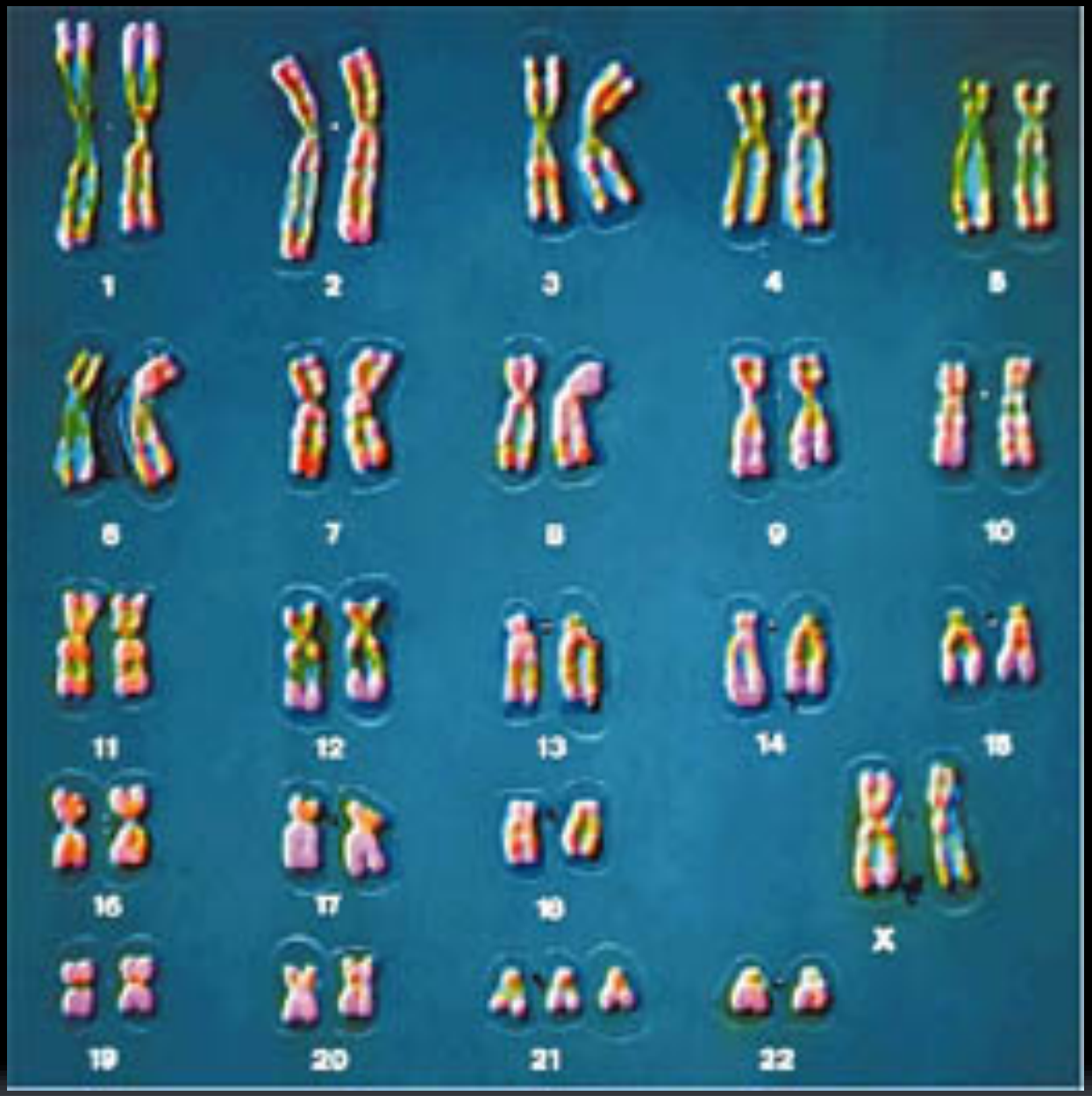
Meiosis – A Source of Distinction

- **Why do you share some but not all characters of each parent?**

- **At one level, the answers lie in meiosis.**

- <u>Meiosis does two things -</u>
  - 1) Meiosis takes a cell with two copies of every chromosome (diploid) and makes cells with a single copy of every chromosome (haploid).
- This is a good idea if you're going to combine two cells to make a new organism. This trick is accomplished by halving chromosome number.
  - In meiosis, one diploid cells produces four haploid cells.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Why do organisms need meiosis?

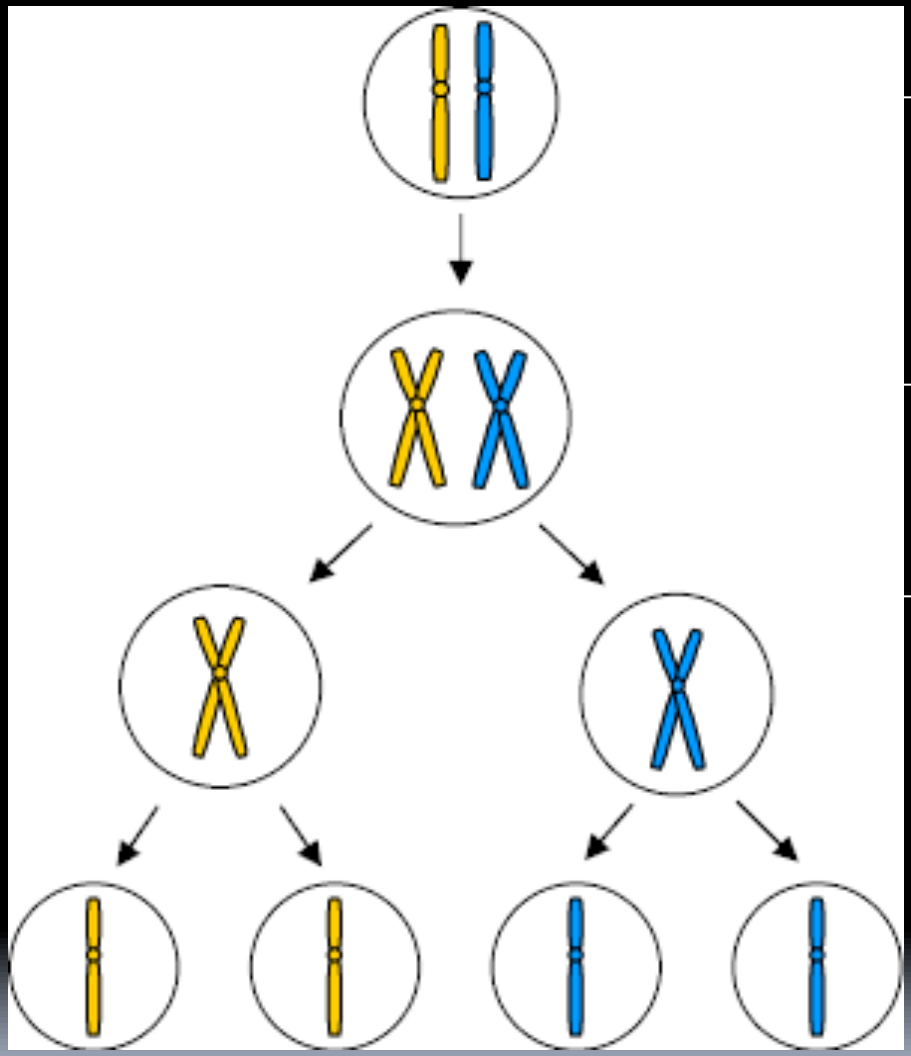
- Meiosis is necessary to halve the number of chromosomes going into the sex cells (plants and animals)

Why halve the chromosomes in gametes?

- At fertilization the male and female sex cells will provide ½ of the chromosomes each – so the offspring has genes from both parents

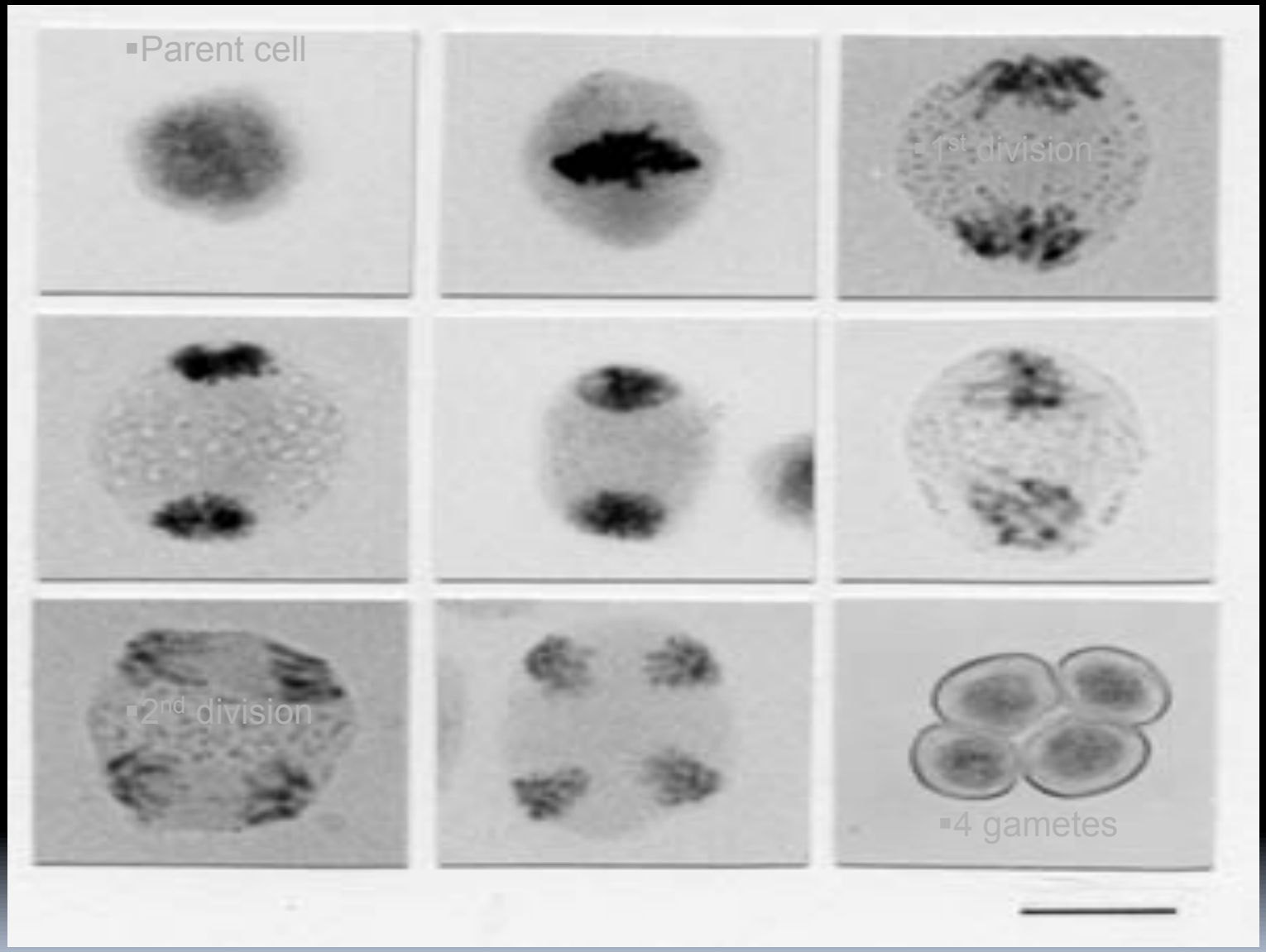
- 2) Meiosis scrambles the specific forms of each gene that each sex cell (egg/sperm, pollen/egg) receives.
- This makes for a lot of genetic diversity. This trick is accomplished through independent assortment and crossing-over.
- Genetic diversity is important for the evolution of populations and species.

Meiosis



- Parent cell (Diploid)– chromosome pair
- Chromosomes copied
- 1st division - pairs split
- 2nd division – produces 4 gamete cells(Haploid) with ½ the original no. of chromosomes

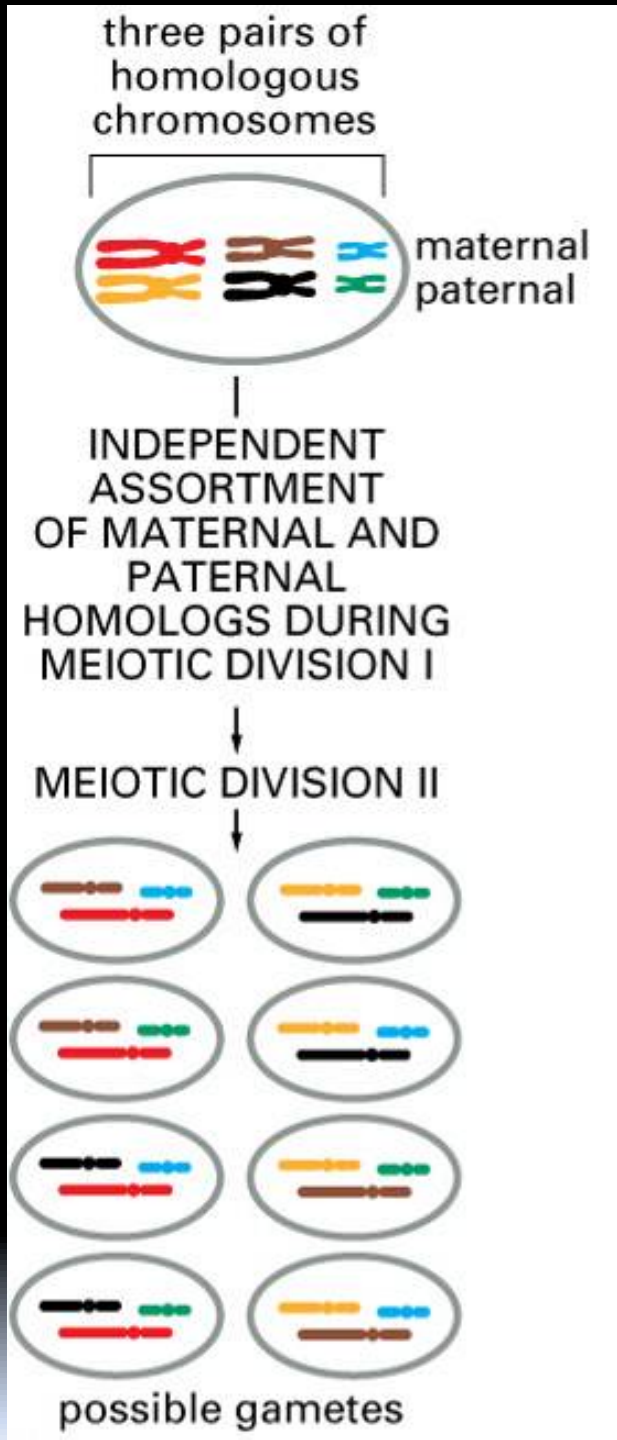
Meiosis – cell splits

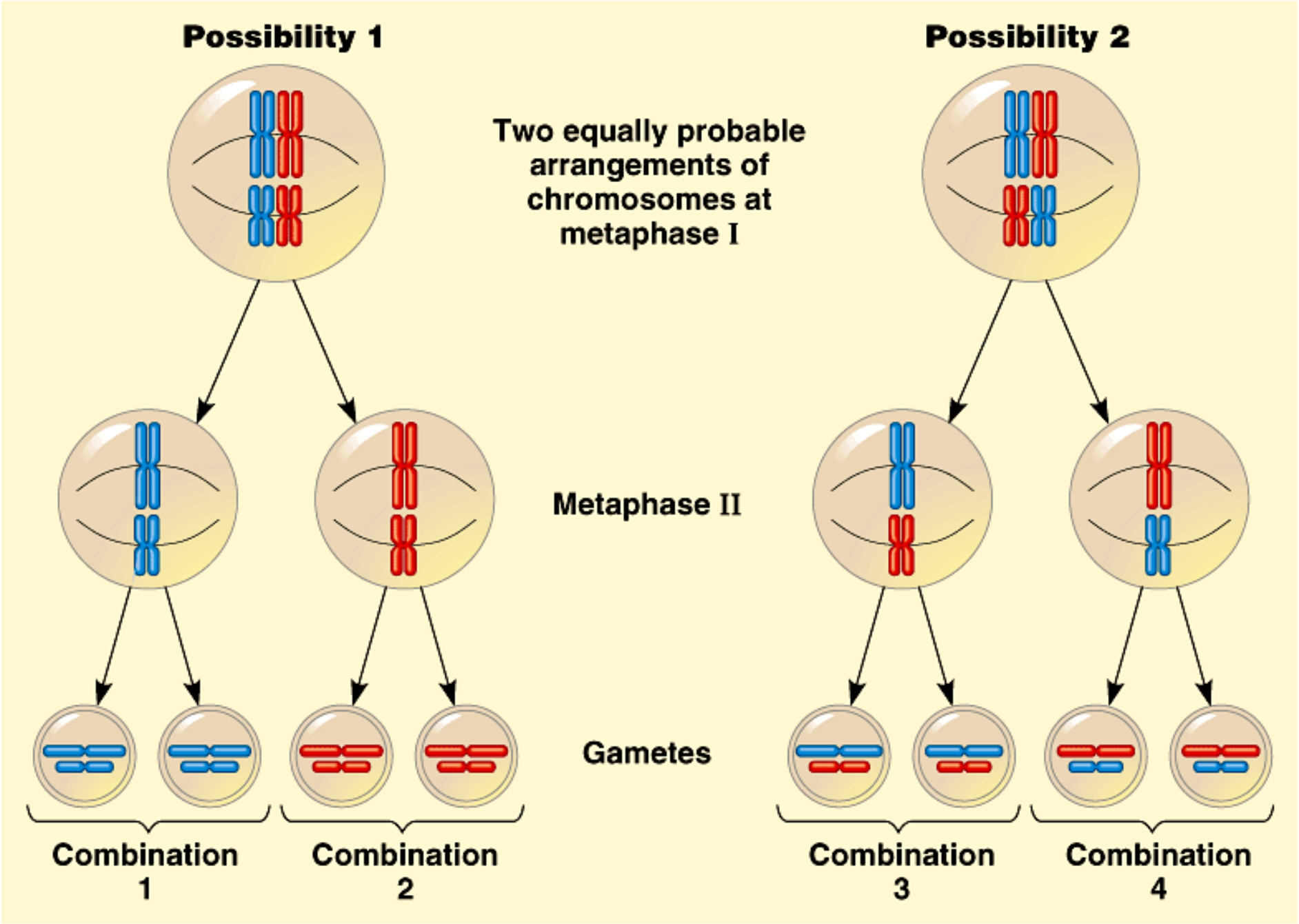


- How does Meiosis cause genetic diversity?
  - One way is Independent Assortment

Genes for different traits are inherited independently from one another. For example, just because you inherit your eye color from you mother, doesn't mean you will inherit your hair color from her.

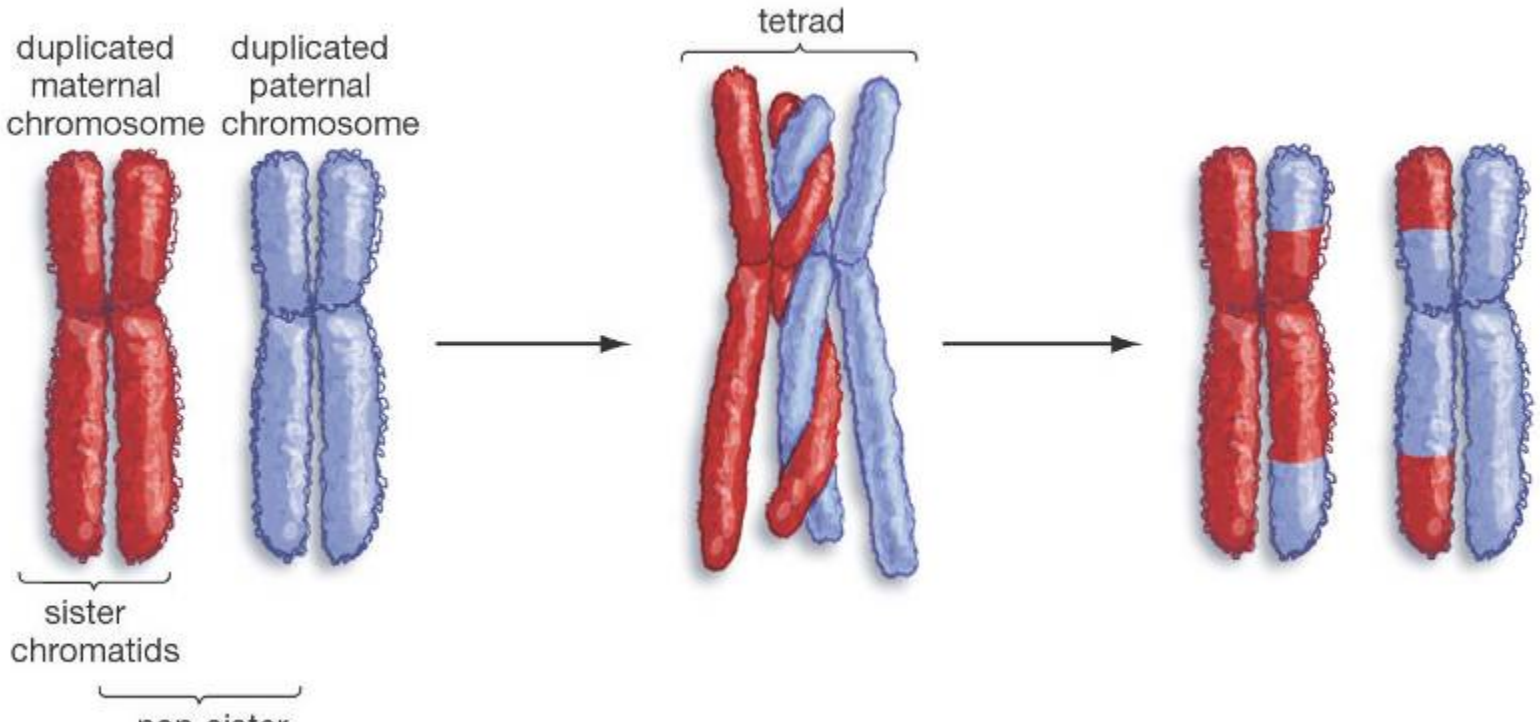
- There are over 6,000 different traits that are inherited separately from one another. That's a lot of diversity by this mechanism alone.



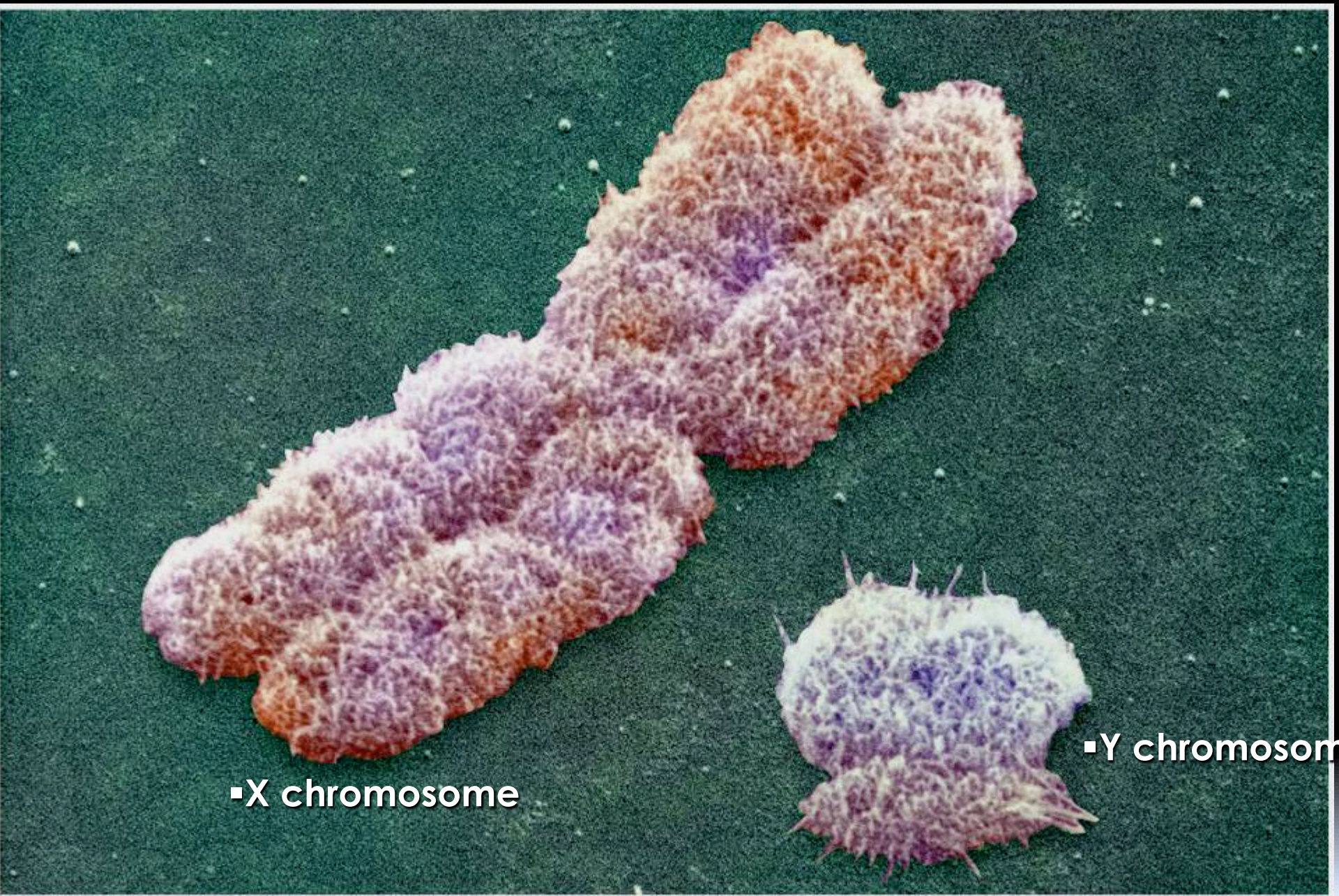


- Another Way is – Crossing-Over
- Crossing over is when homologous chromosomes (chromosomes that have the same genes) will trade information with each other

Exchange of parts of non-sister chromatids.



▪Boy or Girl? The Y Chromosome "Decides"



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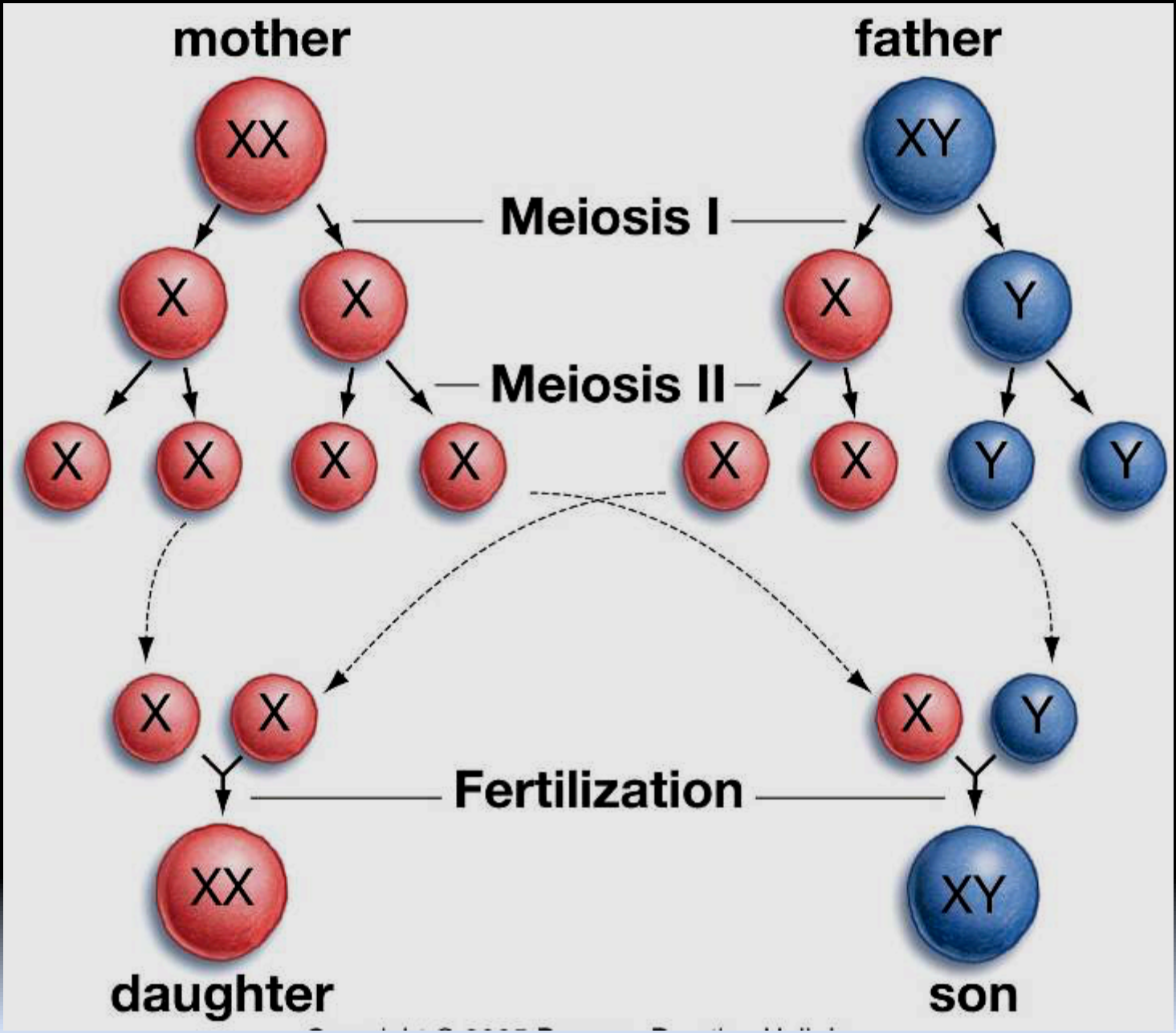
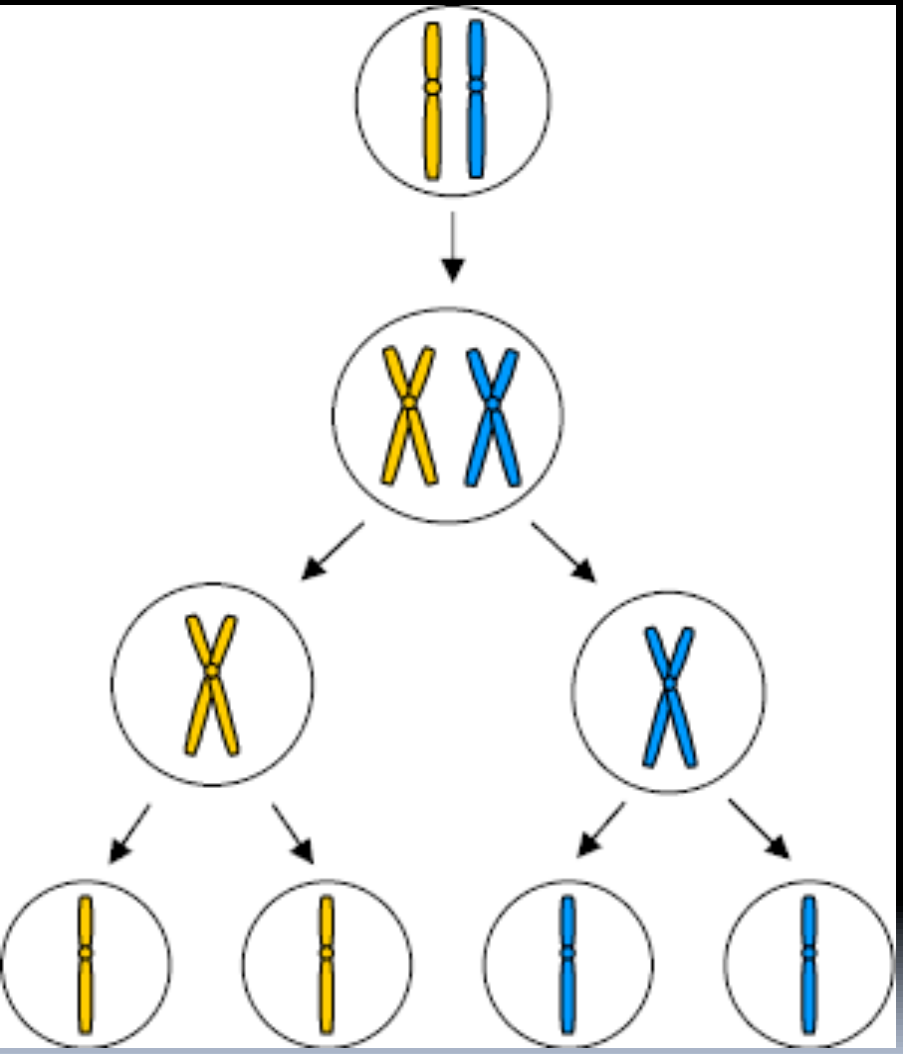


Mutations during Meiosis

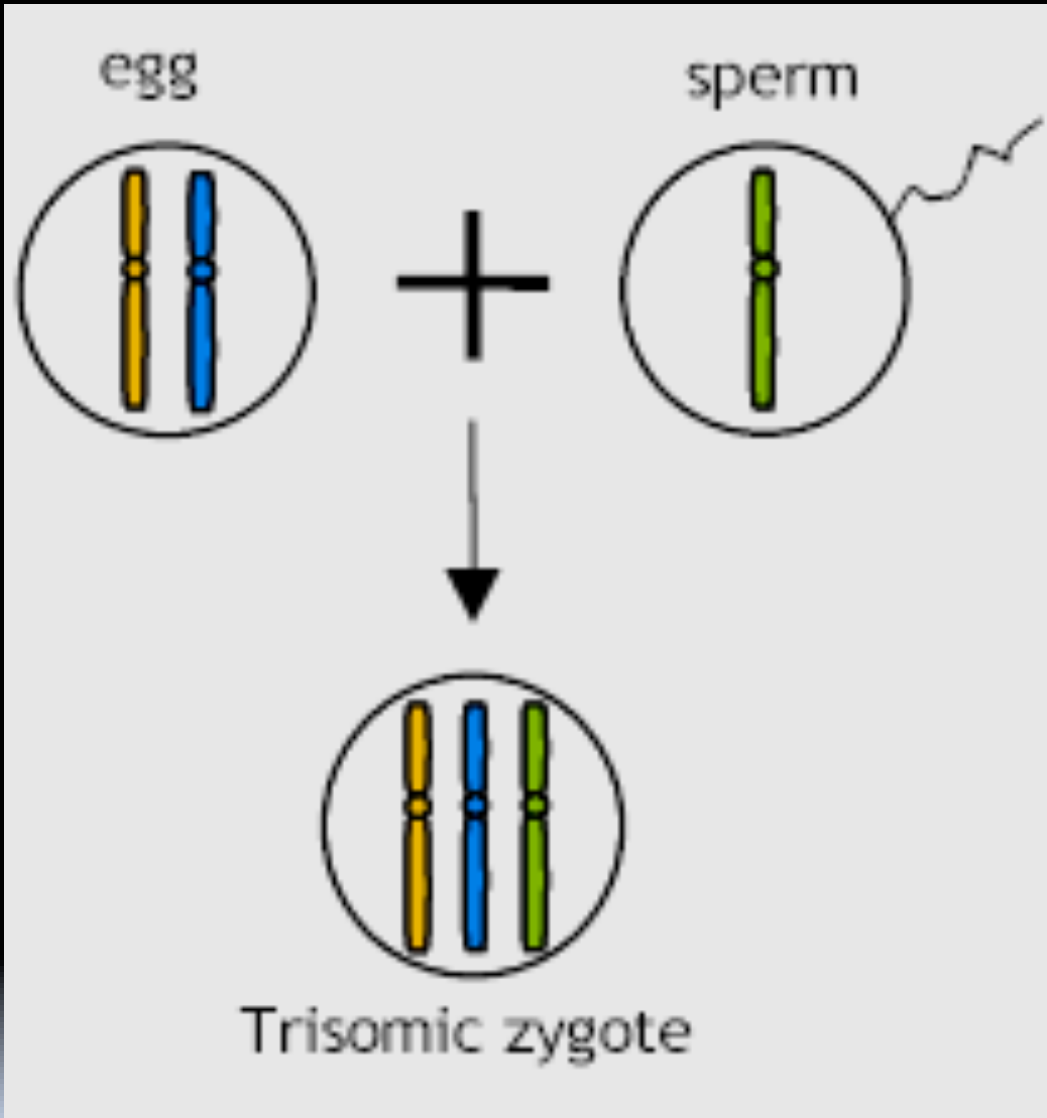


- Mutations will affect 1 of the 4 gametes produced.
- Mutations can affect proteins (remember for last unit)

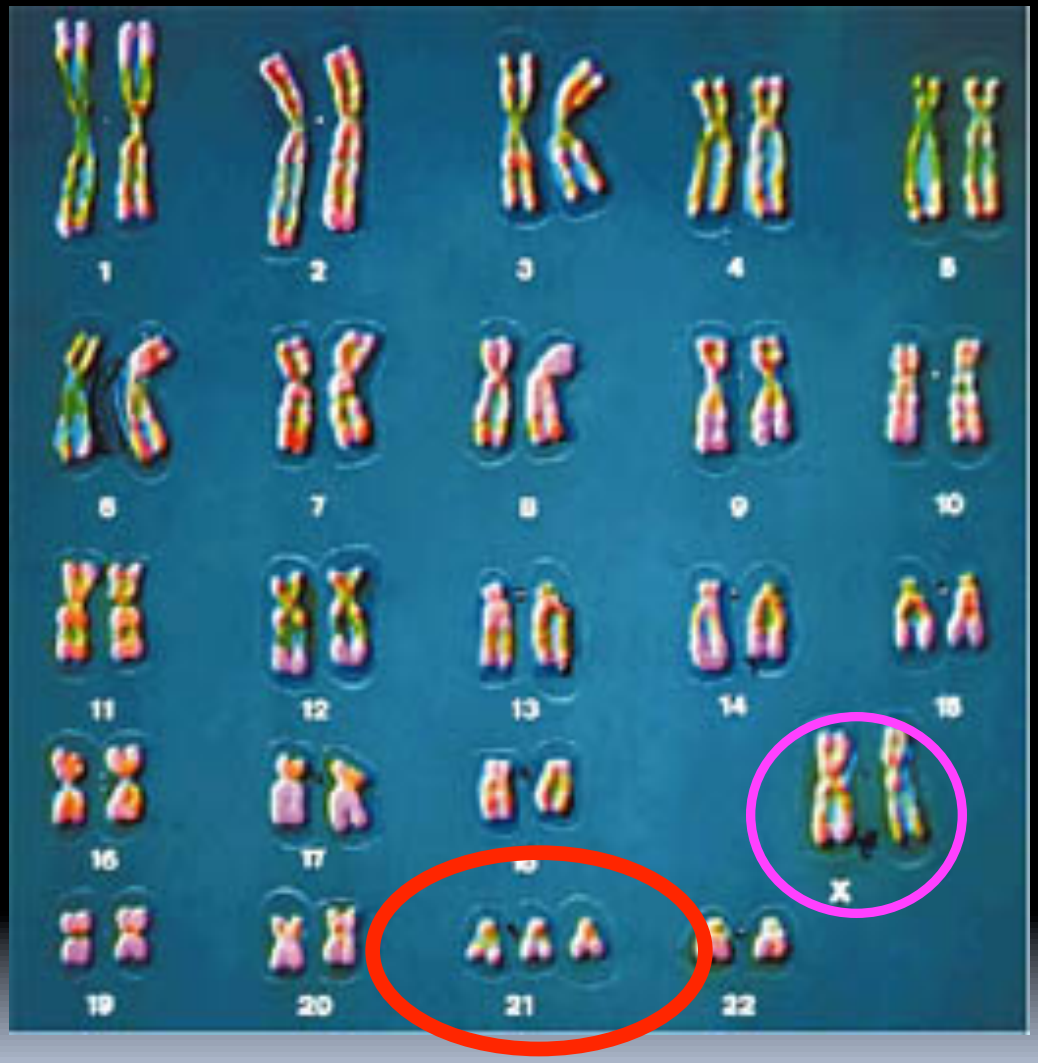
Meiosis error - fertilization

- Should the gamete with the chromosome pair be fertilized then the offspring will not be 'normal'.

- In humans this often occurs with the 21st pair – producing a child with Downs Syndrome



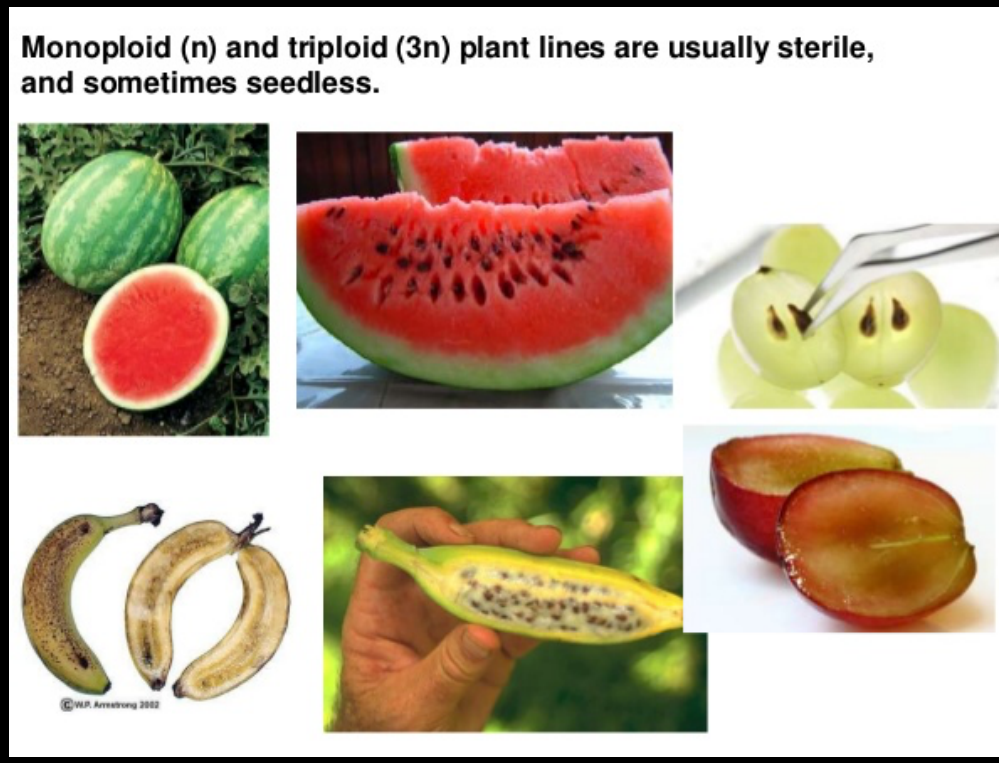
21 trisomy – Downs Syndrome



- Can you see the extra 21st chromosome?
- Is this person male or female?

Extra Chromosomes?

- Polyploidy (extra chromosomes) is more common in plants than animals
- More chromosomes in one gamete will result in less chromosomes in another



What you really need to know about meiosis

Meiosis
occurs in sex cells (gametes, sperm/egg)
produces 4 haploid (n) different daughter cells
Is the cause of genetic diversity

	Mitosis	Meiosis
Where does it occur?	Somatic (body)cells	Gametes (sex cells)
What do you start with?	1 Diploid Parent cell	1 Diploid Parent cell
How many chromosomes?	46	46
What do you end with?	**2 Diploid, Genetically Identical daughter cells**	**4 Haploid daughter cells** **With Different Genetic material**
How many Chromosomes?	46	23

Incomplete Dominance and Co-dominance

Incomplete Dominance

Blended Inheritance

- neither gene is dominant
- i.e., both contribute to expression of the trait
- there is an intermediate phenotype…
- Similar to **mixing paint**

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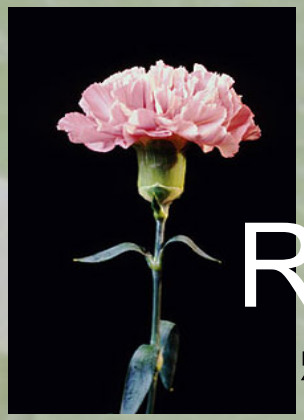

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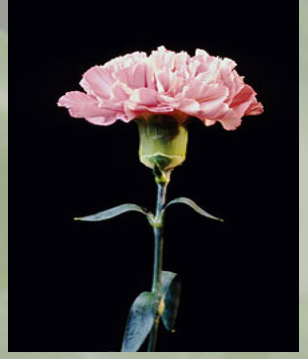
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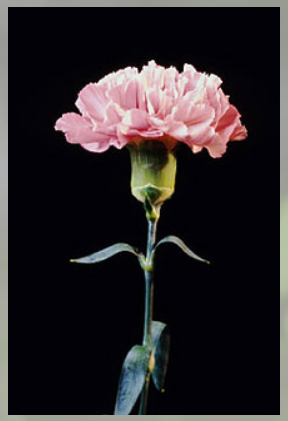
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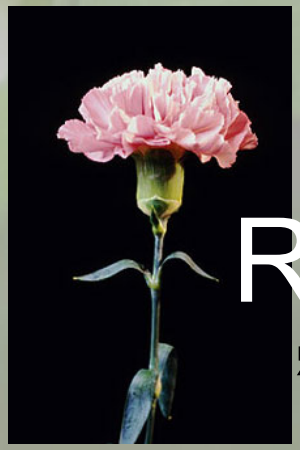
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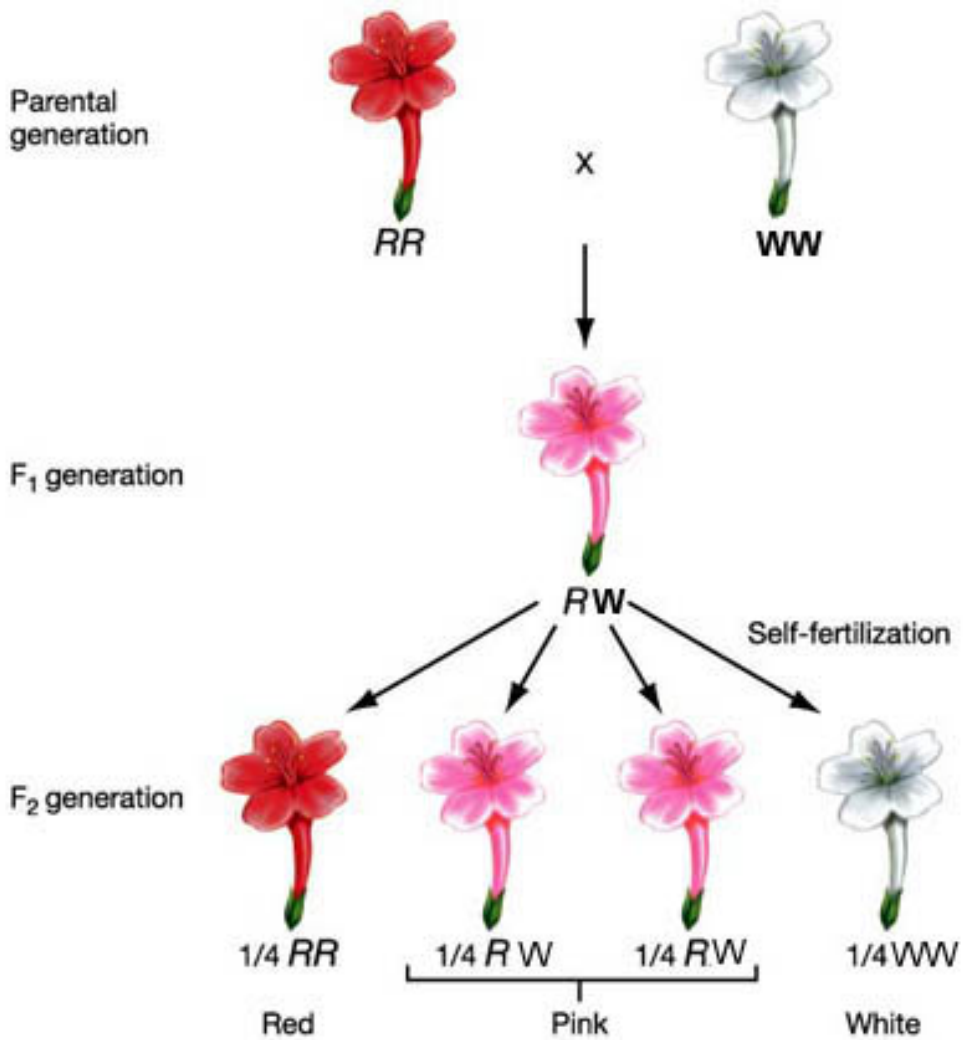
Benjamin Cummings



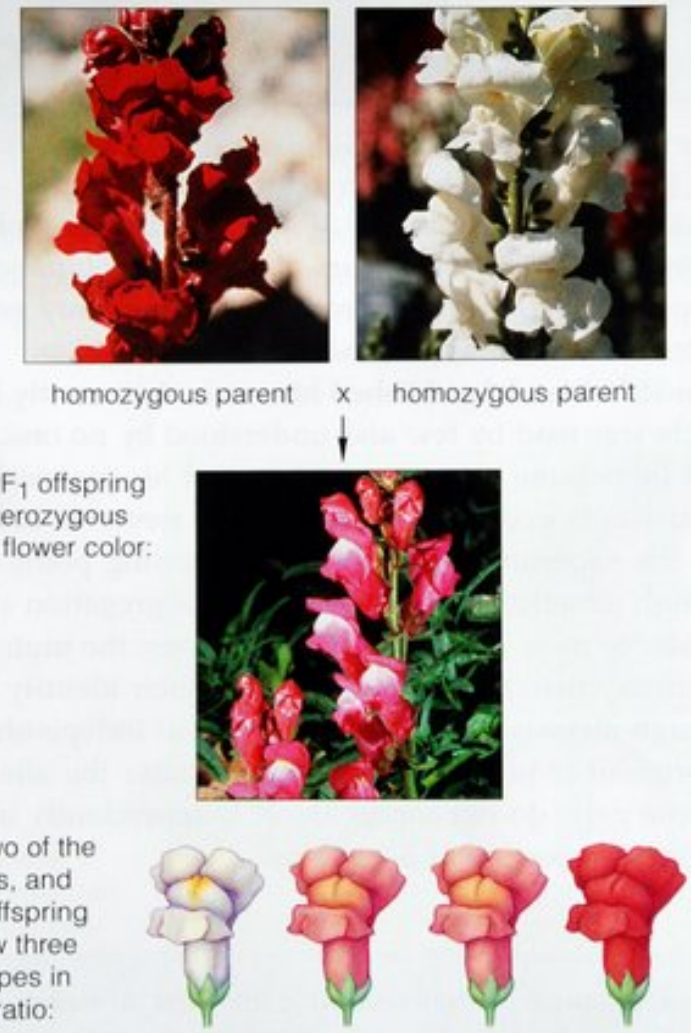
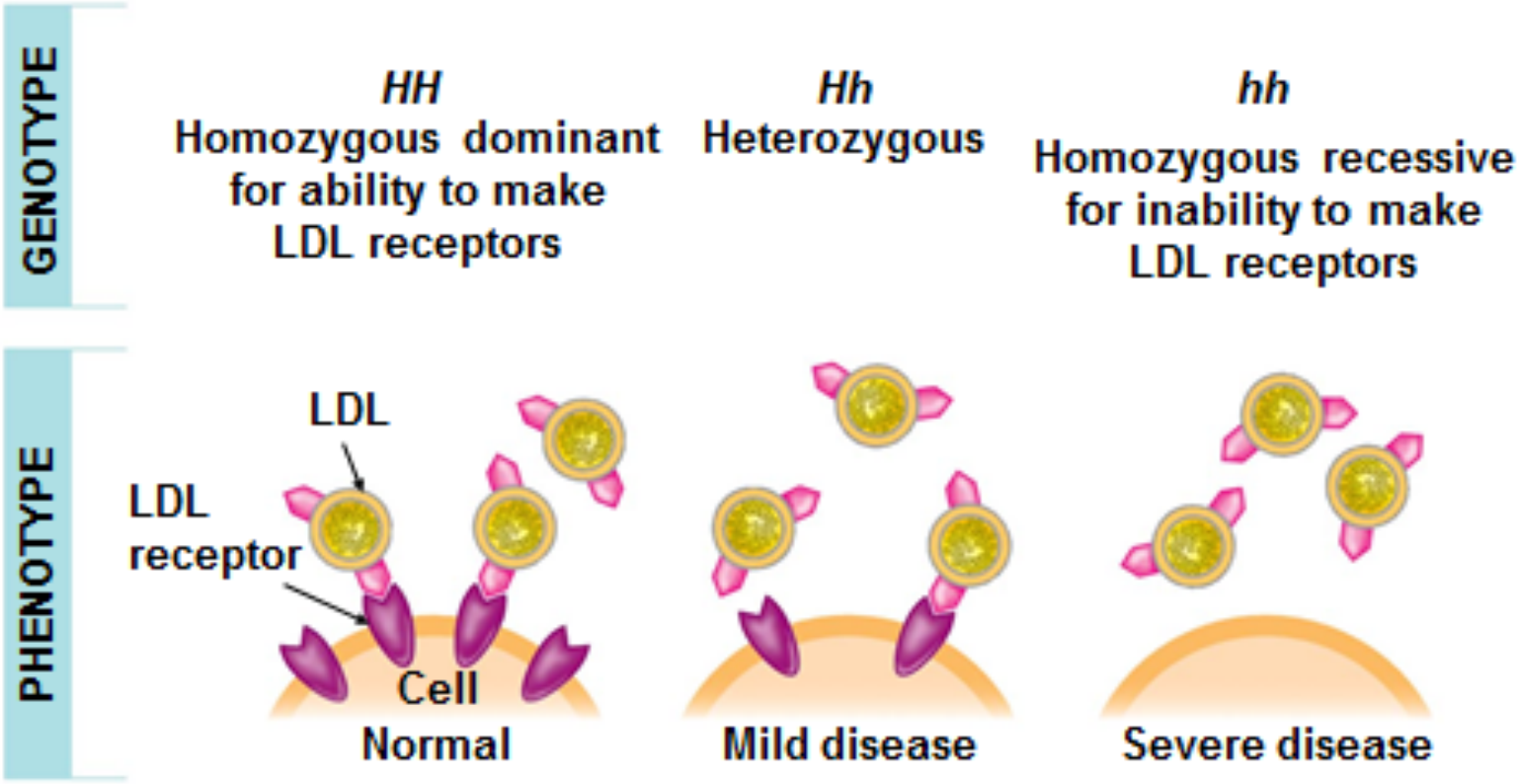


Figure 11.11 Incomplete dominance in heterozygous (*pink*) snapdragons, in which an allele that affects red pigment is paired with a "white" allele.

Red x White = Pink

Hypocholesterolemia



HDL is "good" cholesterol, and LDL is "bad" cholesterol. If you are homozygous dominant (normal) your cells bind and remove LDL. If you are heterozygous or homozygous recessive, you are less able to remove bad (LDL) cholesterol.

Codominance

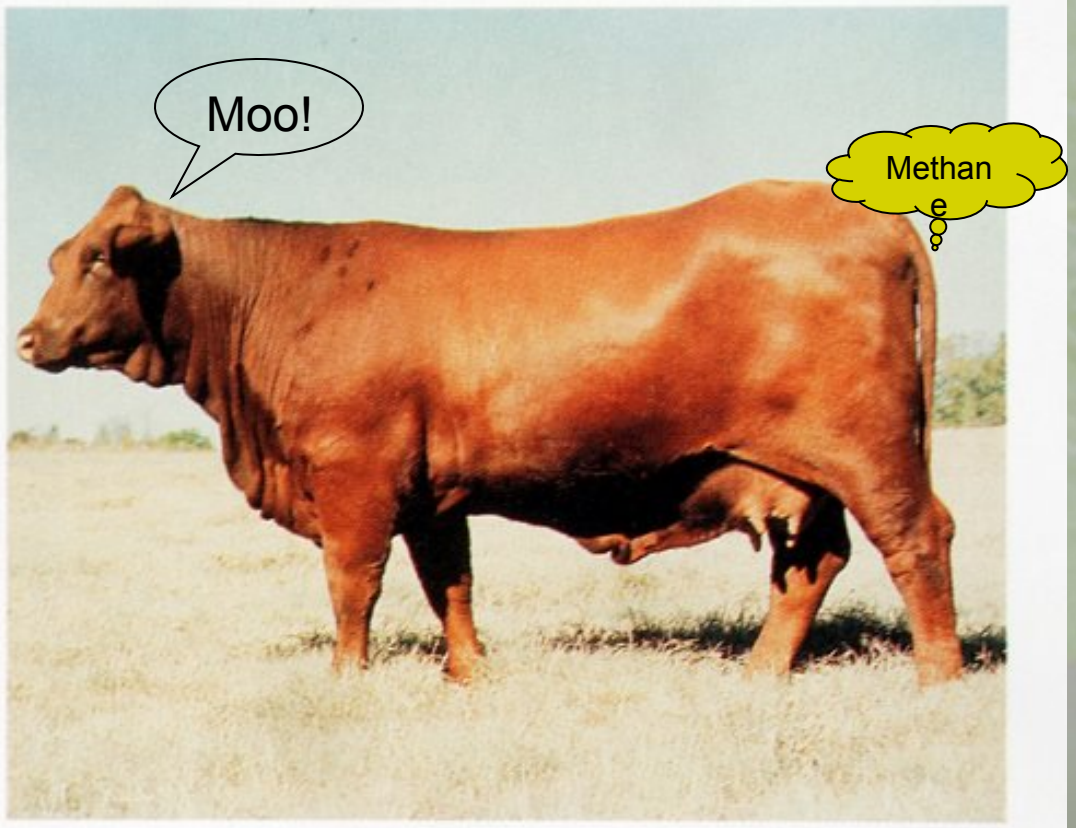
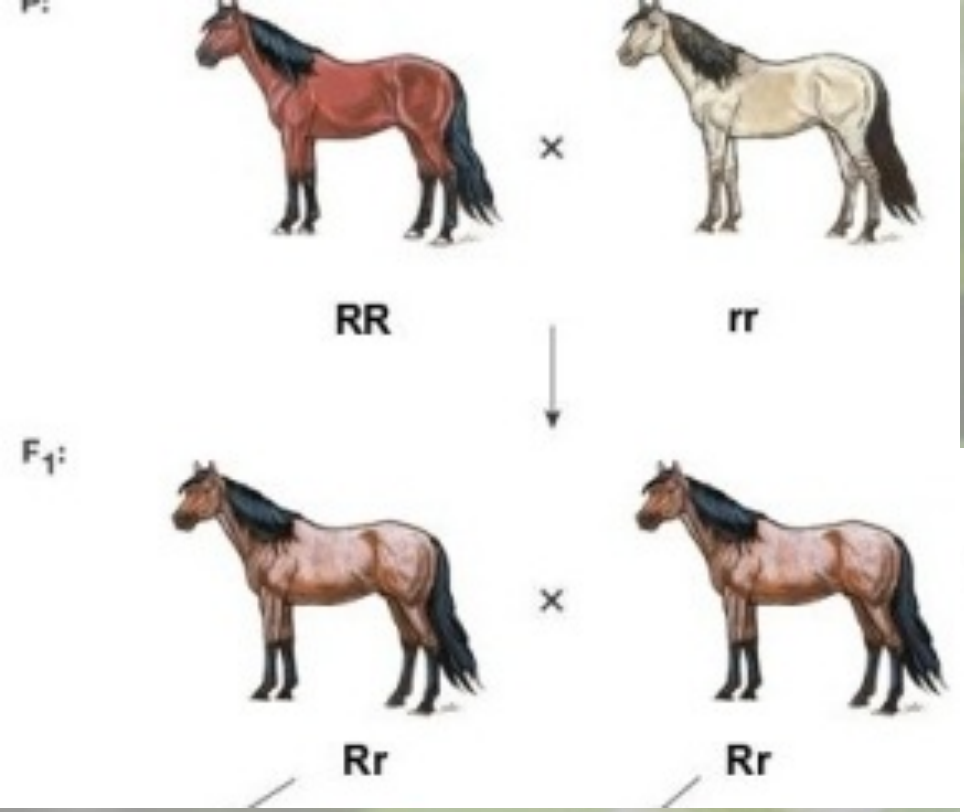


FIGURE 11.4
Codominance in Cattle
The roan-colored cow with its white and red hairs is an example of codominance, the equal expression of two alleles.

- Co—together, at the same time
- Equal expression
- Neither trait recessive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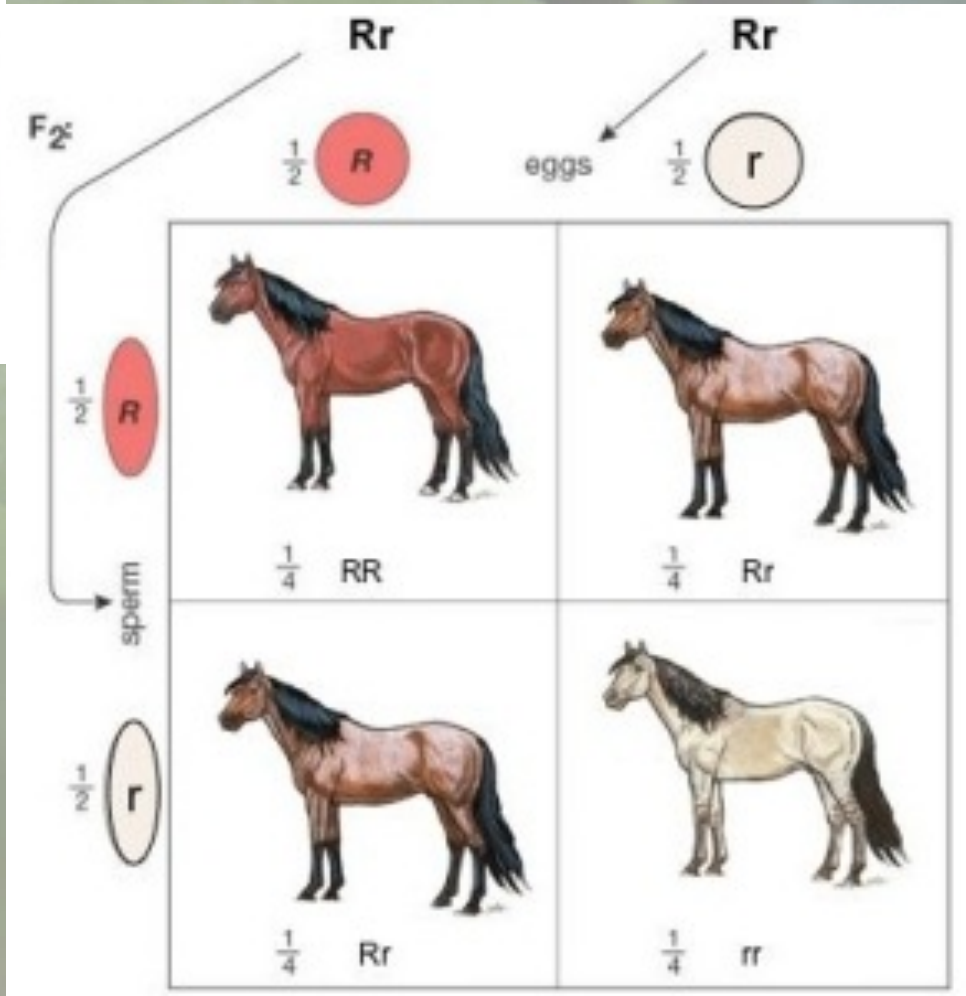
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The ABO Blood System

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
Plasma Antibodies (phenotype)	 b agglutinin only	 a agglutinin only	NONE. No agglutinin	 a and b agglutinin