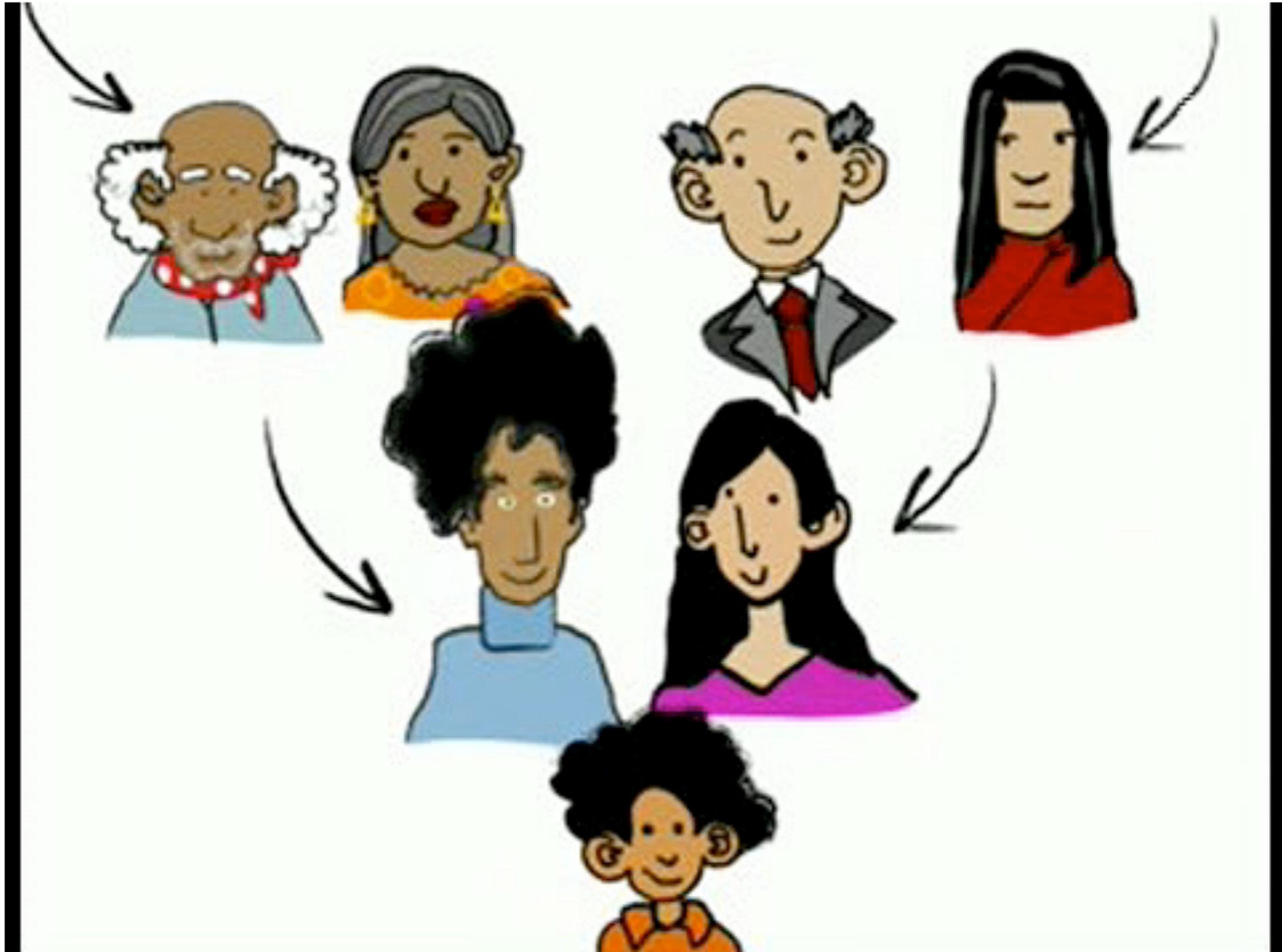


# Meiosis

Life Science: Molecular

# Where Do Genes Come From?



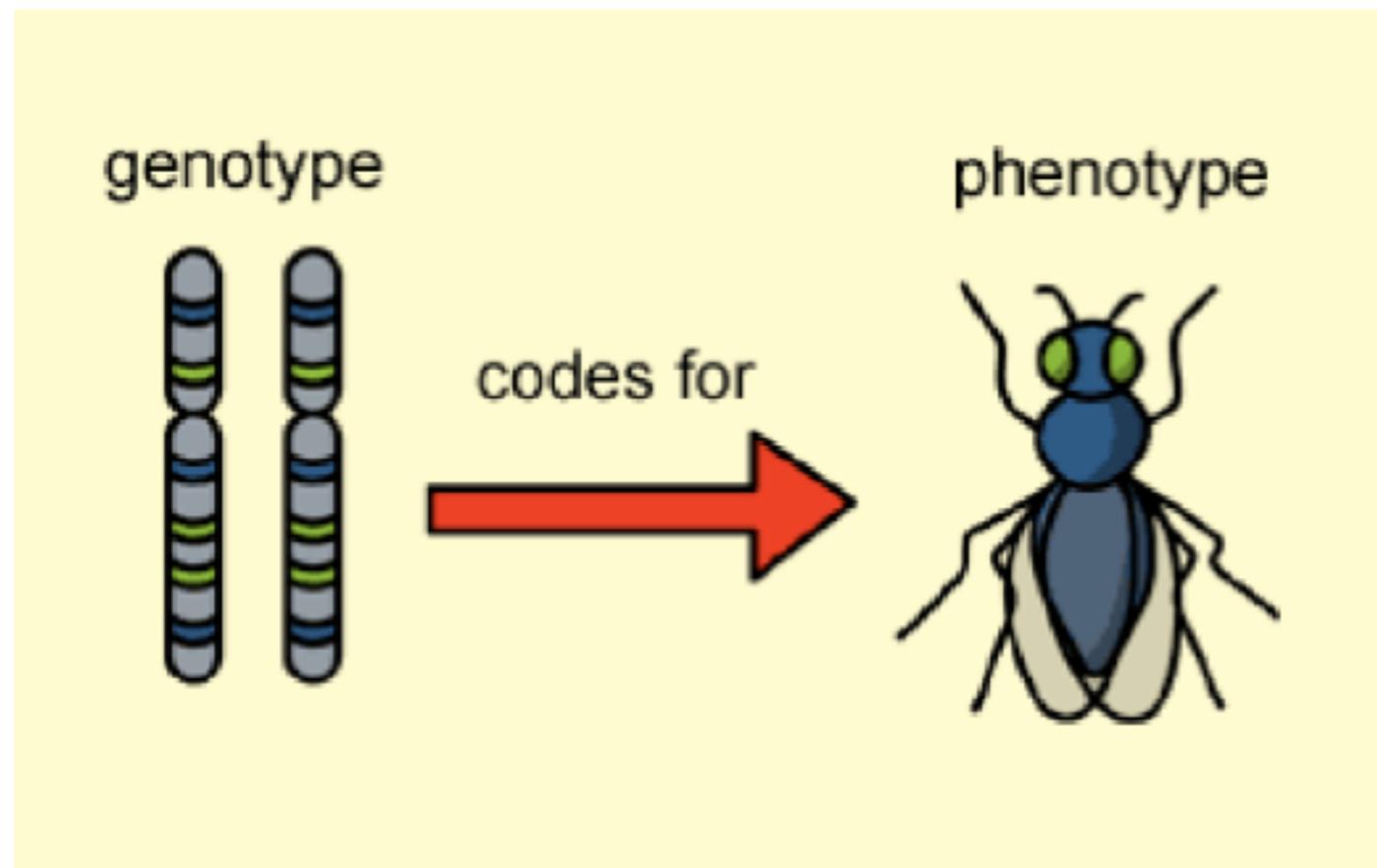
# Chromosome Number

- Human cells contains **46** chromosomes, **23** come from the mother and **23** from the father.
- **Homologous chromosomes** code for the same genes in the same genetic loci.



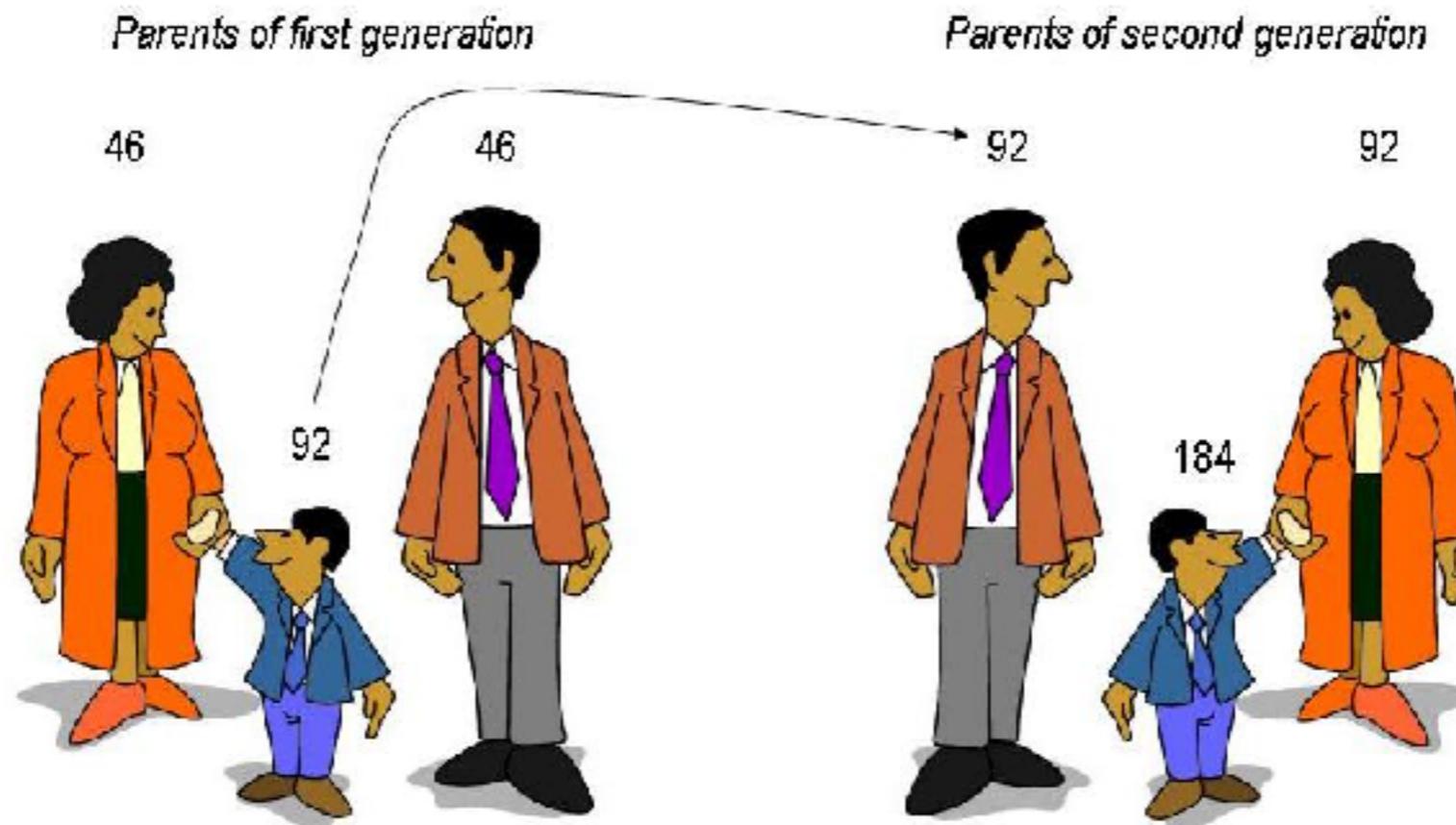
# Genes

- Chromosomes contain **genes**, which determine the characteristics of an individual.
- **Genotype** is the combination of genes that determines an individual's character. Represented with letters (e.g. **BB**).
- **Phenotype** is the observable character of an individual.



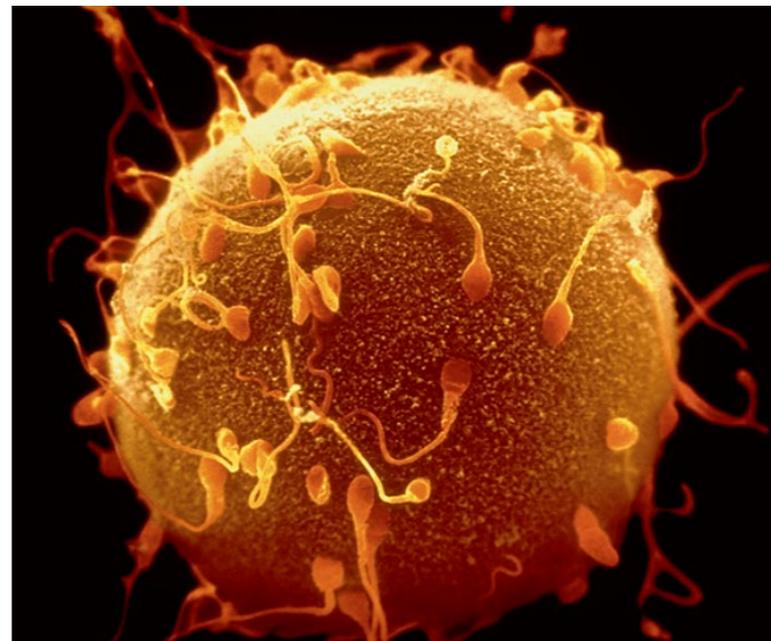
# Meiosis

- **Meiosis** is the process of cell division that reduces the number of chromosomes in reproductive cells by half.
- Meiosis involves two divisions, called **meiosis I** and **meiosis II**.
- Meiosis maintains the number of chromosomes.



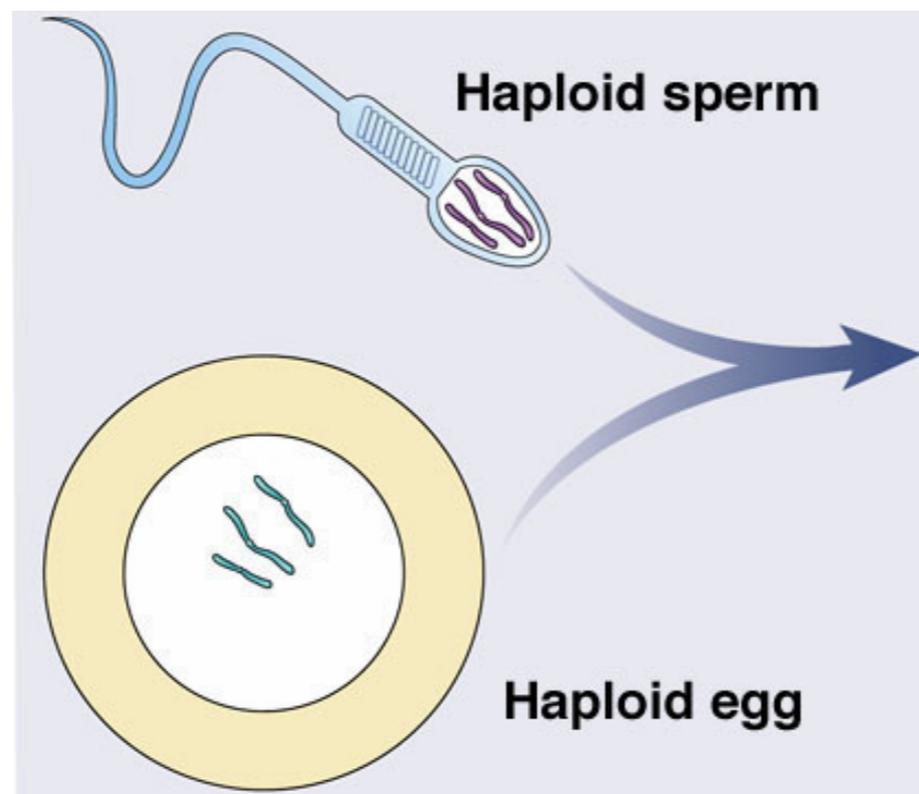
# Sexual Reproduction

- **Gamete** is a term for reproductive cells (egg and sperm).
- A gamete carries only half the amount of genetic information as an adult cell.
- **Sexual Reproduction** involves the fusion of two reproductive cells, or gametes, to form a new organism.



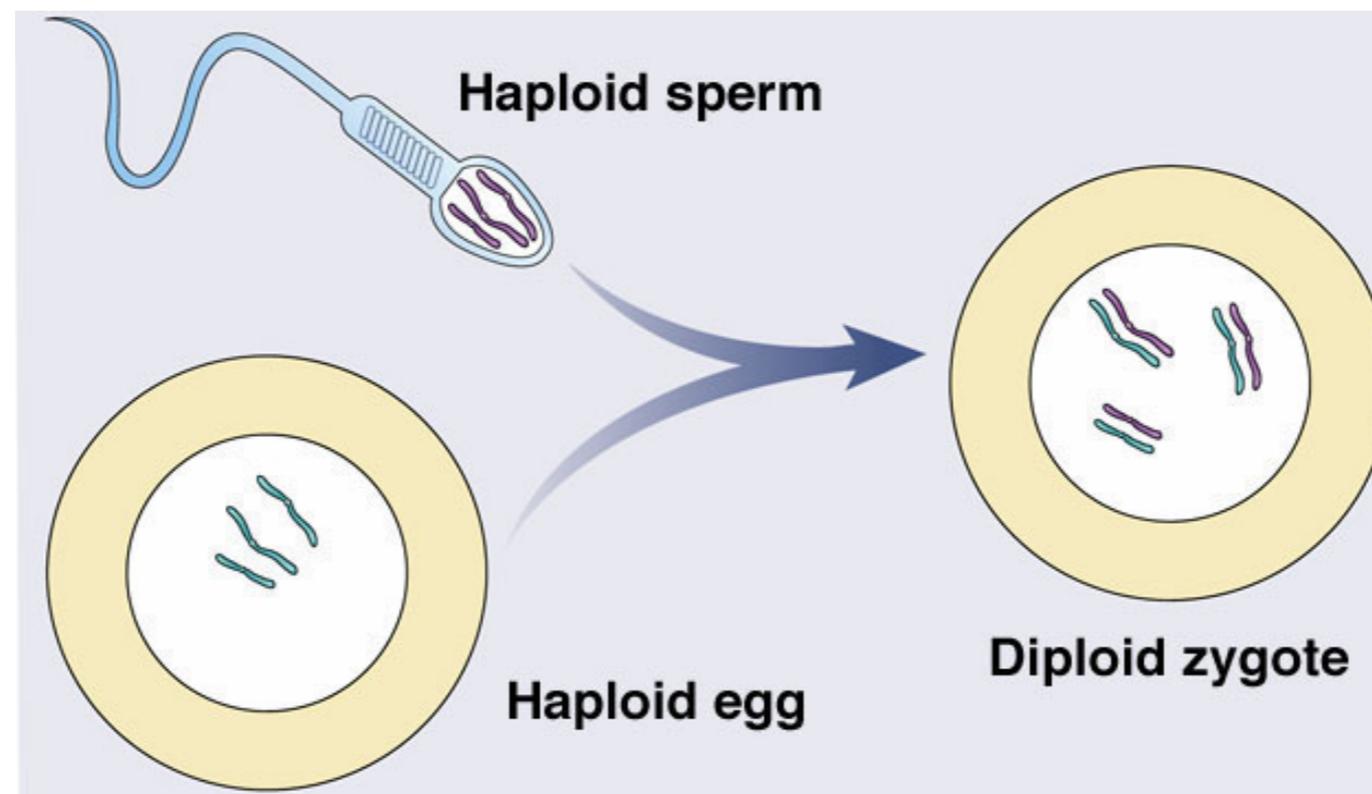
# Haploid Cells

- Haploid cells contain a single set of chromosomes.
- Reproductive cells are **haploid**
- Human reproductive cells have 23 chromosomes (N = 23).



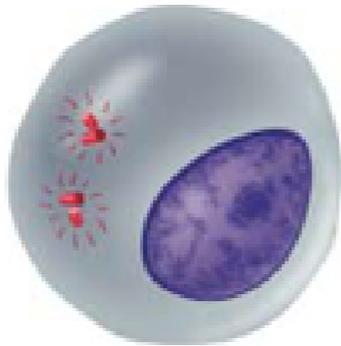
# Diploid Cells

- A **diploid** cell contains two paired sets of homologous chromosomes.
- A **zygote**, or fertilized egg, contains two complete sets of chromosomes ( $2N = 46$ ).



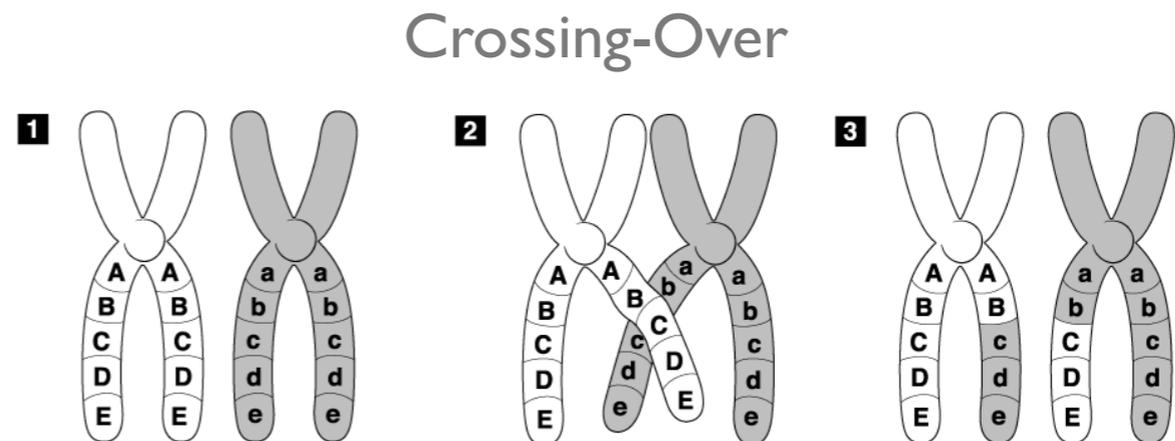
# Meiosis I

- **Interphase**
  - Prior to meiosis the cell undergoes a round of chromosome replication (4N).



# Meiosis I

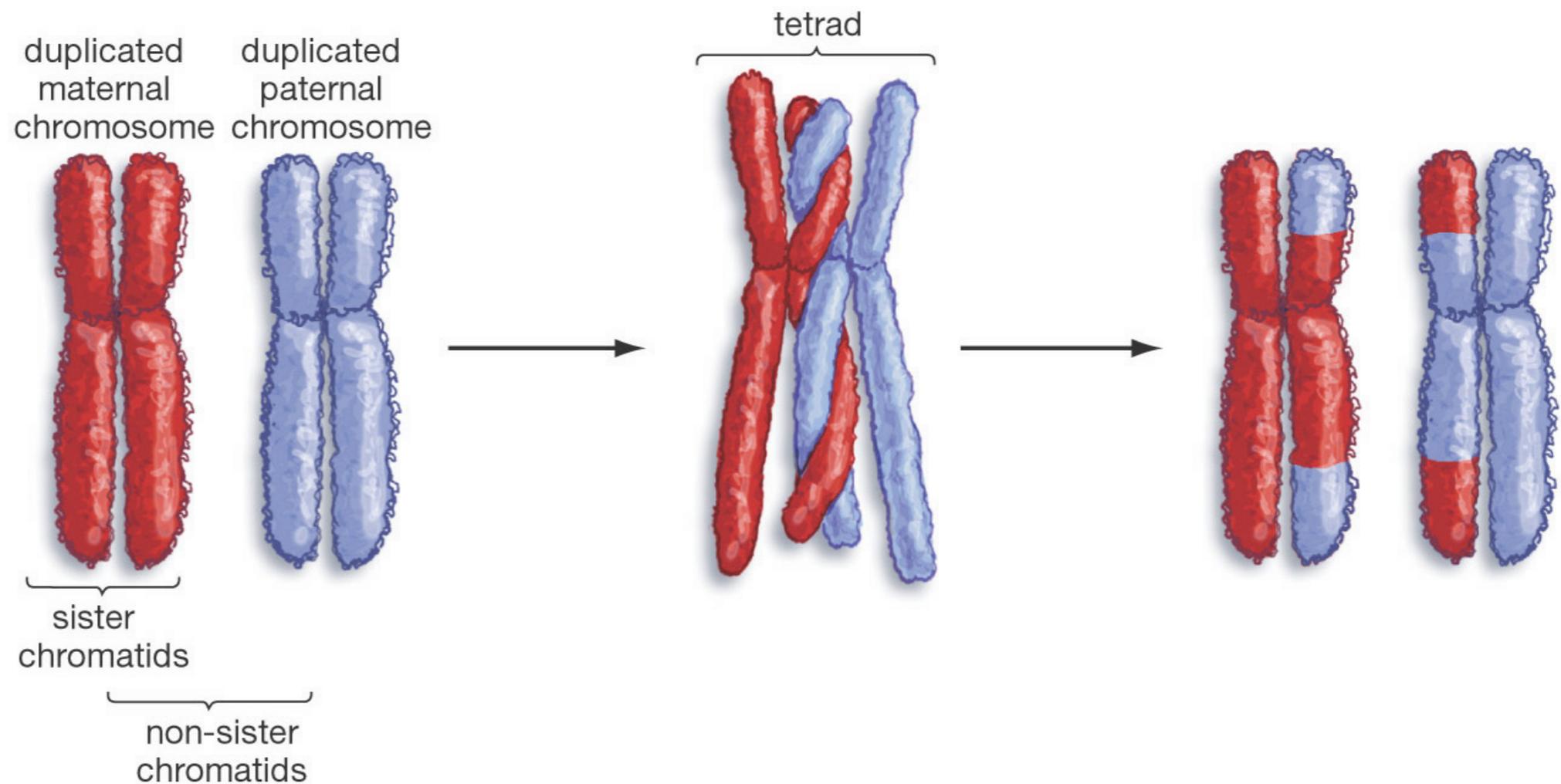
- **Prophase I**
- Each replicated chromosome pairs with its homologous chromosome forming a **tetrad**.
- Chromosomes exchange portions of their chromatids in a process called **crossing-over**.



# Crossing-Over

- **Crossing-over** is a form of genetic recombination that increases variation by creating hybrid chromosomes.

Exchange of parts of non-sister chromatids.



# Meiosis I

- **Metaphase I**
  - Spindle fibers attach to each tetrad
  - Chromosomes line up across the center of the cell.



# Meiosis I

- **Anaphase I**
  - Tetrads separate and homologous chromosomes are pulled towards opposite ends of the cell.
  - Random separation of chromosomes (50:50).



# Meiosis I

- **Telophase I and Cytokinesis**
  - Nuclear membranes reform.
  - Cytokinesis forms two new cells.
  - Two diploid daughter cells.



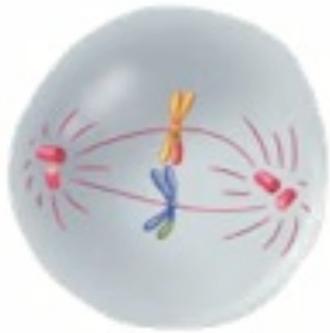
# Meiosis II

- **Prophase II**
  - Nuclear membrane disappears.
  - Chromosomes become visible.



# Meiosis II

- **Metaphase II**
  - Spindle fibers form
  - Chromosomes line up across the middle of the cell.



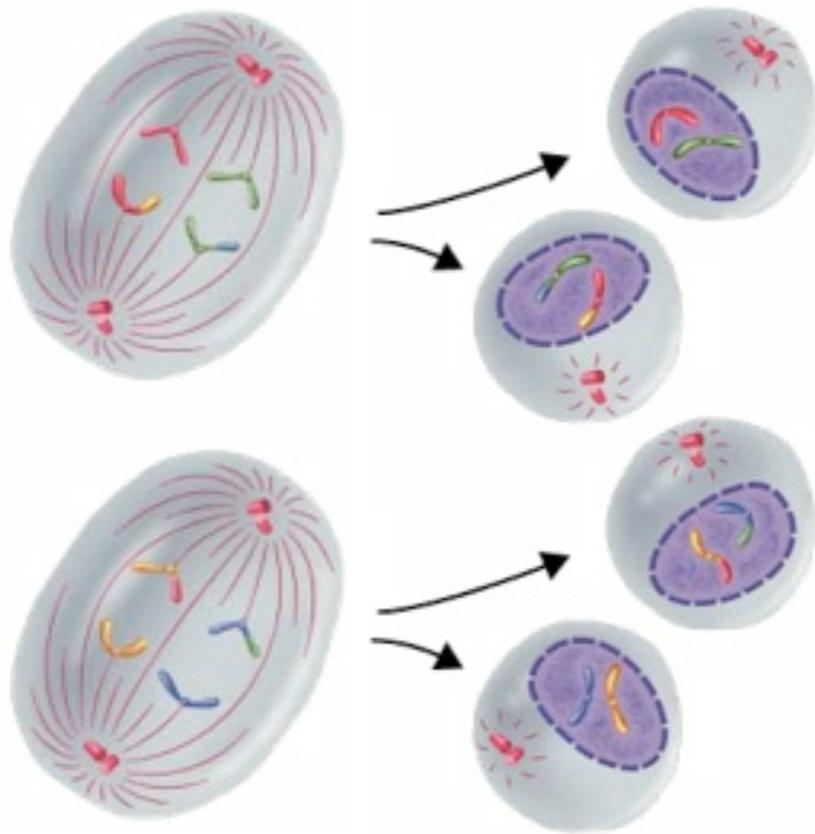
# Meiosis II

- **Anaphase II**
  - Sister chromatids separate.



# Meiosis II

- **Telophase II and Cytokinesis**
- Meiosis results in four genetically unique haploid daughter cells.

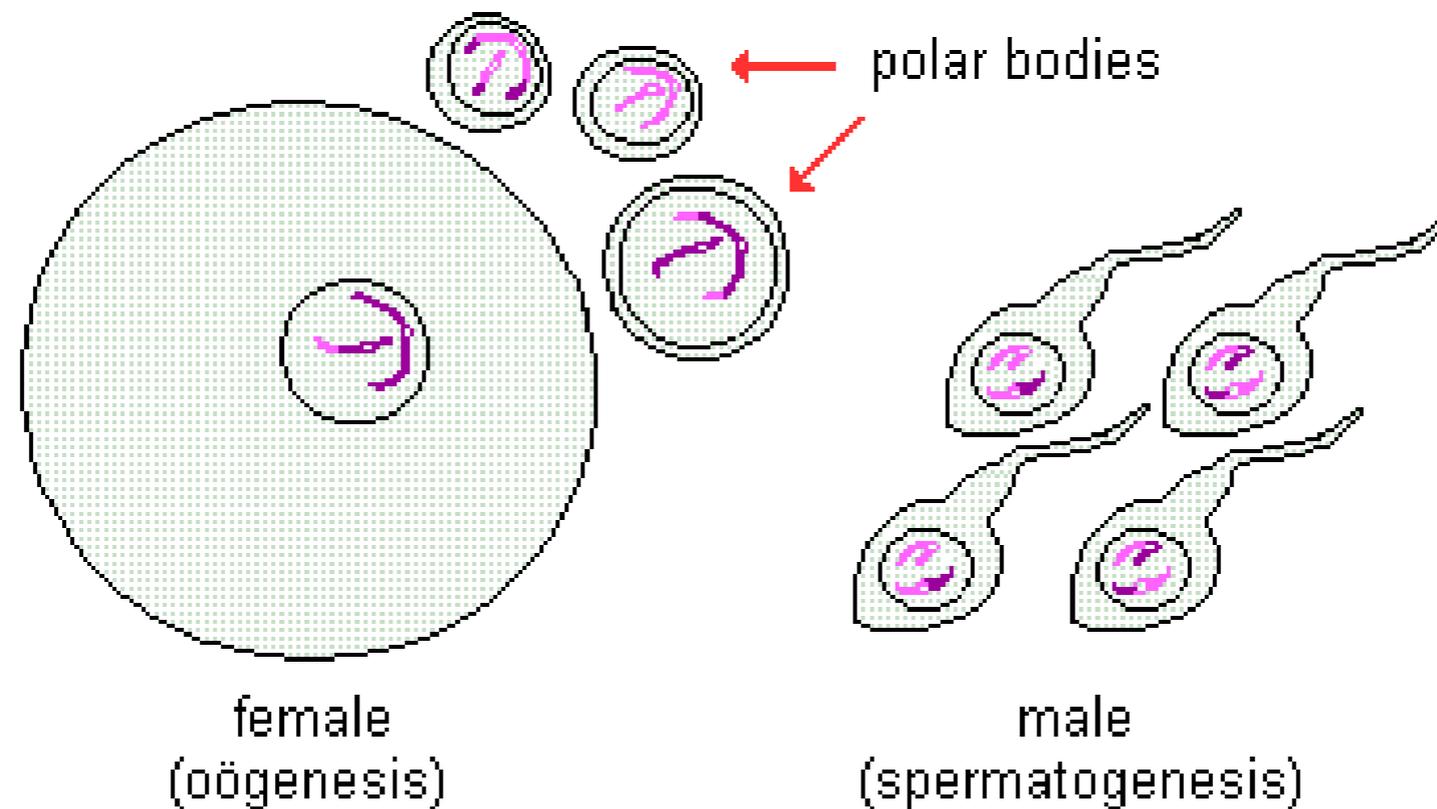


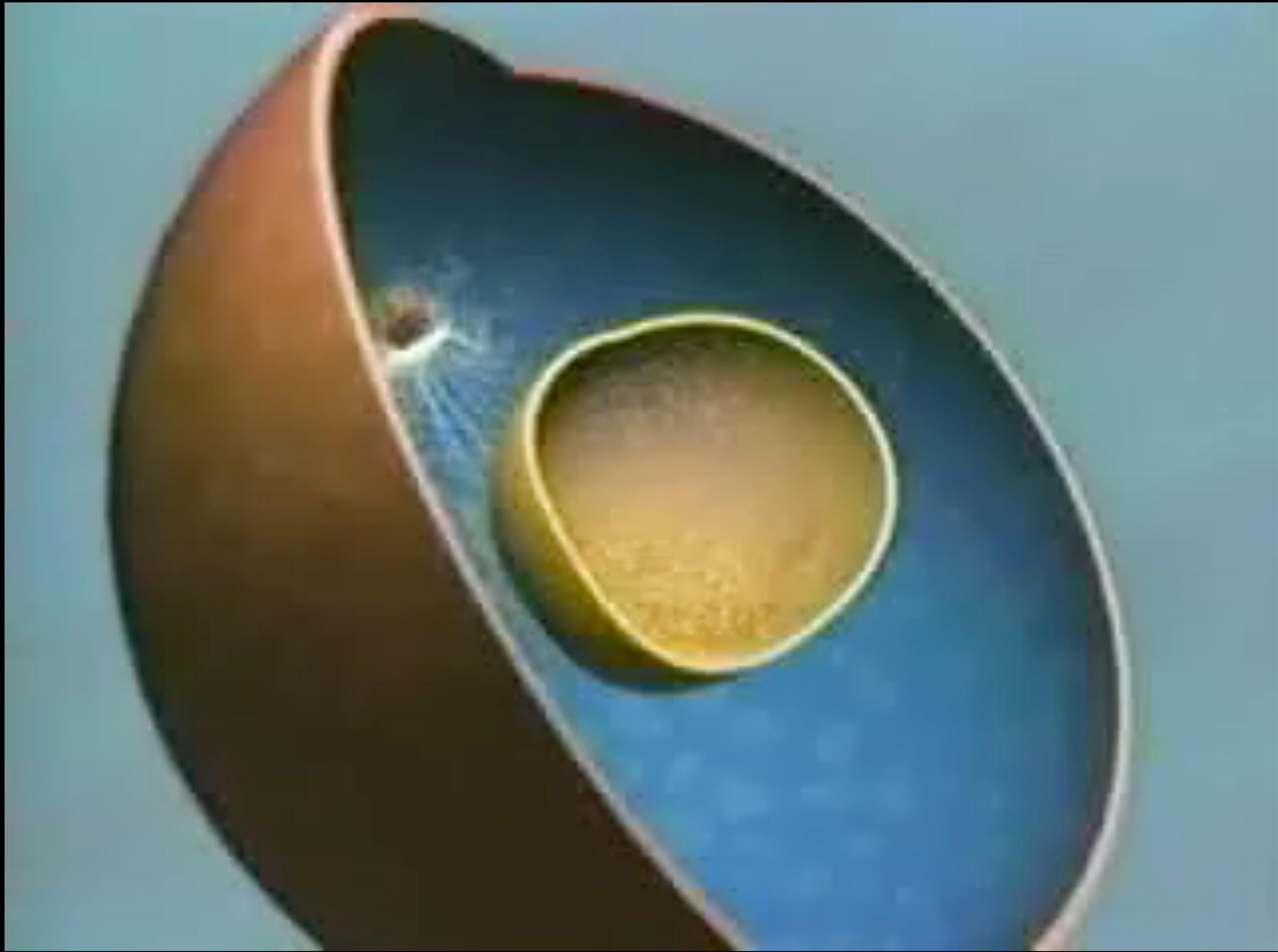
# Meiosis vs. Mitosis

- Mitosis results in 2 genetically identical diploid cells.  
Meiosis results in 4 genetically unique haploid cells.
- Mitosis goes through 1 set of divisions.  
Meiosis goes through 2 sets of divisions.

# Gamete Formation

- In males, **spermatogenesis** results in four haploid sperm cells.
- In females, **oogenesis** results in one haploid egg cell and three polar bodies.





# Problems of Meiosis

- **Non-disjunction** is the failure of homologous chromosomes to separate during meiosis.
- As a result, the gamete has either an extra chromosome, or is missing a chromosome.
- 5% of all zygotes have extra chromosomes.

