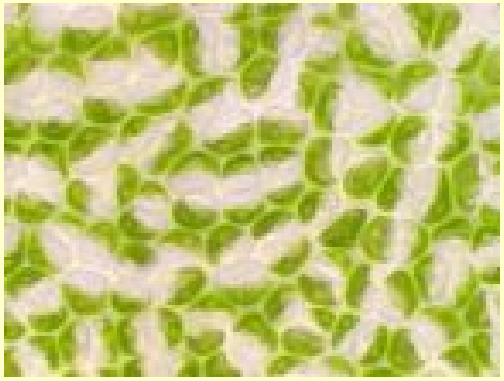
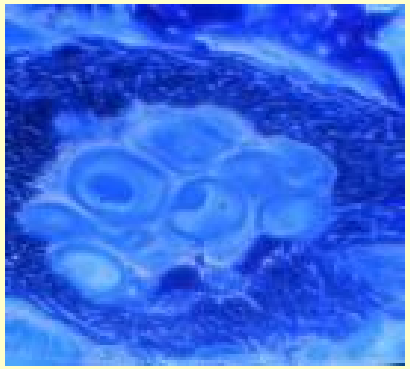
Cell Growth and Reproduction

📖 Describe cells that make up a ***multicellular*** organisms…

- Comes in wide **variety** of **shapes** and **sizes**





📖 Name the cell with the **largest** diameter.

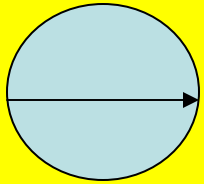
- Yolk of an **ostrich** egg

📖 Name the **diameter range** of most living cells.

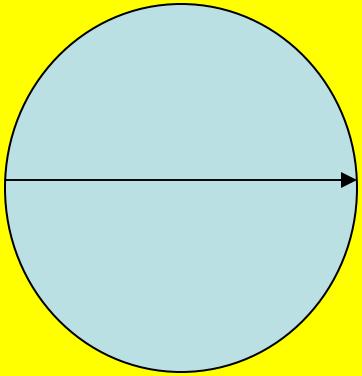
- 2 to 200 µm (micrometers)

Factors that Cause Cell Size Limitations

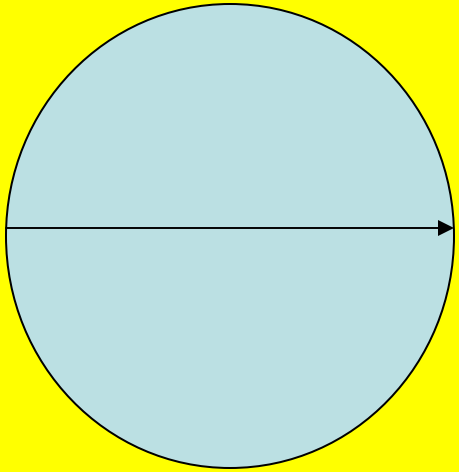
- Why can't most organisms be just **<u>one giant</u>** cell?



Diffusion would be **<u>rapid</u>**



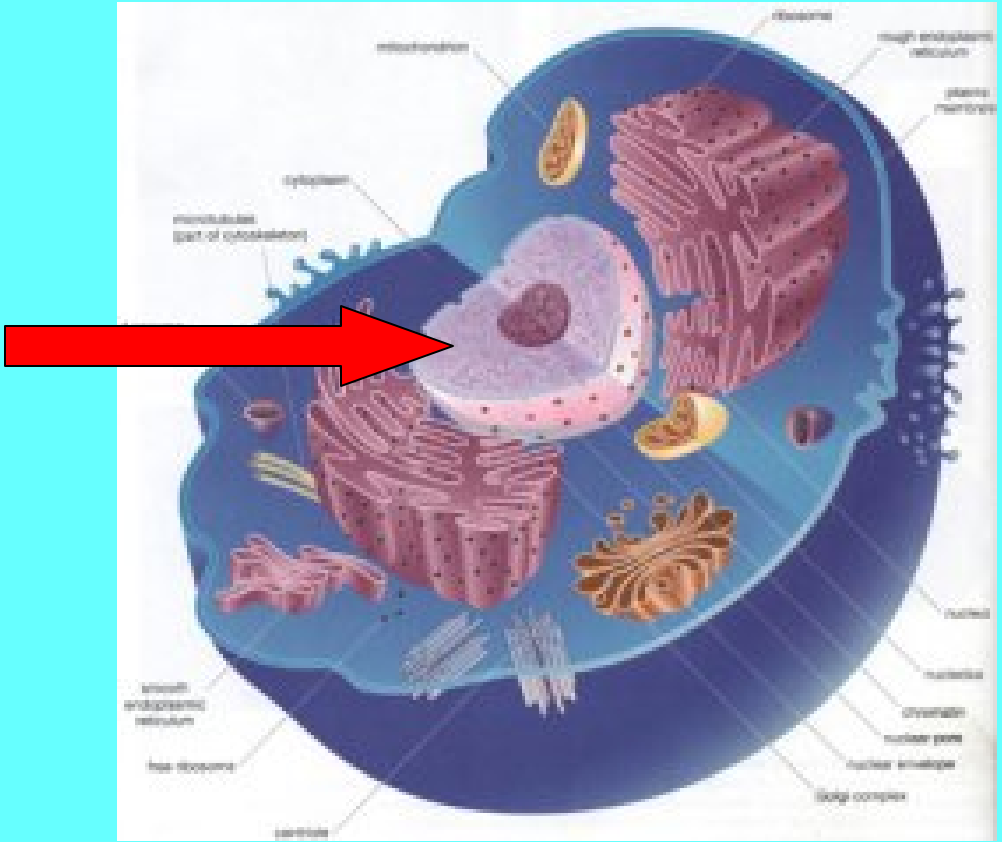
Diffusion would start to **<u>slow</u>** down



Diffusion would be **<u>extremely slow</u>**

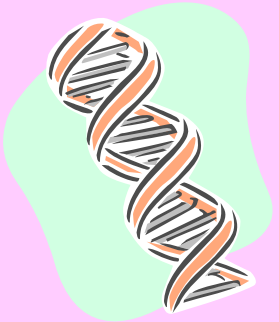
📖 Name the organelle where DNA (blueprint) is located.

- Inside nucleus of the cell.



📖 Explain how DNA limits cell size?

- 🗣 Need to understand…



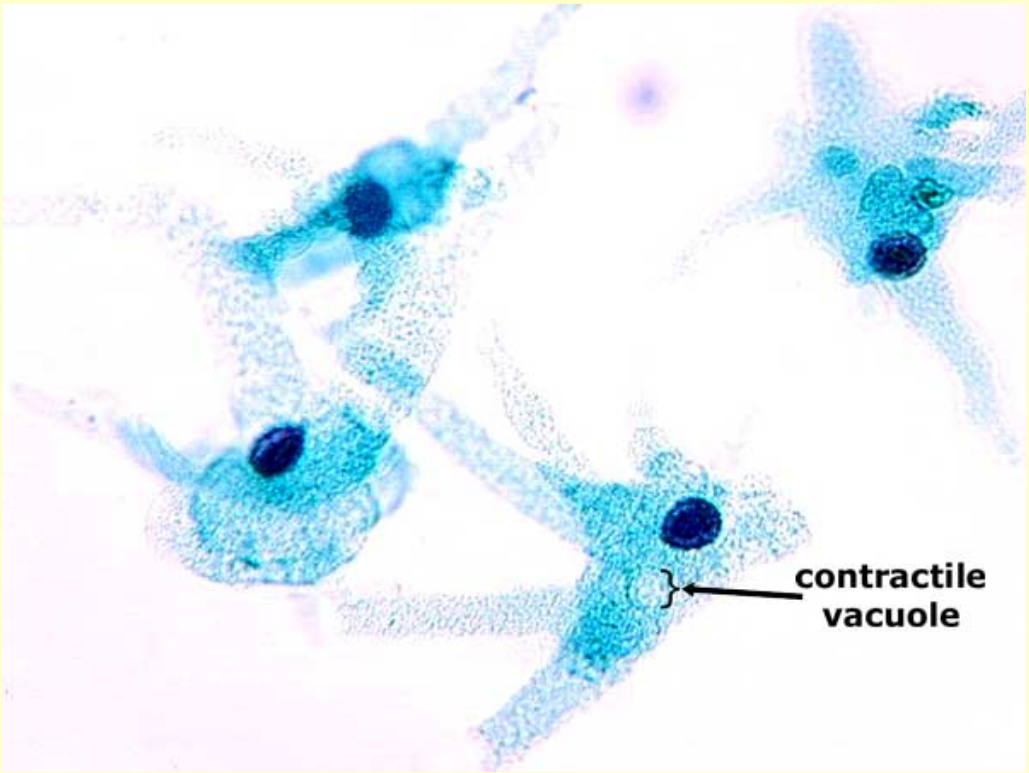
DNA is copied at a **certain rate**. If this rate **slows** down, **less** DNA is copied.

Therefore…

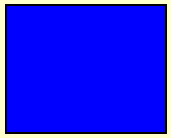
- ❖ Cells **cannot survive** when there is **not enough DNA** to support original protein function.

📖 If a certain number of DNA is required, how then do **larger** cells such as amoeba survive?

- Needs many **nuclei** in order to produce **enough** DNA

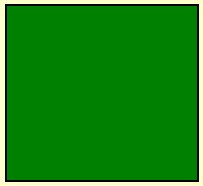


Surface Area to Volume Ratio



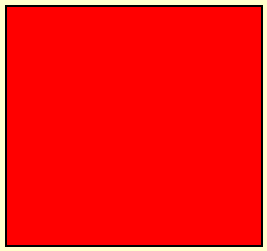
SA: LxWx6
(1mm)
SA: $6mm^2$

Volume: LxWxH
(1mm)
Volume = $1mm^3$



SA: LxWx6
(2mm)
SA: $24mm^2$

Volume: LxWxH
(2mm)
Volume = $8mm^3$



SA: LxWx6
(4mm)
SA: $96mm^2$

Volume: LxWxH
(4mm)
Volume = $64mm^3$

🗣 Surface Area to Volume Ratio

- Surface area is increasing ***slower*** by **4** times.
- Volume is increasing ***faster*** by **8** times
- **Not enough surface area** to allow nutrients and waste to diffuse through
- Cell would **eventually** starve and die

📖 **Therefore**, cells **divide** before they become too **large** to **function**.

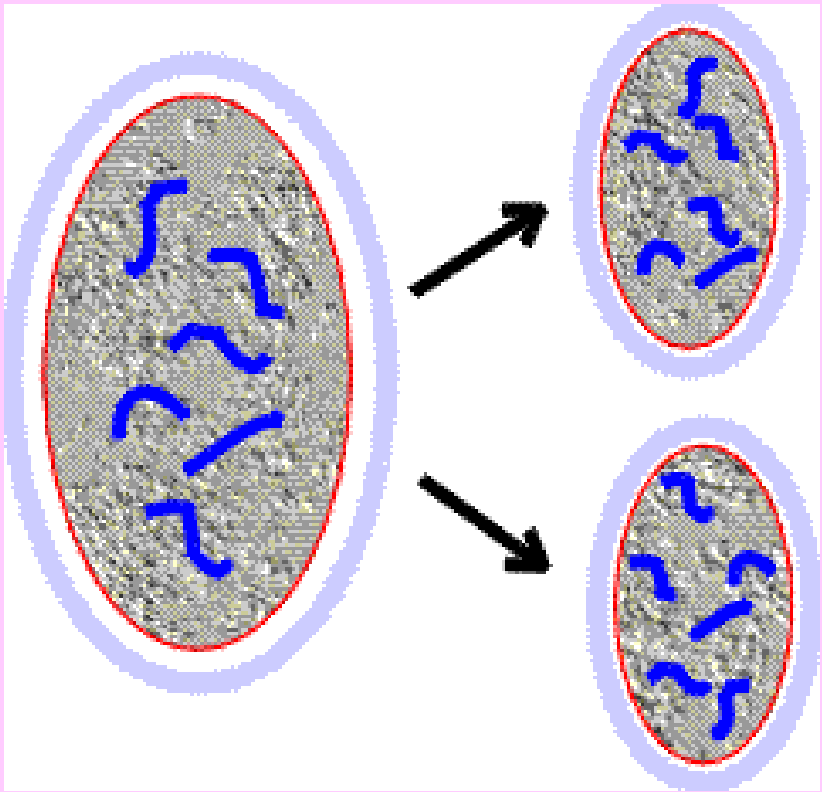
🗣 Cell Reproduction

📖 Recall: List the **3** parts of the "**cell theory**".

1.) All living things are made up of **1** or more cells.
2.) Cells come from other pre-existing cells.
3.) Cells are the basic unit and structure of life.

🗣 Cell Reproduction

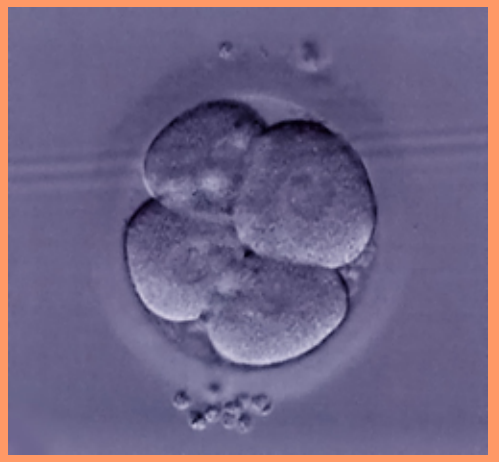
📖 Cell division results in **two** cells that are **identical** to the original **parent** cell.



🗣 Cell Reproduction

📖 Why does cell division occur in our bodies?

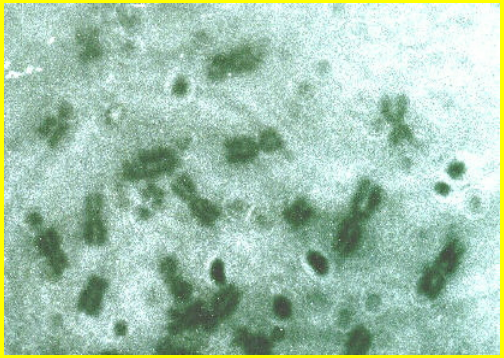
- To replace worn out cells/tissues
- To grow
- To replace dying cells
- To help heel cuts and bruises
- To help with digestion



📖 Define ***Chromosomes.***

- Chromosomes are **dark colored** structures that contain **DNA** in the nucleus.

- Carriers **genetic material** of living things.



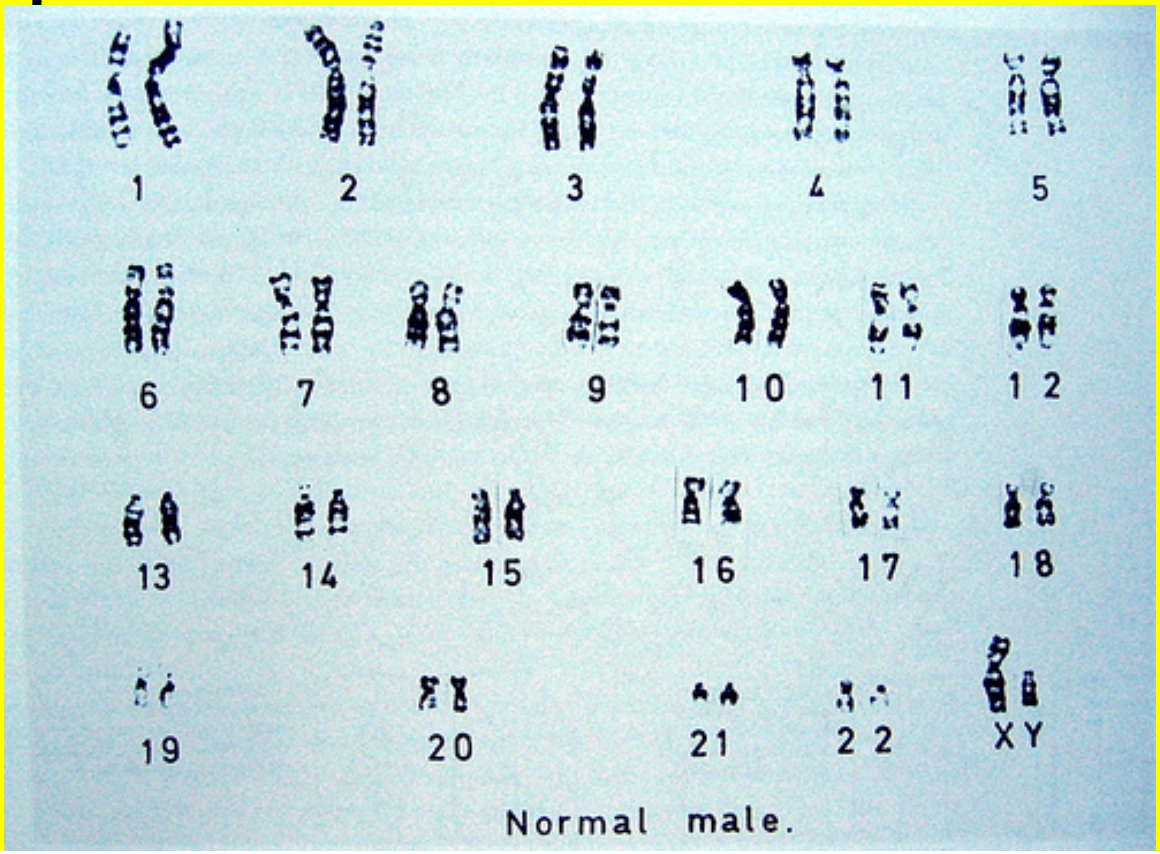
🗣 The **Greek** words…

chroma…meaning colored

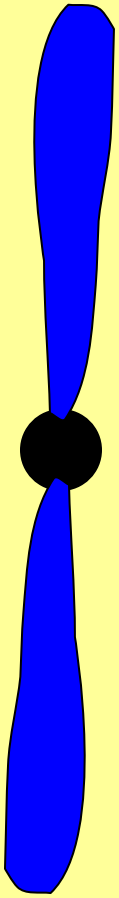
soma…meaning body

🗣 Vocabulary

Karyotype is a **photomicrograph** picture of **chromosomes**



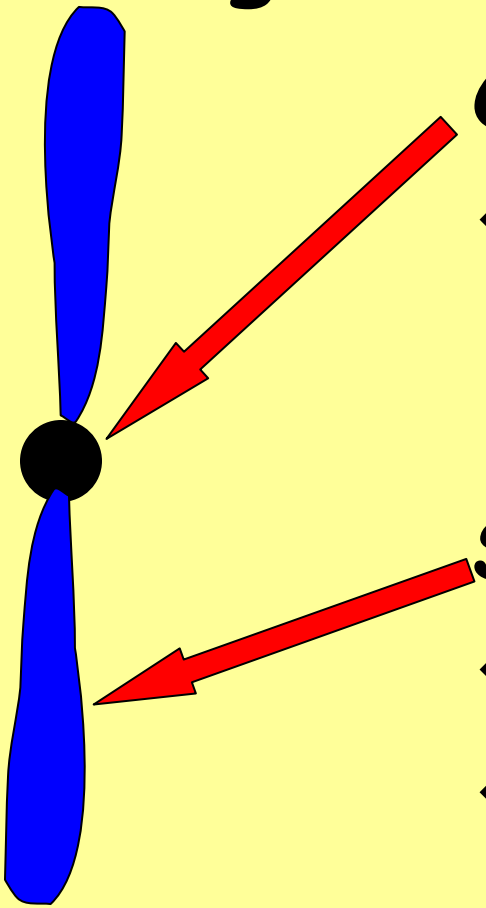
🗣 Vocabulary (draw in upper left of box)



Chromosome

- Single DNA molecule with proteins
- Rod in shape

🗣 Vocabulary (draw in upper right of box)



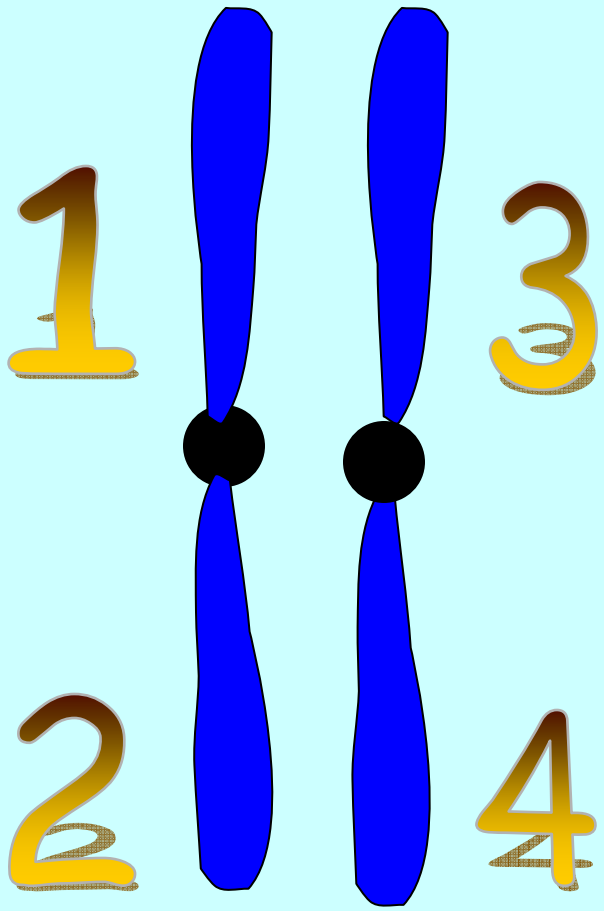
Centromere

- Holds the 2 sister **<u>chromatids</u>** together

Sister chromatids

- ½ of a chromosome
- **<u>2</u> <u>chromatids</u>** makes up **<u>1</u>** whole chromosome.

🗣 ??????????????????????



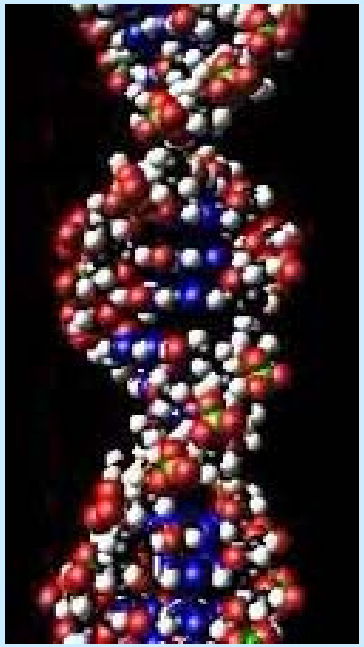
How many **chromatids** are there?

4

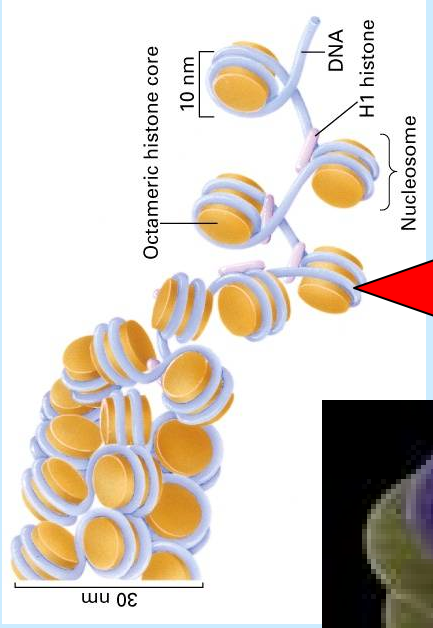
How many **chromosomes** are there?

2

🗣 Vocabulary (bottom picture)

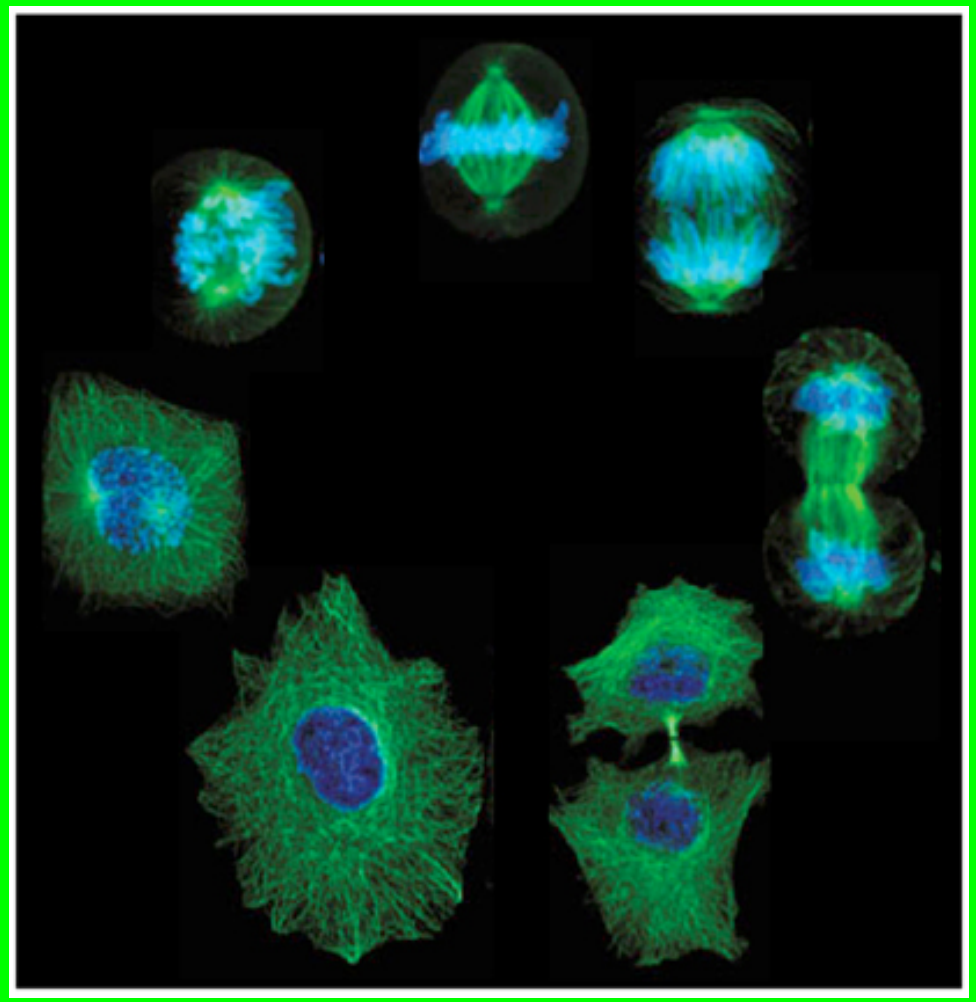


DNA



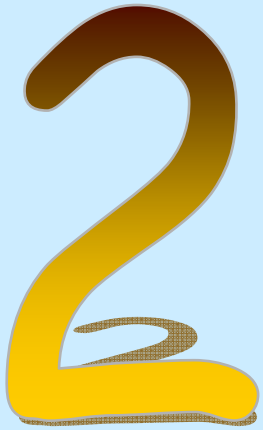
Protein called **histones**. Beads that allow DNA to coil up tightly

📖 Define *cell cycle*.



- The **cell cycle** is the **<u>sequence</u>** of ***growth*** and ***division*** of a cell

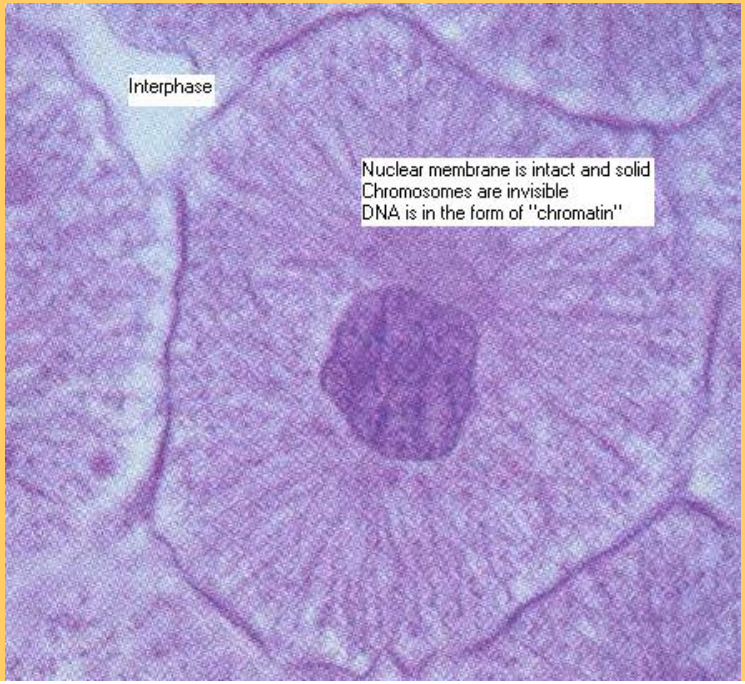
📖 How many periods are in the cell cycle. Name them.



- Growth
- Division of a cell

📖 Name the phase where the **majority** of a cell's life is spent.

- Interphase
  - ➔Where cell spends **<u>90%</u>** of cell cycle

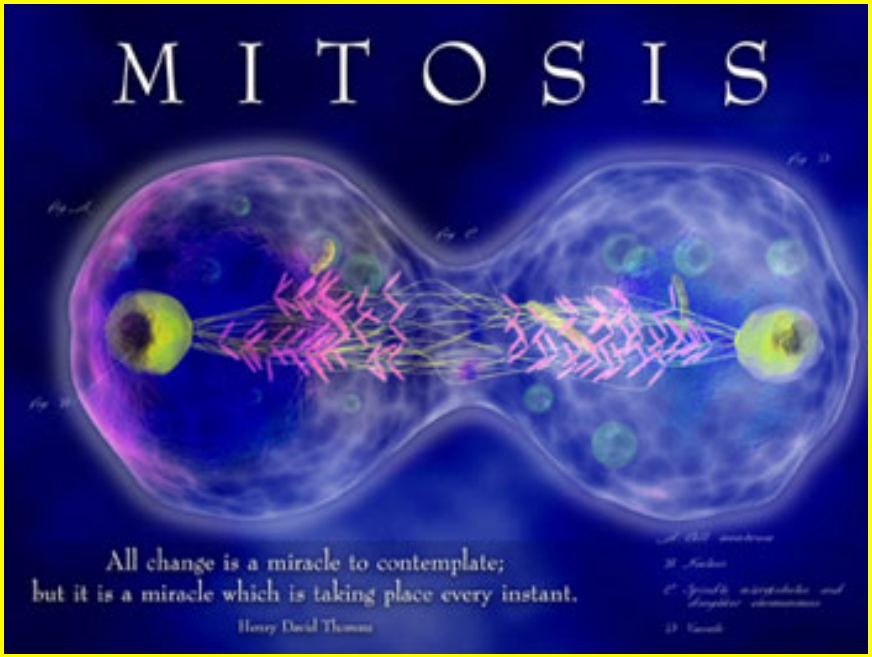


📖 Name the **4** events that occur in this phase of a cell cycle.

1.) Growth
2.) DNA Replication
3.) Carries out metabolic activities
4.) Prepares for cell division

📖 Name and define ***phase 2*** that follows after phase 1, Interphase.

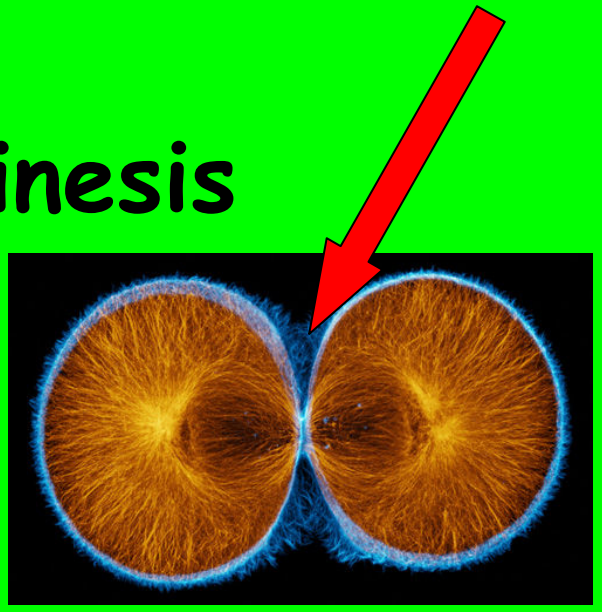
❖ **Mitosis**

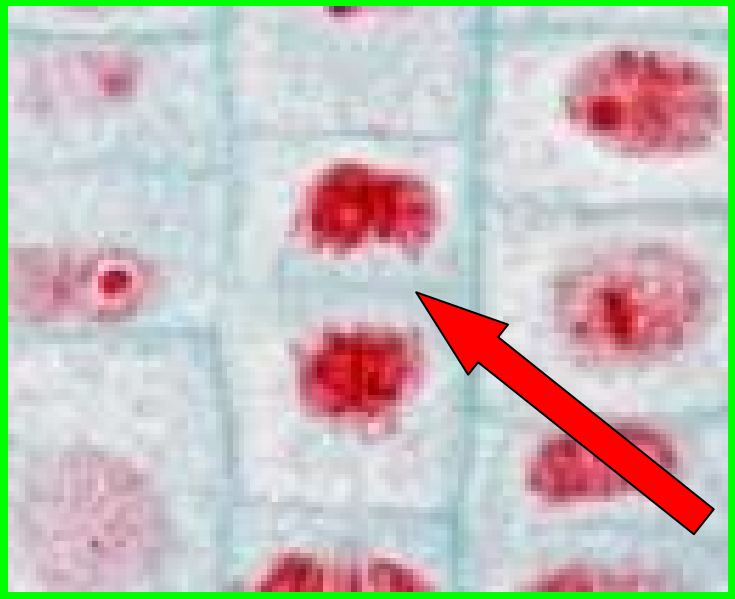


➔ Process by which <u>2</u> **daughters cells** are formed **<u>each</u>** containing **<u>identical</u> chromosomes**.

📖 Name and define **phase 3** that follows after phase 2, Mitosis.

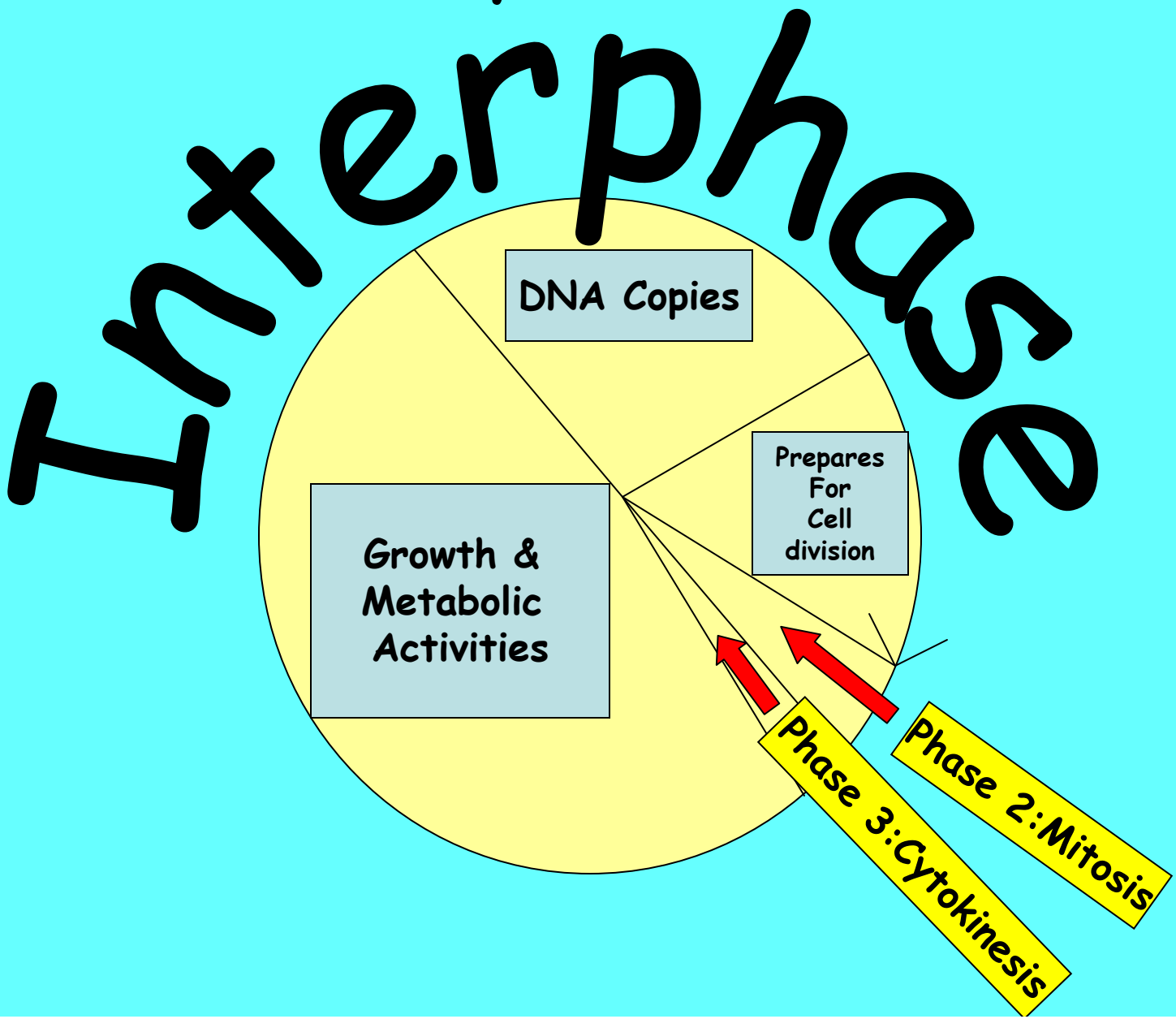
❖ **Cytokinesis**





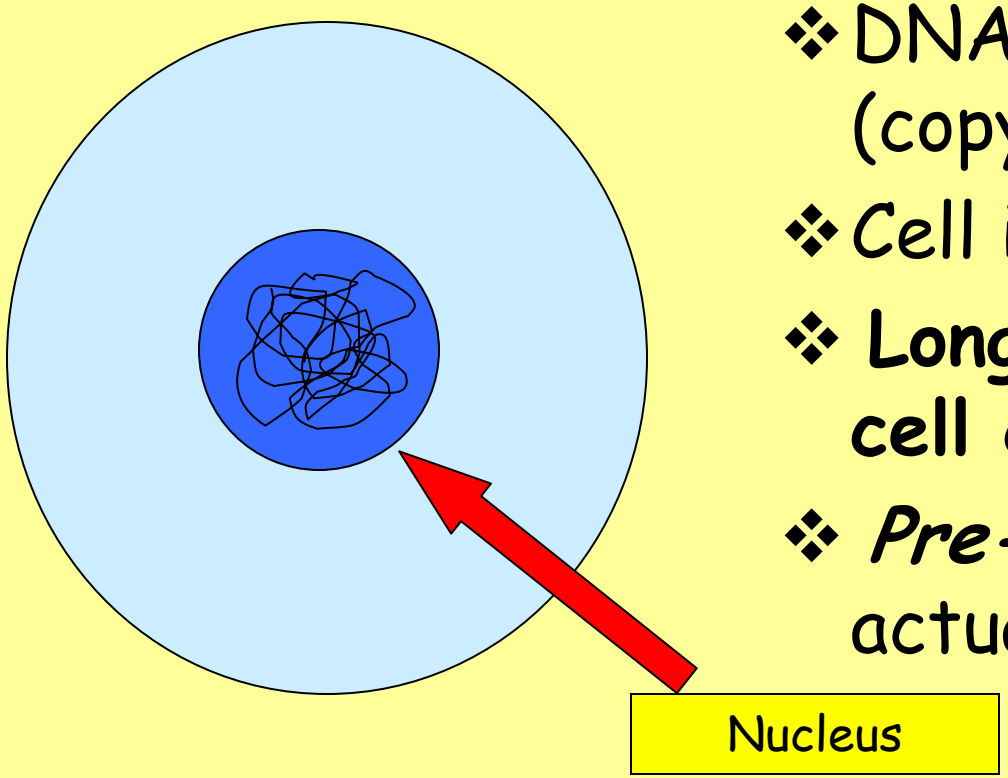
➔ When either the **cell membrane** or **cell wall** reforms in order **<u>to</u>** **<u>separate</u>** the cells into two.

The Cell Cycle



The Phases of Mitosis

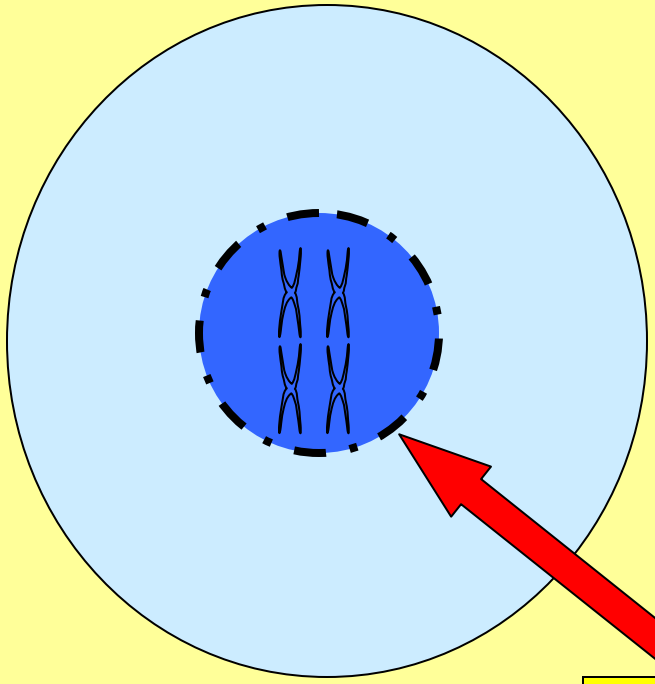
Phase 1: Interphase



- Visible chromosomes **cannot** be seen
- DNA replicating (copying)
- Cell is growing
- **Longest part of the cell cycle (90%)**
- ***Pre-stage*** before actual mitosis begins

The Phases of Mitosis

Phase 2: Prophase

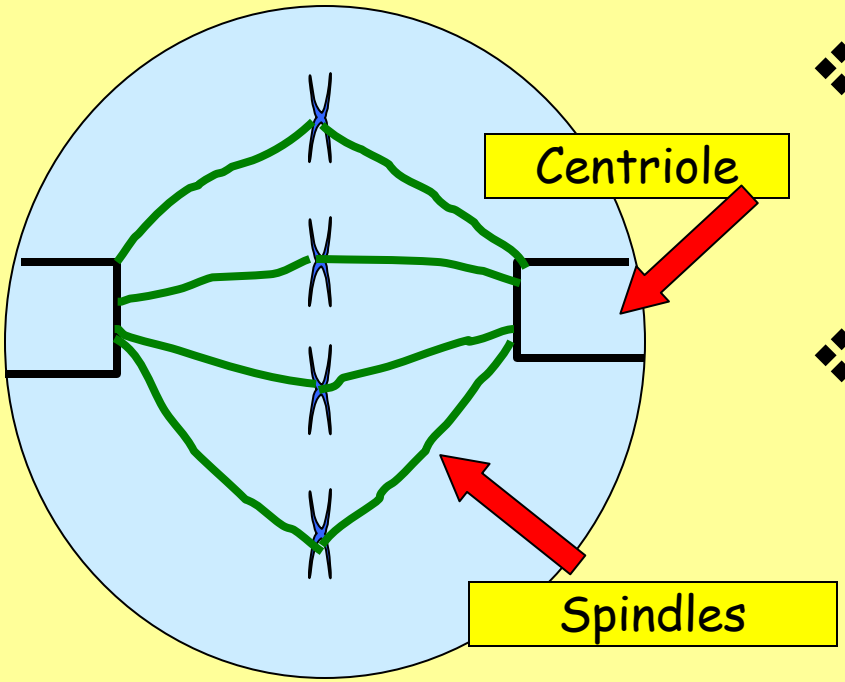


- Nuclear membrane begins to break down
- Chromosomes pair up and **start** becoming visible

The Phases of Mitosis

Phase 3: **Meta**phase

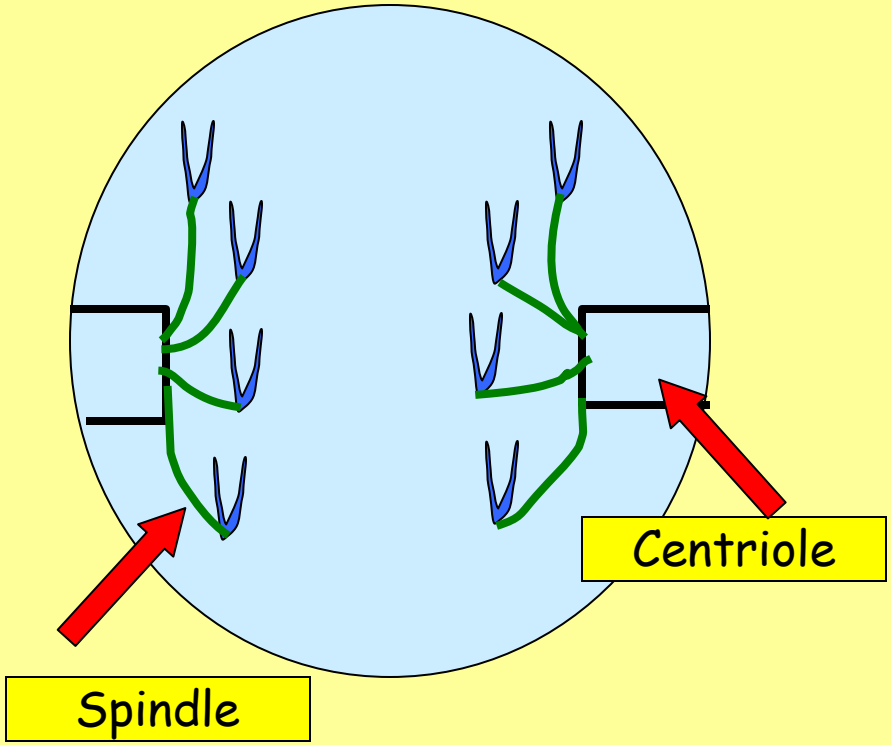
Means "***middle***"



- Chromosomes line up **vertically** at the metaphase plate (equator)
- **Spindles** (***fishing line***) form and attach to chromosomes
- **Centrioles** form (***boxes***). Acts as reel of fishing rod or like magnets.

The Phases of Mitosis

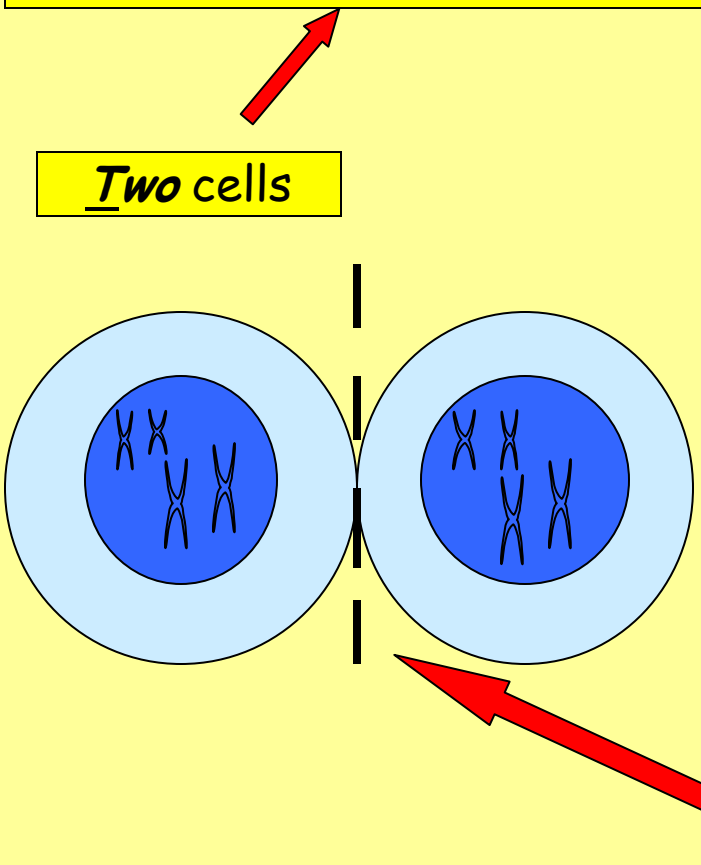
Phase 4: Anaphase



- Chromosomes split **apart**
- **Sister chromatids move** to **opposite** sides of centrioles (poles)
- Spindles shorten to reel sister chromatids in

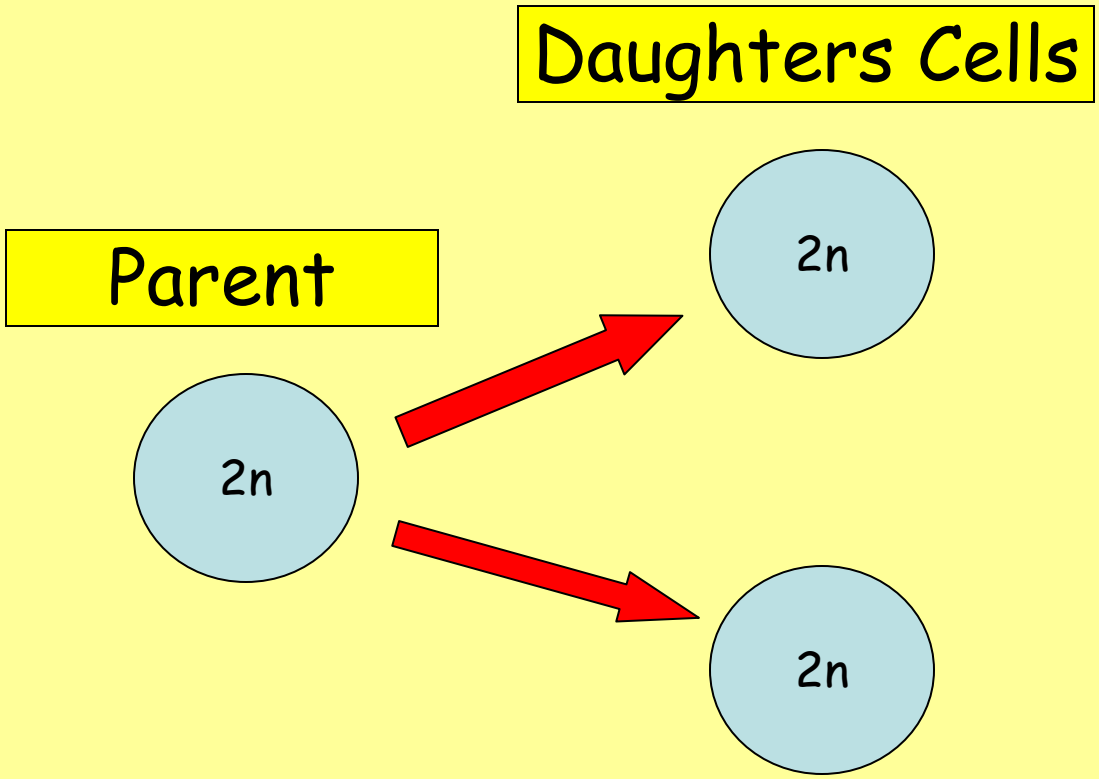
The Phases of Mitosis

Phase 5: Telophase



- Nuclear membrane reforms
- Chromosomes straighten out
- Plant Cell: cell wall forms
- Animal Cell: cell membrane closes inward and pinches off to make 2 ***identical*** cells (**cytokinesis**)

🗣 Formula for Mitosis



❖ **n** = number of chromosomes present

🗣 Results of Mitosis (Organization Level)

- Cells
  - Tissues
    - Organs
      - Organs Systems
      - Organisms