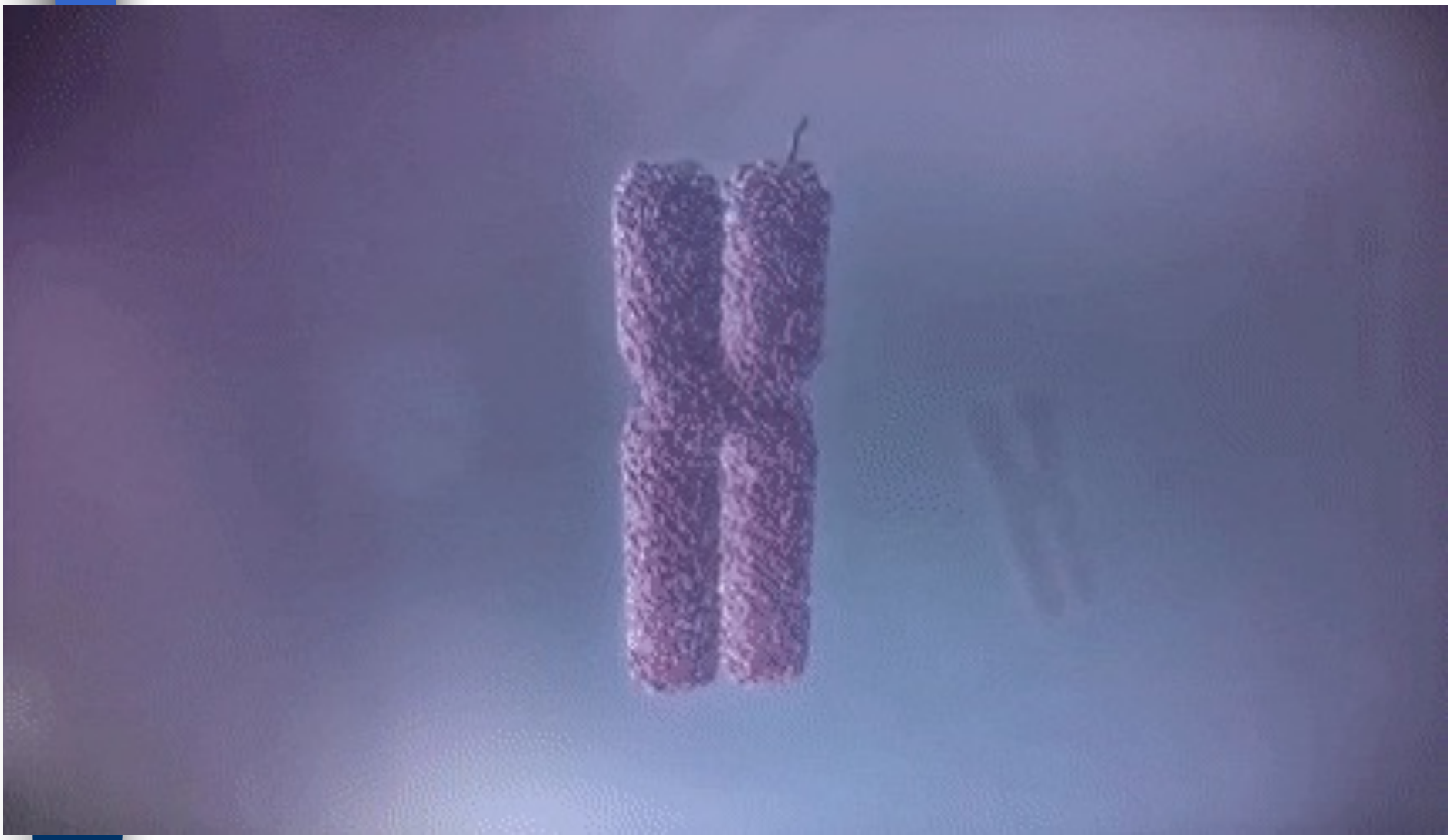
The Cell Cycle and Mitosis

Some Definitions

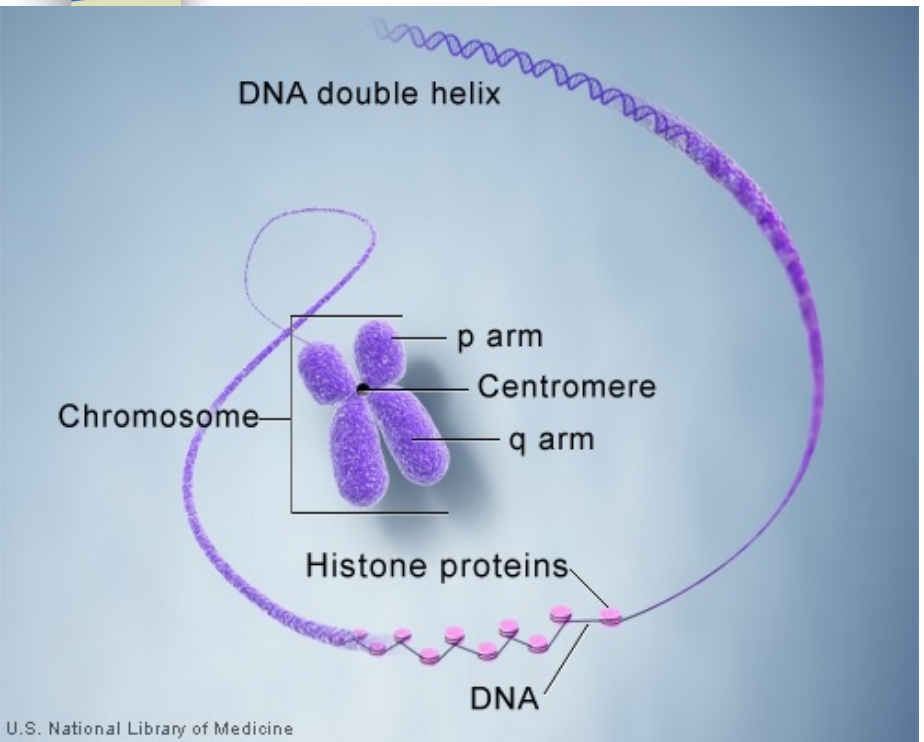
- Homologous Chromosomes – each member of a chromosome pair
- Diploid – total of 46 chromosomes in people – zygote & somatic cells
- Haploid – total of 23 chromosomes in people, gametes (sperm & egg)

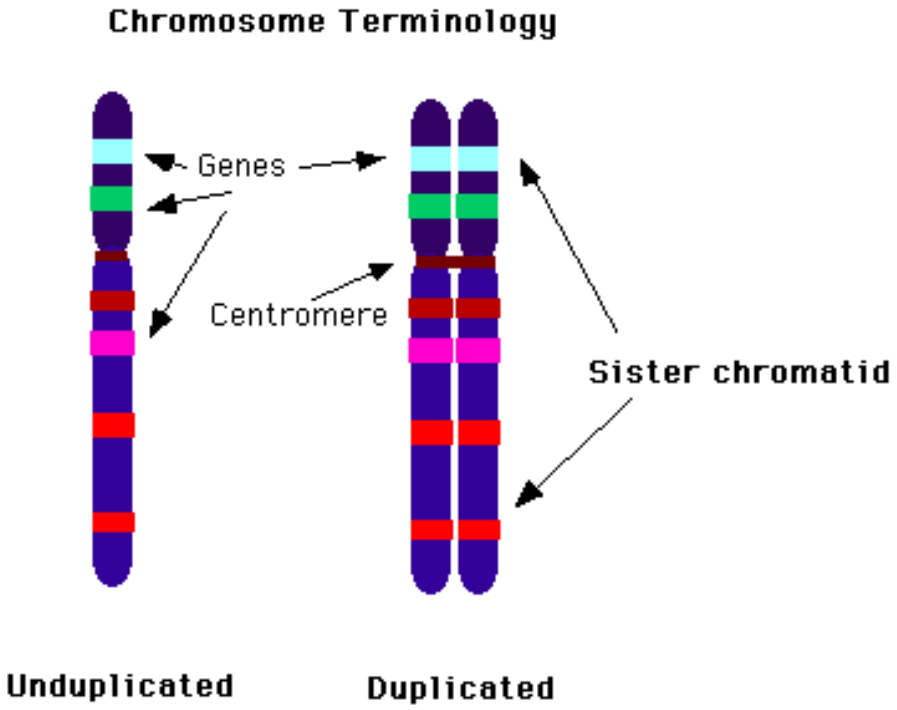


Chromosomes

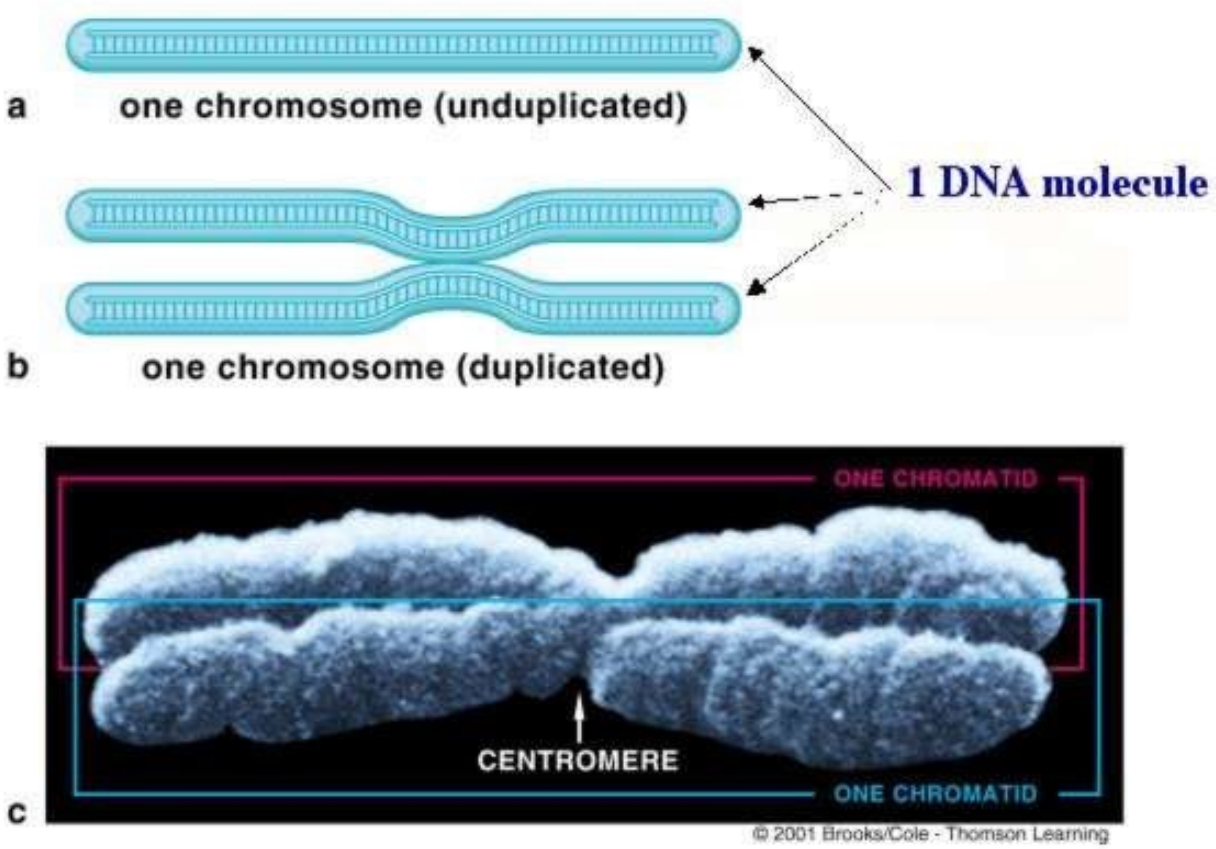
Genetic information is passed from one generation to the next on **chromosomes**.

Before cell division, each chromosome is duplicated, or copied.



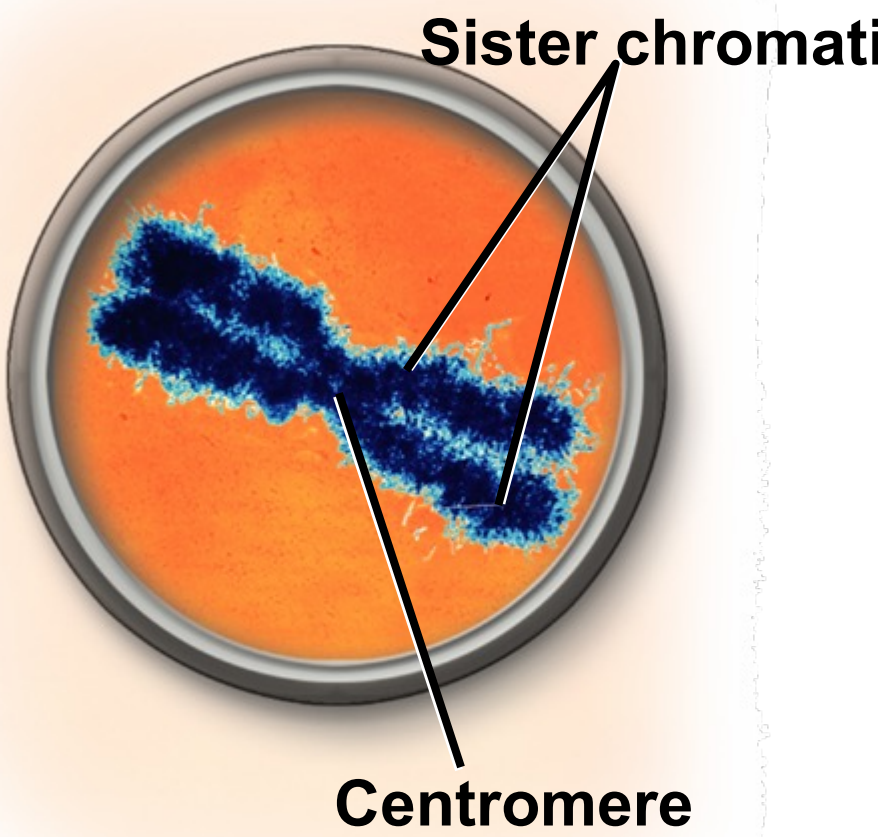


Chromosomes are made of DNA molecules



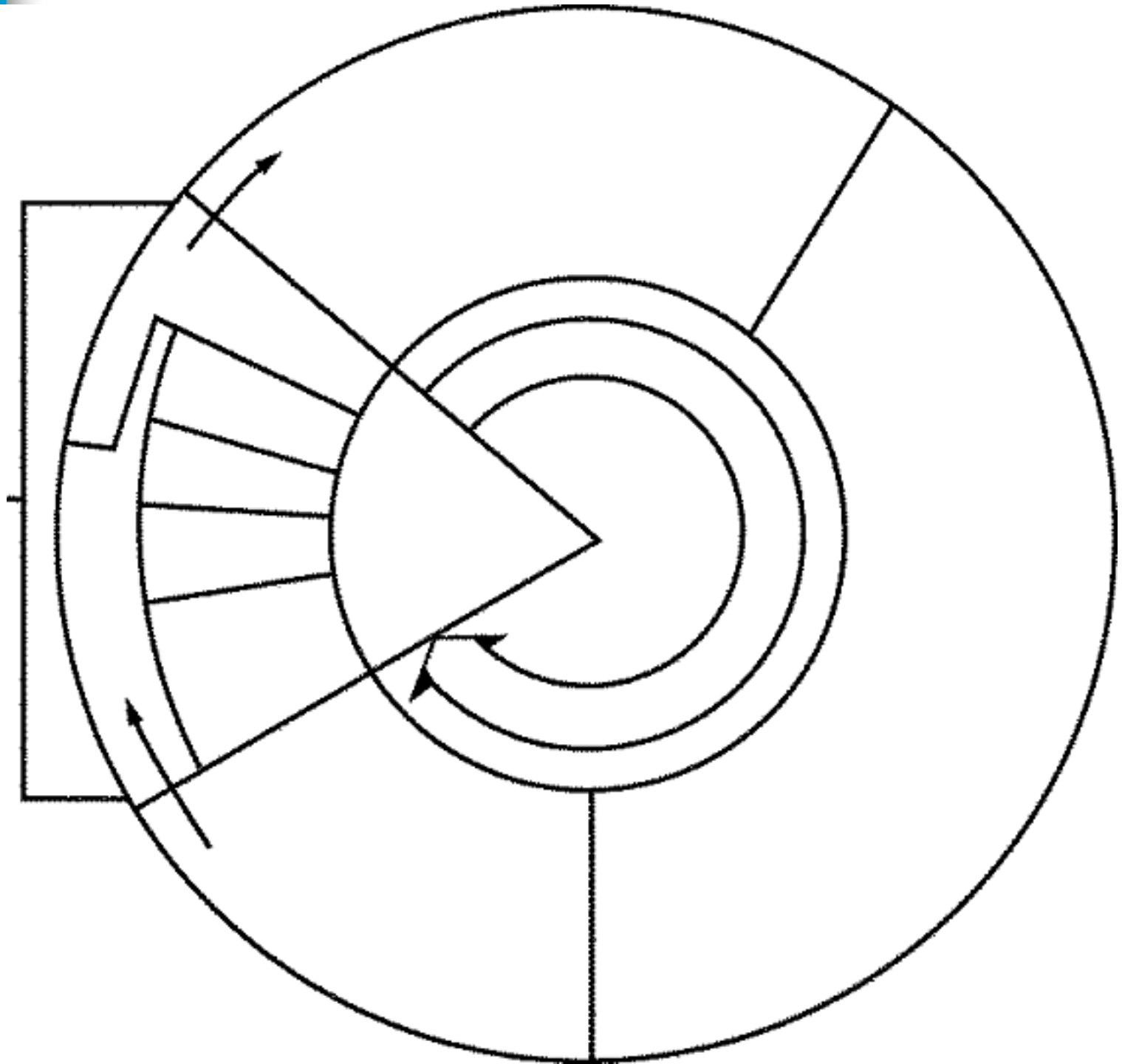
Each chromosome consists of two identical **“sister” chromatids**.

Each pair of chromatids is attached at an area called the **centromere.**

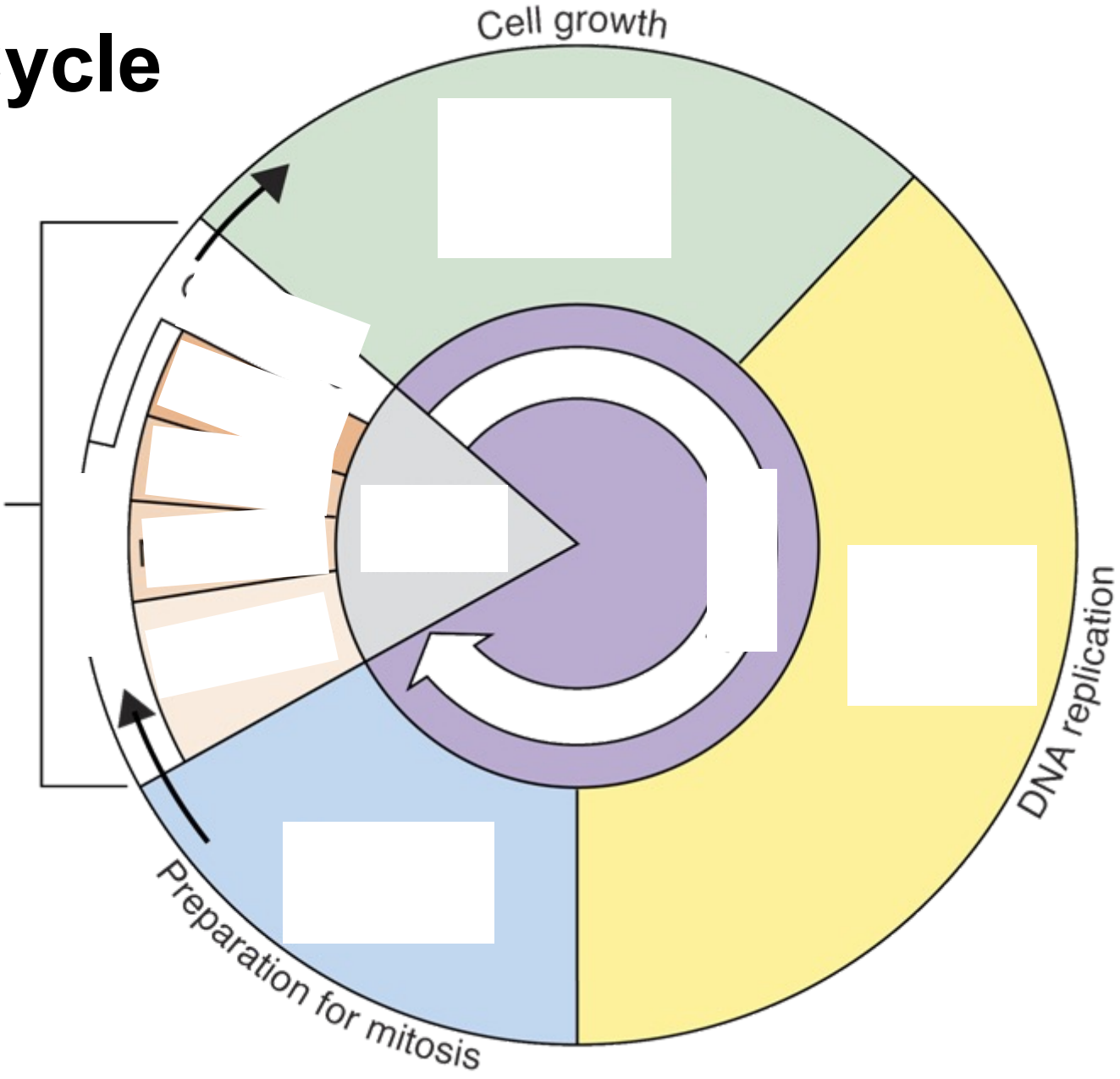


The Cell Cycle

- The sequence of growth and division of a cell.
- 95% of cell cycle in interphase
- 5% of cell cycle in mitosis



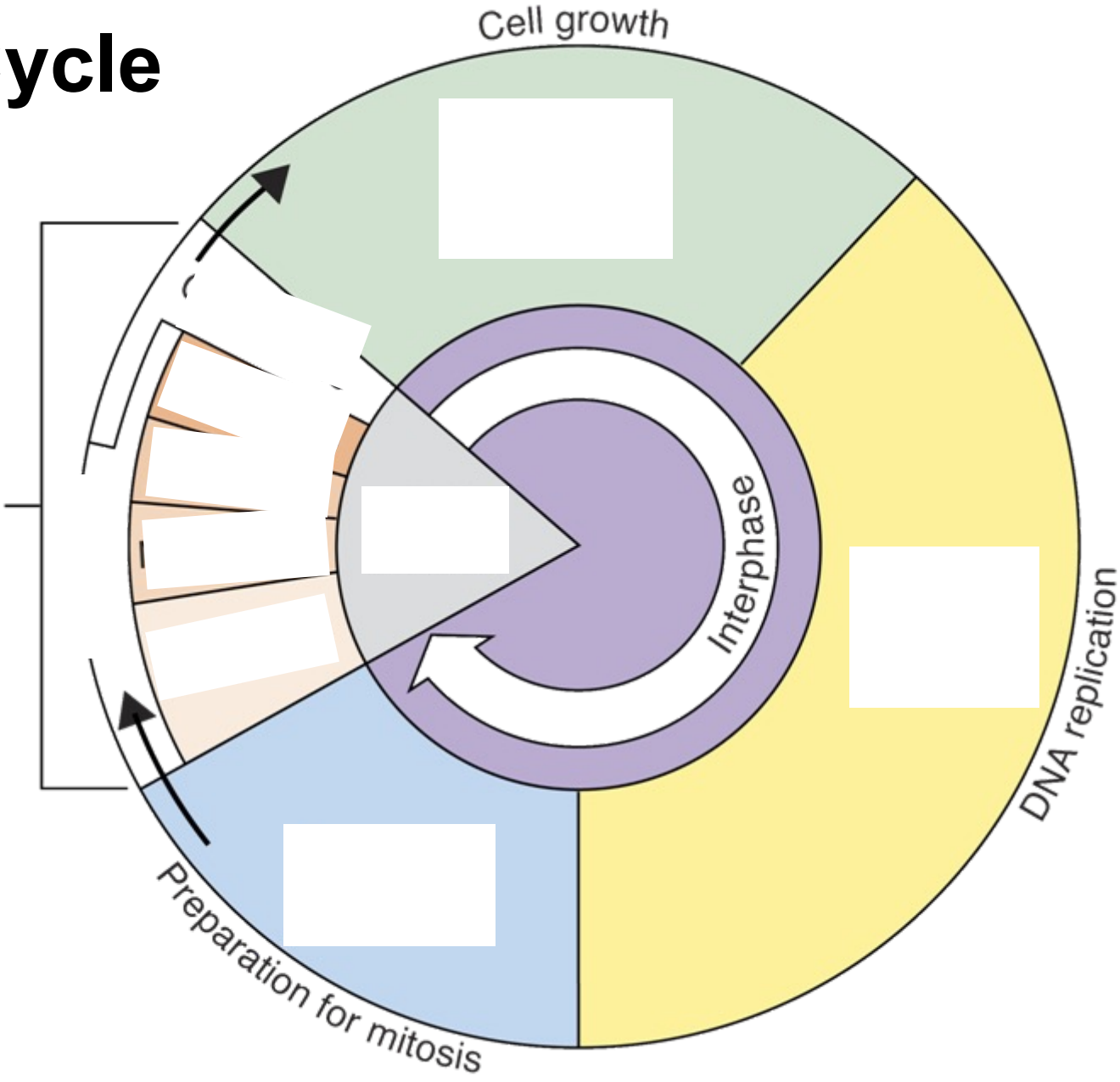
Cell Cycle



Interphase

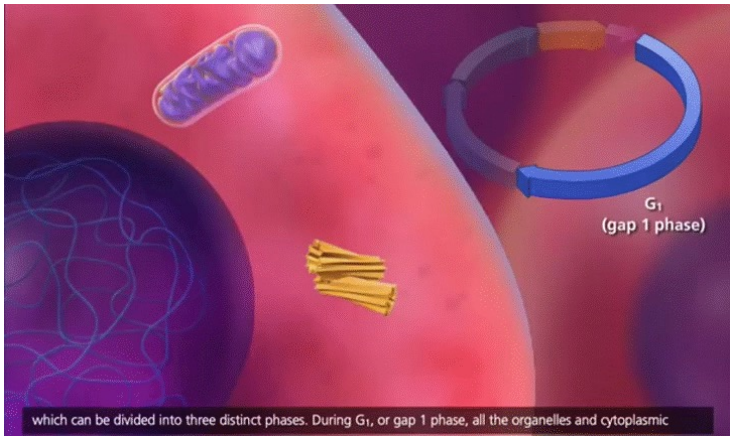
- Growth Stage 1 (G_1)
- Synthesis Stage (S)
- Growth Stage 2 (G_2)

Cell Cycle

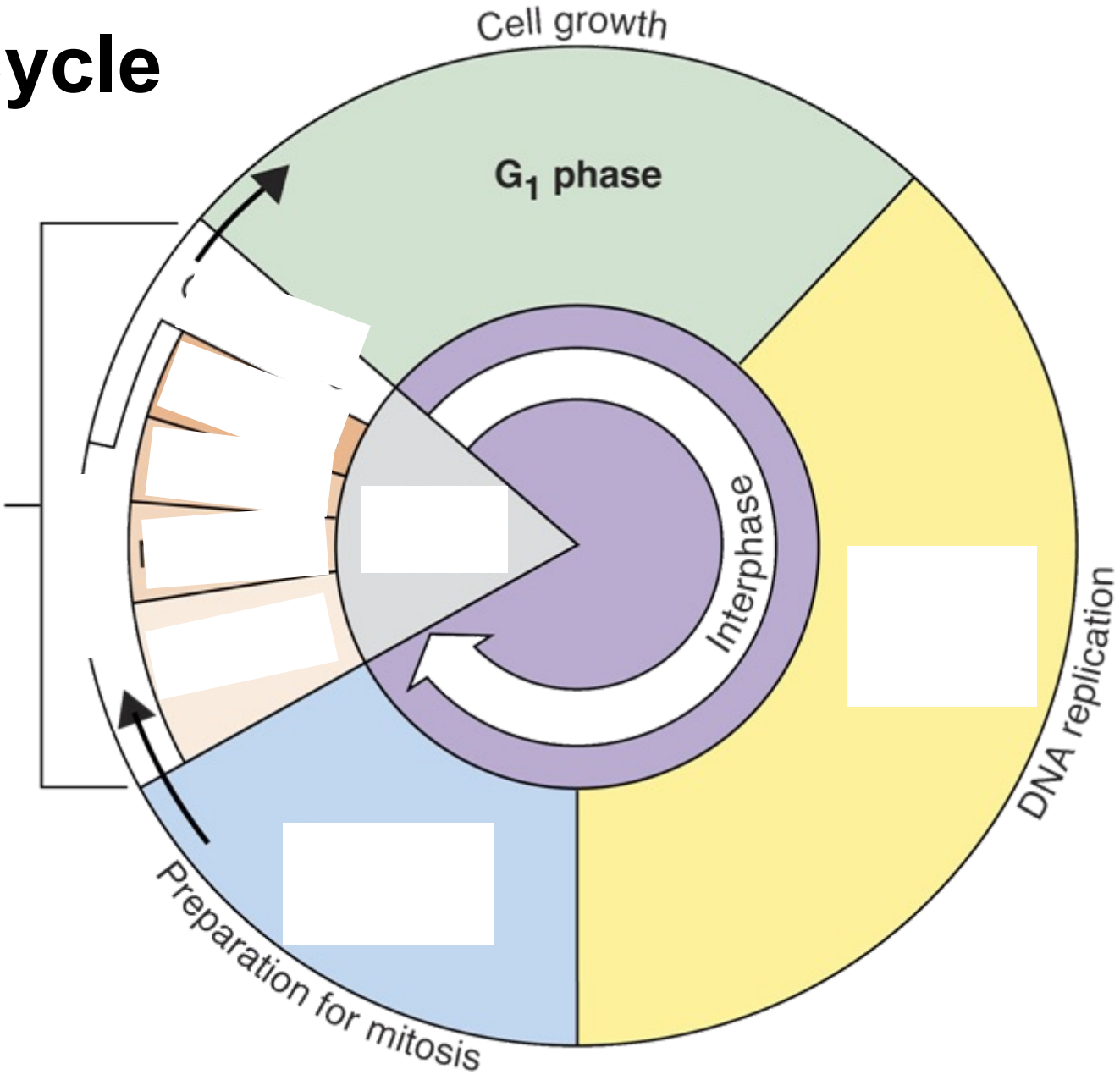

Cell growth
Interphase
DNA replication
Preparation for mitosis

Events of the Cell Cycle

- During **G_1** (Growth Stage 1)
  - Cell increases in size
  - synthesizes new proteins and organelles



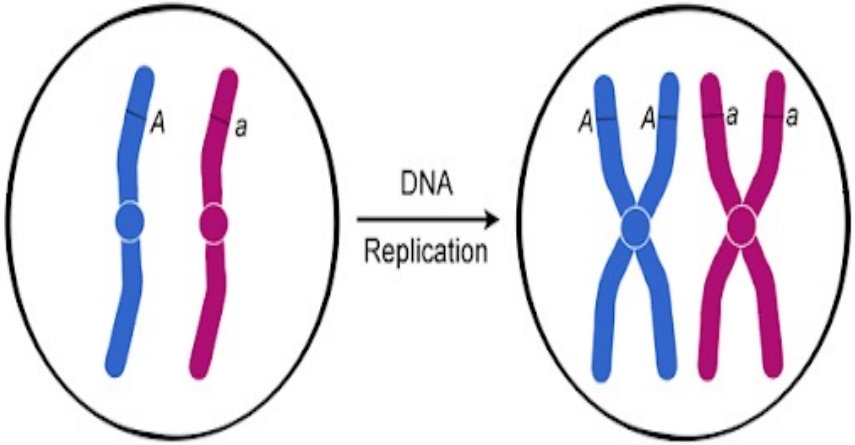
Cell Cycle

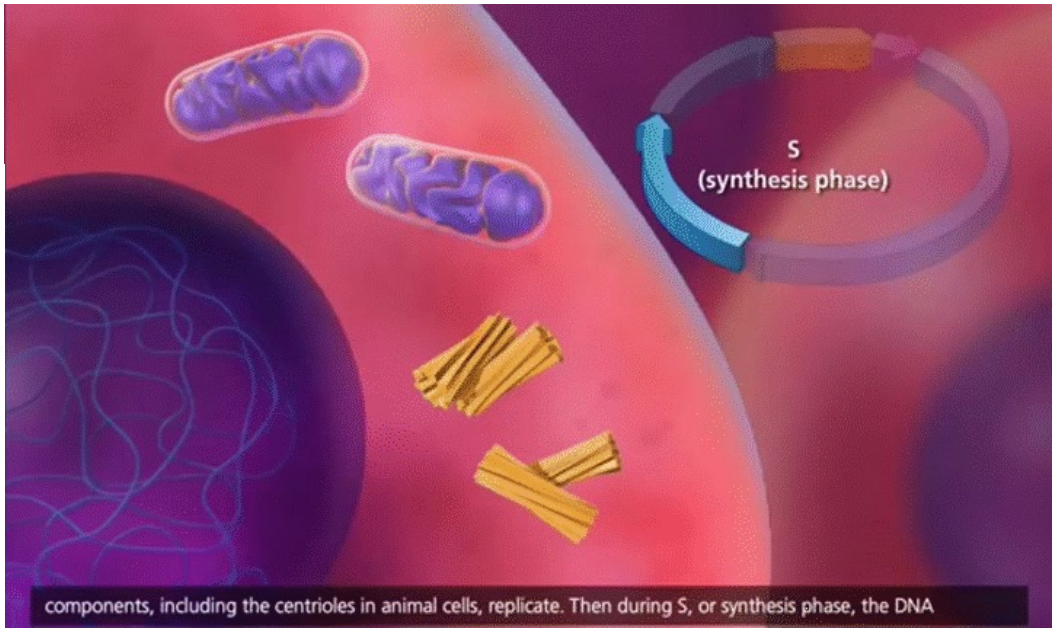

Cell growth
G_1 phase
Interphase
DNA replication
Preparation for mitosis

During the **S phase** (Synthesis Phase),

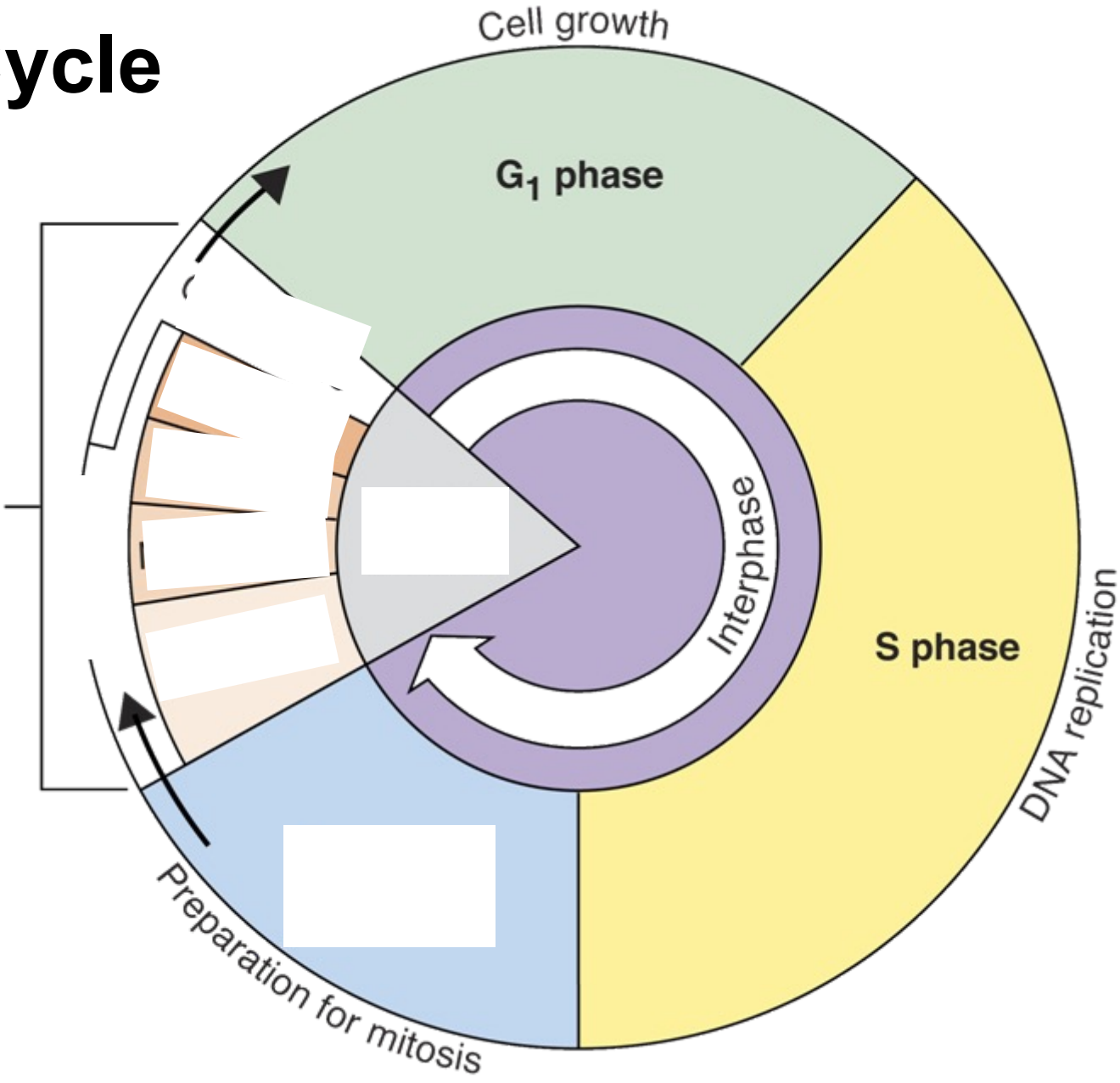
- chromosomes are replicated
- **DNA synthesis** takes place

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



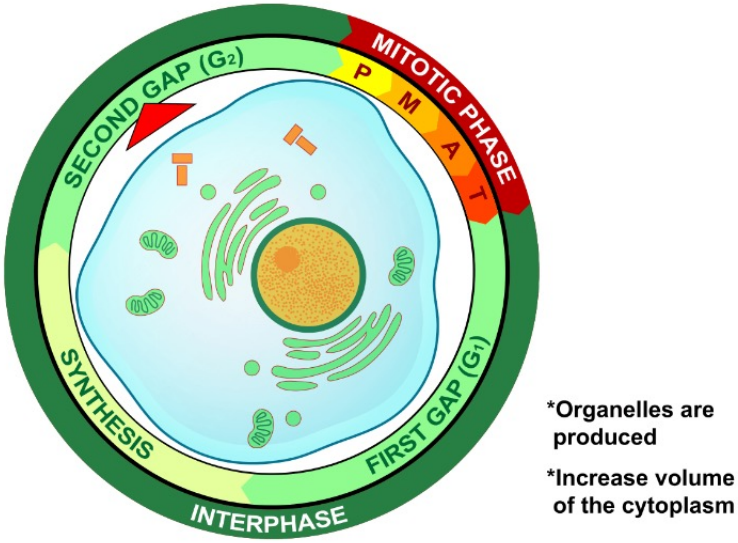


Cell Cycle


Cell growth
G_1 phase
Interphase
S phase
DNA replication
Preparation for mitosis

The $\underline{G_2}$ Phase (Second Growth Phase)

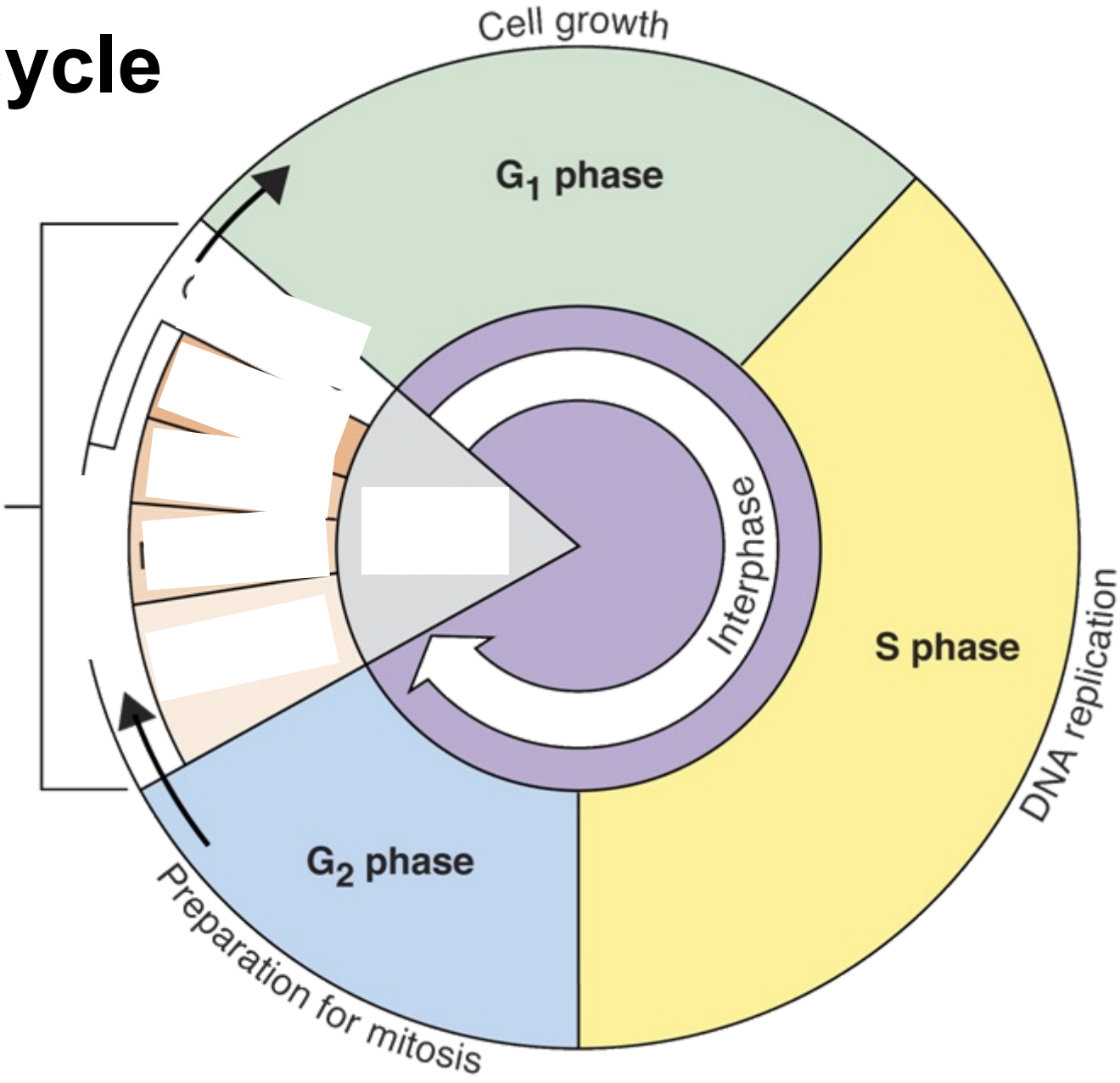
- organelles and molecules required for cell division are produced
- Once G_2 is complete, the cell is ready to start the M phase—Mitosis



*Organelles are produced

*Increase volume of the cytoplasm

Cell Cycle

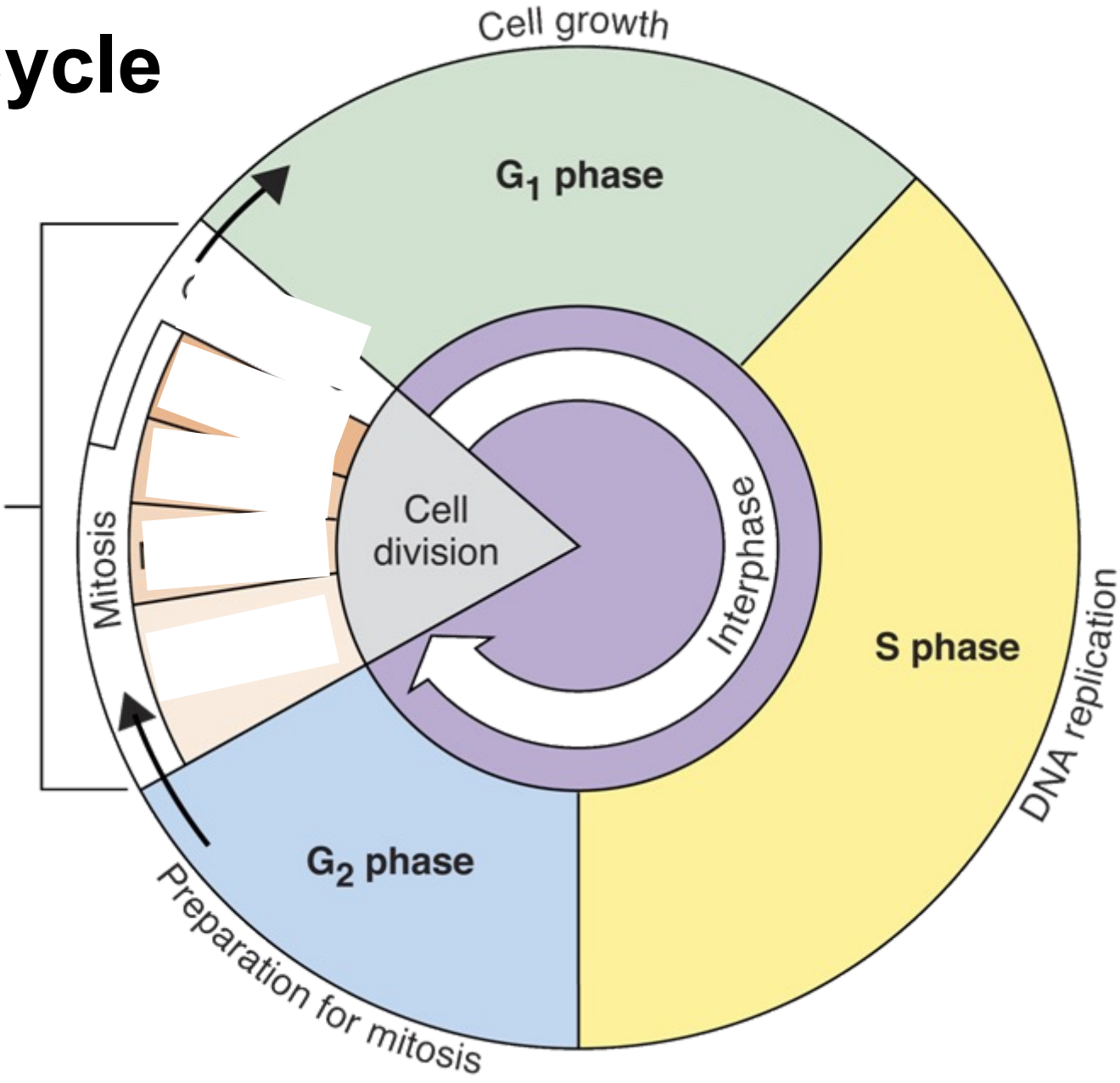

Cell growth
G_1 phase
Interphase
S phase
DNA replication
G_2 phase
Preparation for mitosis

Mitosis

- Happens in **all** cells
- Cell division process
- 5 major stages

Cell Cycle

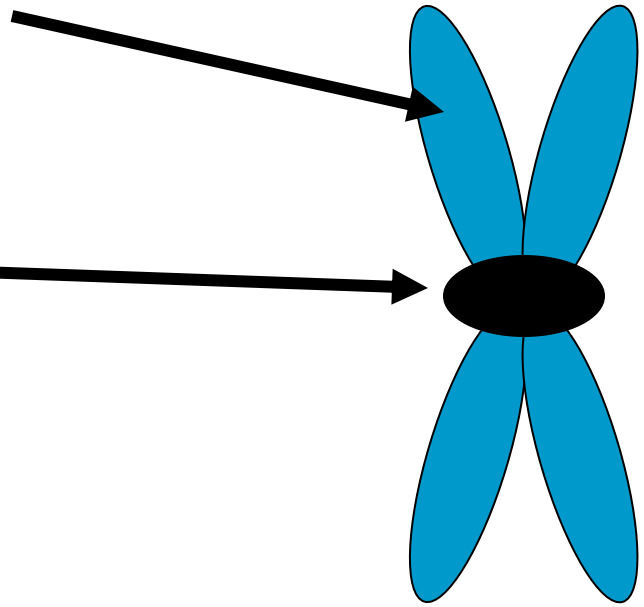
M Phase



Prophase

- Nuclear envelope disappears
- Chromosomes condense – can see sister chromatids

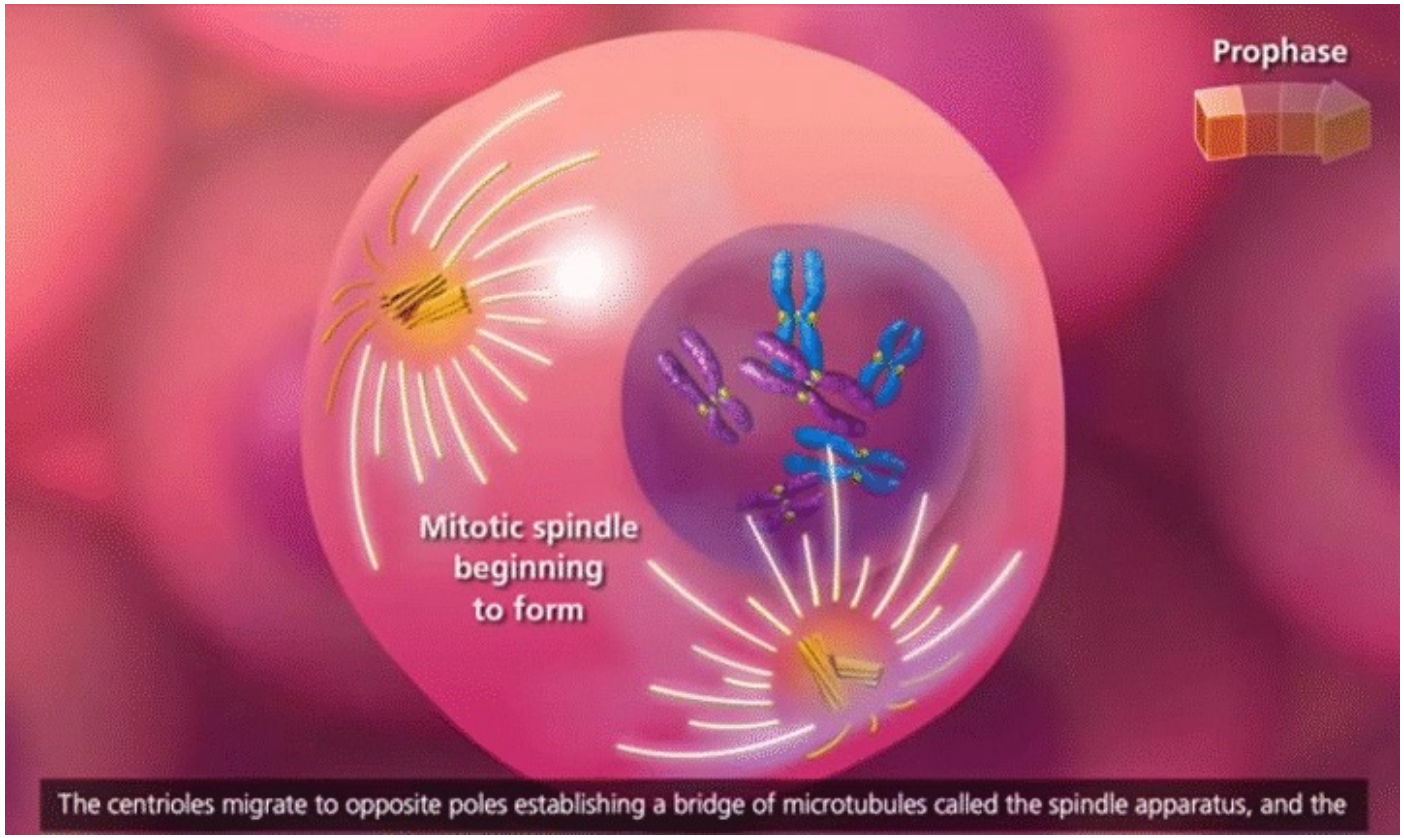
  and centromere
- Spindle forms



Prophase

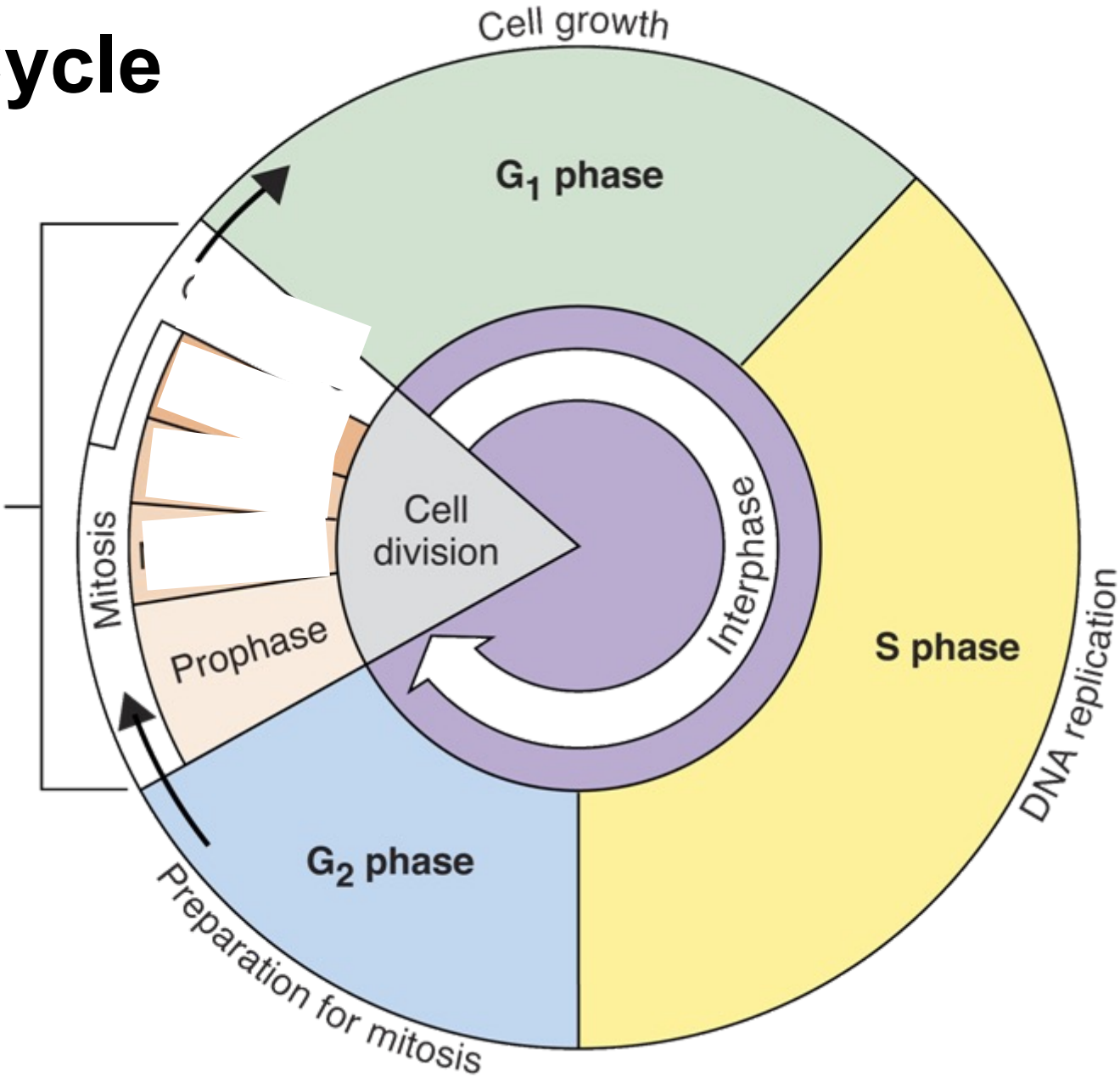
Prophase is the first and longest phase of mitosis.

The **centrioles** separate and take up positions on opposite sides of the nucleus.



Cell Cycle

M Phase



Metaphase

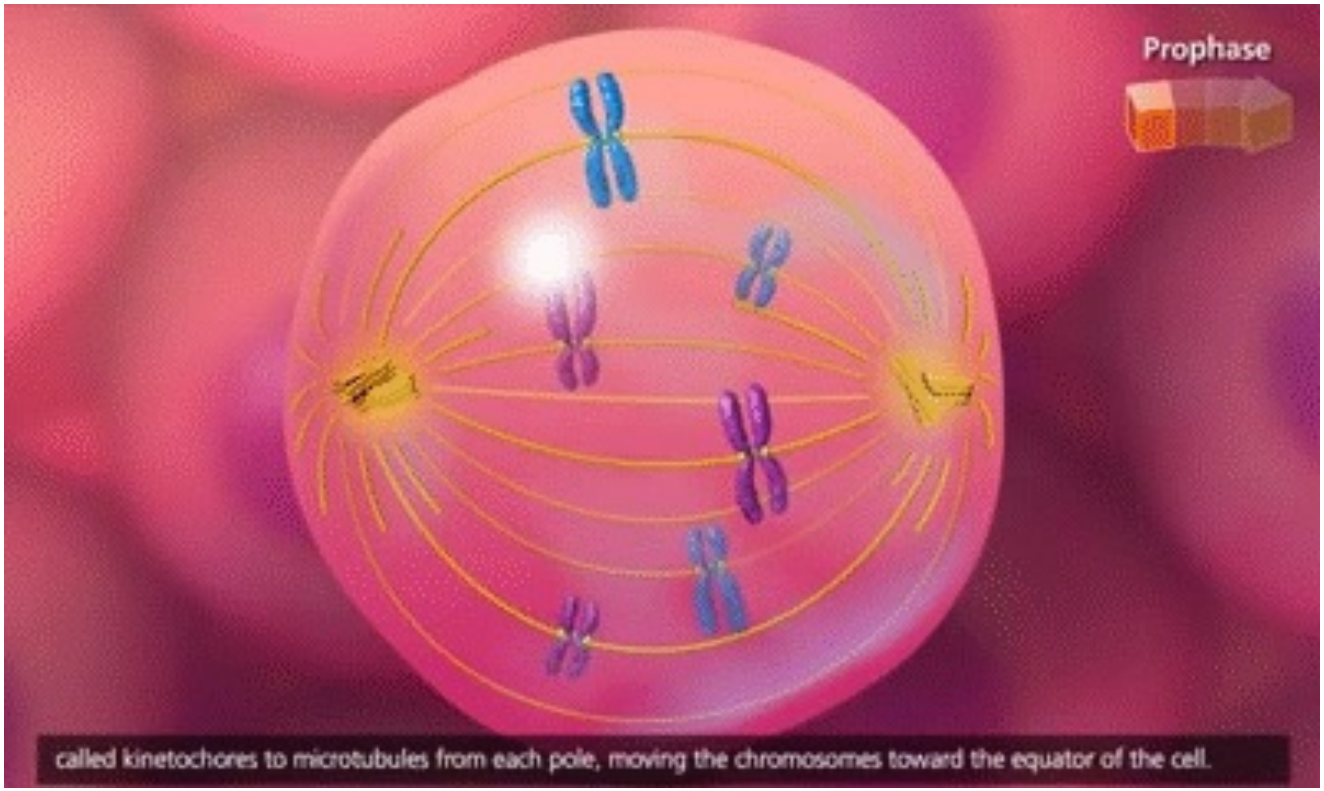
- Chromosomes move to the equator (middle) of spindle
- Each chromatid is attached to spindle with centromere

Metaphase

The second phase of mitosis is metaphase.

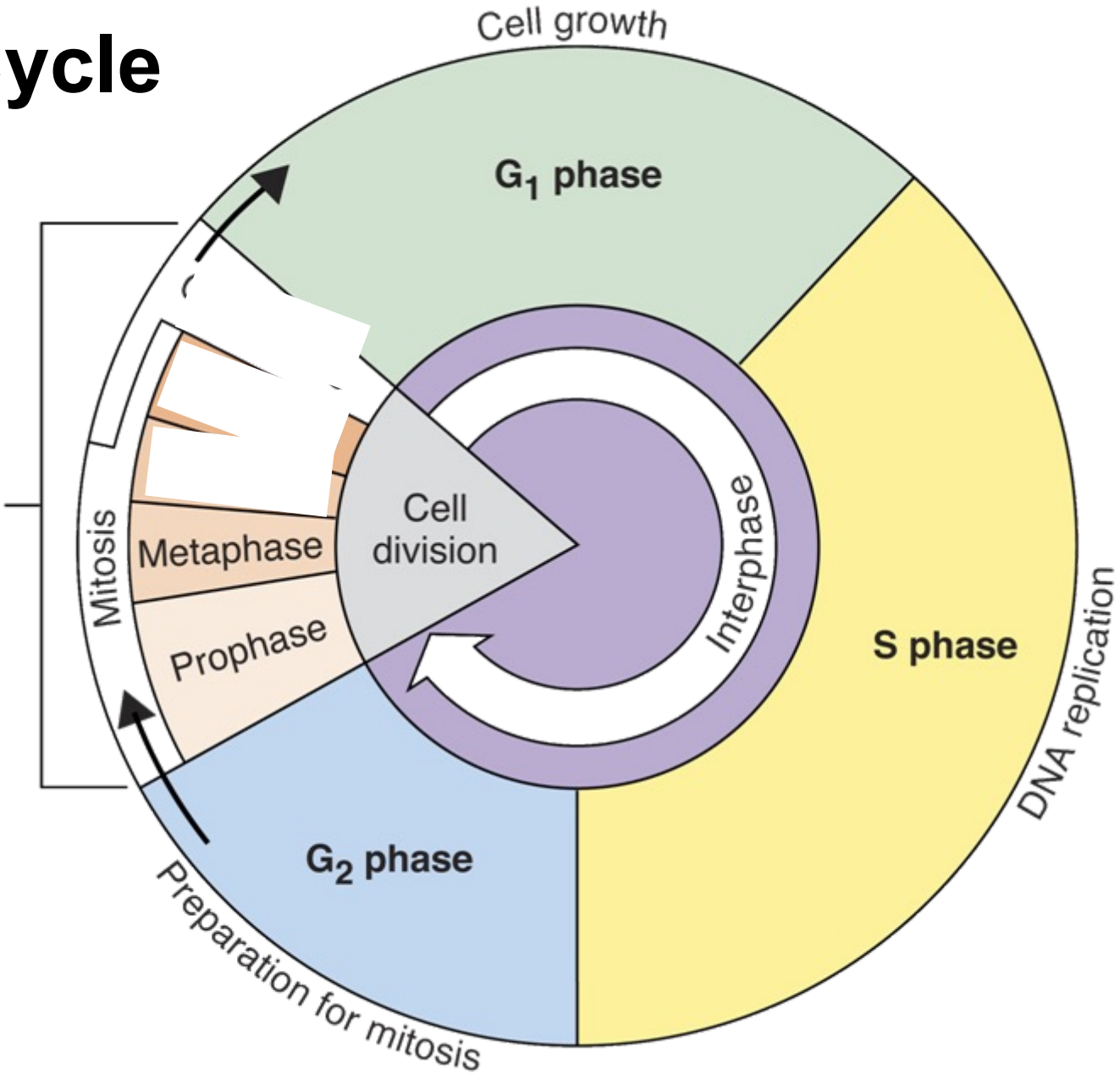
The chromosomes line up across the center of the cell.

Microtubules connect the centromere of each chromosome to the poles of the spindle.



Cell Cycle

M Phase



Anaphase

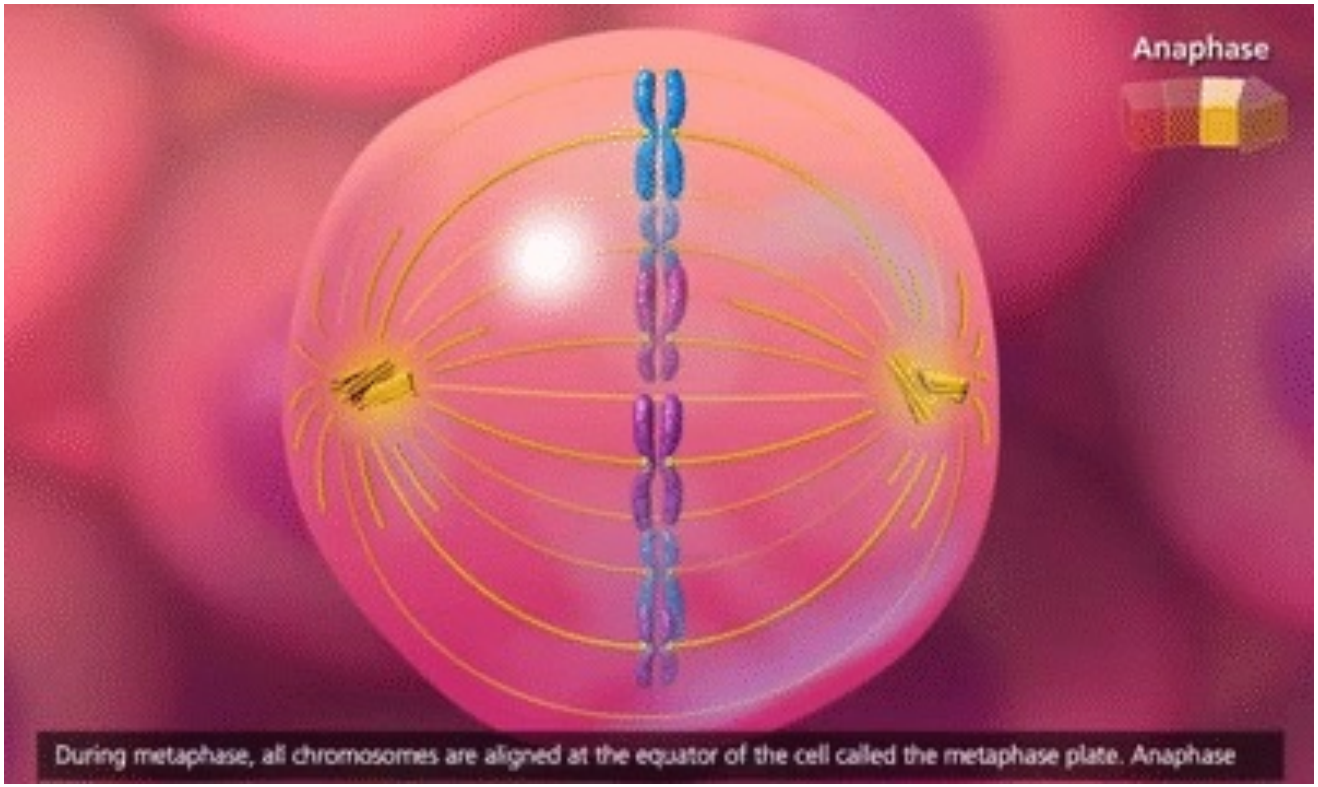
- Centromeres split
- Sister chromatids are pulled apart to opposite poles of the cell
- Each chromatid is now a separate chromosome

Anaphase

Anaphase is the third phase of mitosis.

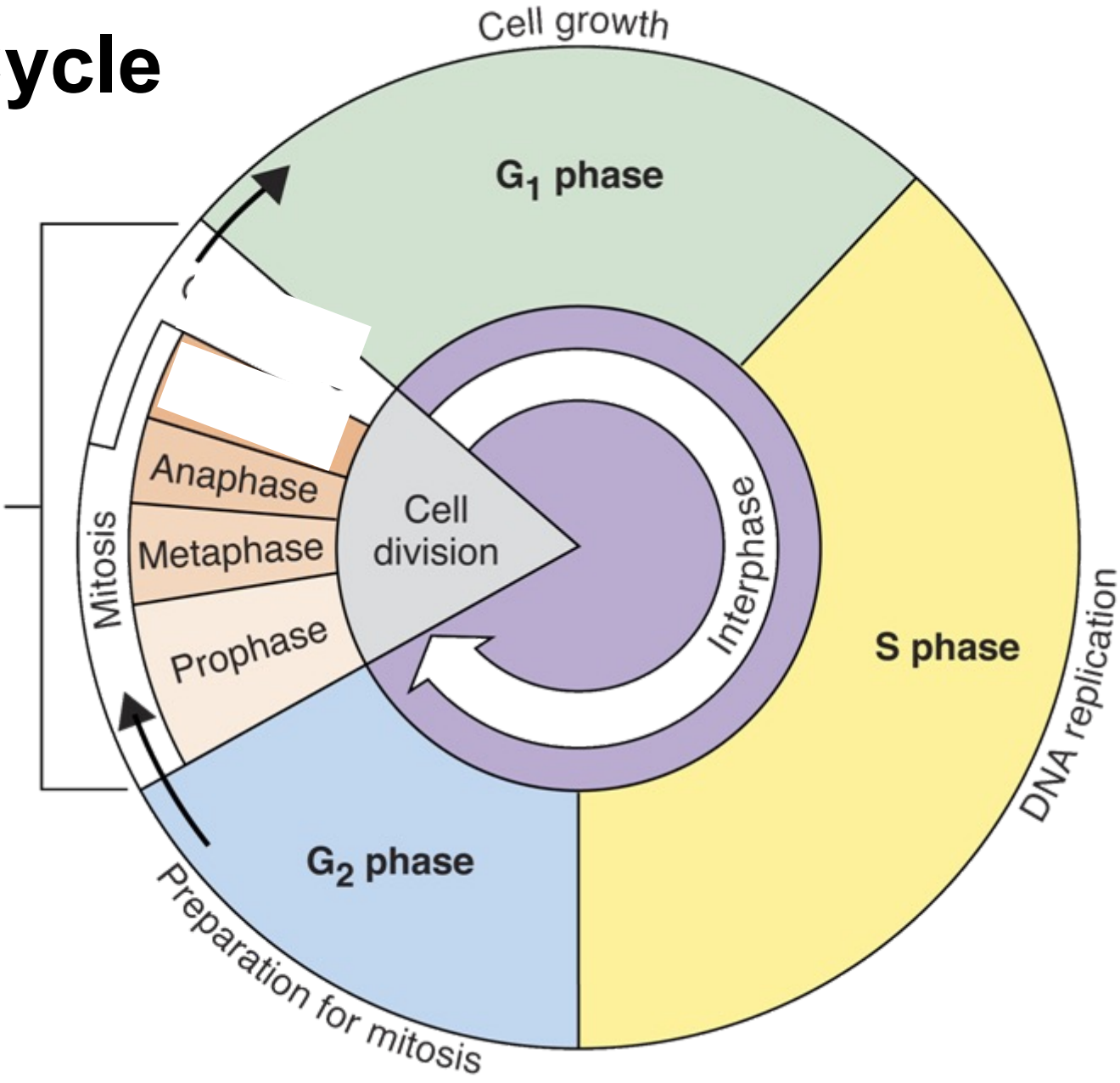
The sister chromatids separate into individual chromosomes.

The chromosomes continue to move until they have separated into two groups.



Cell Cycle

M Phase



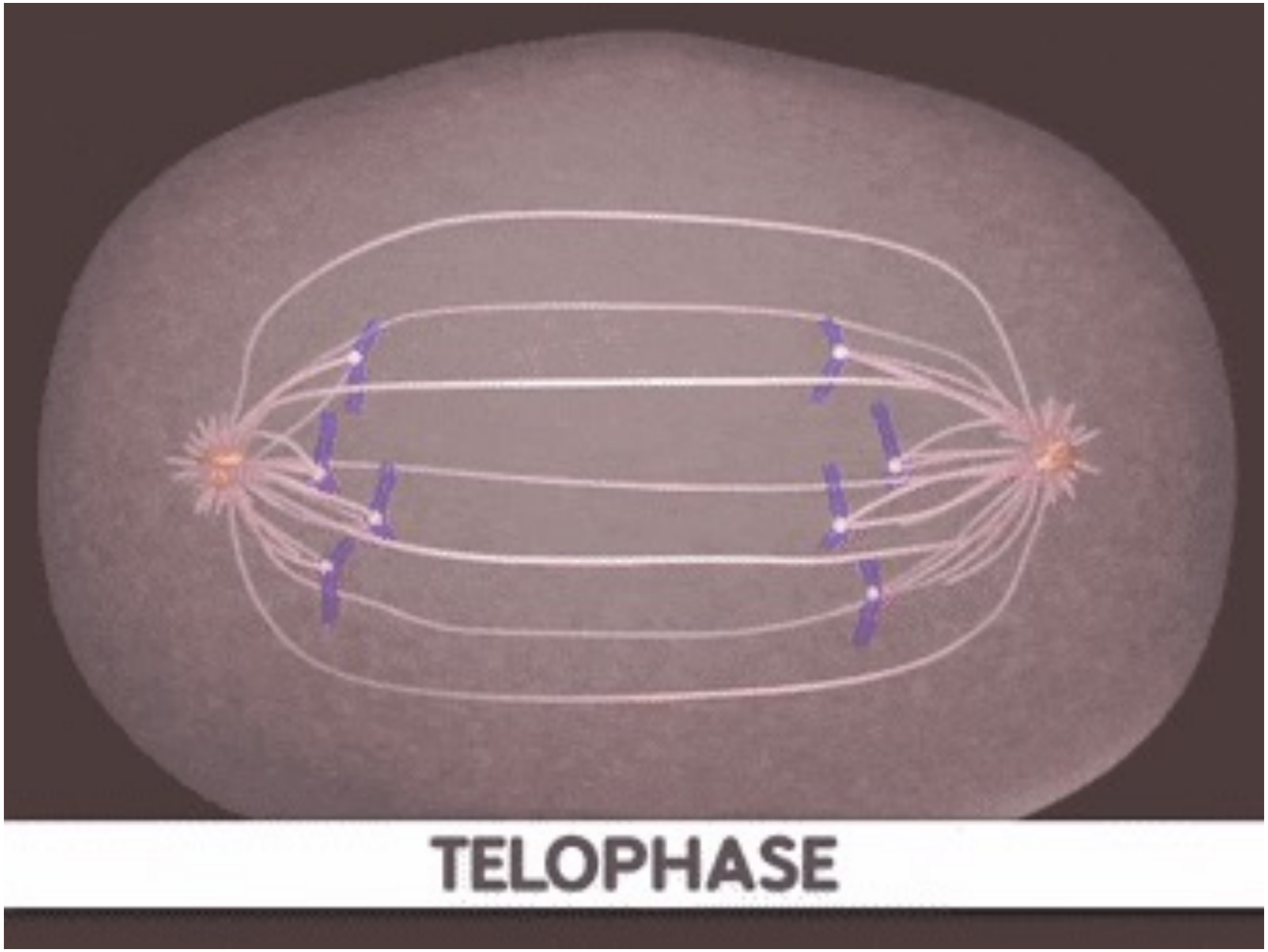
Telophase

- Nuclear envelopes (2) reform
- Chromosomes begin to uncoil

Telophase

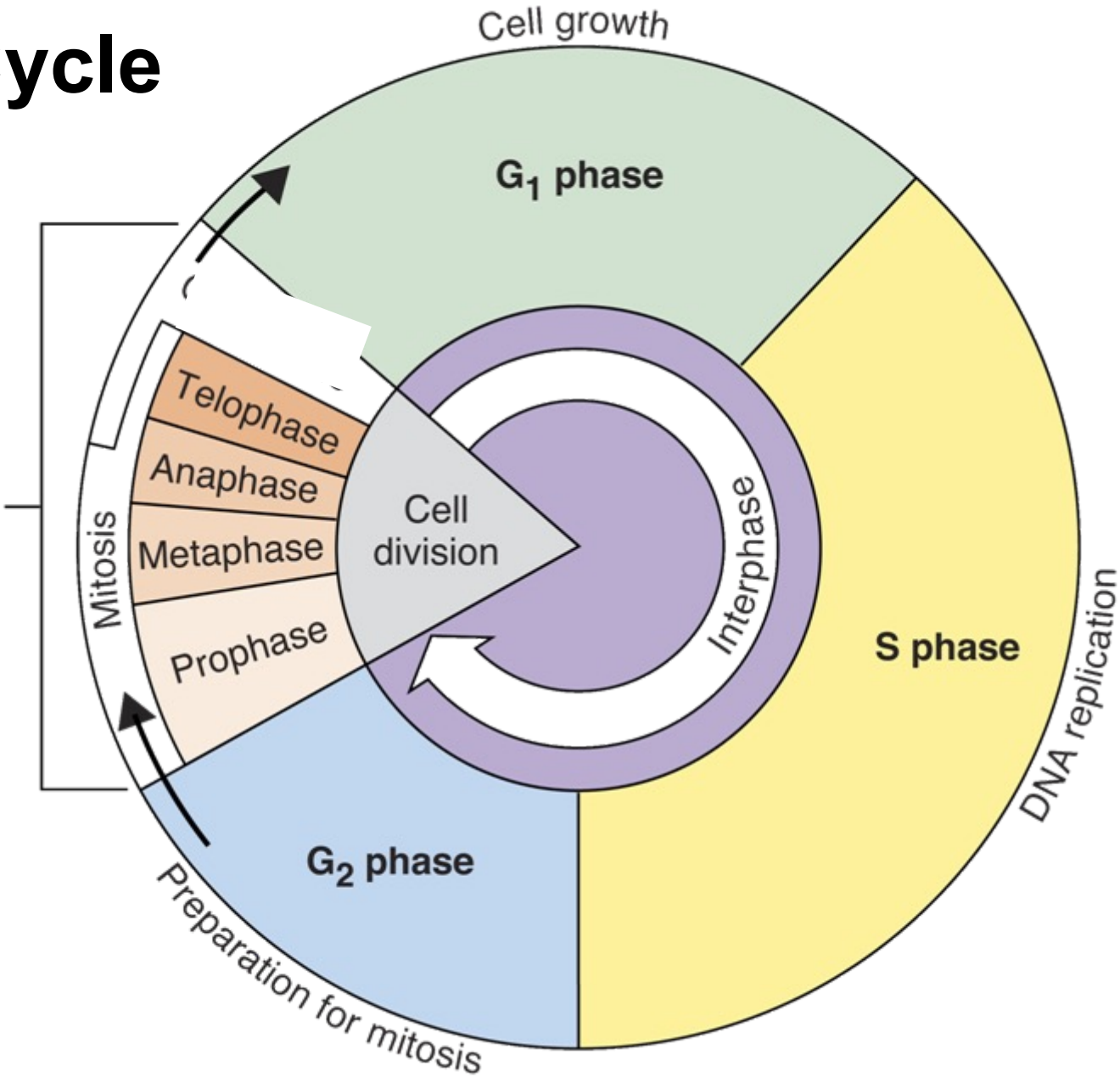
Telophase is the fourth phase of mitosis.

Chromosomes gather at opposite ends of the cell and lose their distinct shape.



Cell Cycle

M Phase



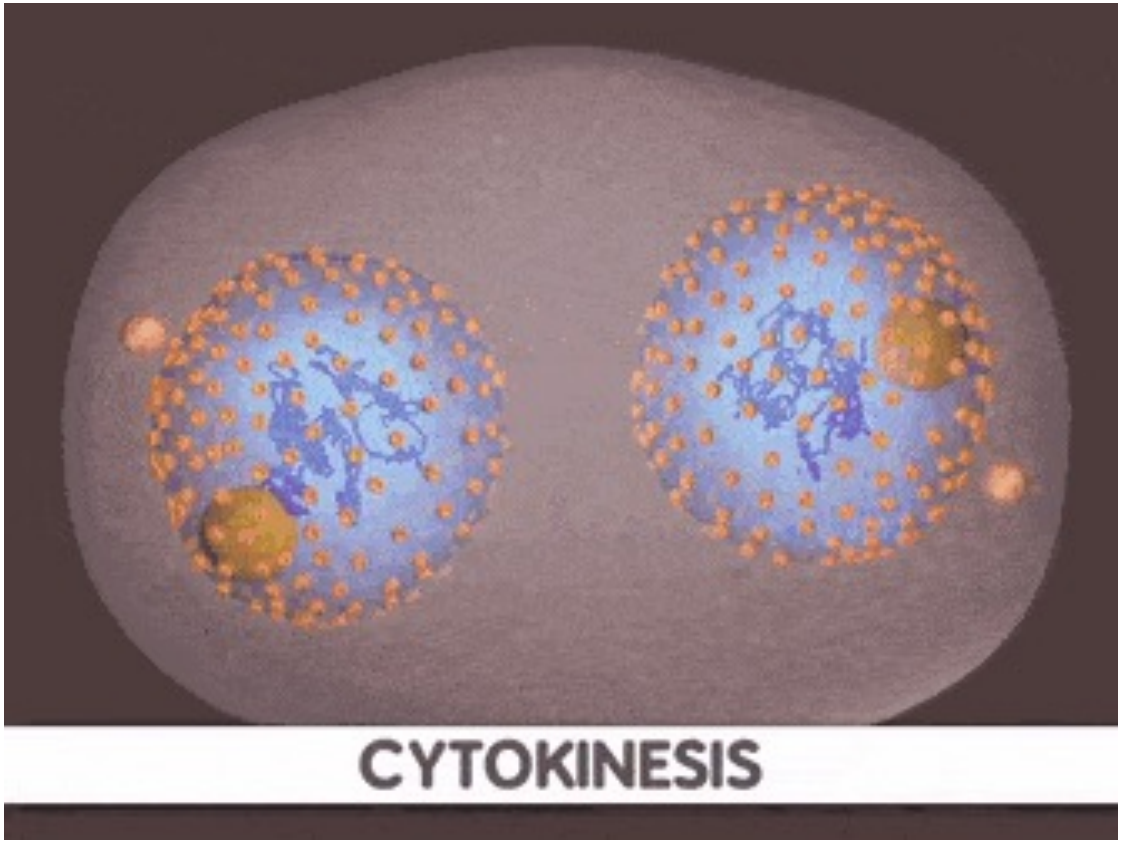
Cytokinesis

- Cytoplasm divides
- Two new **daughter cells** are now separate

Cytokinesis

During cytokinesis, the cytoplasm pinches in half.

Each daughter cell has an identical set of duplicate chromosomes



Full Cell Cycle

- https://www.youtube.com/watch?v=7NM-UWFHG18