

# BELL WORK

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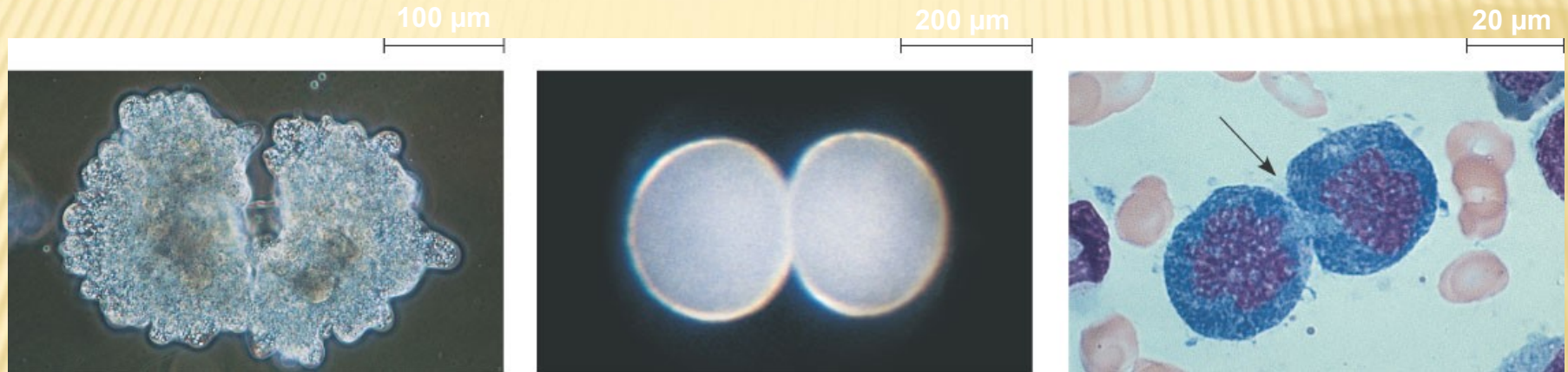
Talk to your neighbors about:

- How does your body repair itself?
- How does your body grow?
- Do you think you have the same cells you were born with?

# **CELL REPRODUCTION**

**CELL CYCLE, BINARY FISSION, MITOSIS & MEIOSIS**

# FUNCTIONS OF CELL DIVISION



(a) **Reproduction.** An amoeba, a single-celled eukaryote, is dividing into two cells. Each new cell will be an individual organism (LM).

(b) **Growth and development.** This micrograph shows a sand dollar embryo shortly after the fertilized egg divided, forming two cells (LM).

(c) **Tissue renewal.** These dividing bone marrow cells (arrow) will give rise to new blood cells (LM).

# DNA

- Genetic information - genome
- Packaged into chromosomes

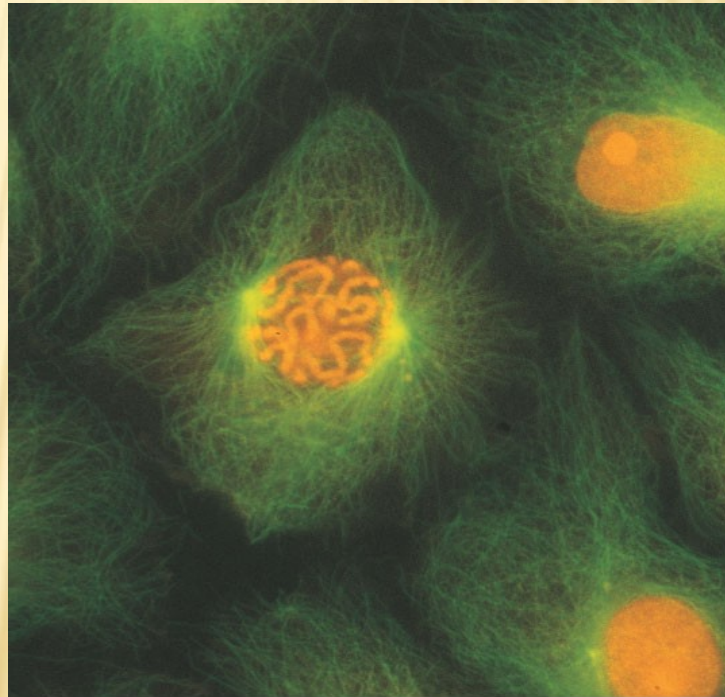


Figure 12.3

50  $\mu\text{m}$

# DNA AND CHROMOSOMES

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- ▣ An average eukaryotic cell has about 1,000 times more DNA than an average prokaryotic cell.
- ▣ The DNA in a eukaryotic cell is organized into several linear chromosomes, whose organization is much more complex than the single, circular DNA molecule in a prokaryotic cell

# CHROMOSOMES

- All eukaryotic cells store genetic information in chromosomes.
- Most eukaryotes have between 10 and 50 chromosomes in their body cells.
- Human cells have 46 chromosomes.
- 23 nearly-identical pairs



**THINK ABOUT THE FOLLOWING...  
TURN TO YOUR SHOULD PARTNER  
AND TALK ABOUT THESE POINTS.**

- 1) **What are the functions of cell division? (Hint there are three main functions)**
- 2) **Which structures in the nucleus stores genetic information?**
- 3) **How many chromosomes does a human have in their normal body cells?**

**Press Pause, Think,  
& Share**



# WHAT DID YOU DISCUSS?

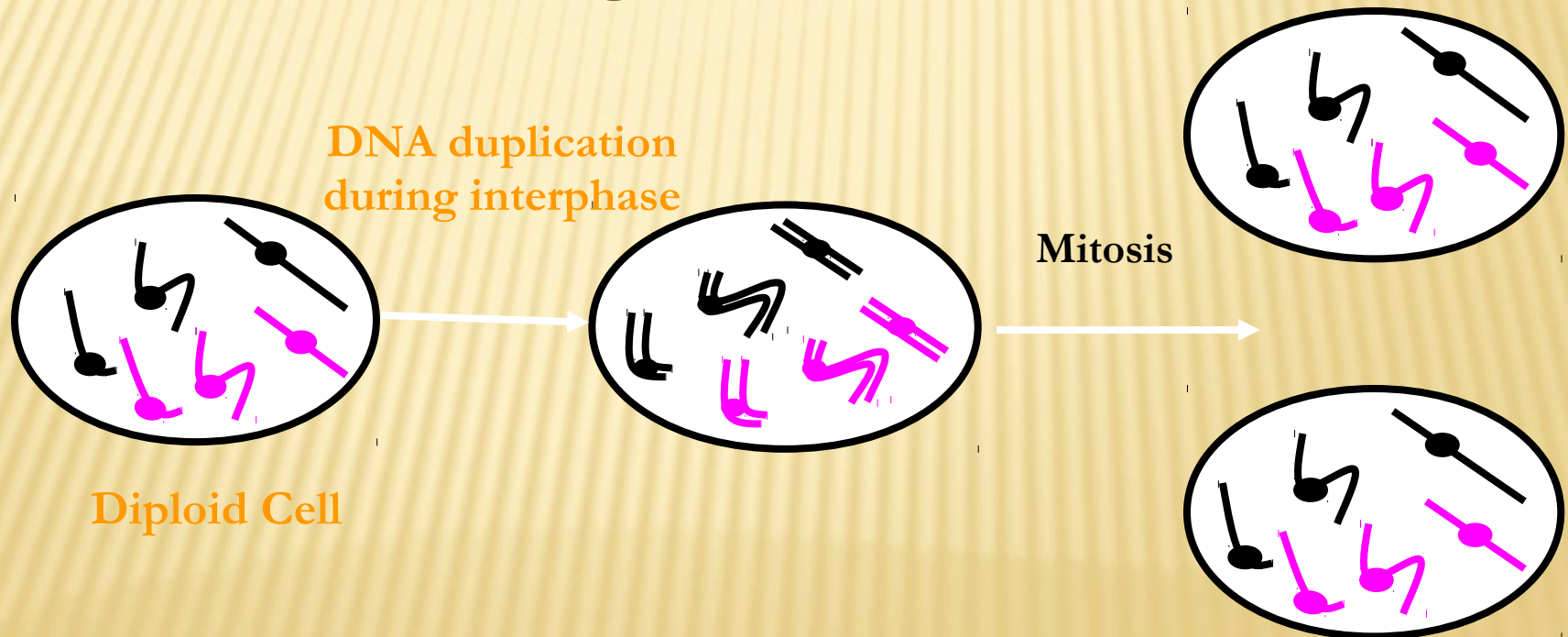
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- 1) What are the functions of cell division? (Hint there are three main functions)
  - Reproduction in some organisms (unicellular)
  - Growth
  - Repair
- 1) Which structures in the nucleus stores genetic information?
  - Chromosomes
- 1) How many chromosomes does a human have in their normal body cells?
  - 46 (23 pairs)



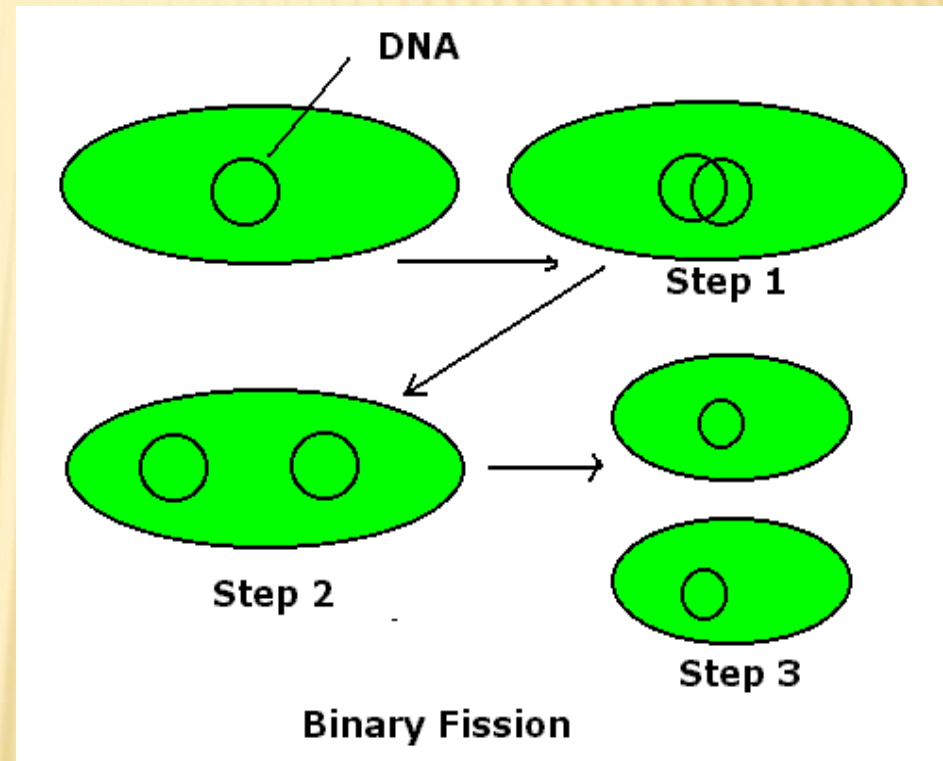
# MITOSIS

- Eukaryotic cells divide by mitosis
- Each new cell receives one copy of every chromosome that was present in the original cell.
- Produces 2 new nuclei that are both genetically identical to the original cell.



# BINARY FISSION

- Most cells reproduce through some sort of **Cell Division**
- Prokaryotic cells divide through a simple form of division called **Binary Fission**
- 3 step process
- Single “naked” strand splits and forms a duplicate of itself.
- The two copies move to opposite sides of the cell
- Cell “pinches” into two new and identical cells called **“daughter cells”**. (Cell wall then forms if applicable)



# MITOSIS

- The process by which eukaryotic cells reproduce themselves, resulting in daughter cells that contain the same amount of genetic material as the parent cell.
- Occur in body cells (somatic cells)

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**CELL DIVISION OCCURS IN  
A SERIES OF STAGES OF  
PHASES**

# DISCUSS

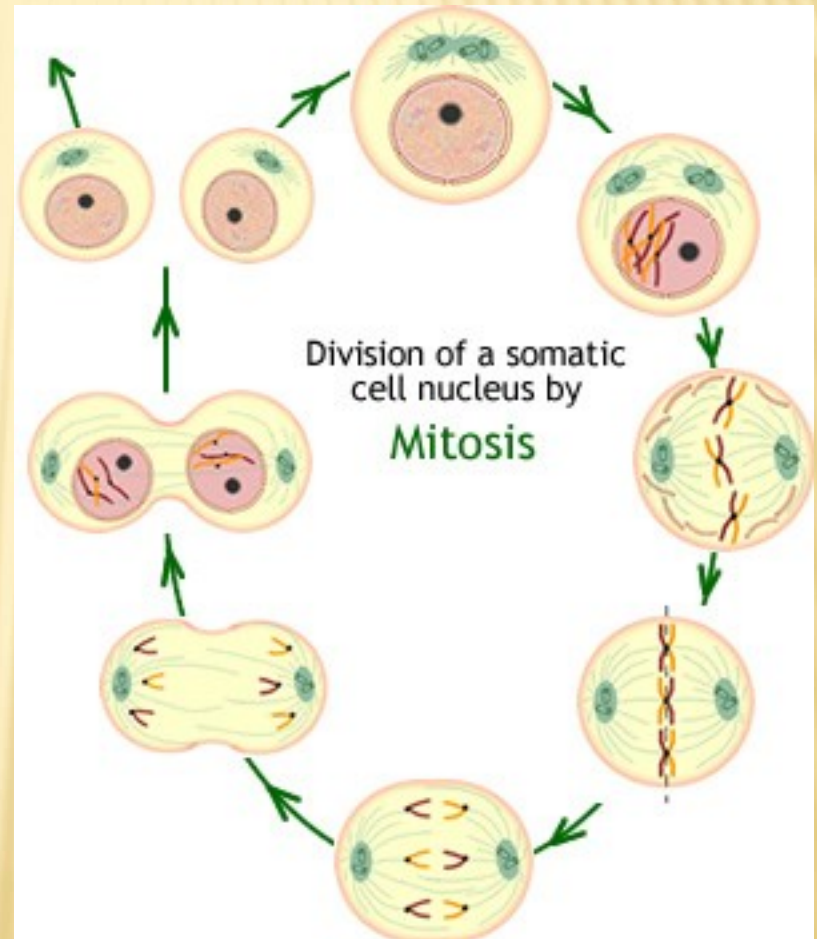
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**How do mitosis and binary fission compare???**

# Animated Mitosis Cycle

<http://www.cellsalive.com/mitosis.htm>

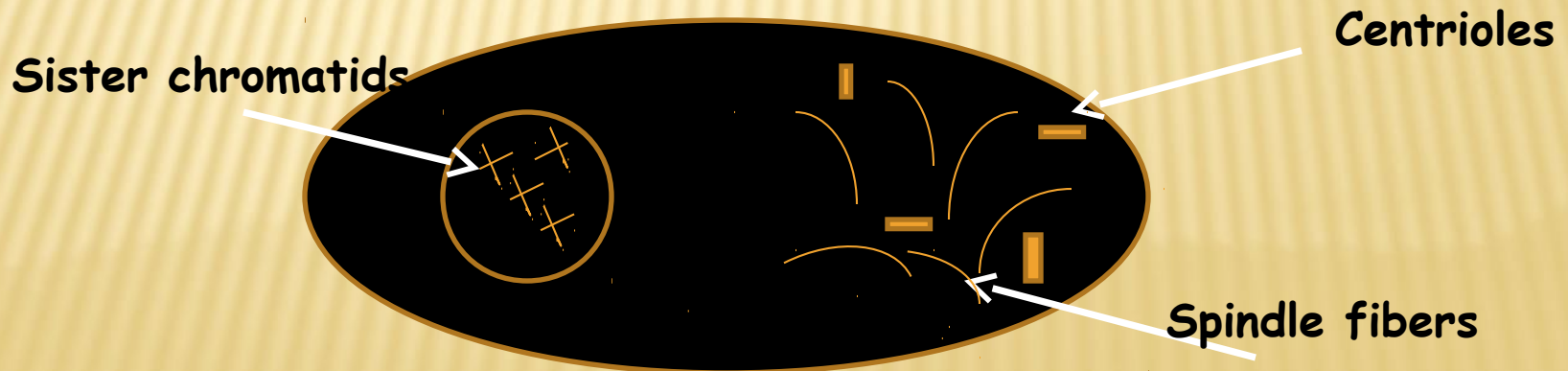
- **P**rophase
- **M**etaphase
- **A**naphase
- **T**elophase



# PROPHASE

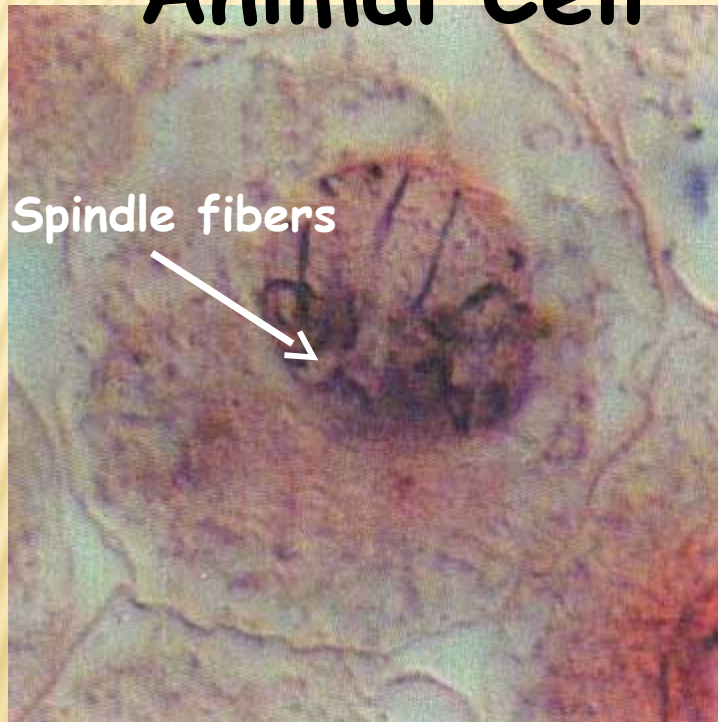
## 1<sup>ST</sup> STEP IN MITOSIS

- Nuclear envelope disappears
- Centrioles appear and begin to move to opposite end of the cell.
- Spindle fibers form between the poles.

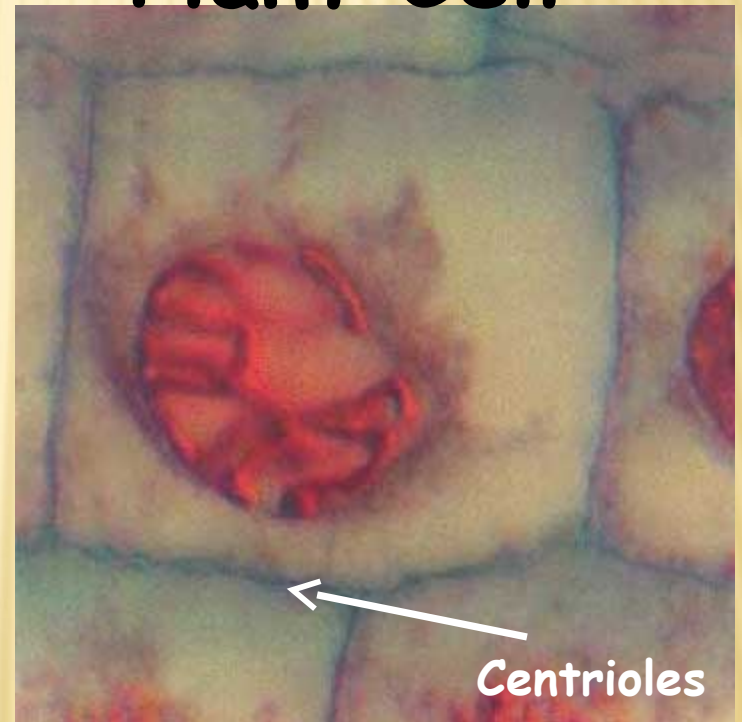


# PROPHASE

## Animal Cell



## Plant Cell

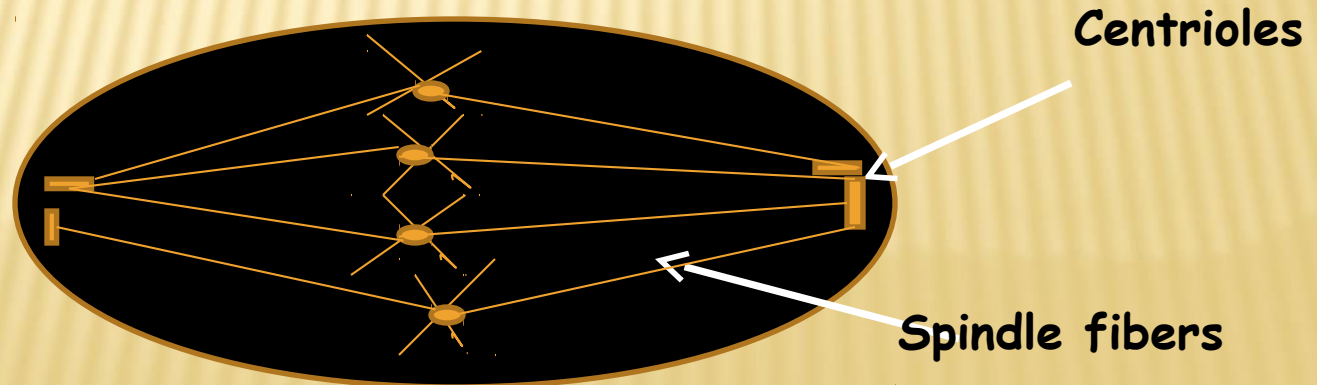




# METAPHASE

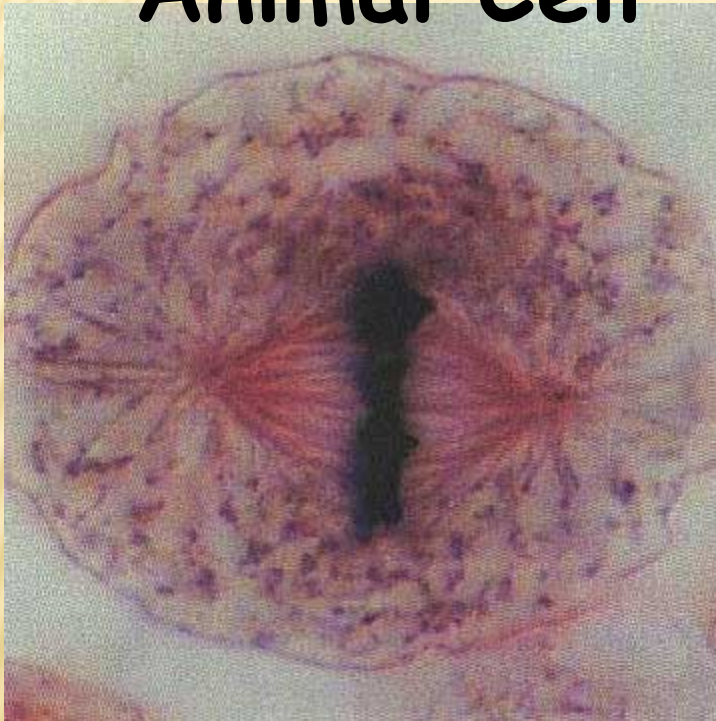
## 2<sup>ND</sup> STEP IN MITOSIS

- Chromatids (or pairs of chromosomes) attach to the spindle fibers.
- Line up in the middle of the cell

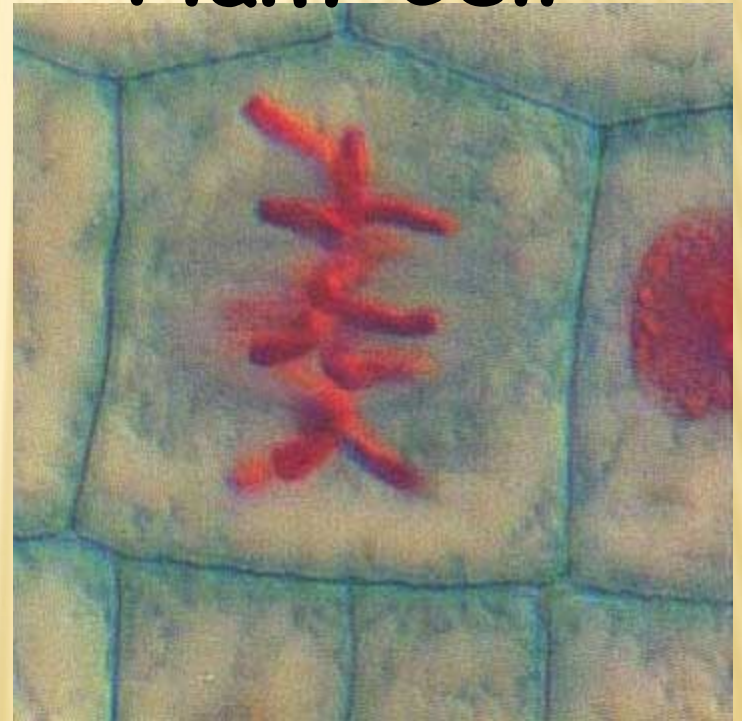


# METAPHASE

## Animal Cell



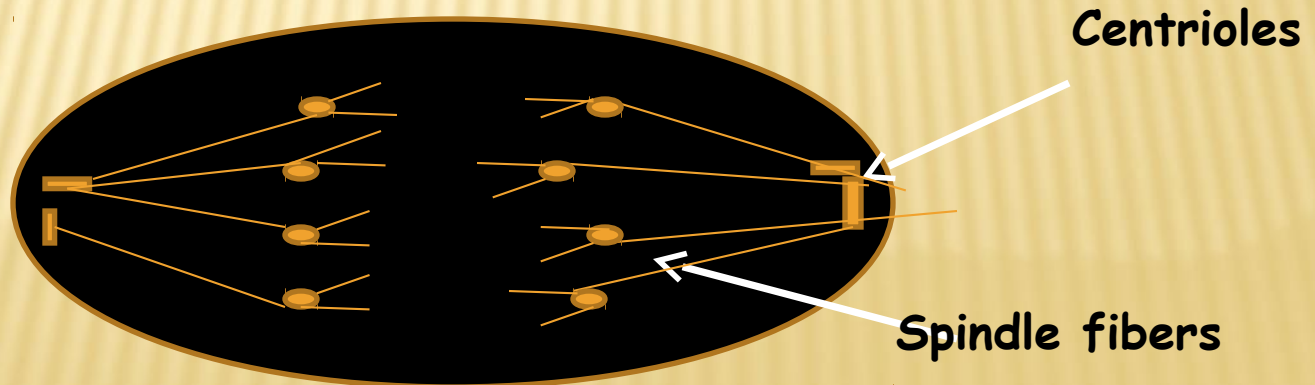
## Plant Cell



# ANAPHASE

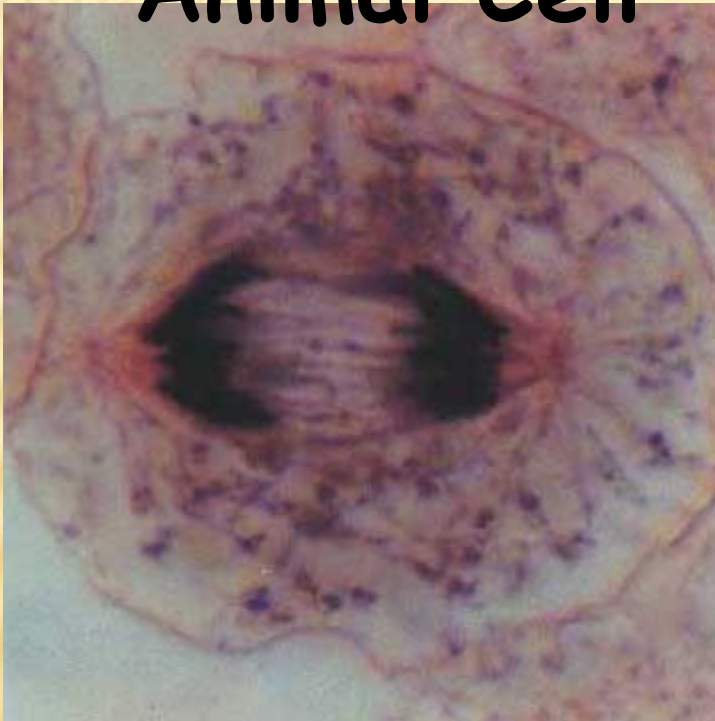
## 3<sup>RD</sup> STEP IN MITOSIS

- Chromatids (or pairs of chromosomes) separate and begin to move to opposite ends of the cell.

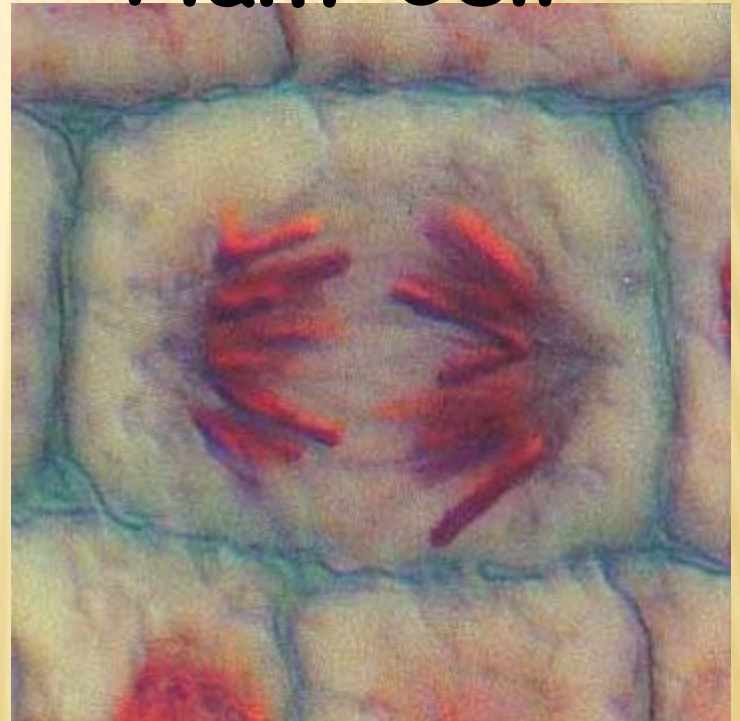


# ANAPHASE

## Animal Cell



## Plant Cell



# TELOPHASE

## 4TH STEP IN MITOSIS

- Two new nuclei form.
- Chromosomes appear as chromatin (threads rather than rods).
- Mitosis ends.

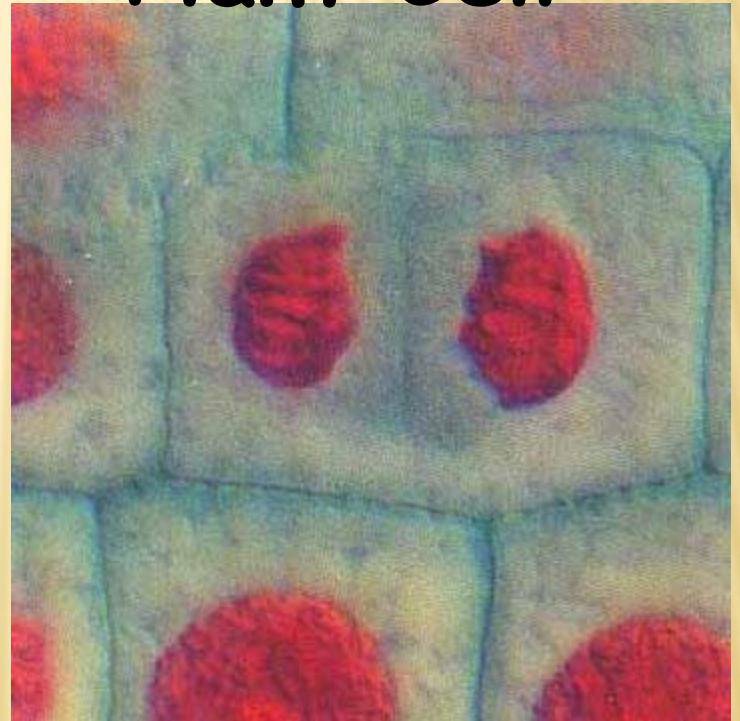


# TELOPHASE

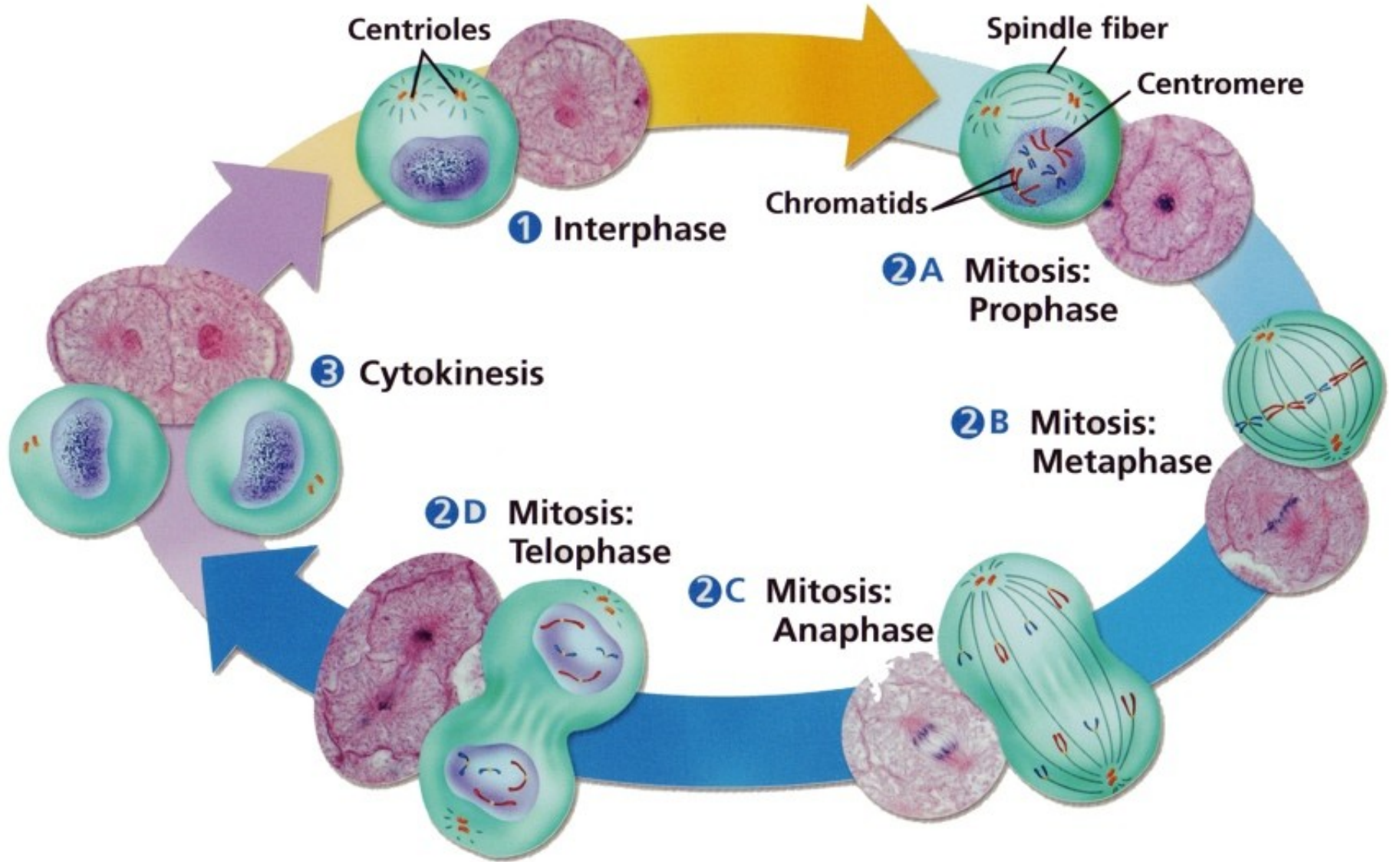
## Animal Cell



## Plant Cell



# CELL CYCLE



**THINK ABOUT THE FOLLOWING...  
TURN TO YOUR SHOULD PARTNER  
AND TALK ABOUT THESE POINTS.**

- 1) **What are the phases of mitosis (hint: there are 4)**
- 2) **Describe the major event that happens in each phase.**

## **Press Pause, Think, & Share**





# WHAT DID YOU DISCUSS?

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- 1) What are the phases of mitosis? (Hint: there are four)
  - Prophase
  - Metaphase
  - Anaphase
  - Telophase
  
- 1) Describe the major event that happens in each step.
  - Prophase= spindle fibers form, nuclear envelope disappears
  - Metaphase= chromatids line up at center of cell
  - Anaphase= chromatids are pulled to opposite ends of the cell
  - Telophase= 2 new nuclear envelopes appear, mitosis ends

# TIME TO WRITE

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- ▢ Use the guided notes to create a mitosis foldable.
- ▢ Once you are finished share your paper with a partner.
- ▢ Make any necessary changes.

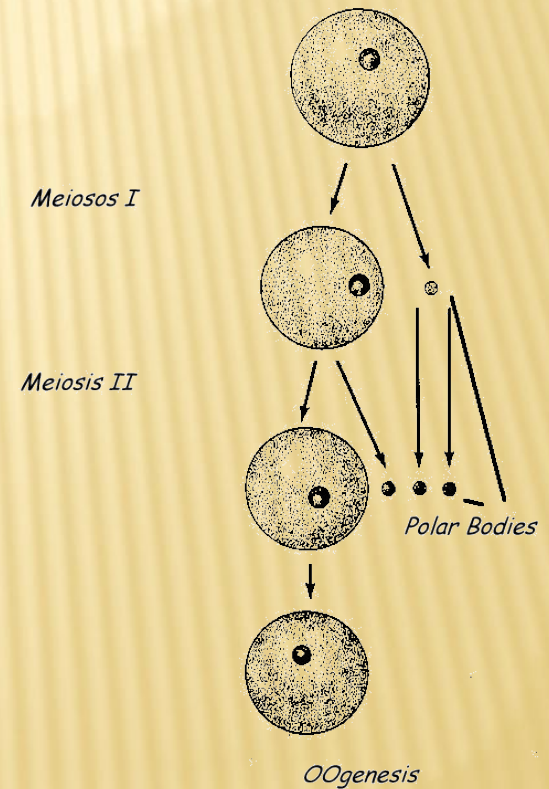
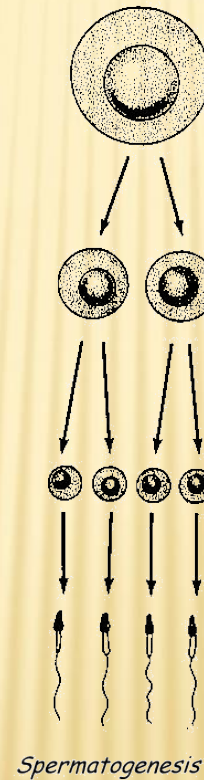
# MEIOSIS

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- **Similar in many ways to mitosis**
- **Several differences**
  - **Involves 2 cell divisions**
  - **Results in 4 cells with  $1/2$  the normal genetic information**

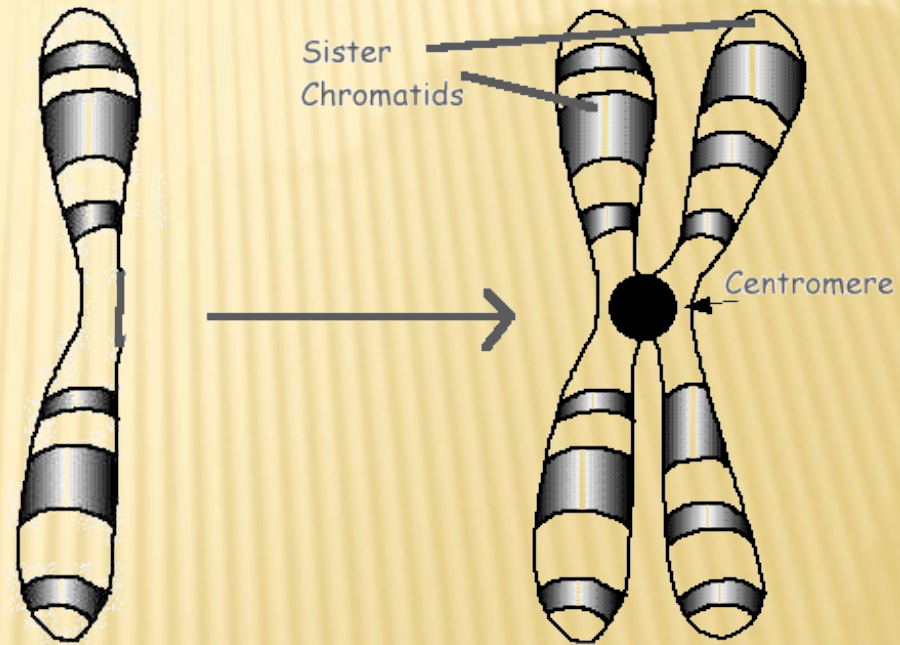
# VOCABULARY

- **Diploid (2N)** - Normal amount of genetic material (somatic cells)
- **Haploid (N)** - 1/2 the genetic material. (gametes)
- Meiosis results in the formation of haploid cells.
- In Humans, these are the **Ova** (egg) and **sperm**.
- Ova are produced in the **ovaries** in females
- Process is called **oogenesis**
- Sperm are produced in the **testes** of males.
- Process is called **spermatogenesis**



# MEIOSIS PHASES

- Meiosis occurs in 2 phases; **Meiosis I**, & **Meiosis II**.
- Meiosis I.**
  - Prior to division, amount of DNA doubles

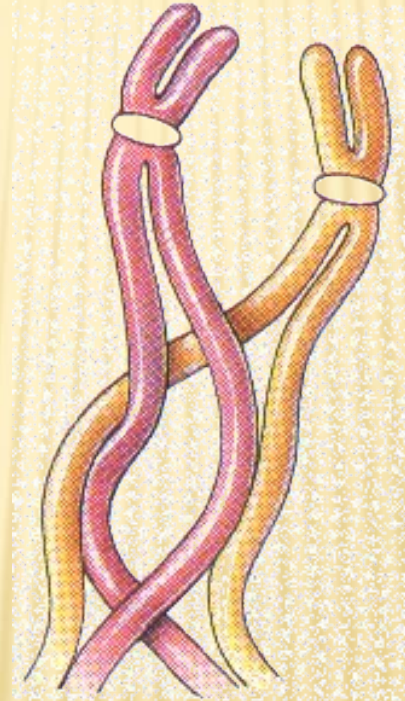


Chromosome before  
DNA replication

Chromosome after  
DNA replication

# CROSSING OVER

- During prophase 1 homologous chromosomes come together.
- Areas of homologous chromosomes connect at areas called **chiasmata**



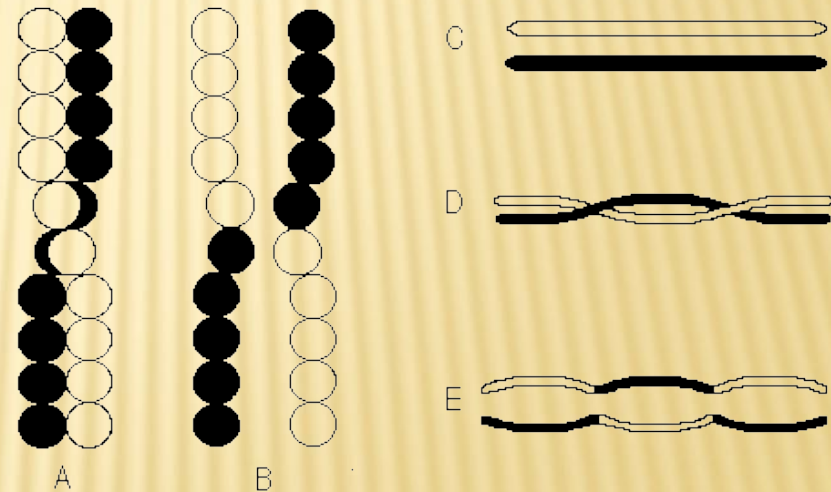
# CROSSING OVER CONTD.

▣ Crossing Over of genes occurs now

- ▣ Segments of homologous chromosomes break and reform at similar locations.
- ▣ Results in new genetic combinations of offspring.

▣ This is the main advantage of sexual reproduction

## Chromosome Crossing-over



# PAUSE AND THINK

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- What is the difference between haploid and diploid?
- Where are ova and sperm made?
- How many phases of meiosis occur?
- What is crossing over and when does that occur?



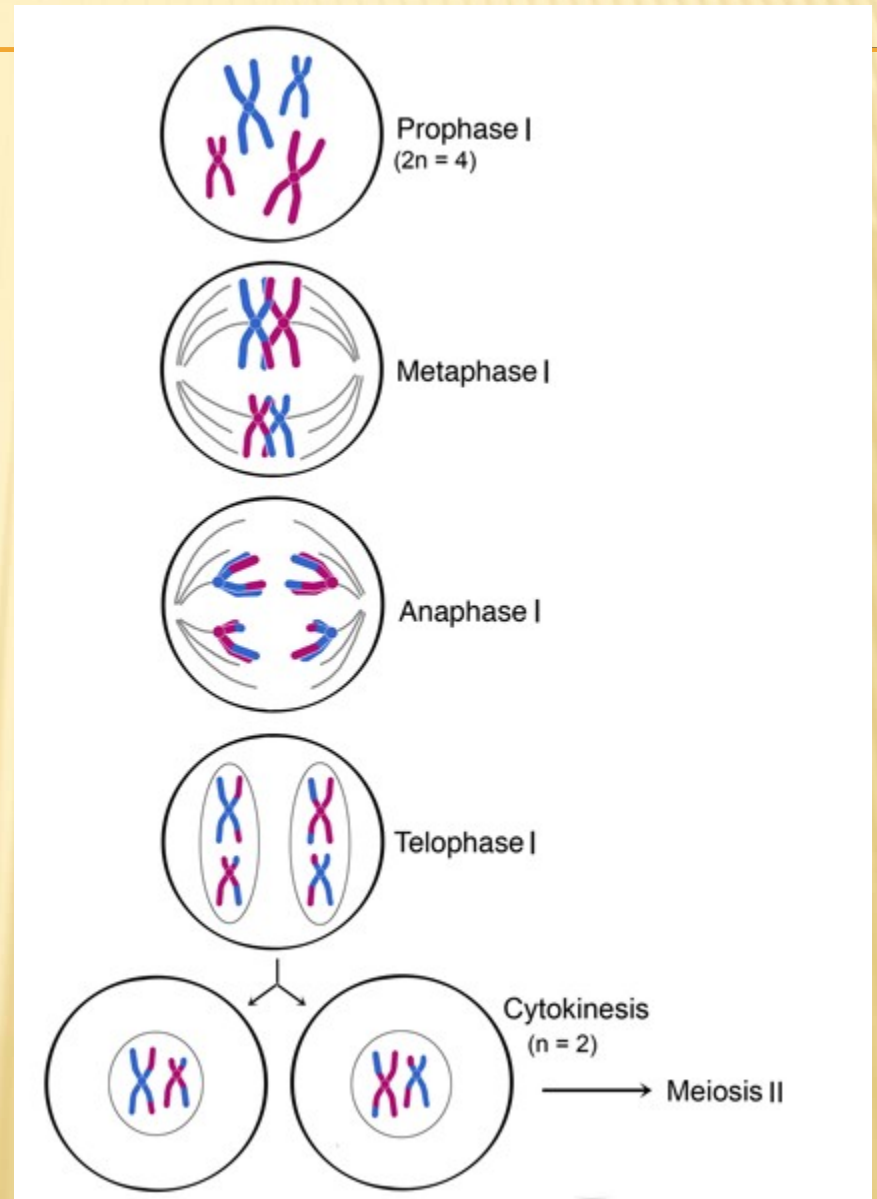
# PAUSE AND THINK

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- What is the difference between haploid and diploid?
  - Haploid ( $n$ ) contains half the number of chromosomes
  - Diploid ( $2n$ ) contains two sets of chromosomes
- Where are ova and sperm made?
  - Testes and ovaries
- How many phases of meiosis occur?
  - 2 divisions
- What is crossing over and when does that occur?
  - Leads to genetic diversity, Prophase I

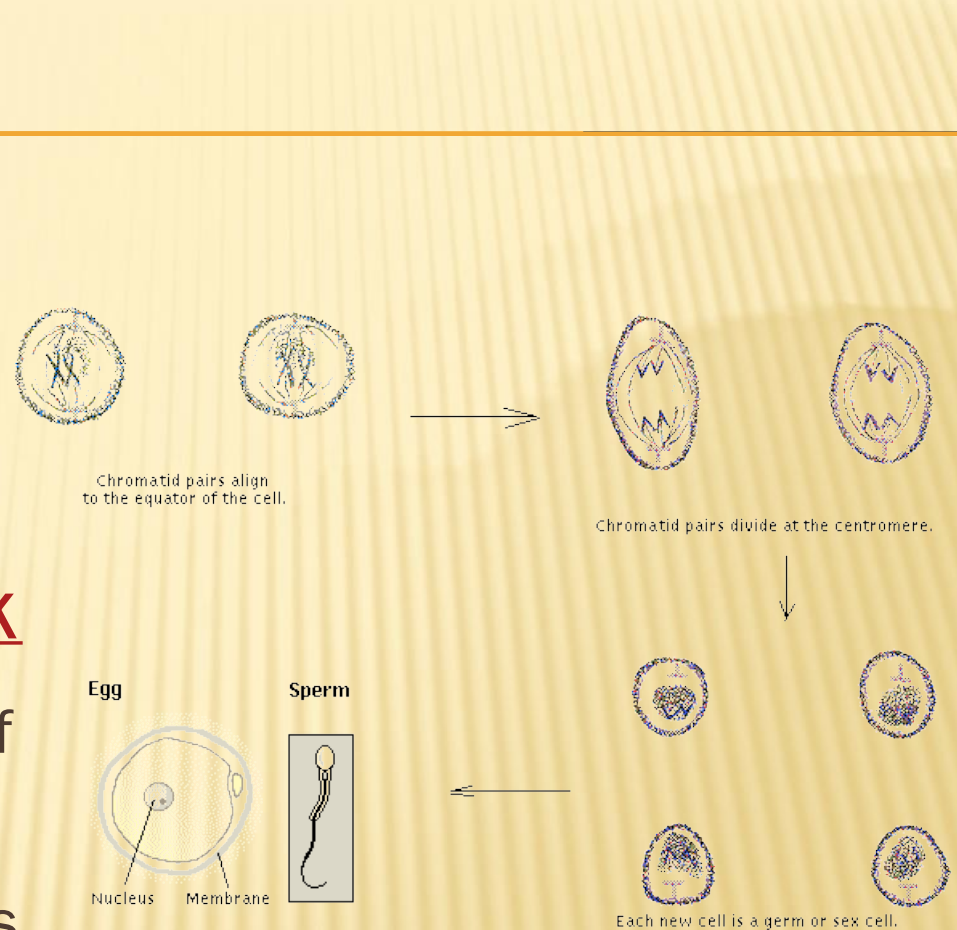
# MEIOSIS I

- Does this look familiar?
- Can you explain what is happening?



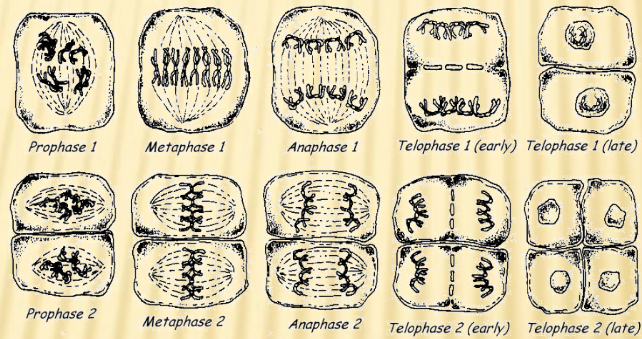
# MEIOSIS II

- DNA **does not** double
- Chromosomes randomly line-up along metaphase plate like regular mitosis.
- During anaphase 2, **CENTROMERES BREAK** and each chromosome is pulled to opposite sides of the cell.
- Nuclei reform and cytokinesis usually occurs (although it is often unequal).

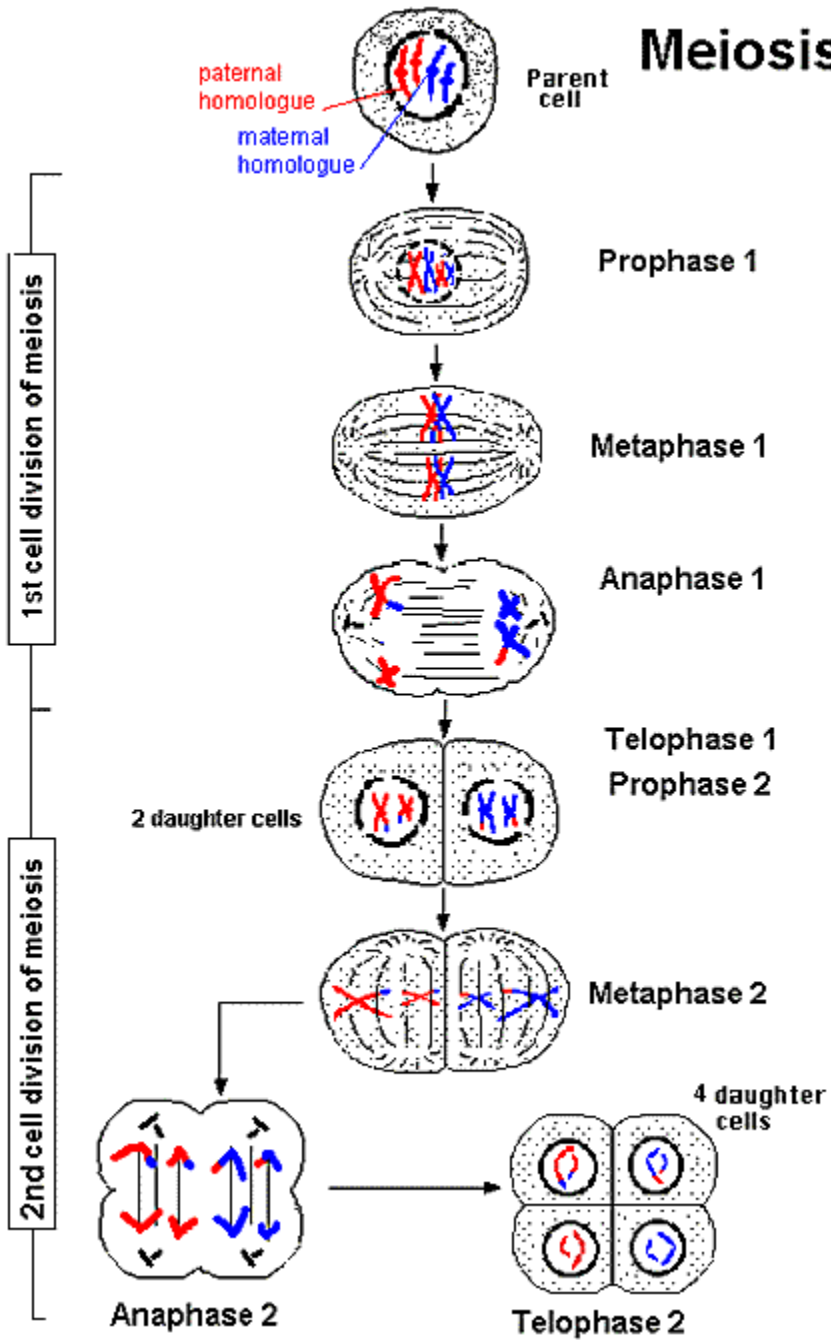


Meiosis II

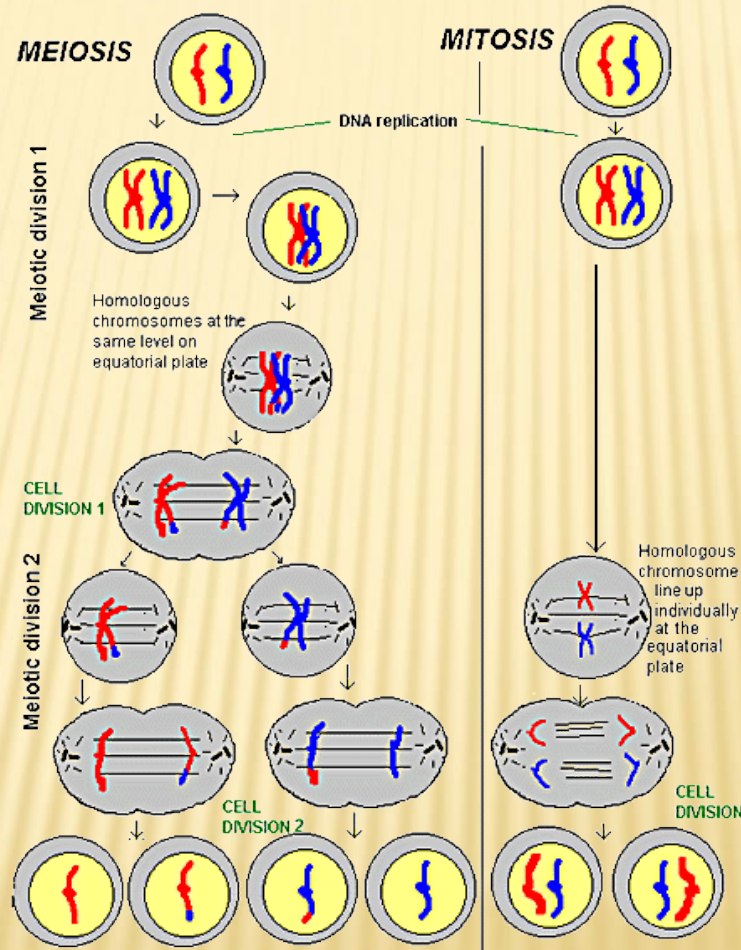
# OVERVIEW OF MEIOSIS



# Meiosis



# COMPARISON OF MITOSIS & MEIOSIS



**THINK ABOUT THE FOLLOWING...  
TURN TO YOUR SHOULD PARTNER  
AND TALK ABOUT THESE POINTS.**

- 1) **When does crossing over occur? What benefit does it create over asexual reproduction?**
- 2) **How many times does the nucleus divide in Meiosis?**
- 3) **How many cells are produced from Meiosis?**

## **Press Pause, Think, & Share**



# WHAT DID YOU DISCUSS?

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- 1) When does crossing over occur? What benefit does it create over asexual reproduction?
  - Prophase I
  - Due to crossing over species have genetic diversity
- 1) How many times does the nucleus divide?
  - Twice, during Meiosis and I and again in Meiosis II
- 1) How many cells are produced from Meiosis?
  - 4 different, haploid, gamete cells



# Time to Write

**USE THE GUIDED NOTES TO COMPLETE THE MEIOSIS SIDE OF THE FOLDABLE.**

**ONCE YOU ARE FINISHED SHARE YOUR PAPER WITH A PARTNER.**

**MAKE ANY NECESSARY CHANGES.**

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