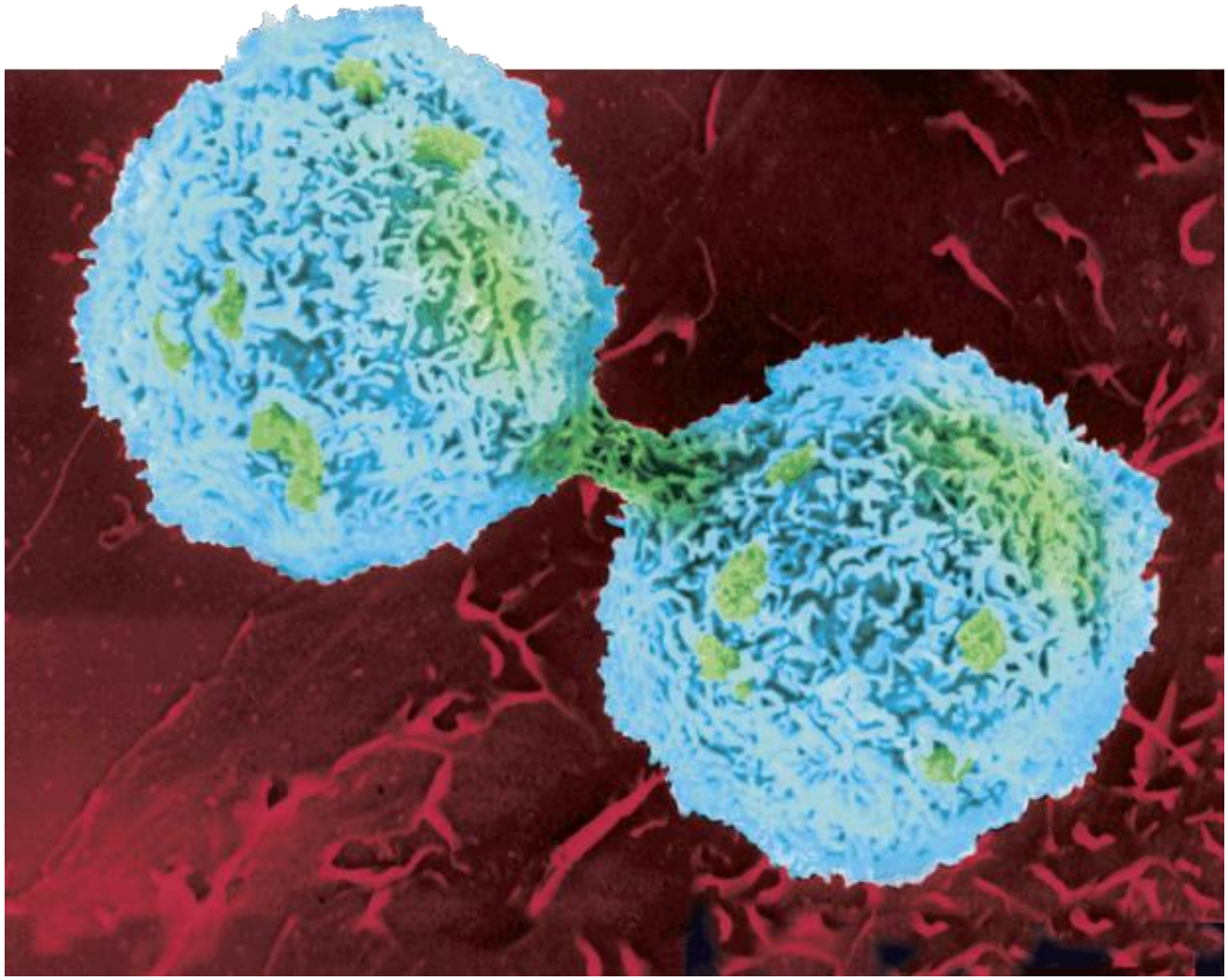
10-2 Cell Division



Cell Growth and Division

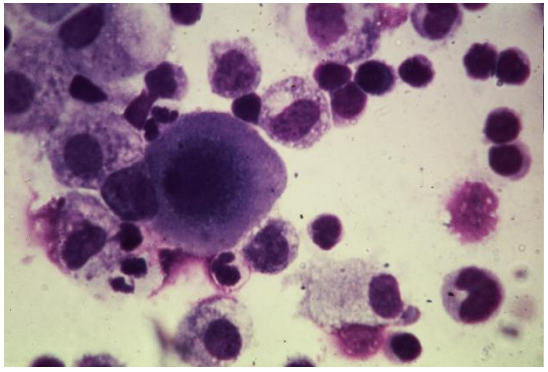
- In **multicellular** organisms, cell division makes new cells
  - To **replace** old or damaged ones
  - So organisms can **grow**

- In **single-celled** organisms, cell division
  - Allows them to **reproduce**

Cell Growth and Division

- There are **two** main reasons why cells **divide** instead of growing forever:

1) The **larger** a cell becomes, the **more demands** the cell places on its DNA and organelles.
2) The **larger** a cell becomes, the **more trouble** the cell has moving enough nutrients and wastes through the cell membrane.



The Cell Cycle: Asexual Reproduction

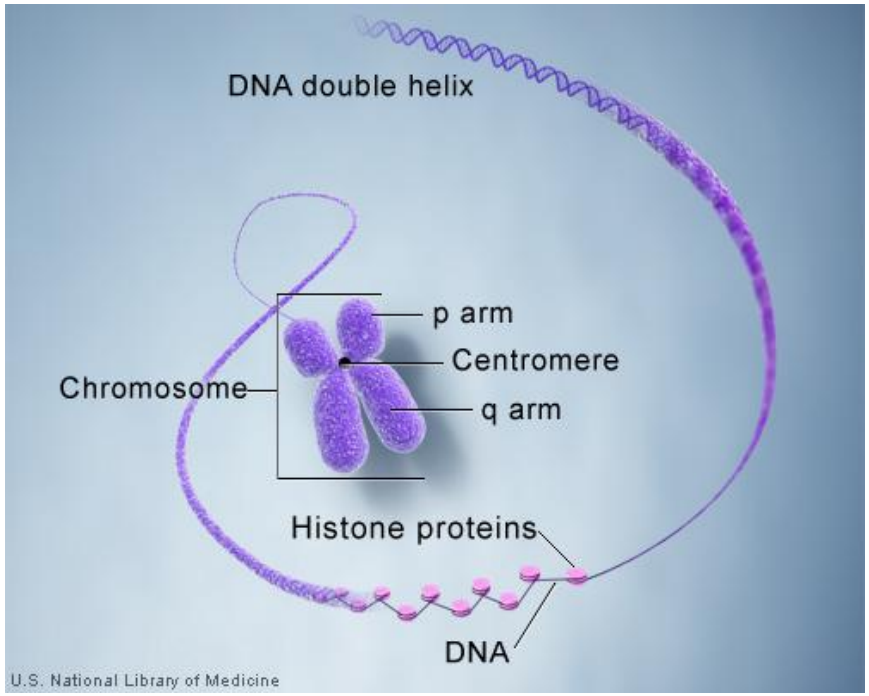
- **Body** cells reproduce ***asexually***
  - (they split themselves in two after making 2 copies of their DNA).
- The cell growth and division process is called the **Cell Cycle**.

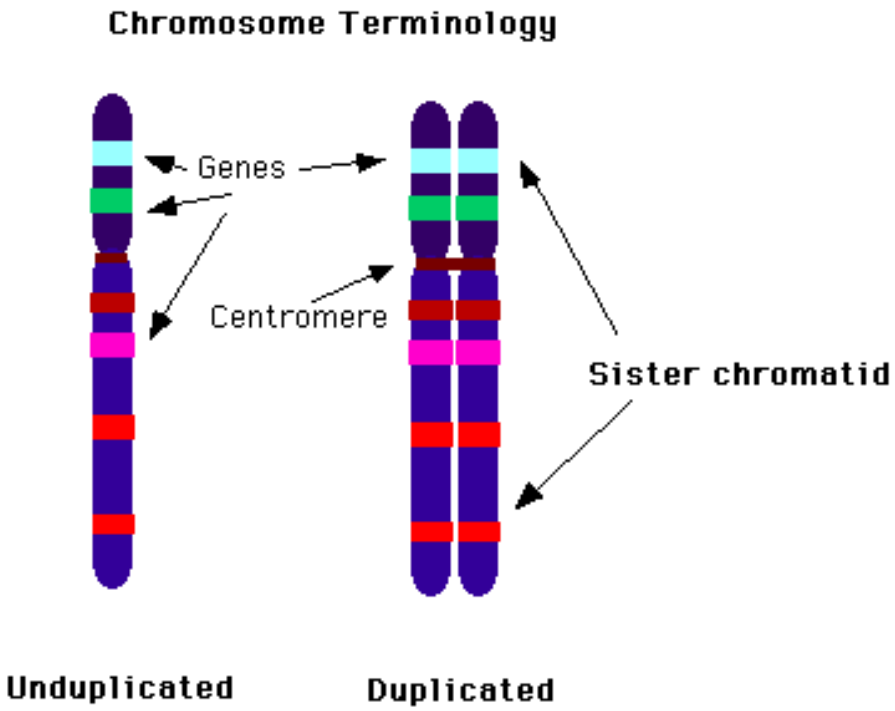
Cell Division

- In **eukaryotes**, cell division occurs in two major stages.
  1. Stage 1: division of the cell nucleus (**mitosis).**
  2. Stage 2: division of the cell cytoplasm (**cytokinesis).**

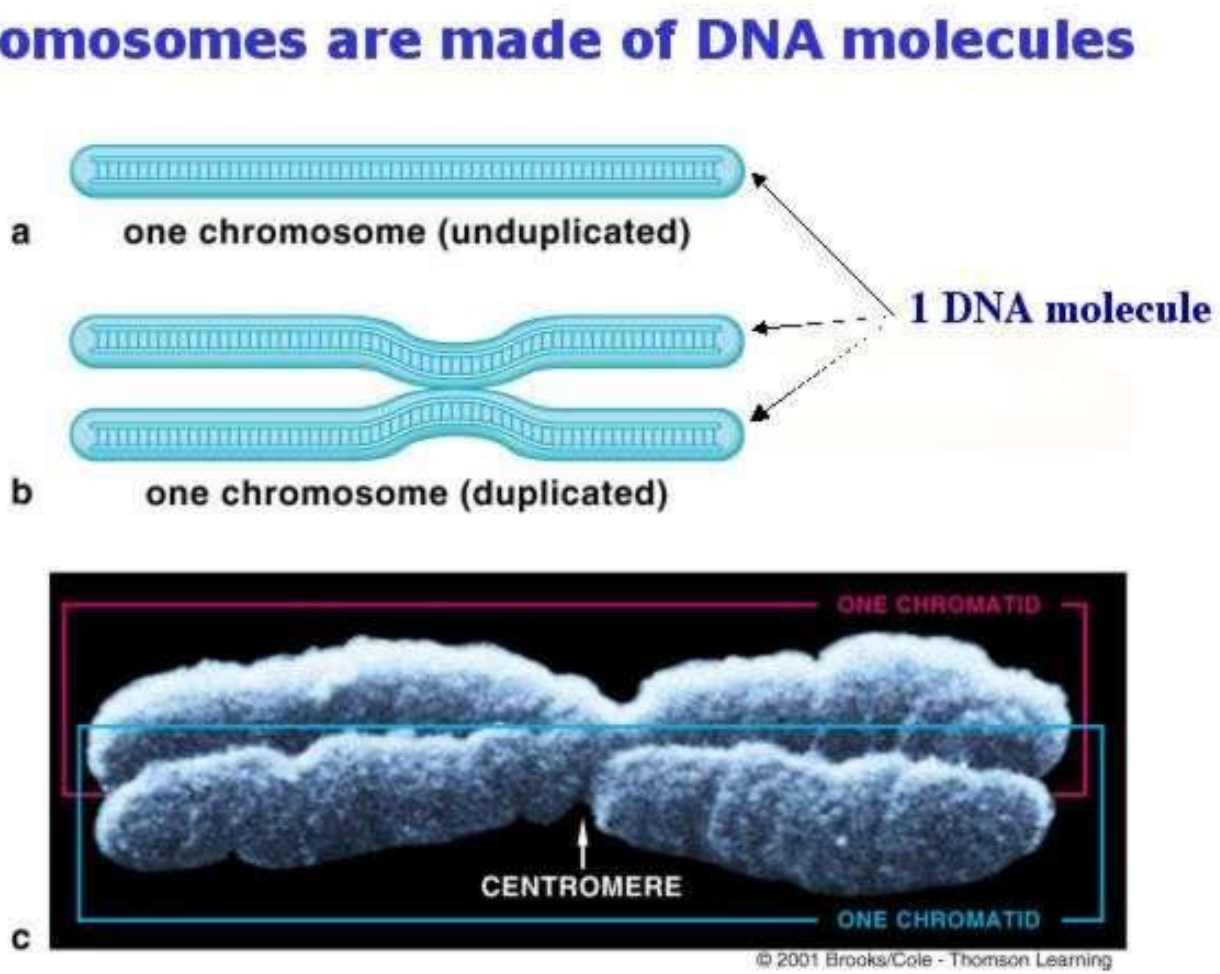
Chromosomes

- **<u>Chromosomes</u>**: Genetic information is passed from one generation to the next on **chromosomes**.
  - *Before* cell division, <u>each chromosome is duplicated, or copied</u>.



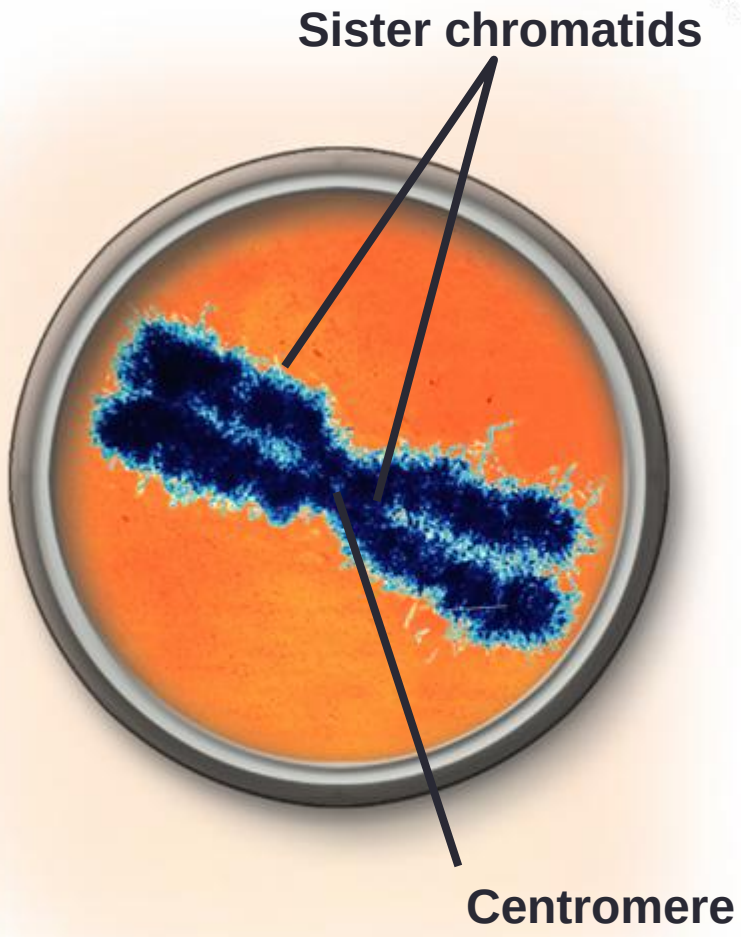


Chromosomes



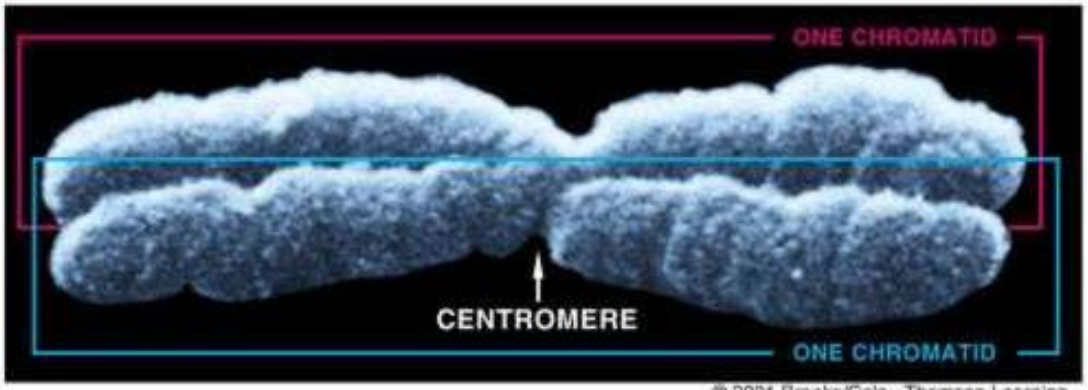
Chromosomes

- Each chromosome consists of two identical **"sister" chromatids**.
- Each pair of chromatids is attached at an area called the **centromere.**



Chromosomes

- When the cell divides, the chromatids separate.
- **Each new cell gets <u>one chromatid</u>.**



The Cell Cycle

- The **cell cycle** is the series of events that cells go through as they **grow and divide**.
- **Interphase** is the period of growth that occurs between cell divisions.

The Cell Cycle

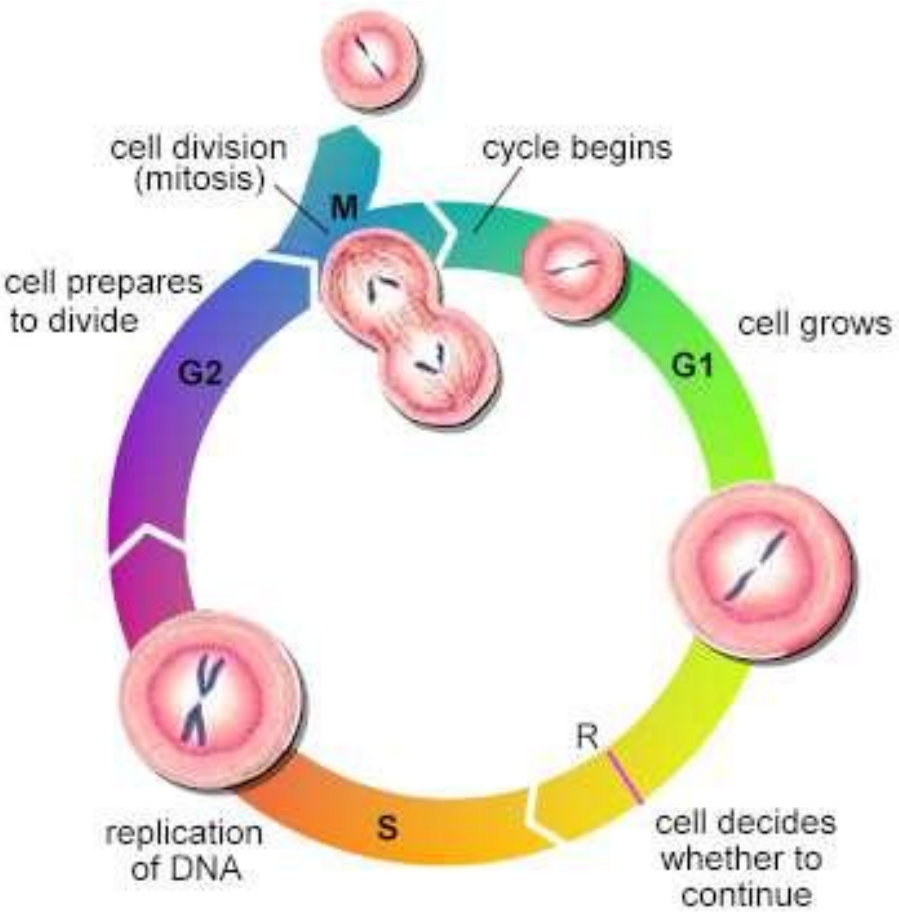
During the cell cycle:

- **Cell grows**
- **Cell prepares for division**
- **Cell divides to form two daughter cells** (each daughter cell begins the cycle again)

The Cell Cycle

The cell cycle consists of **four phases**:

- G_1 (First Gap Phase)
- S Phase
- G_2 (Second Gap Phase)
- M Phase



The Cell Cycle

During **G_1**:

- Cell increases in size (grows)
- Cell makes new proteins and organelles

The Cell Cycle

During **S phase:**

- chromosomes are replicated
- **DNA synthesis** takes place

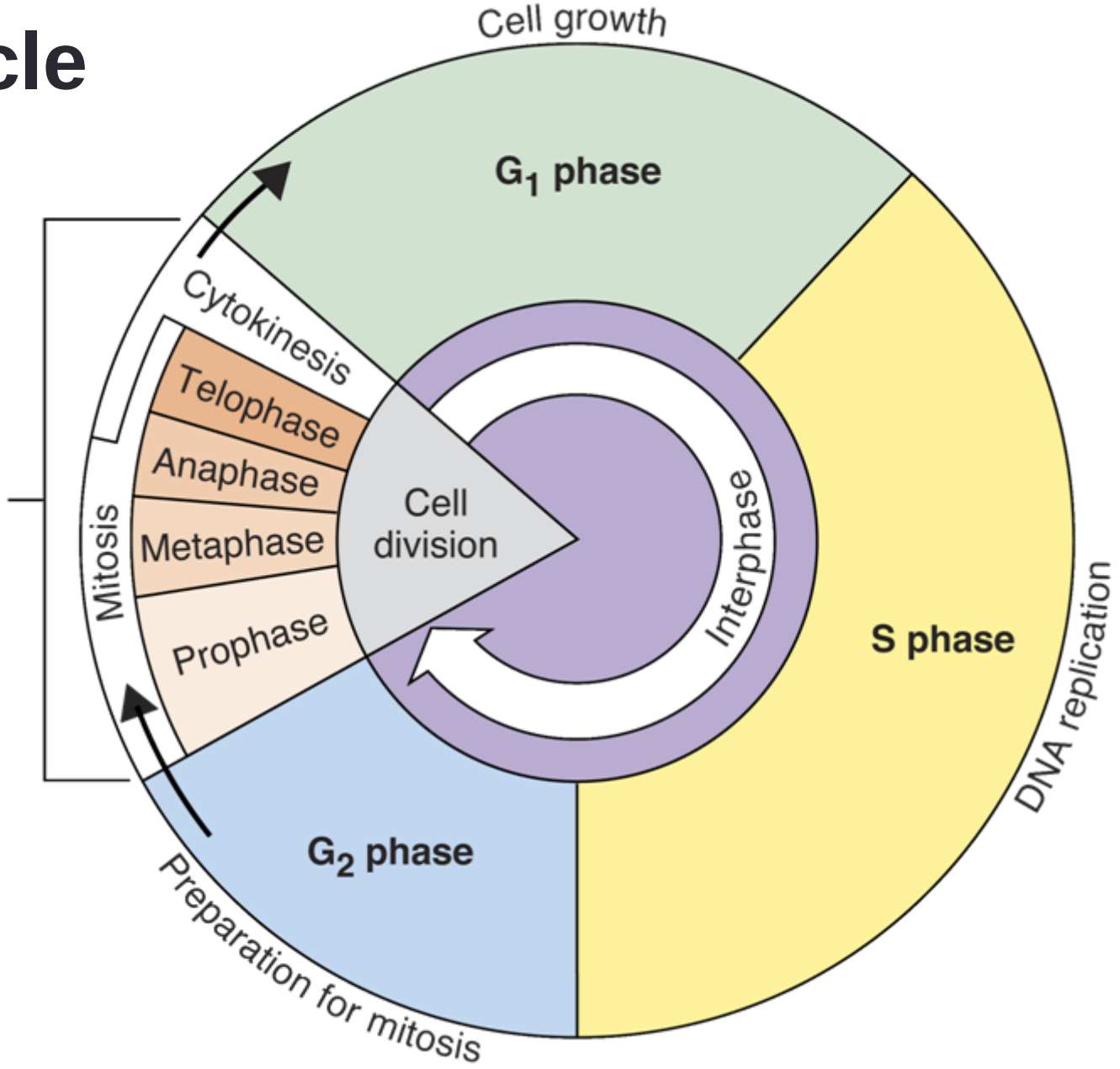
Once a cell enters the S phase, it usually completes the rest of the cell cycle.

The Cell Cycle

During **G_2** Phase (Second Gap Phase)

- organelles and molecules required for cell division are produced
- Once G_2 is complete, the cell is ready to start the M phase—Mitosis.

Cell Cycle

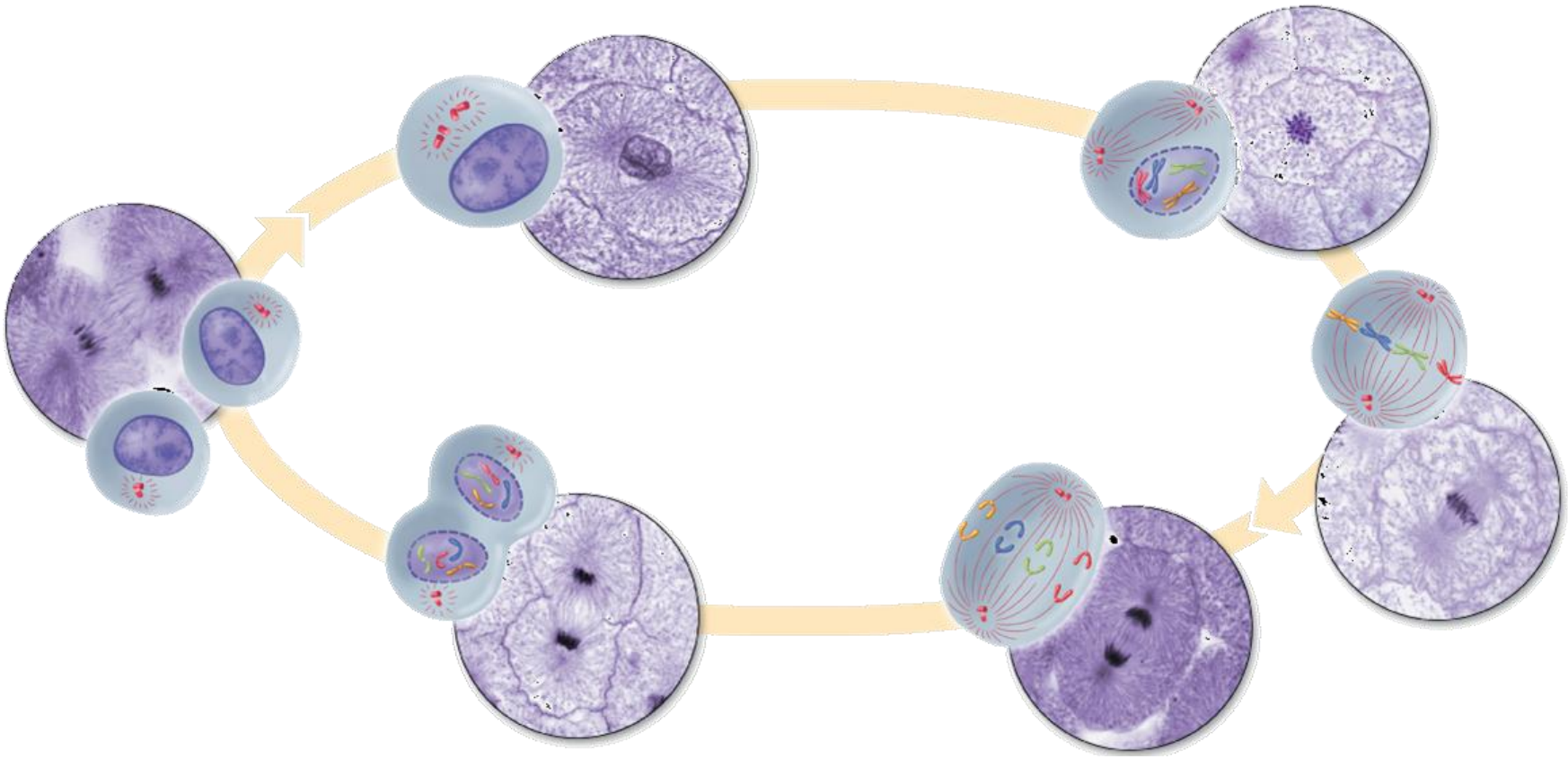


Mitosis

- Mitosis is the division of the cell's nucleus.
- Biologists divide the events of mitosis into four phases: **(PMAT)**

1. **Prophase**
2. **Metaphase**
3. **Anaphase**
4. **Telophase**

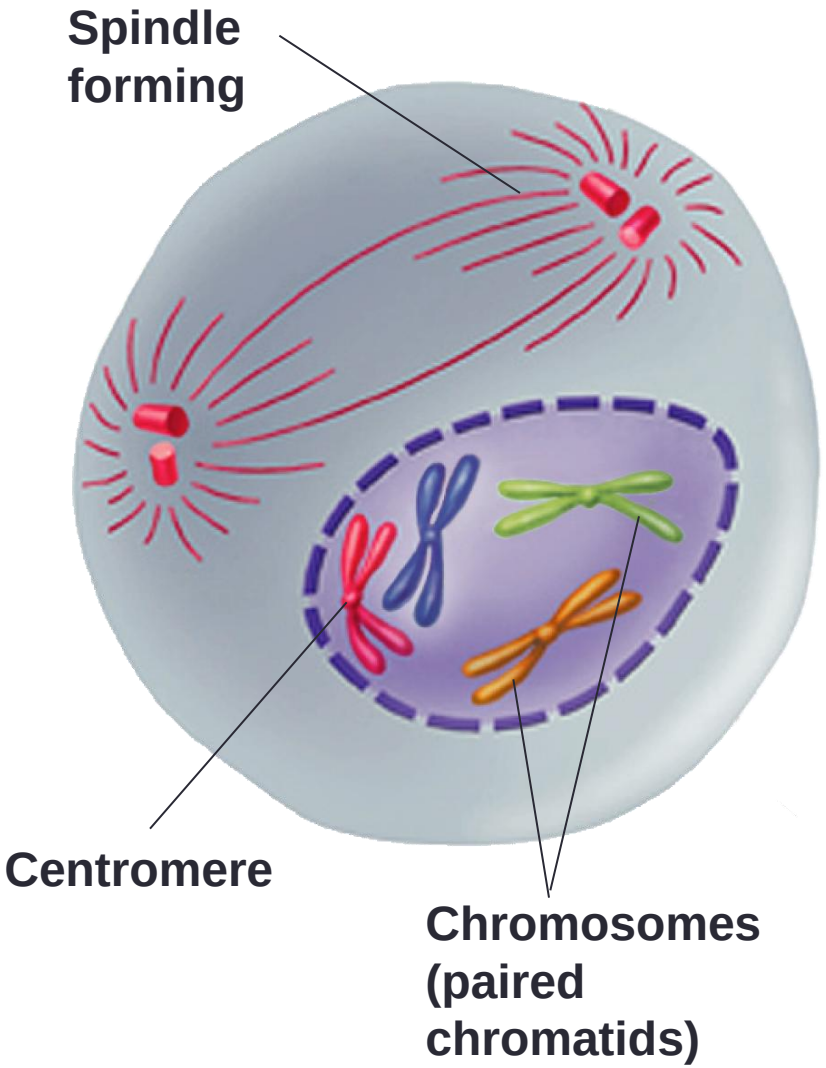
Mitosis



Mitosis

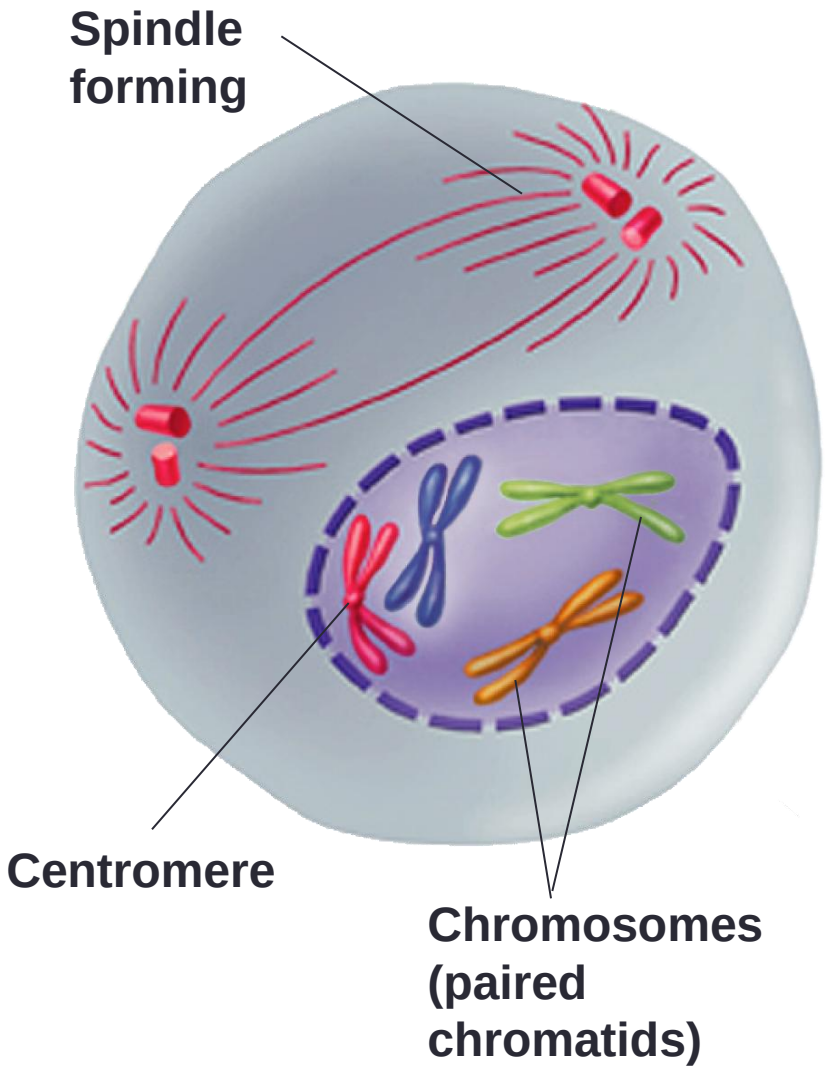
Prophase:

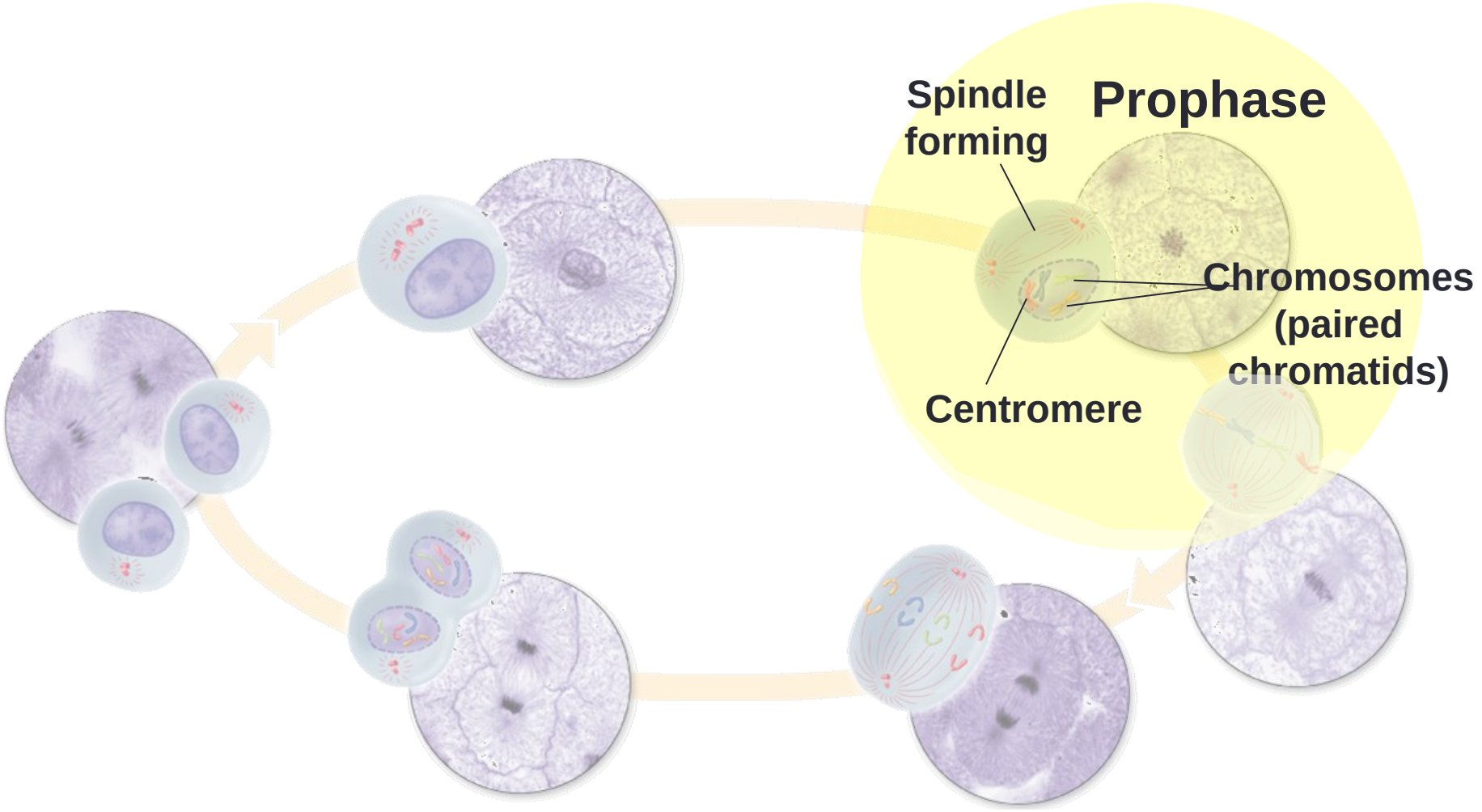
- First phase of mitosis.
- Longest phase of mitosis.
- **Centrioles separate** and move to opposite sides of the nucleus.



Mitosis: Prophase

- Chromatin condenses into chromosomes.
- The centrioles separate and a spindle begins to form.
- The nuclear envelope breaks down.



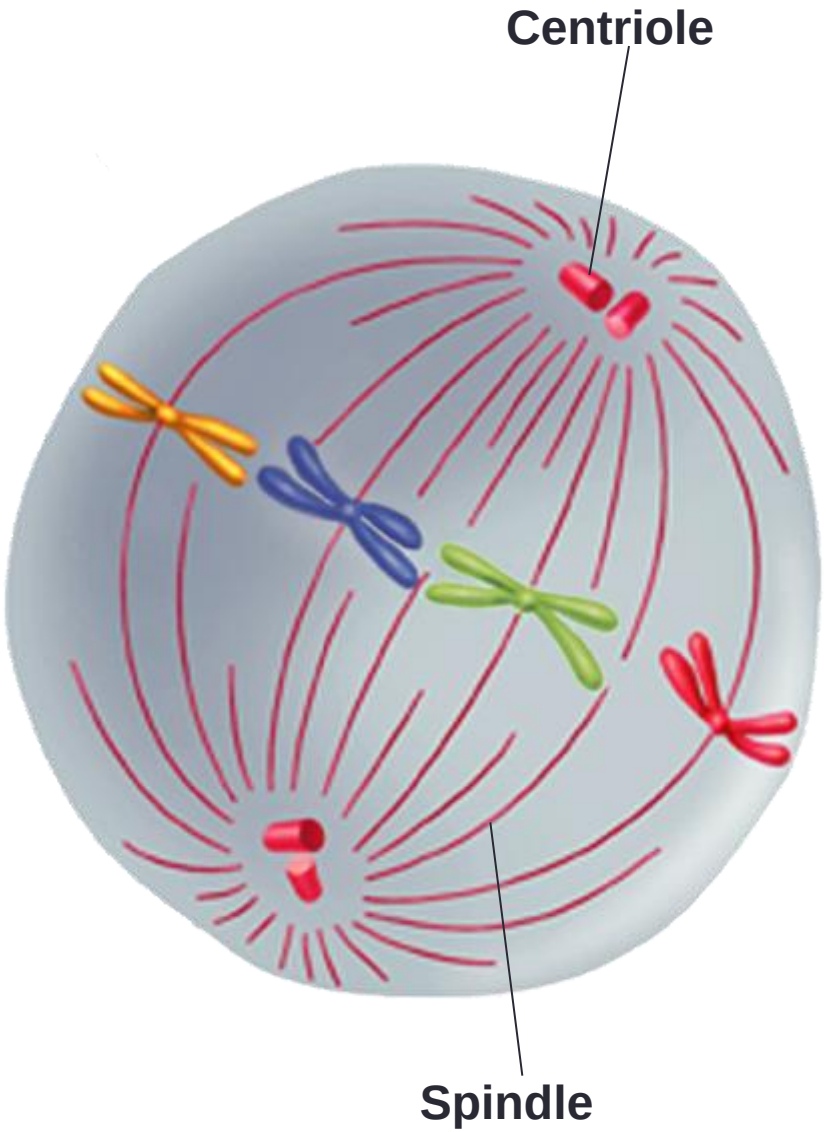


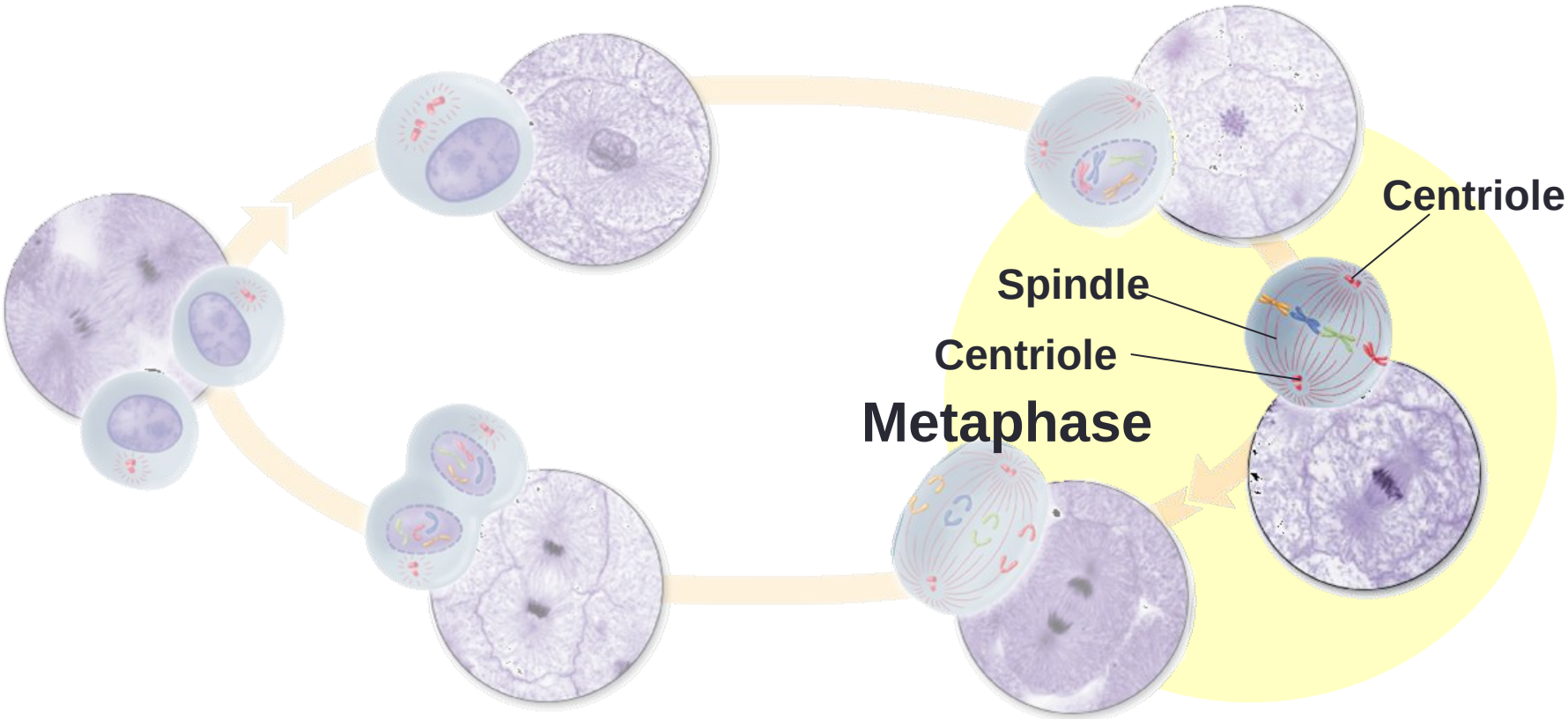
Click to Continue

Mitosis

Metaphase:

- Second phase.
- Chromosomes **line up** across the **MIDDLE** of the cell.
- Spindle fibers are connected to each centromere.



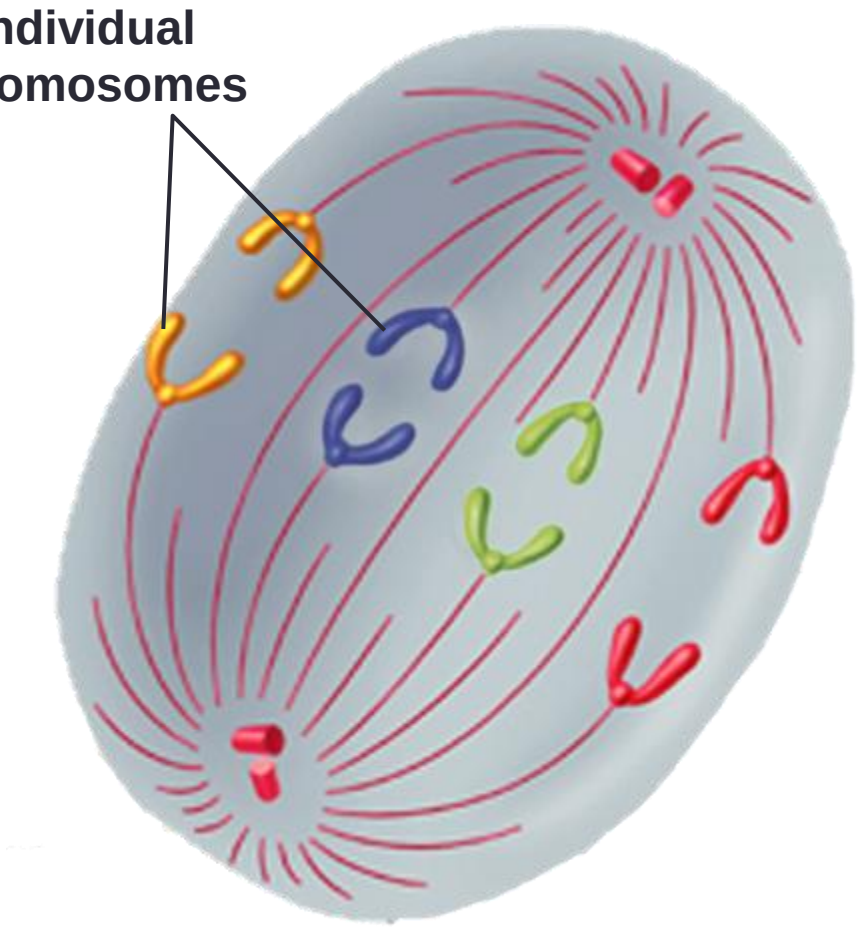


Click to Continue

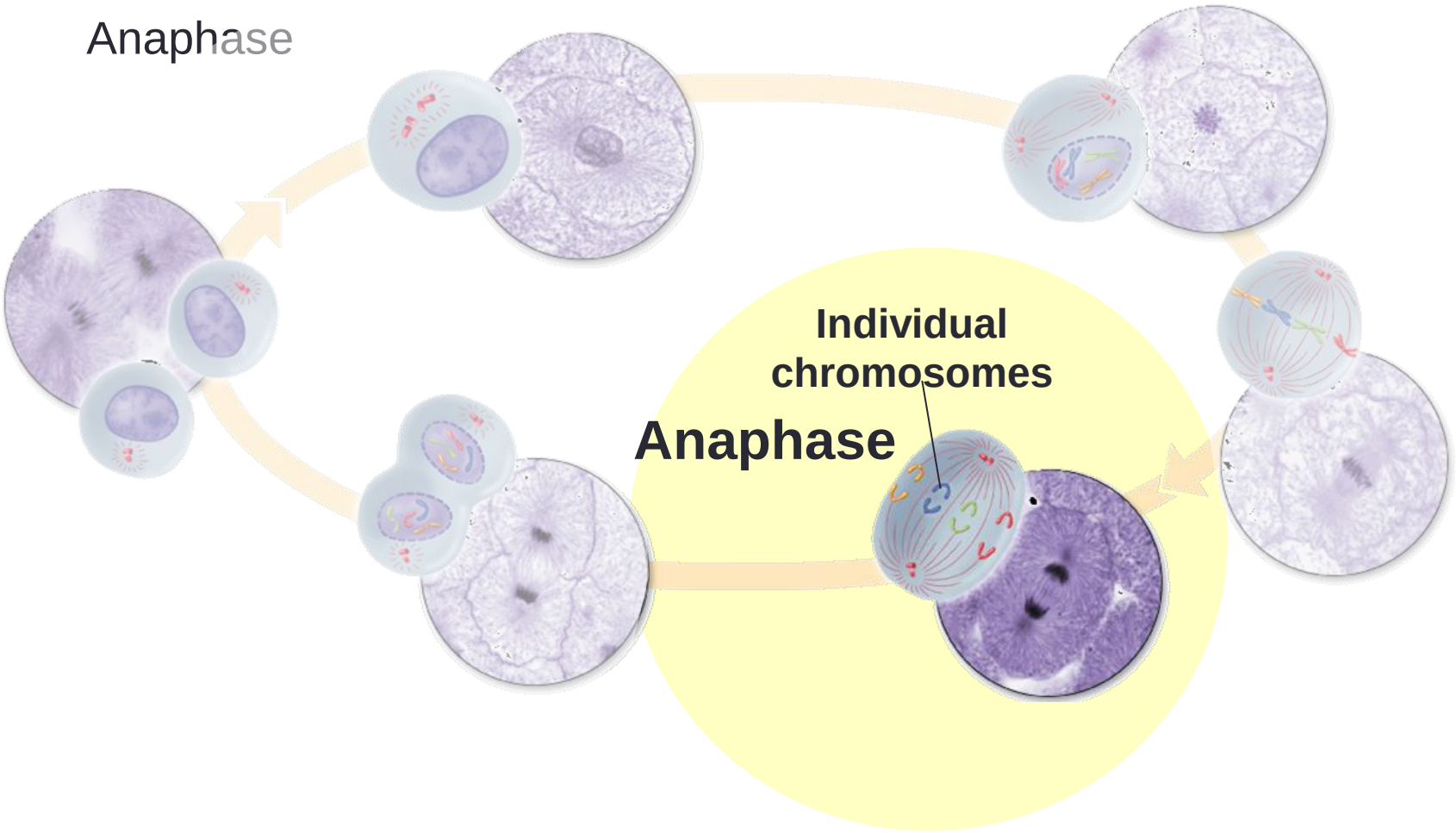
Mitosis

Anaphase:

- Third phase.
- **Sister chromatids** separate into individual chromosomes.
- Chromosomes move **APART** until they have separated into two groups.



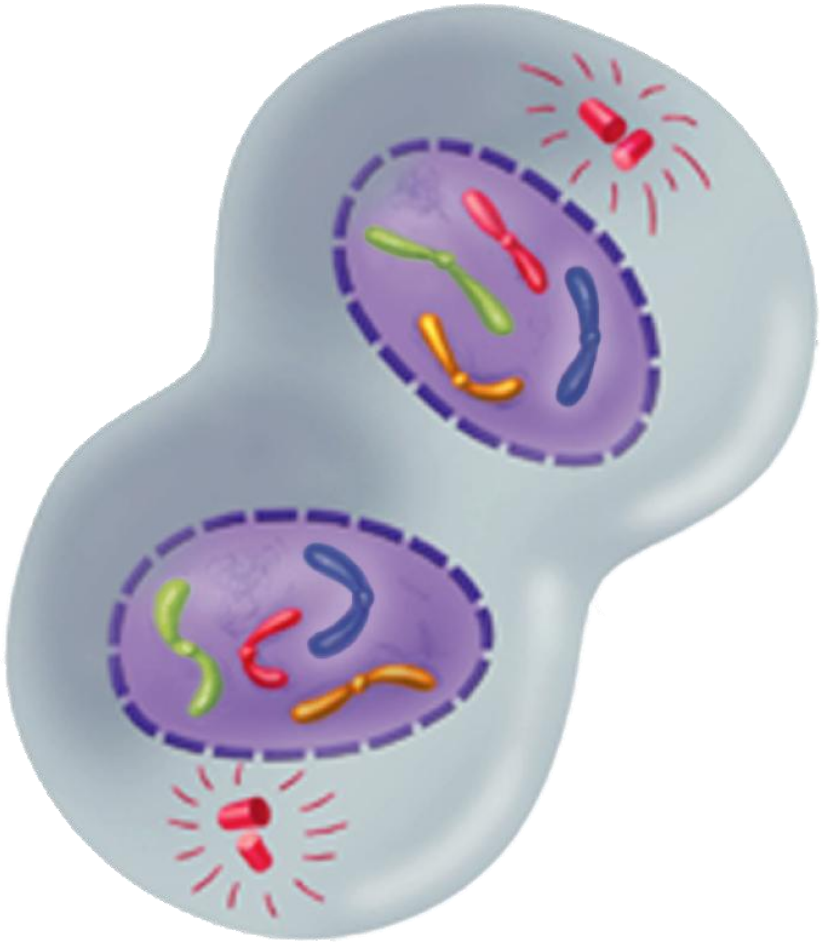
Anaphase

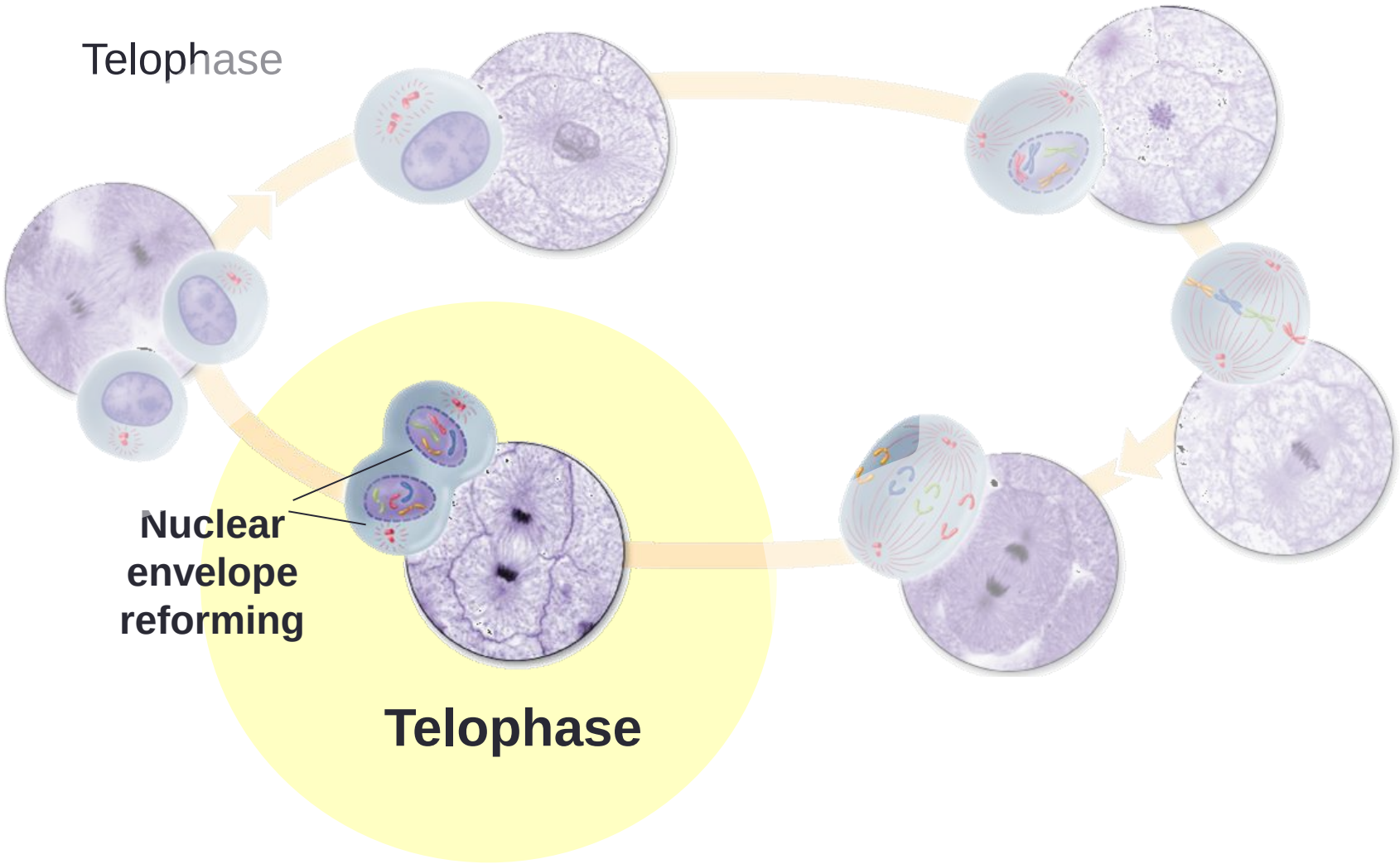


Mitosis

Telophase

- Fourth phase.
- Final phase.
- Chromosomes gather at opposite ends of the cell and lose their distinct shape.
- A new nuclear envelope forms around each **cluster of chromosomes**.



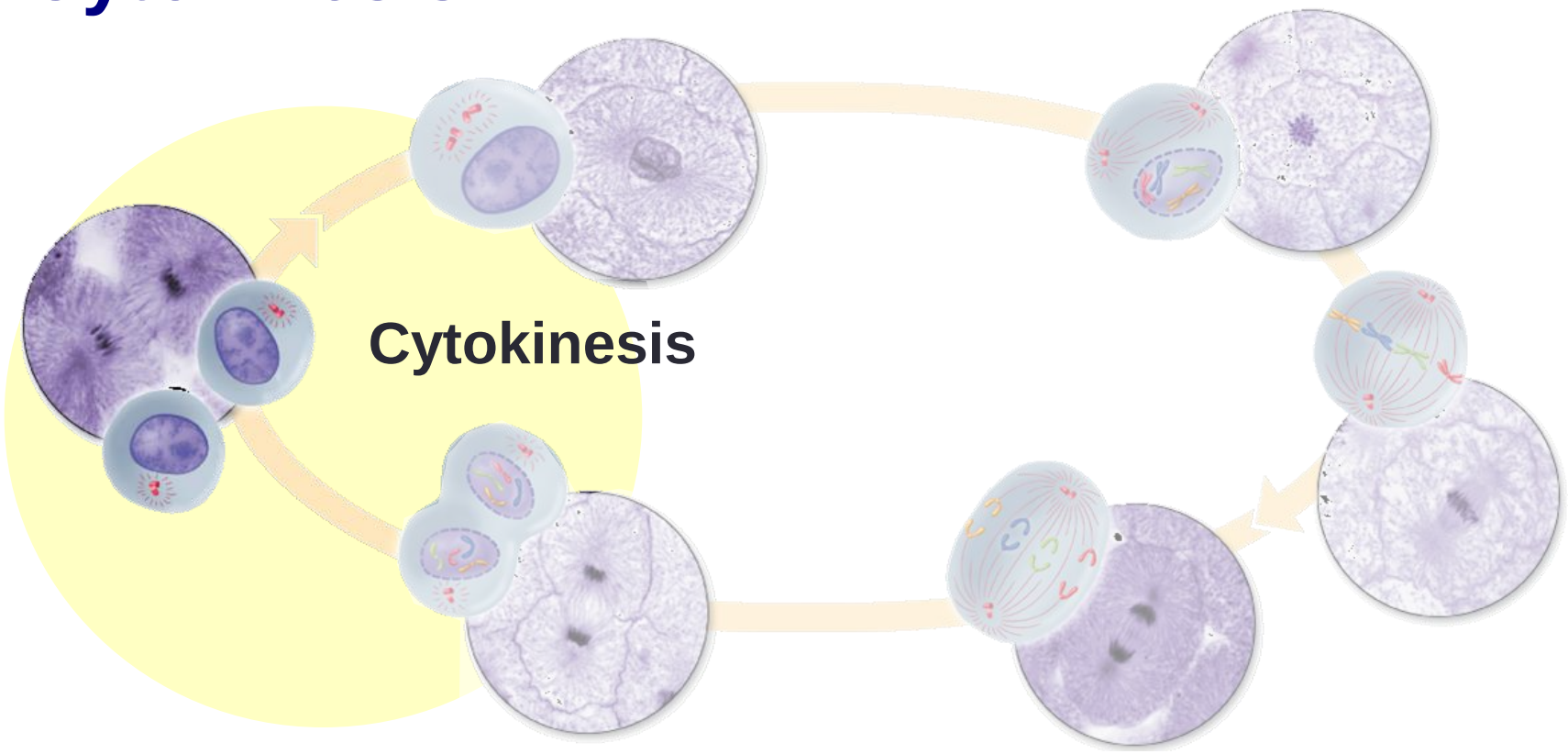


Cytokinesis

Division of the cytoplasm:

- **Cytoplasm** pinches in half.
- Each daughter cell has an **identical** set of duplicate chromosomes.

Cytokinesis



Cytokinesis in Plants

In plants, a structure known as the **cell plate** forms midway between the divided nuclei.