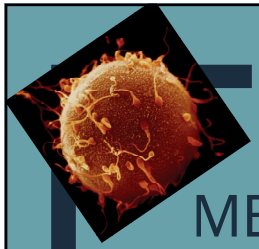


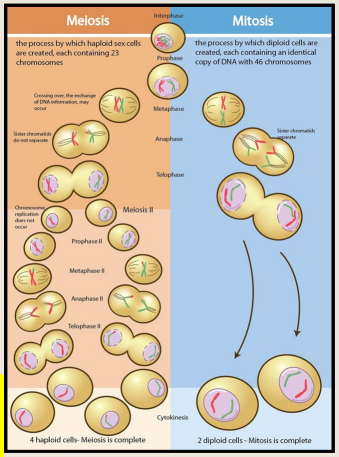
MEIOSIS CELL DIVISION

Chapter 6.1 – 6.2

- WHAT DETERMINES WHAT YOU LOOK LIKE?

Meiosis Animation

Section 6.1: Meiosis

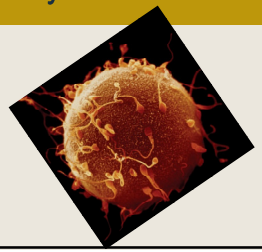


Meiosis creates 4 genetically different gametes (haploid)

Mitosis creates 2 identical daughter cells (diploid)

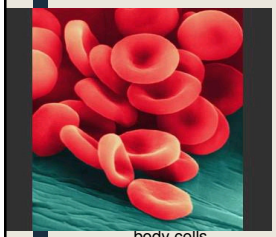
Section 6.1: Meiosis

- **Process of reduction division**
- **Purpose: Produces gametes (sex cells) – sperm & egg**
- **Meiosis is NOT a cycle like mitosis.**

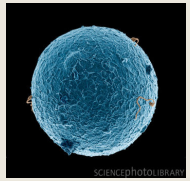


Two types of cells in your body

1. Body cells are also called **somatic cells**.
   - *Mitosis*
2. Gametes are also called **sex cells**.
   - *Meiosis*
   - *Egg and sperm produced*


body cells


sex cells (sperm)



sex cells (egg)

Diploid vs. Haploid

- Diploid – a cell that contains homologous chromosomes (one from each parent)
  - *represented by the symbol 2N*
  - *Found in somatic or body cells (ex. Skin, digestive tract)*
    - Example : Humans → 2N = **46**

- Haploid – a cell that contains only a single set of chromosomes (one from either parent, not both);
  - *represented by the symbol N or 1N*
  - *Found in gametes or sex cells – sperm & egg*
    - Example: Humans → N = **23**

Germ Cell (diploid)  or  

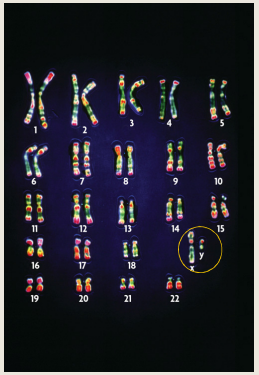
Chromosome Numbers of Some Common Organisms

Organism	Body Cell (2*n*)	Gamete (*n*)
Human	46	23
Garden Pea	14	7
Fruit fly	8	4
Tomato	24	12
Dog	78	39
Chimpanzee	48	24
Leopard frog	26	13
Corn	20	10
Apple	34	17
Indian fern	1260	630

Human Chromosomes

Your body cells have 23 pairs of chromosomes.

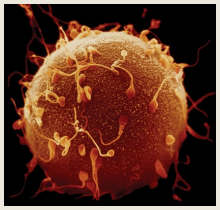
- Pairs 1-22 are **Autosomes**
  - They don't contain any genes dealing with the sex of an organism.
- **Sex chromosomes** (X or Y) determine gender in mammals and are chromosome pair 23.
- They are in homologous pairs, meaning both chromosomes have similar genes.
  - One from each parent



Since we all have 2 copies of each chromosome…
Females have XX
Males have XY

Sexual Reproduction

- **Sexual reproduction**: the fusion of two gametes (egg & sperm) to produce offspring that are a genetic mixture of both parents
- Fertilization: the actual fusion of an egg & sperm
- Egg & sperm only need half of the number of chromosomes—1 from each homologous pair



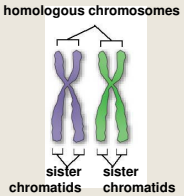
Homologous Chromosomes

- Pairs of homologous chromosomes separate in meiosis I.

-Homologous chromosomes are similar but not identical.

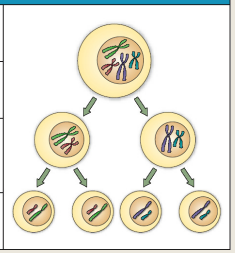
-Sister chromatids divide in meiosis II.

-Sister chromatids are copies of the same chromosome.

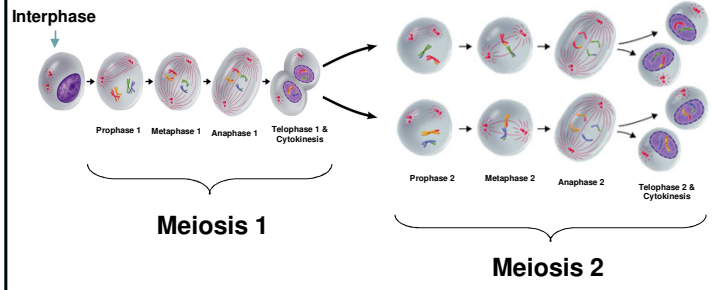


Process of Meiosis

- Cells go through two rounds of division in meiosis.
  1. *Meiosis I (4 phases)*
  2. *Meiosis II (4 phases)*
- By the end of Meiosis II, the 1 diploid cell that entered meiosis has become 4 haploid cells
- Meiosis reduces chromosome number and creates genetic diversity.

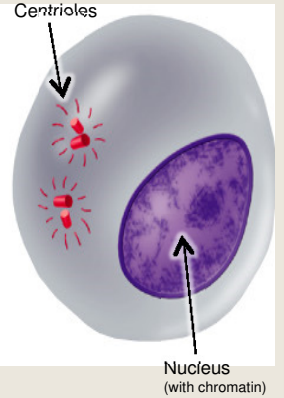
MEIOSIS	
Produces genetically unique cells	
Results in haploid cells	
Takes place only at certain times in an organism's life cycle	
Involved in sexual reproduction	

Meiosis



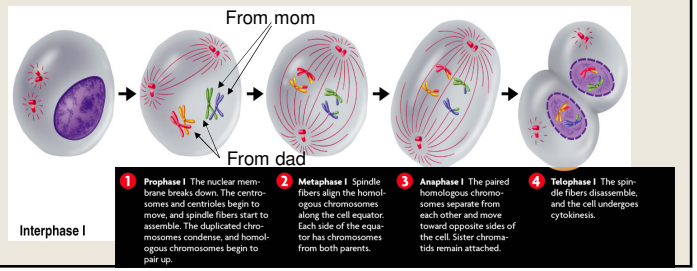
Interphase

- Stage between divisions
  - *Before meiosis 1*
  - *Before meiosis 2*
- Contains: centrioles and chromatin
- Made of stages:
  G1 – basic cell growth
  S – replication and repair of DNA
  G2 – final preparation for cell division



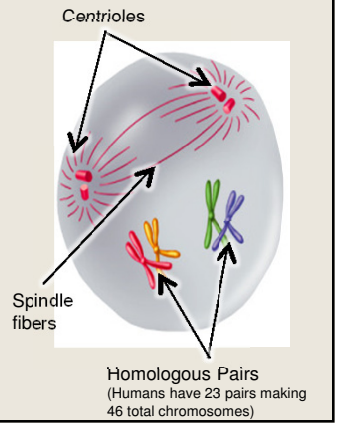
Meiosis I

- Occurs after DNA has been replicated.
- Cell division that reduces the homologous chromosome number by one-half.
- Four Phases:
  - prophase I, metaphase I, anaphase, telophase I

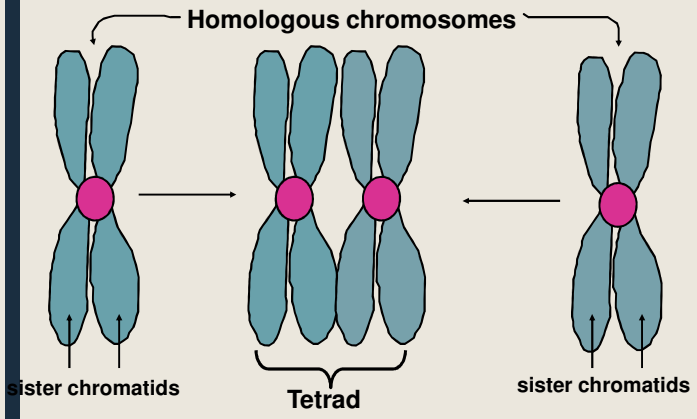


Prophase I

- Similar chromosomes from each parent pair up to form **homologous pairs** during synapsis
- When homologous chromosome overlap its called **crossing over.**

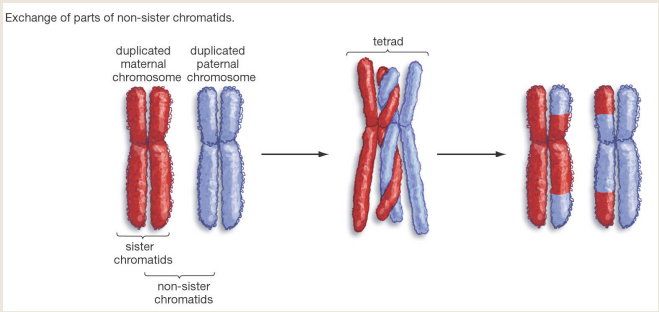


Prophase I - Synapsis



Prophase I

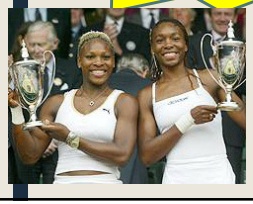
- Crossing over happens when parts of the homologues chromosomes switch places after overlapping
  - *It increases genetic diversity*



Importance of crossing over

- The gene combinations that a person gets from his or her parents will be different, to varying degrees, than the combination a sibling may get.

- Crossing over increases genetic diversity

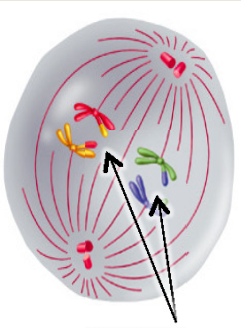


Metaphase I

- The **centrioles** send out **spindle fibers** to line up **homologous pairs** in the middle of cell

INDEPENDENT ASSORTMENT OCCURS:

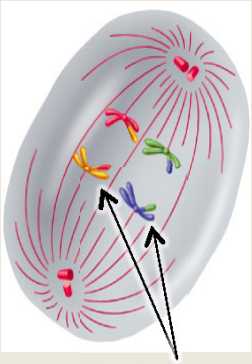
1. Alignment of homologous pair to poles is random.
2. Variation



Anaphase I

- The centrioles use the spindle fibers to separate the **homologous pairs**

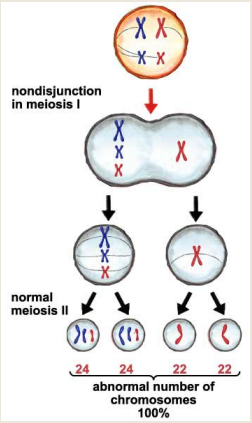
•Each homologous chromosome is **pulled to the opposite** pole of the cell



Anaphase I
Nondisjunction in Meiosis I

- If the centrioles do not properly attach the spindle fibers to the homologous chromosome before they start to pull, then a **Nondisjunction** will occur

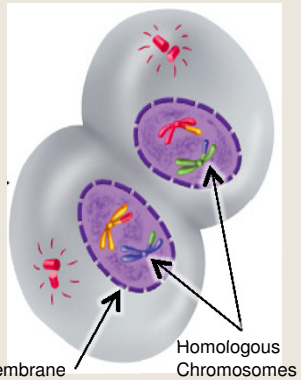
- A **Nondisjunction** causes the gametes to have the wrong amount of chromosomes



Telophase I & Cytokinesis

- Telophase I – the cell creates a temporary nucleus around the two homologous chromosome sets

•Cytokinesis – the cell divides into two cells

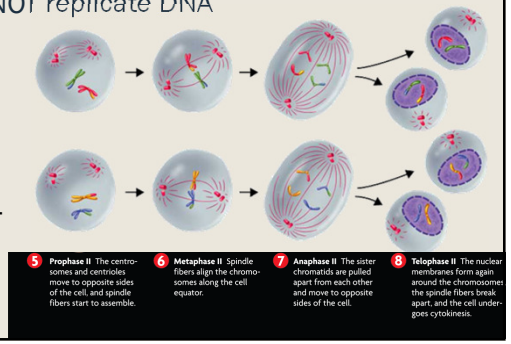


Meiosis II

No interphase II

- The two new cells produced by meiosis I now enter a **second** meiotic division
- The cells do NOT *replicate* DNA

- Each cell has half of the original DNA
- Resulting in 4 haploid cells
- 2N ÷ 2 = N



Prophase II

- Each of the Meiosis II stages are running in 2 cells at the same time.
- Similar to Prophase of Mitosis
- Centrioles attach spindle fibers to the chromosomes

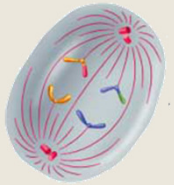
Metaphase II

- Centrioles use spindle fibers to line up the chromosomes in the middle
- Similar to mitosis

Anaphase II

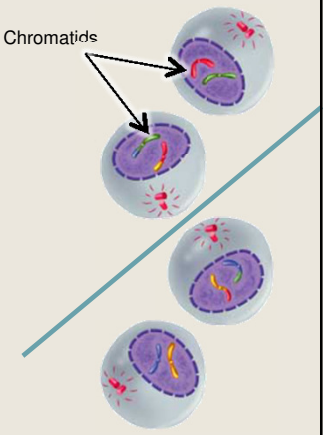
- The centrioles use the spindle fibers to separate the chromosomes into individual **chromatids**

•Each **chromatid** is pulled to the opposite pole of the cell

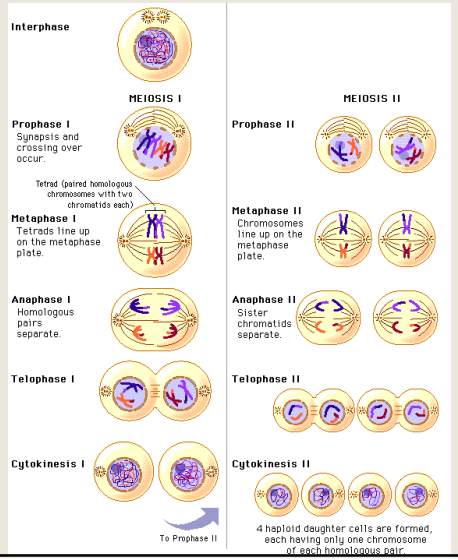


Telophase II & Cytokinesis

- Telophase II – the cells creates a permanent nucleus around the two haploid chromosome sets



•Cytokinesis – the cells divides into four haploid daughter cells

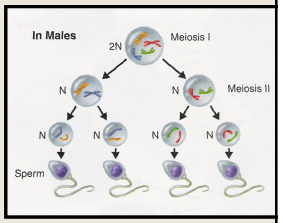


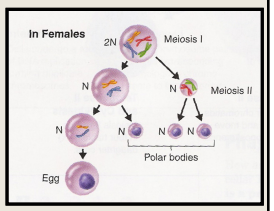
Meiosis Animation

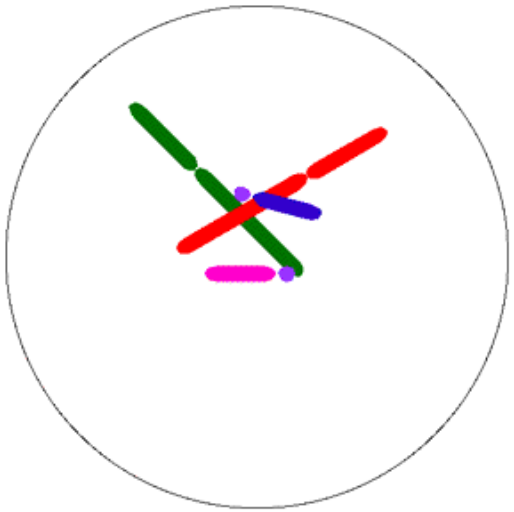
Meiosis Student Activity

Haploid cells develop into Gametes (Sex Cells)

- Gametogenesis is the production of gametes.
- In male animals (including humans), the haploid gametes produced by meiosis are called sperm
  - *4 sperm are produced*
  - *Sperm become motile*
  - *Produced constantly after puberty*
- In female animals (including humans), the haploid gametes produced by meiosis are called eggs
  - *1 large egg is produced along with 3 other cells, called **polar bodies**, which are discarded and not involved in reproduction*
  - *All produced before birth and releases one monthly*

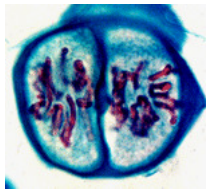






Comparing Mitosis & Meiosis

- Number of cells at beginning of process
  - Mitosis = 1 Diploid cell
  - Meiosis = 1 Diploid Cell
- Number of cells at the end of the process
  - Mitosis = 2 Diploid Cells
  - Meiosis = 4 Haploid Cells

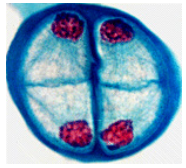


Comparing Mitosis & Meiosis

- Number of chromosomes at the **START**
  - Mitosis = 46 (***Diploid***, "two sets")
  - Meiosis = 46
- Number of chromosomes at the **END**
  - Mitosis = 46
  - Meiosis = 23 (***Haploid***, "one set")

Comparing Mitosis & Meiosis

- Is the genetic make-up of the daughter cells UNIQUE or IDENTICAL?
  - Mitosis produces 2 IDENTICAL CELLS
  - Meiosis produces 4 UNIQUE CELLS



Comparing Mitosis & Meiosis

- Type of cell in the human body that can undergo each phase
  - ❖Mitosis produces Somatic BODY cells (skin)
  - ❖Meiosis produces Gamete SEX cells (sperm or eggs)

Do you Remember

1. Which of the following best describes the genetic material a person receives from his or her father?
   a. 22 pairs of homologous chromosomes and an X and Y chromosome
   b. 22 haploid cells and an X or Y chromosome
   c. 23 diploid cells and an X and Y chromosome
   d. 22 autosomes and an X or Y chromosome

2. How many chromosomes are in a human gamete?
   a. 46
   b. 23
   c. 22
   d. 44

3. A kidney cell is an example of which type of cell?
   a. sex cell
   b. germ cell
   c. somatic cell
   d. haploid cell

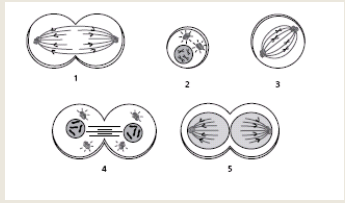
4. Which phrase best describes the process of meiosis?
   a. occurs in body cells
   b. results in genetically identical cells
   c. happens only in haploid cells
   d. produces haploid gametes

Review

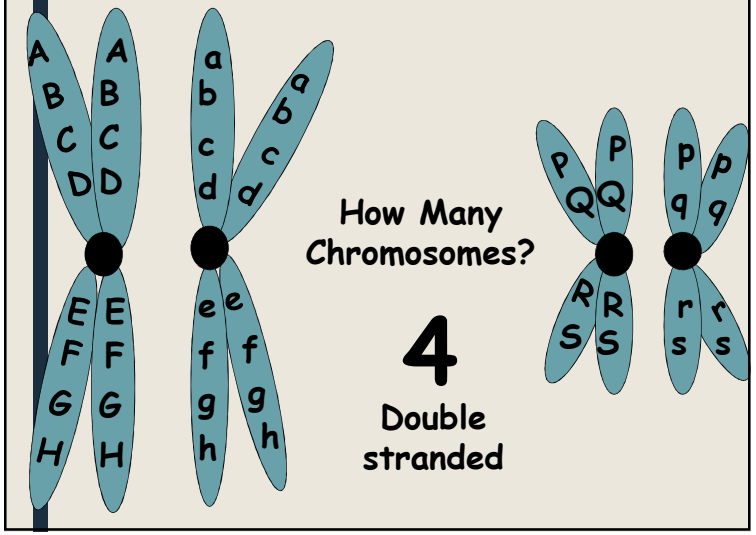
1. Which of the following is a phase of mitosis?
   A. cytokinesis
   B. interphase
   C. prophase
   D. S phase

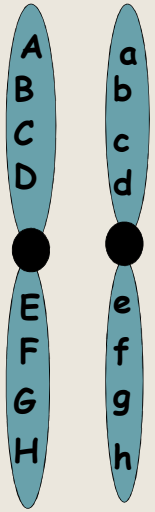
2. If the parent cell starts out with 24 Chromosome and undergoes mitosis, then how many will the sister cells have?
   A. 48 **B.** 12 **C.** 5 **D.** 24

3. In Meiosis if the parent cells has 40 chromosomes, then how many will the daughter cells have?
   A. 40 **B.** 10 **C.** 20 **D.** 18



4. Put the following stages in the cell cycle in order.
   A. 5, 3, 1, 2, 4
   B. 3, 1, 4, 2,5
   C. 4, 1, 2, 5, 3
   D. 2, 3, 1, 5, 4

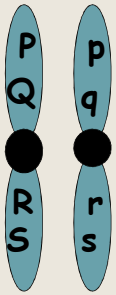




How Many Chromosomes?

4

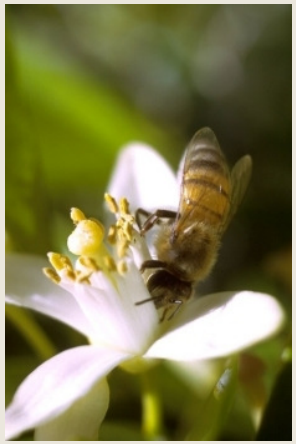
Single stranded



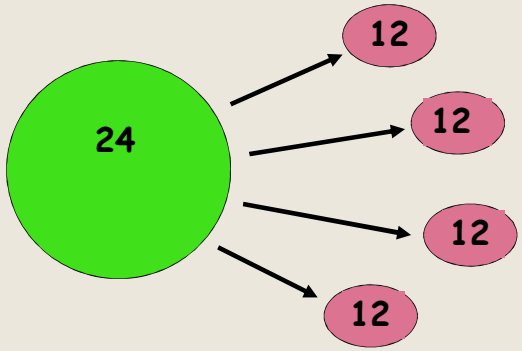
What kind of reproduction?

Sexual

The honeybee is transferring the male pollen to the female stigma that fertilizes the ovules to make seeds



4. How many chromosomes would be found in the gamete of an organism whose diploid number is 24?



5. The cells that are produced by mitosis have what number of chromosomes?

Diploid

The cells that are produced by meiosis have what number of chromosomes?

Haploid