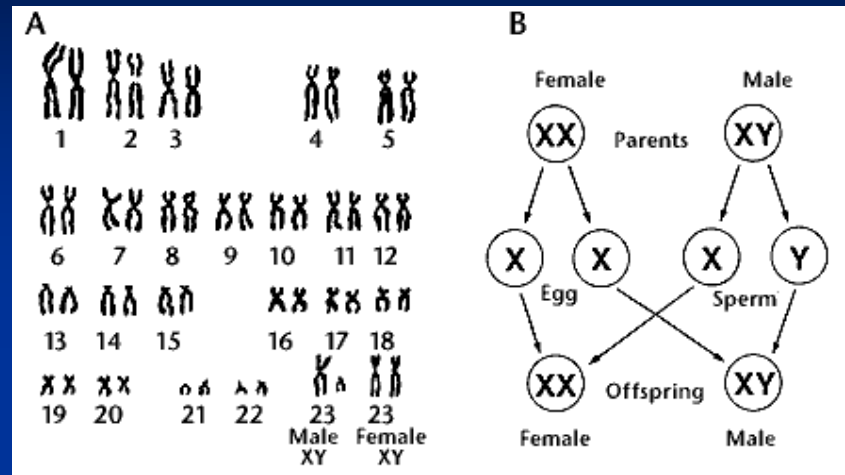
- The exception to homologous pairs
- Humans have 22 pairs of autosomes (body cells) and 1 pair of sex chromosome

QQ#1: What determines if you are male or female?



Sex Determination

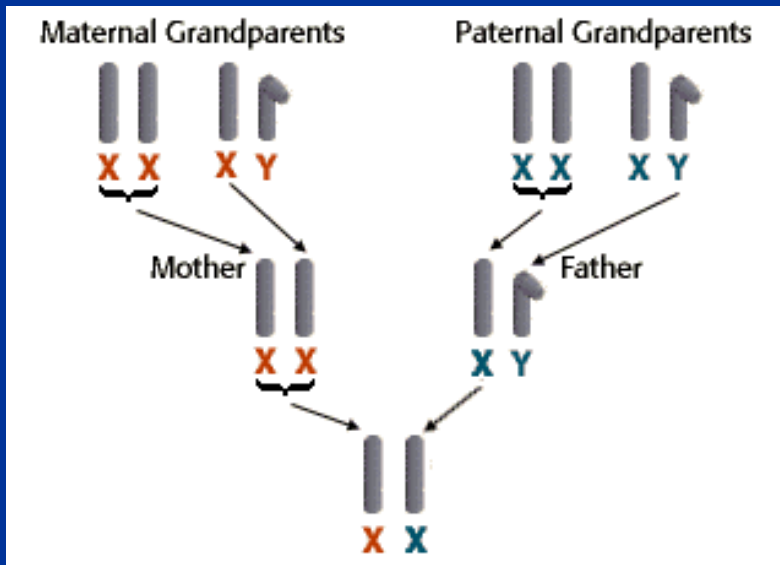
- Females = XX
 - meiosis separates X's
 - 100% eggs = X
 - 22 autosomes + 1 X chromosomes (sex chromosome)
- Males = XY
 - meiosis separates X and Y
 - 50% sperm = Y
 - 50% sperm = X
 - 22 autosomes + 1 Y chromosomes



QQ#2: Can a recessive gene ever be expressed without being homozygous recessive?

Sex-Linked Inheritance

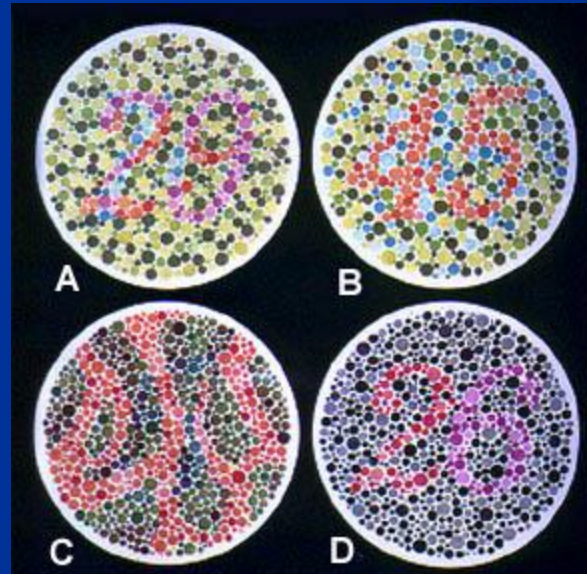
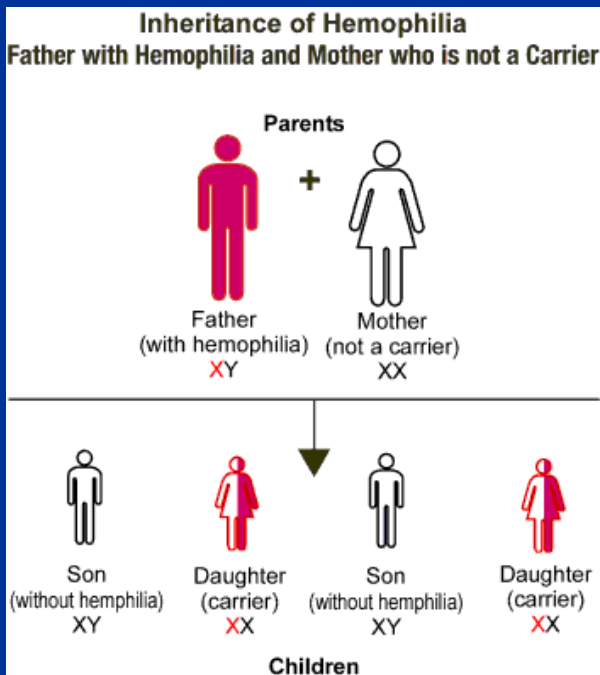
- Genes carried on X or Y chromosomes are called “sex-linked”
- Y is smaller and only carries a few genes
- X carries many genes associated with growth and development
- Recessive disorders on X are always expressed in males



QQ#3: Why would it be the mother's "fault" if a son has a X-linked disorder

Sex-Linked Examples

- Colorblindness (X^cX^c) or (X^cY)
- Hemophilia (X^hX^h) or (X^hY)

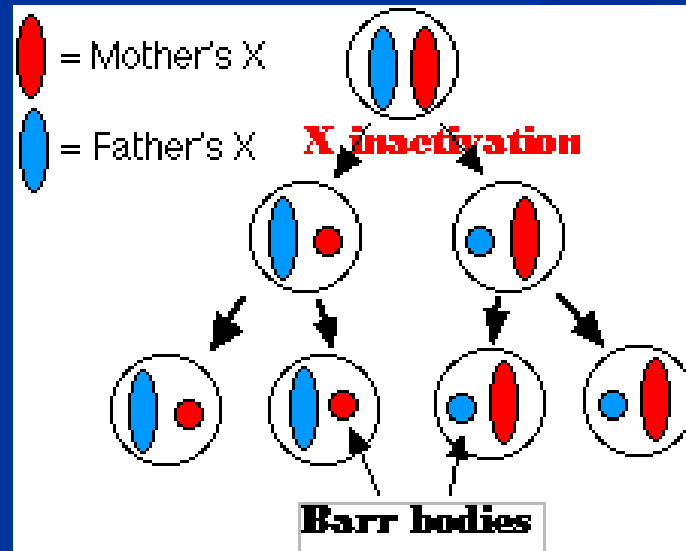


4 Sex-Linked Traits:

1. Normal Color Vision:
A: 29, B: 45, C: --, D: 26
2. Red-Green Color-Blind:
A: 70, B: --, C: 5, D: --
3. Red Color-blind:
A: 70, B: --, C: 5, D: 6
4. Green Color-Blind:
A: 70, B: --, C: 5, D: 2

The Barr Body

- One of the two X chromosomes in each autosomal (body cell) cell of all females is genetically inactivated
- Occurs around the 16th day of embryonic development

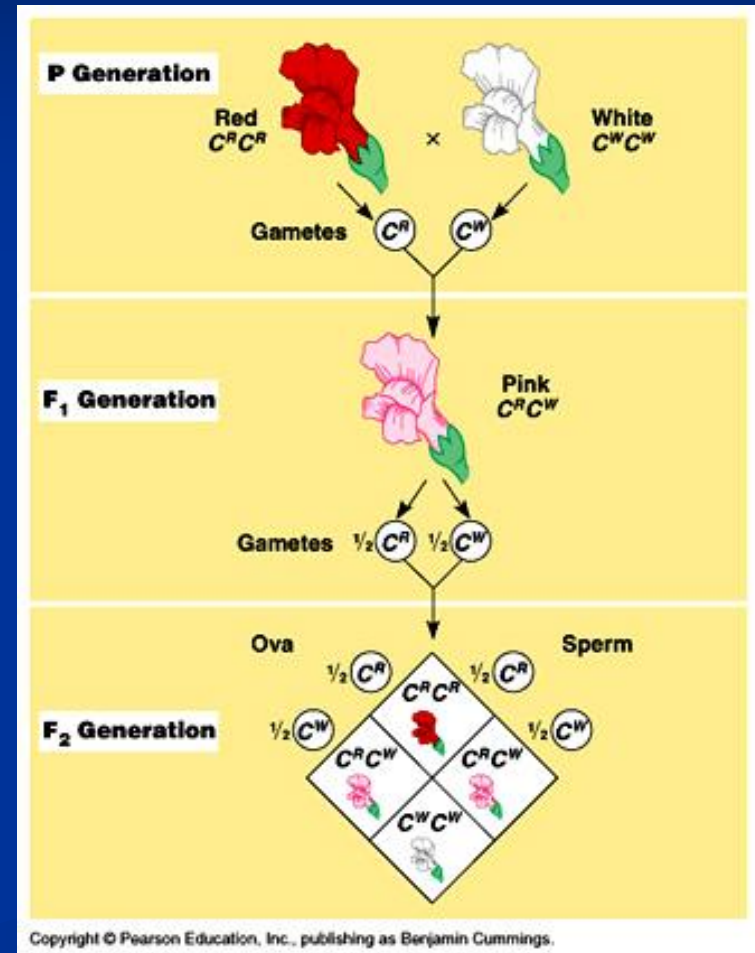


Principle of Dominance

- Mendel's principle of dominance states that for every gene, one allele is dominant and the other is recessive.
- But genetics is not that simple! Not all genes act in this way!





Incomplete Dominance

- Inheritance in which an active allele does not entirely compensate for an inactive allele
- The result is an offspring that is an intermediate between the two phenotypes (not a blending, an intermediate)



Codominance

- Condition in which both alleles of a gene are completely expressed

The ABO Blood System				
Blood Type (genotype)	Type A (AA, AO)	Type B (BB, BO)	Type AB (AB)	Type O (OO)
Red Blood Cell Surface Proteins (phenotype)				
	A agglutinogens only	B agglutinogens only	A and B agglutinogens	No agglutinogens

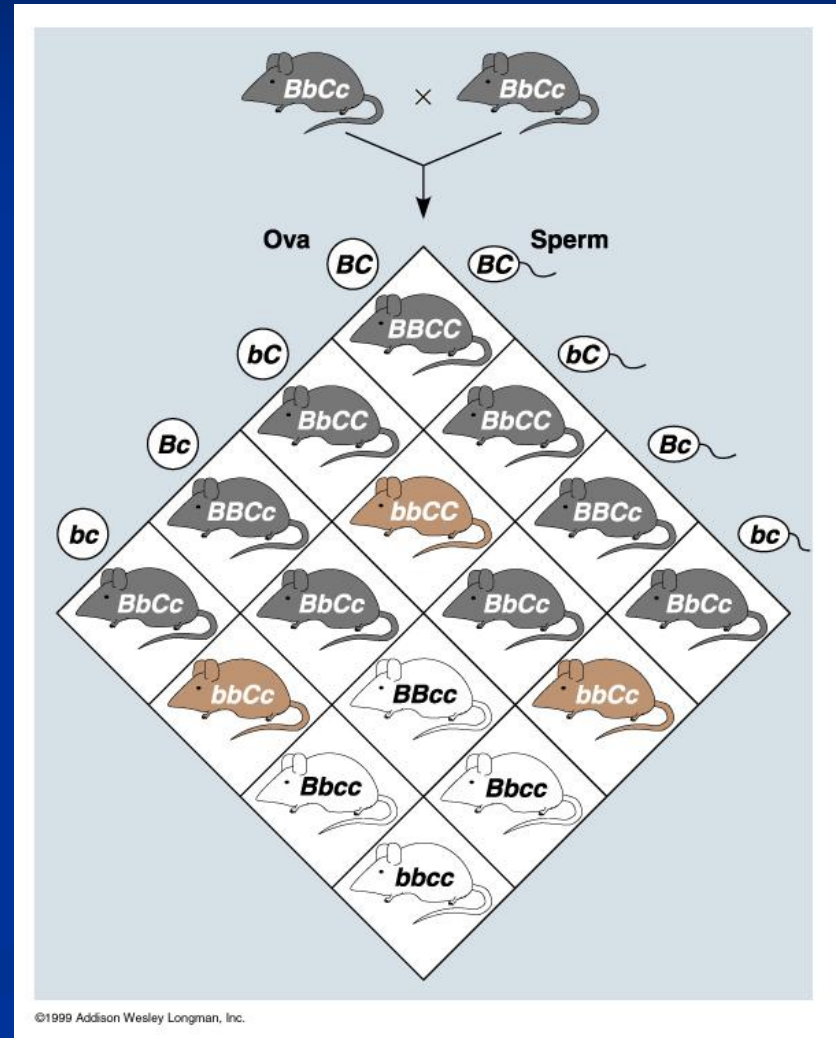


Co-dominance and Incomplete Dominance are not the same thing!!!!

QQ#4: Explain the difference between co-dominance and incomplete dominance in a way that makes sense to you.

Multiple Alleles

- When three or more alleles of the same gene code for a single trait
- Ex: Fur color in mice
 - 2 genes: one codes for black or brown color, the other codes for color presence
 - B is black and b is brown
 - C is for color presence and c is for no color (albino)



Pedigrees

- Shape refers to gender
 - Boxes signify “male”
 - Circles signify “female”
- Fill represents degree of affect
 - Filled in box/circle means “affected”
 - Half-filled in box/circle means “carrier”
 - Empty box/circle means “unaffected”

