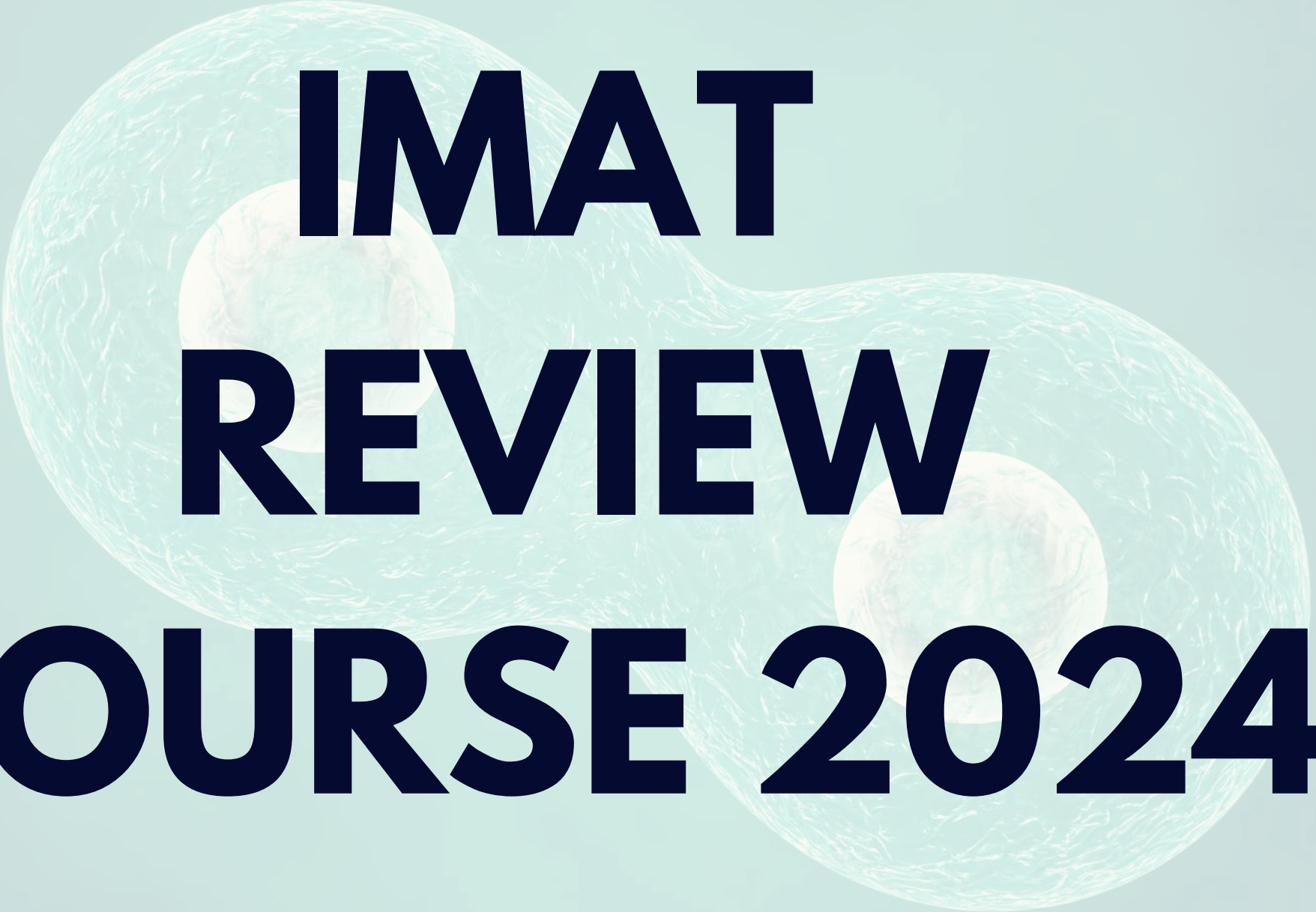


BIOLOGY



IMAT REVIEW COURSE 2024

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Cell Division P1

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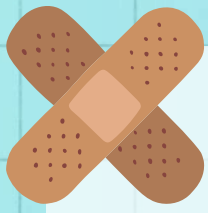
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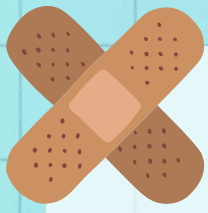
Cell Cycle Overview

The cell cycle is a carefully controlled process that makes sure cells grow and divide correctly.

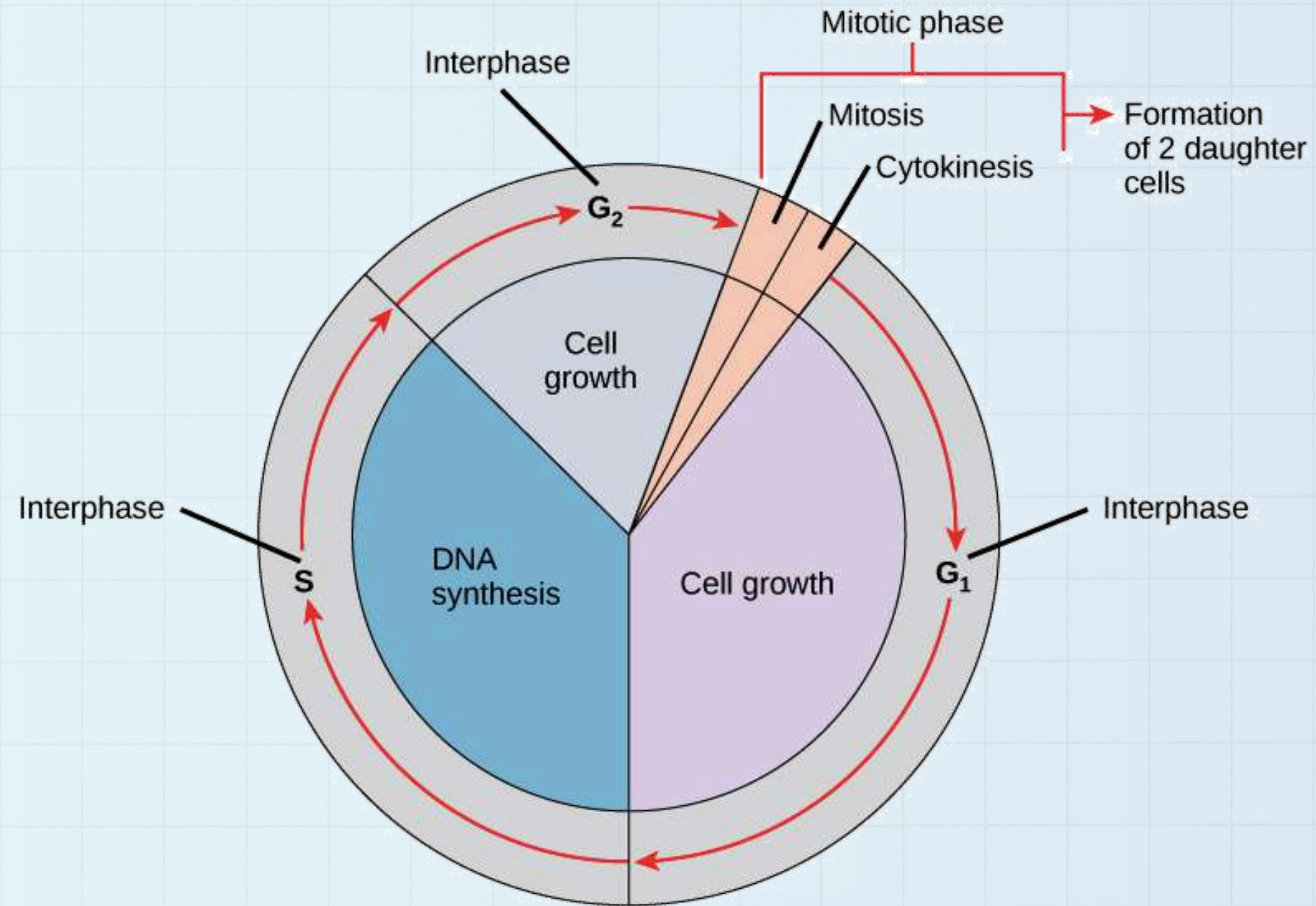
It has two main stages: Interphase and the Mitotic Phase.

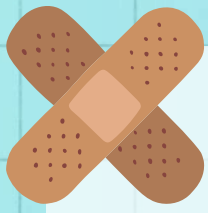
- Interphase is the longest stage where the cell gets ready to divide.
- Mitotic Phase includes nuclear division (where the cell's nucleus splits) and cytokinesis (where the cell actually splits into two).





Cell Cycle Overview





G1 Phase

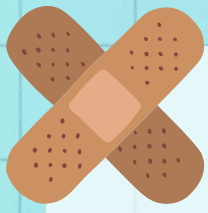
The G1 (Gap 1) phase is the first part of Interphase.

In this phase, the cell grows and performs its usual functions.

It also makes important preparations for copying its DNA in the next phase. (s)

G1 includes **key checkpoints that check the cell's DNA** for any problems and **assess external signals** before moving on to the **S phase**.



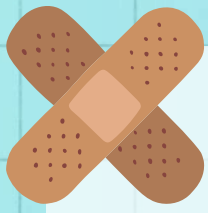


S Phase

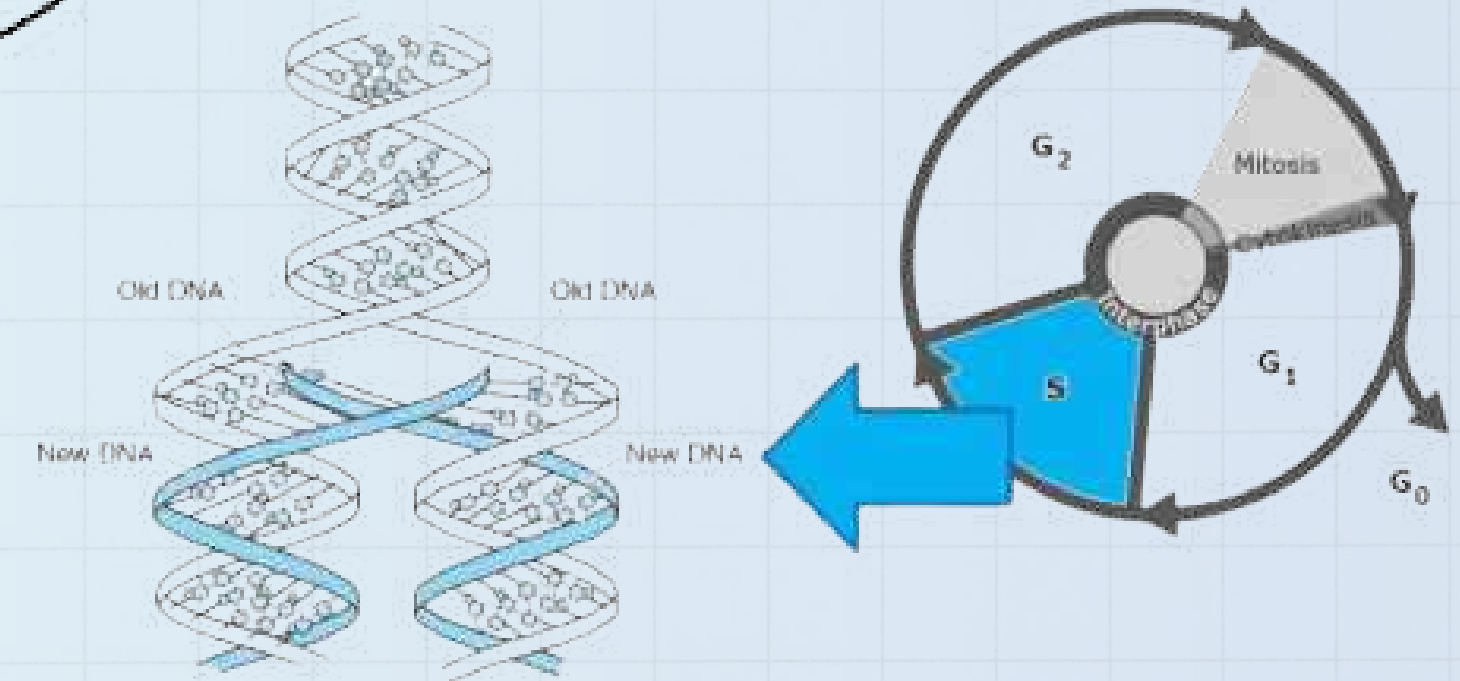
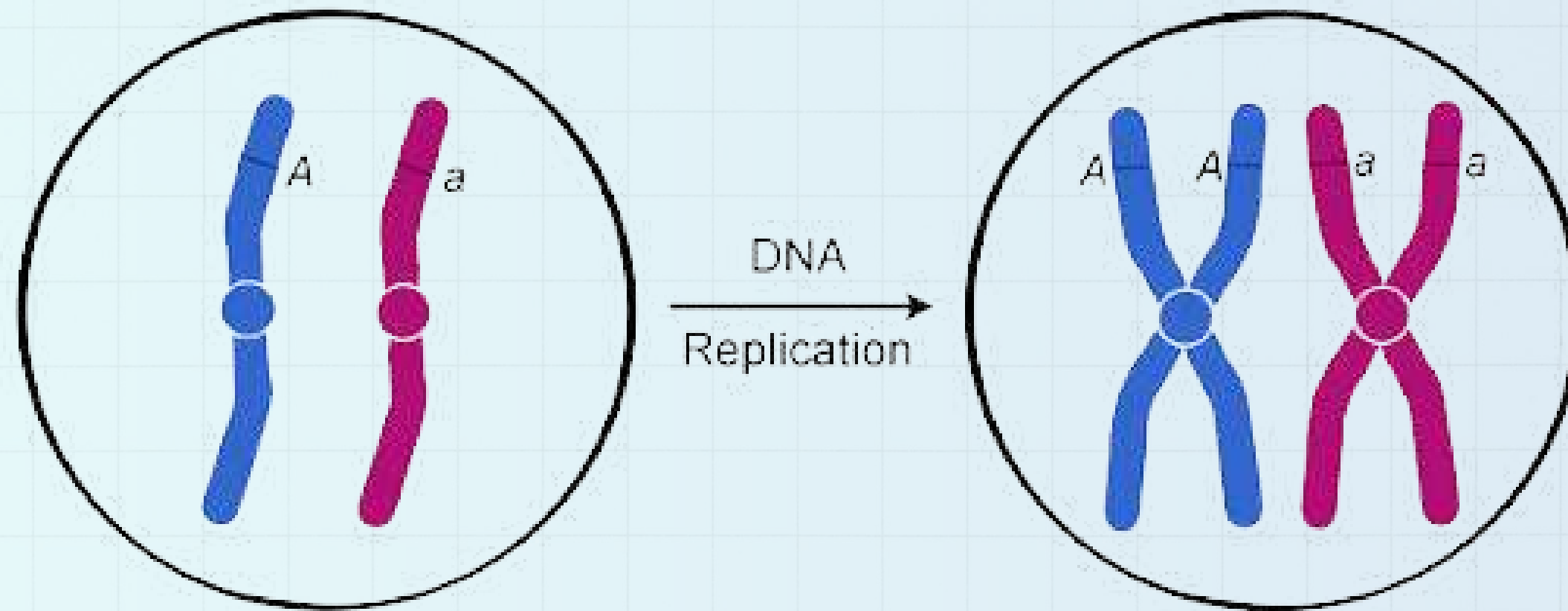
The S (Synthesis) phase is when DNA replication happens.

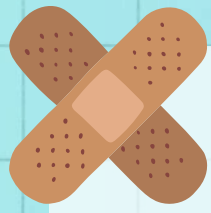
During this phase, the cell **copies all of its DNA**, so each **daughter cell** will get a complete set of **genetic material**.



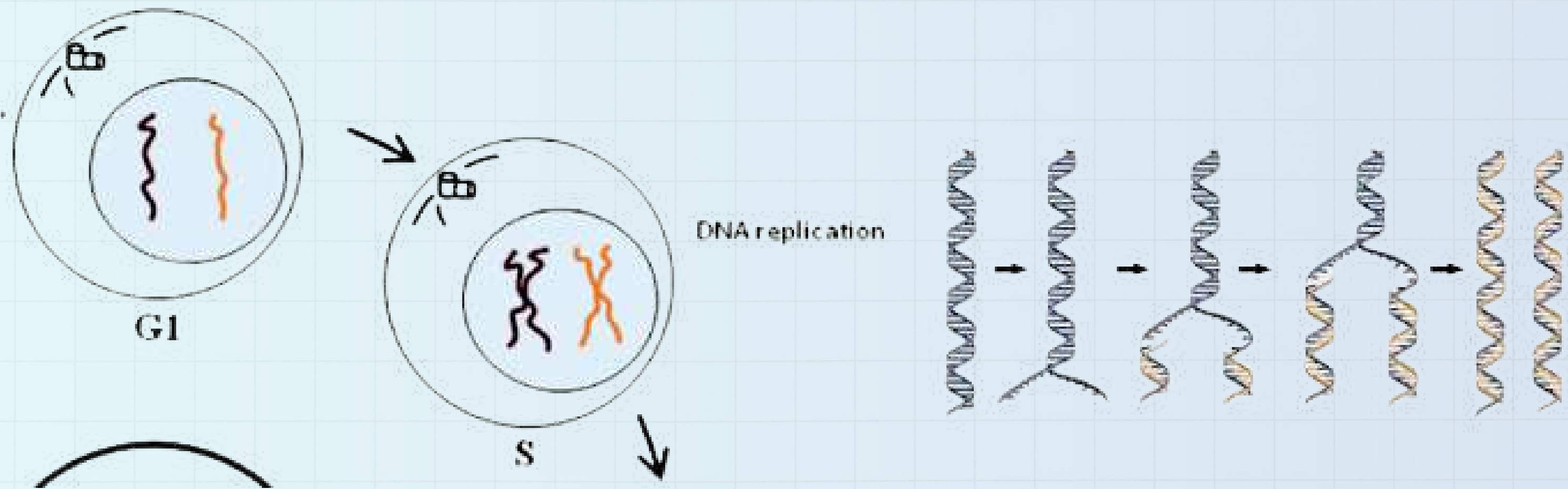


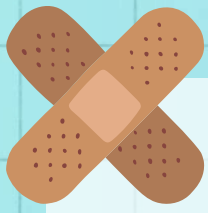
S Phase





S Phase



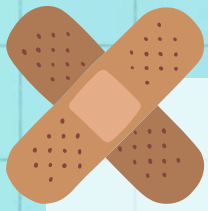


S Phase

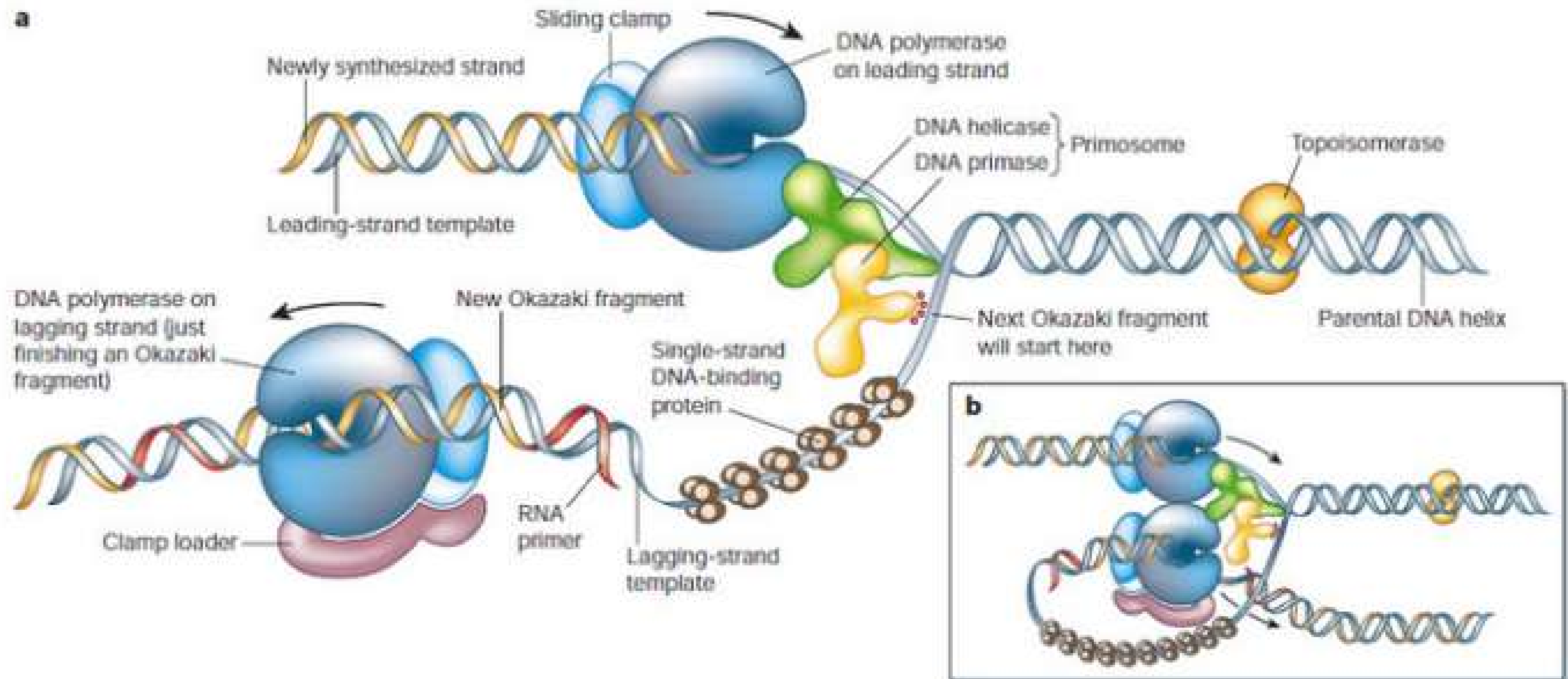
DNA replication is a very precise and carefully controlled process, involving several enzymes and proteins.

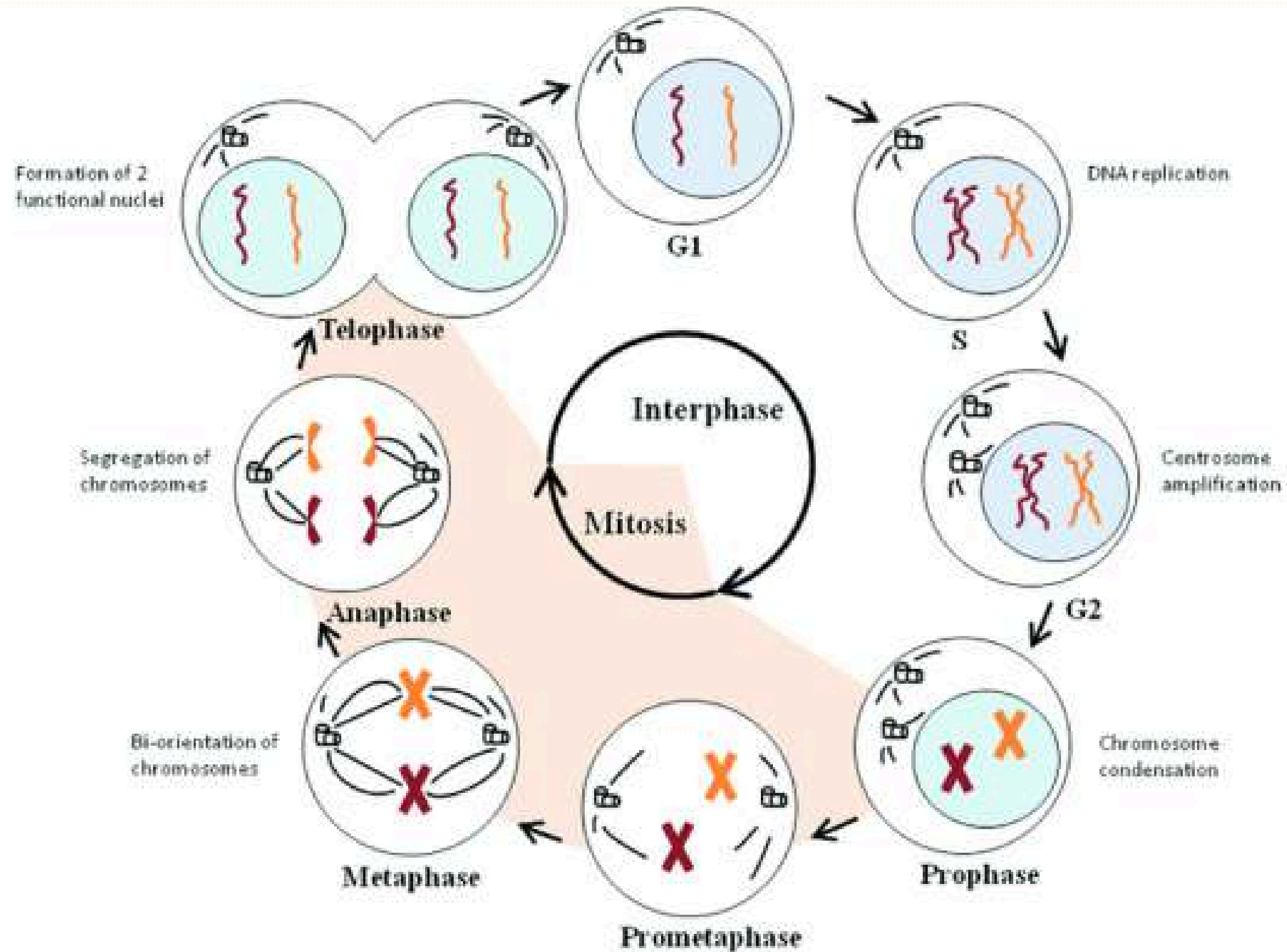
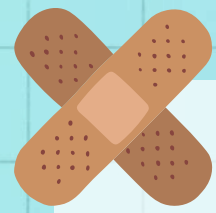
By the end of the S phase, each chromosome has been **copied, creating two identical sister chromatids** that are connected by a **centromere**.

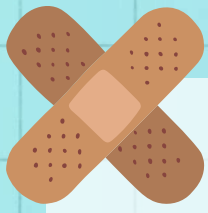




S Phase







Mitotic phase

- The mitotic phase includes two main processes:
 - Mitosis: This is the division of the nucleus.
 - Cytokinesis: This is the division of the cytoplasm.
- These processes make sure that genetic material and cytoplasmic components are evenly distributed to the daughter cells.



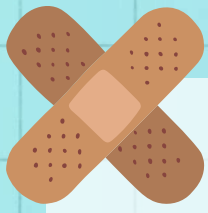
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01 • Cell Cycle

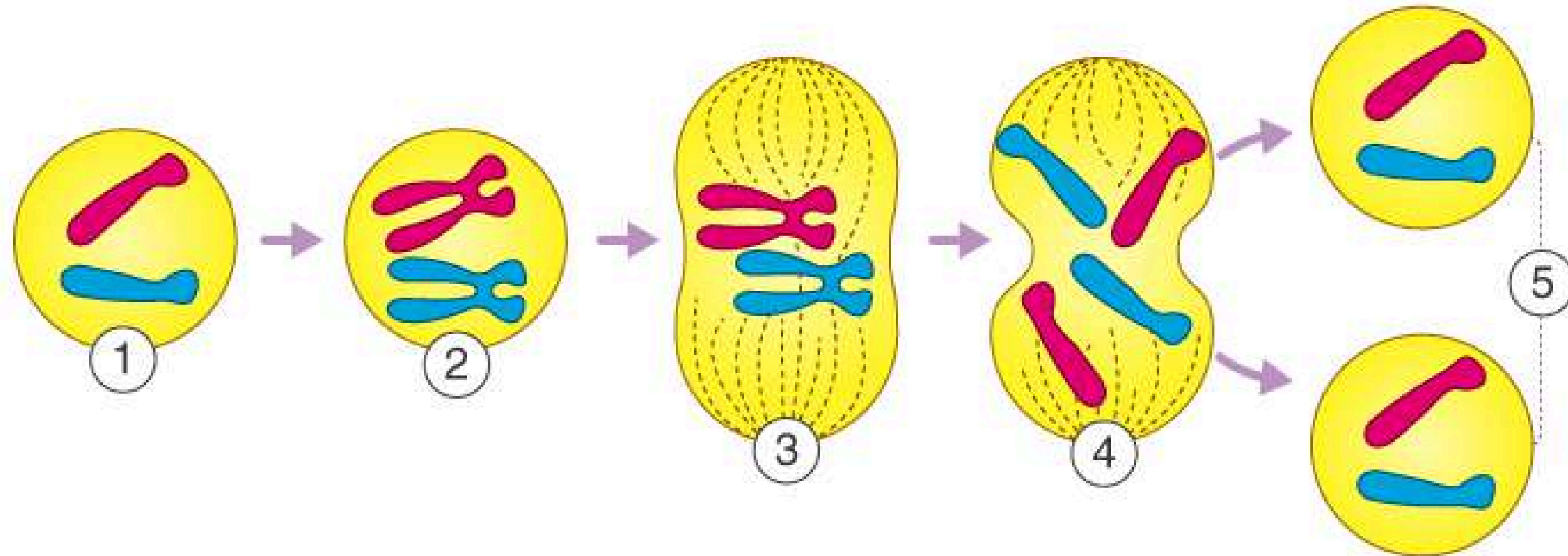
02 • Mitosis

03 • Cytokinesis

04 • Regulation of the Cell Cycle

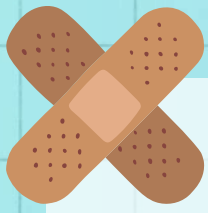


Mitosis phases



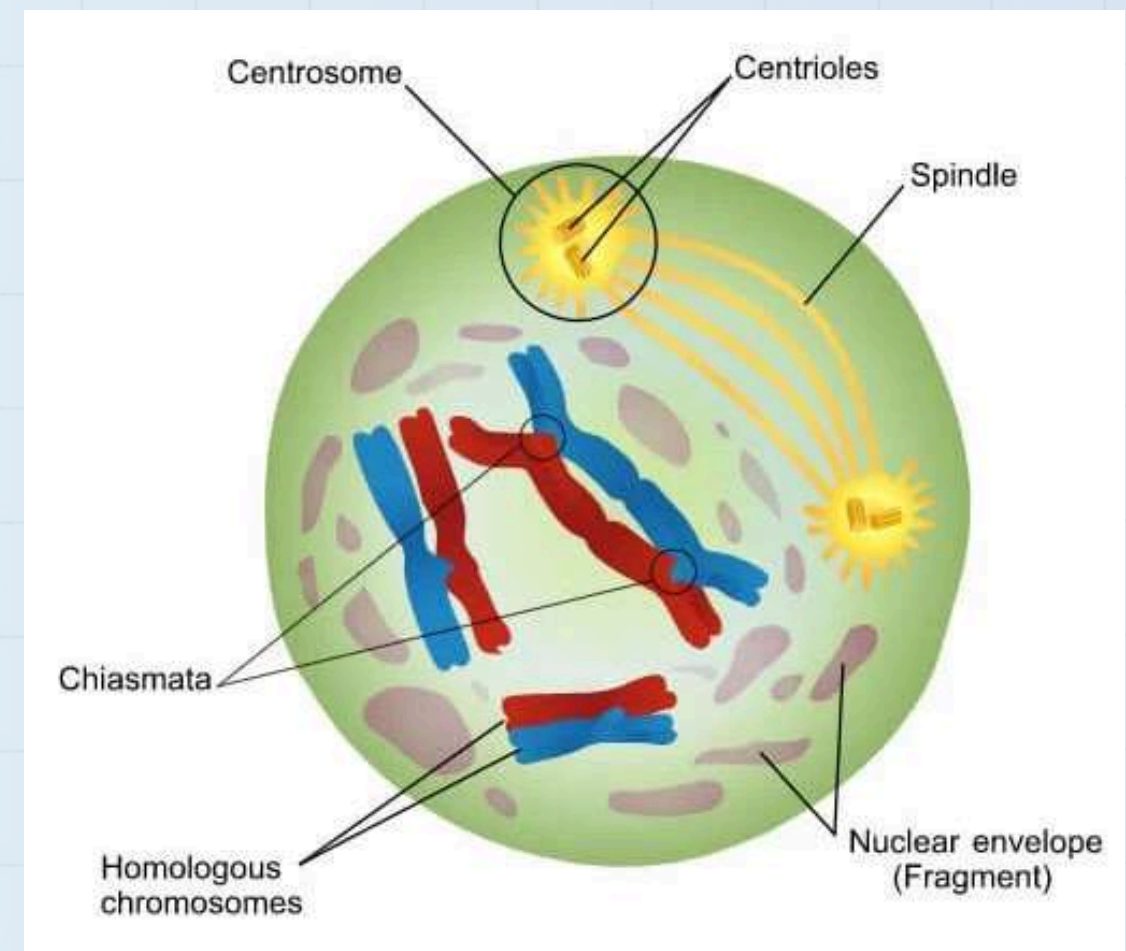
① Interphase | ② Prophase | ③ Metaphase | ④ Anaphase | ⑤ Telophase

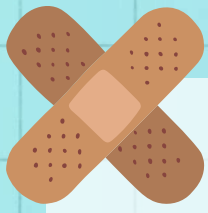




Prophase

- Prophase:
 - Chromatin condenses into visible chromosomes.
 - The nuclear envelope breaks down.
 - Centrosomes move to opposite sides of the cell.
 - Microtubules begin to form the mitotic spindle.

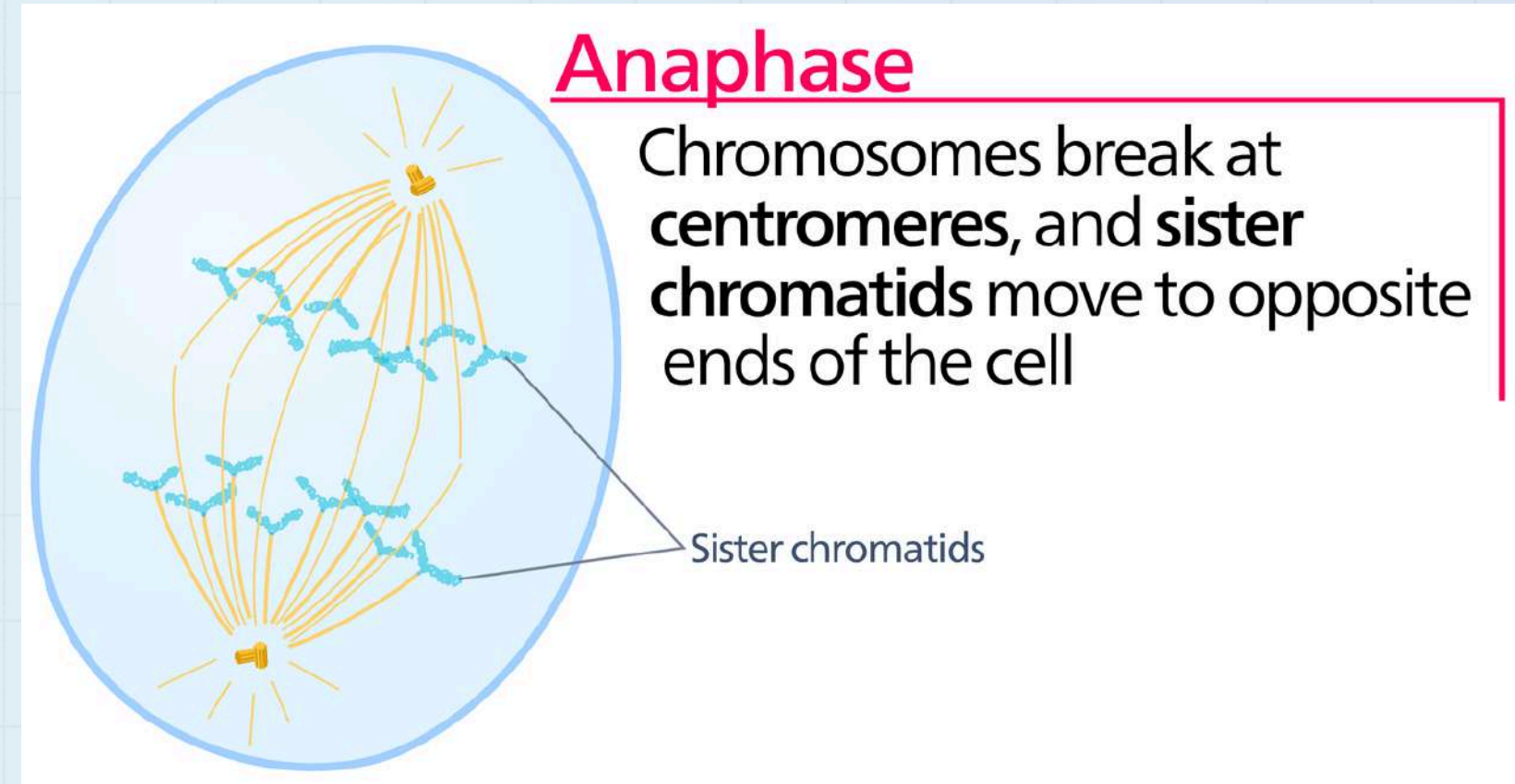
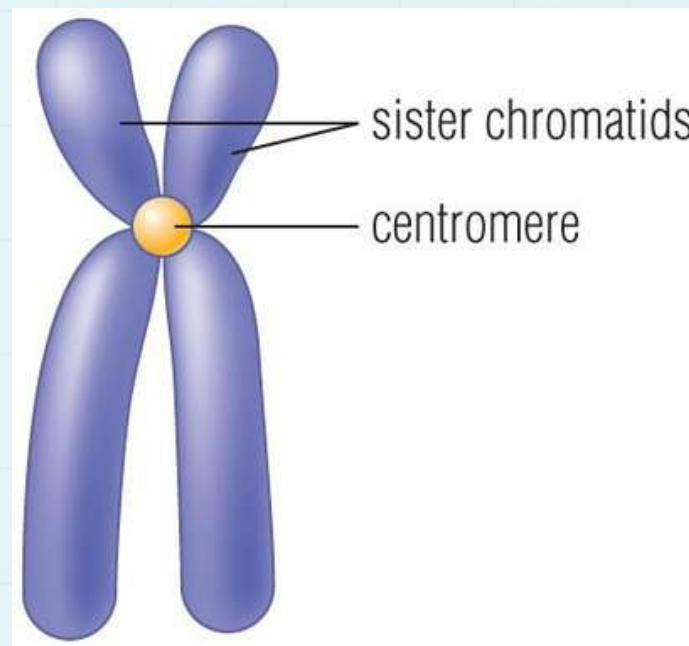




Anaphase

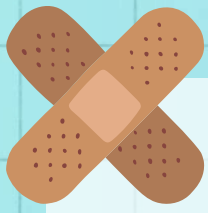
Anaphase:

- Sister chromatids separate at the **centromere**.
- They move to opposite ends of the cell, helped by the shortening of microtubules.



Centromeres are what holds the sister chromatids together

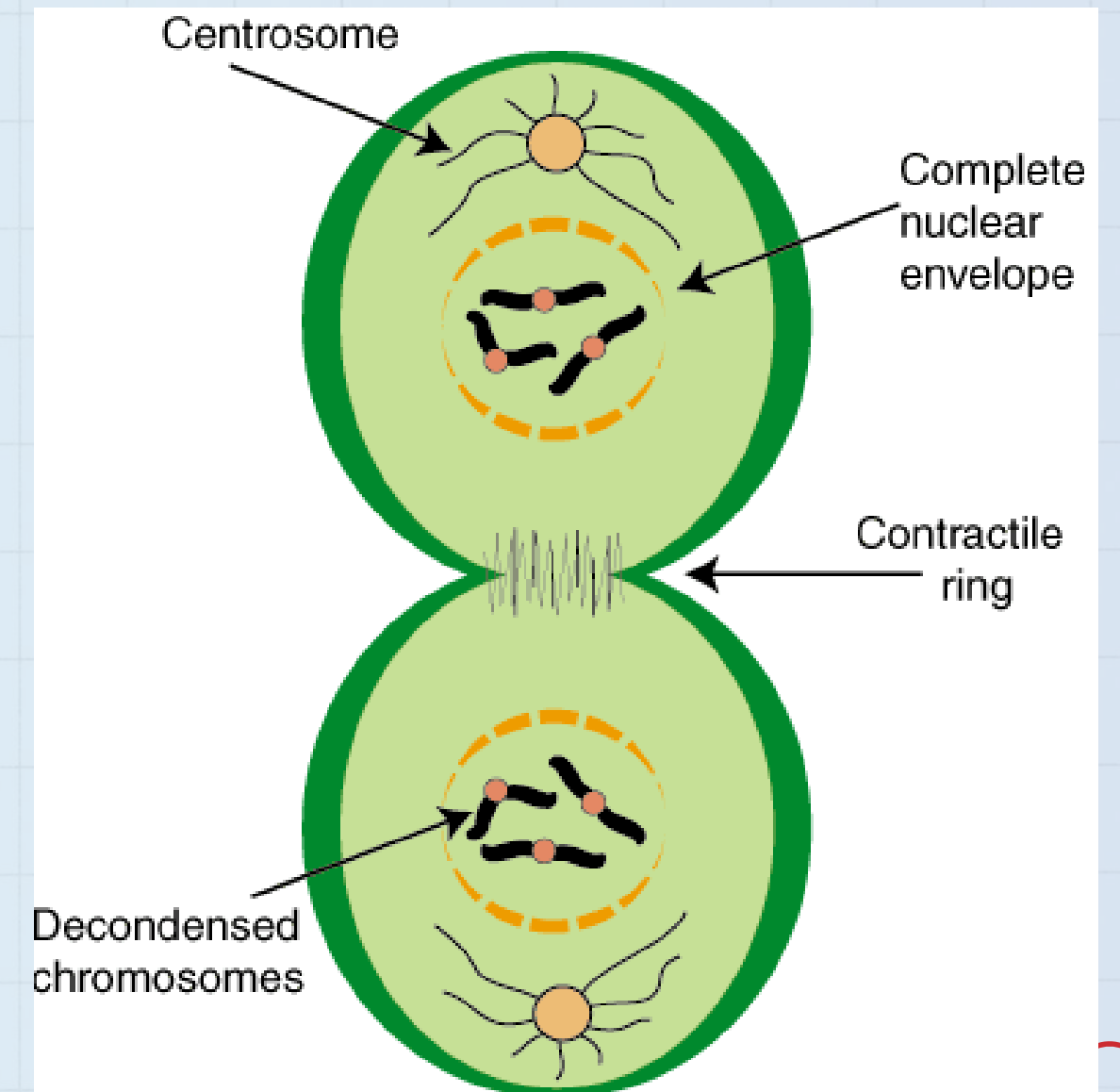


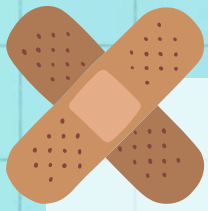


Telophase

Telophase:

- The separated chromosomes reach the cell's poles.
- New nuclear envelopes start to form around each set of chromosomes.
- The mitotic spindle breaks down.
- Chromosomes begin to unwind and decondense.





Overview

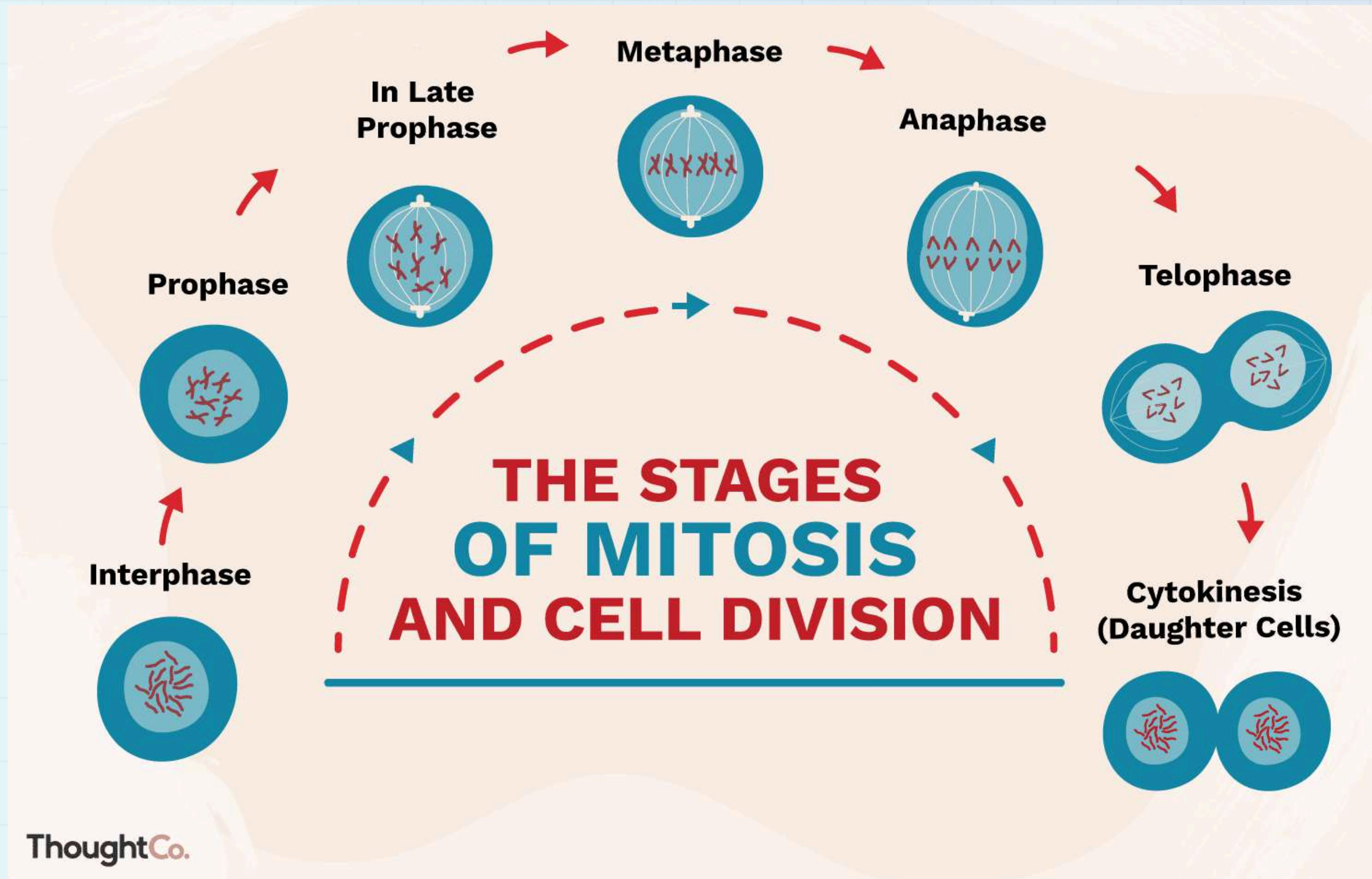


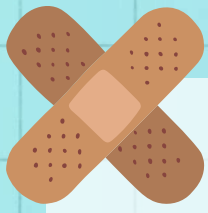
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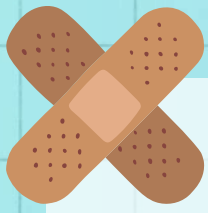
04 • Regulation of the Cell Cycle



Cytokinesis

- Cytokinesis happens after mitosis, and involves splitting the cytoplasm.
 - In animal cells:
 - A ring made of actin and myosin filaments forms around the center of the cell.
 - The ring contracts, creating a cleavage furrow that eventually divides the cell into two daughter cells.

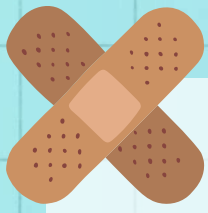




Cytokinesis

- In plant cells:
 - A structure called the **cell plate** forms between the two daughter nuclei.
 - The cell plate grows outward, merging with the cell membrane.
 - It eventually forms a new cell wall, dividing the parent cell into two daughter cells.

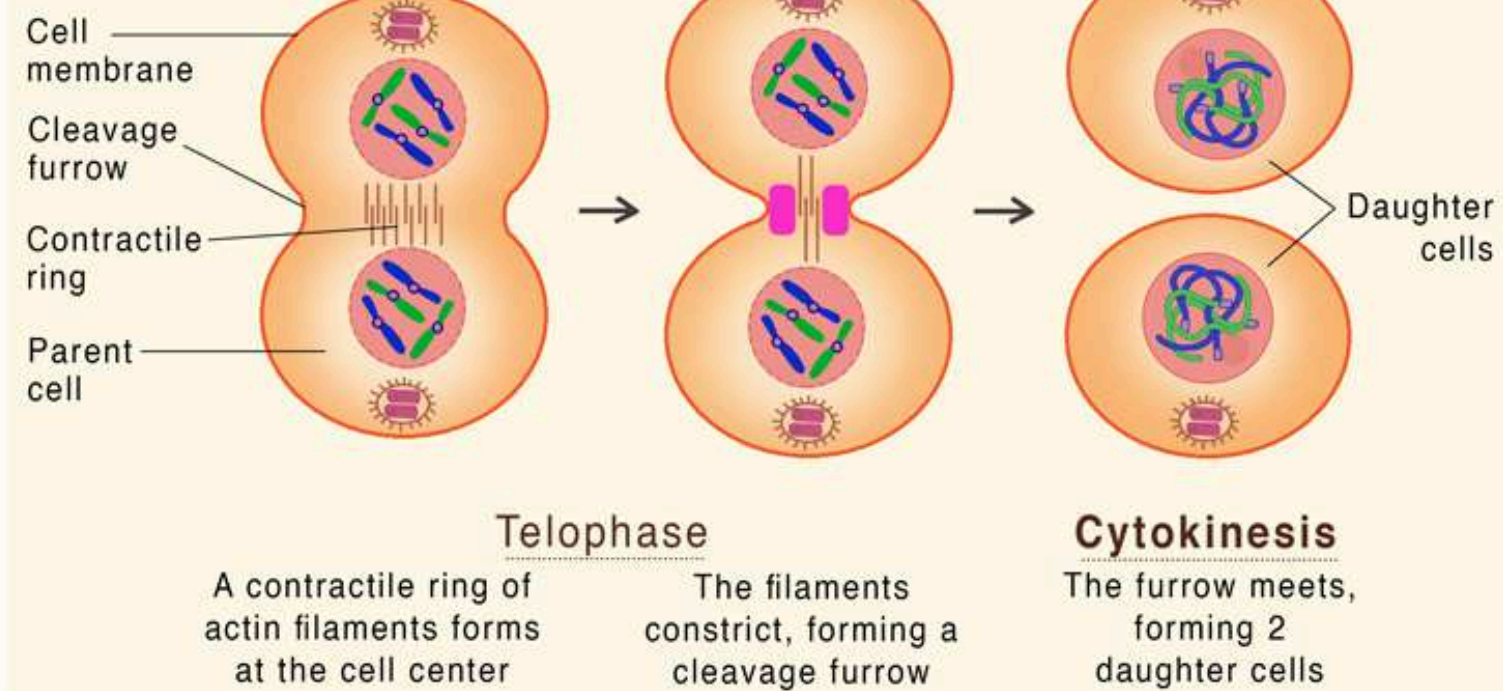




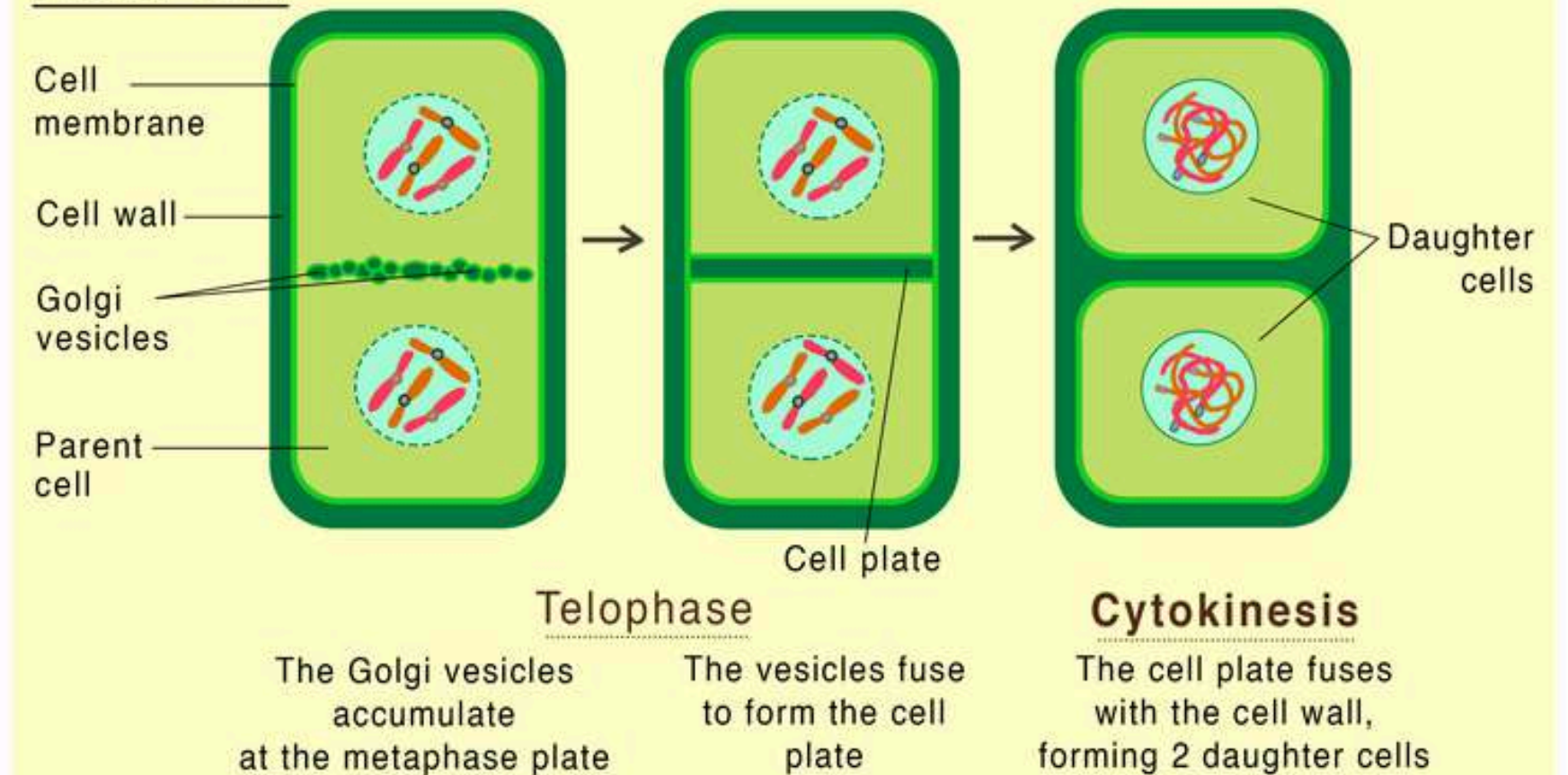
Cytokinesis

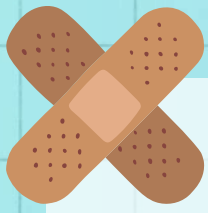
Cytokinesis

Animal cell



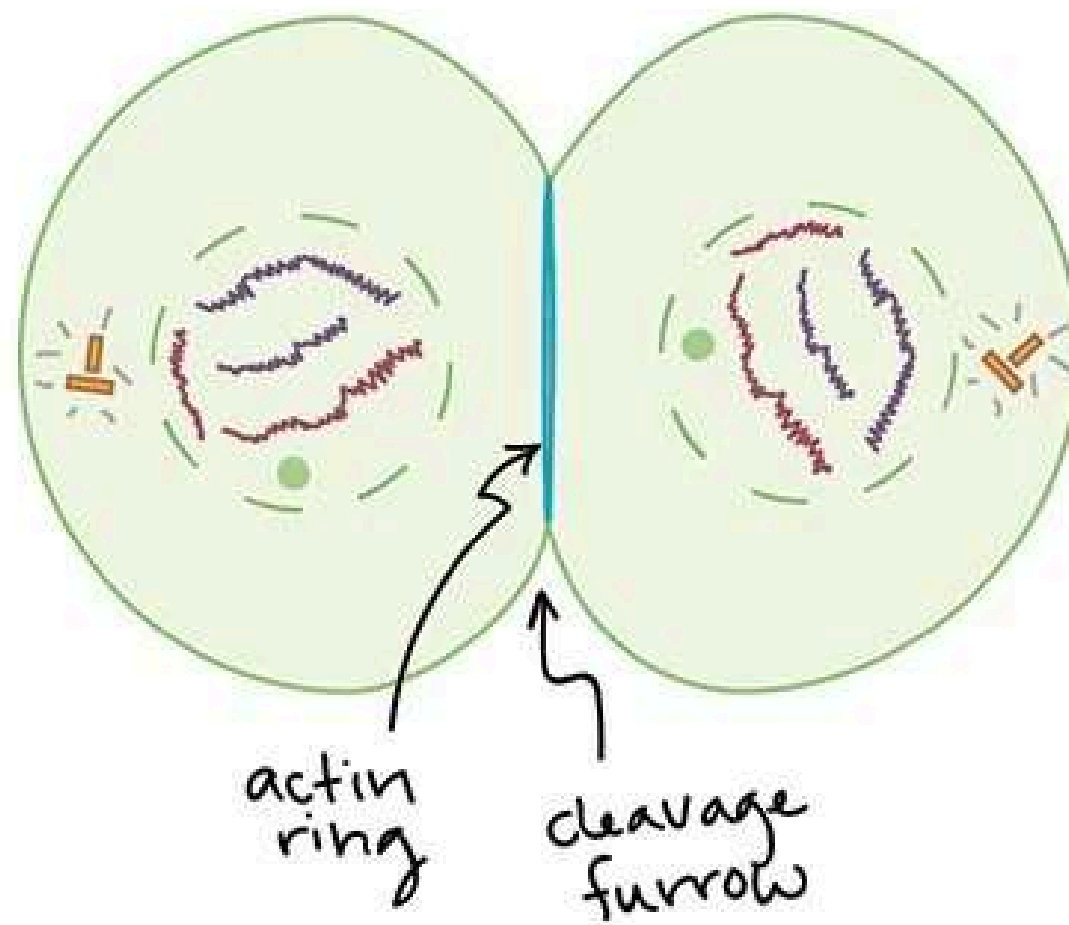
Plant cell





Cytokinesis

Cytokinesis in animal cells



Cytokinesis in plant cells

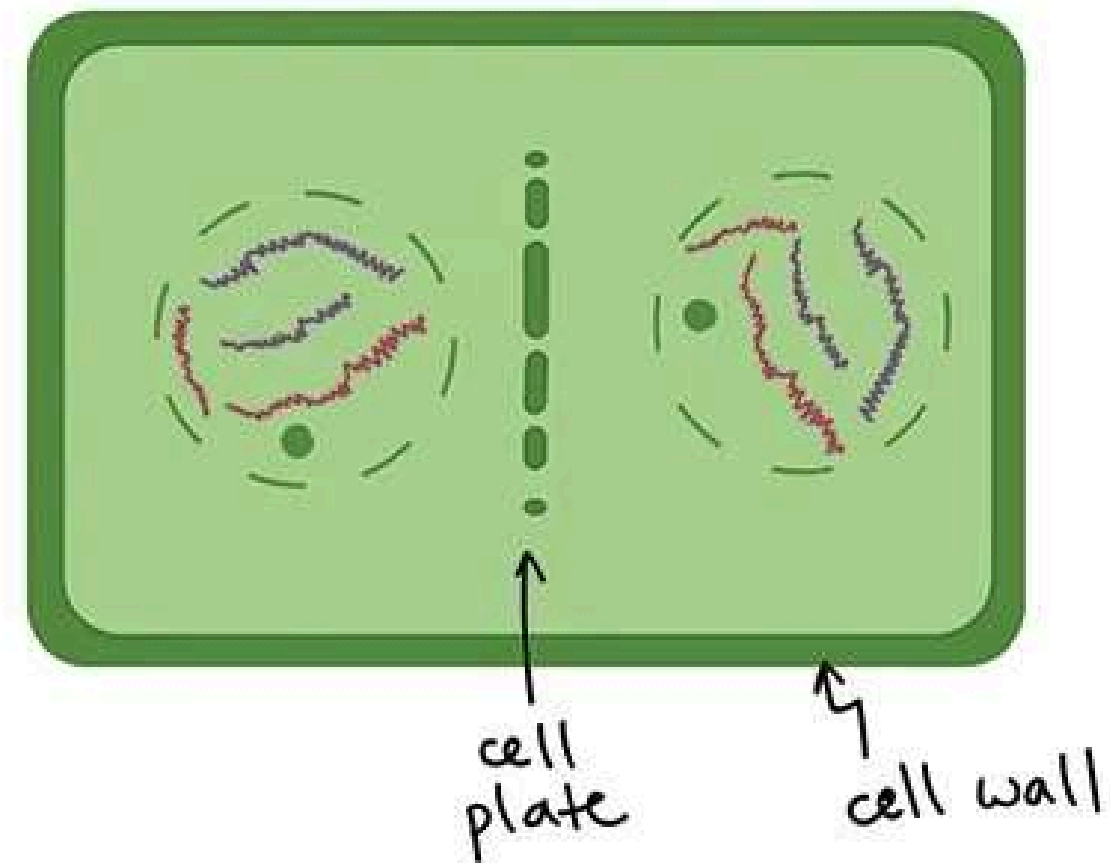


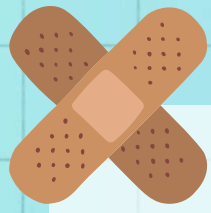
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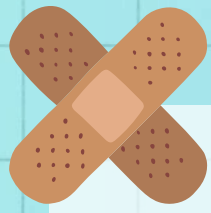
04 • Regulation of the Cell Cycle



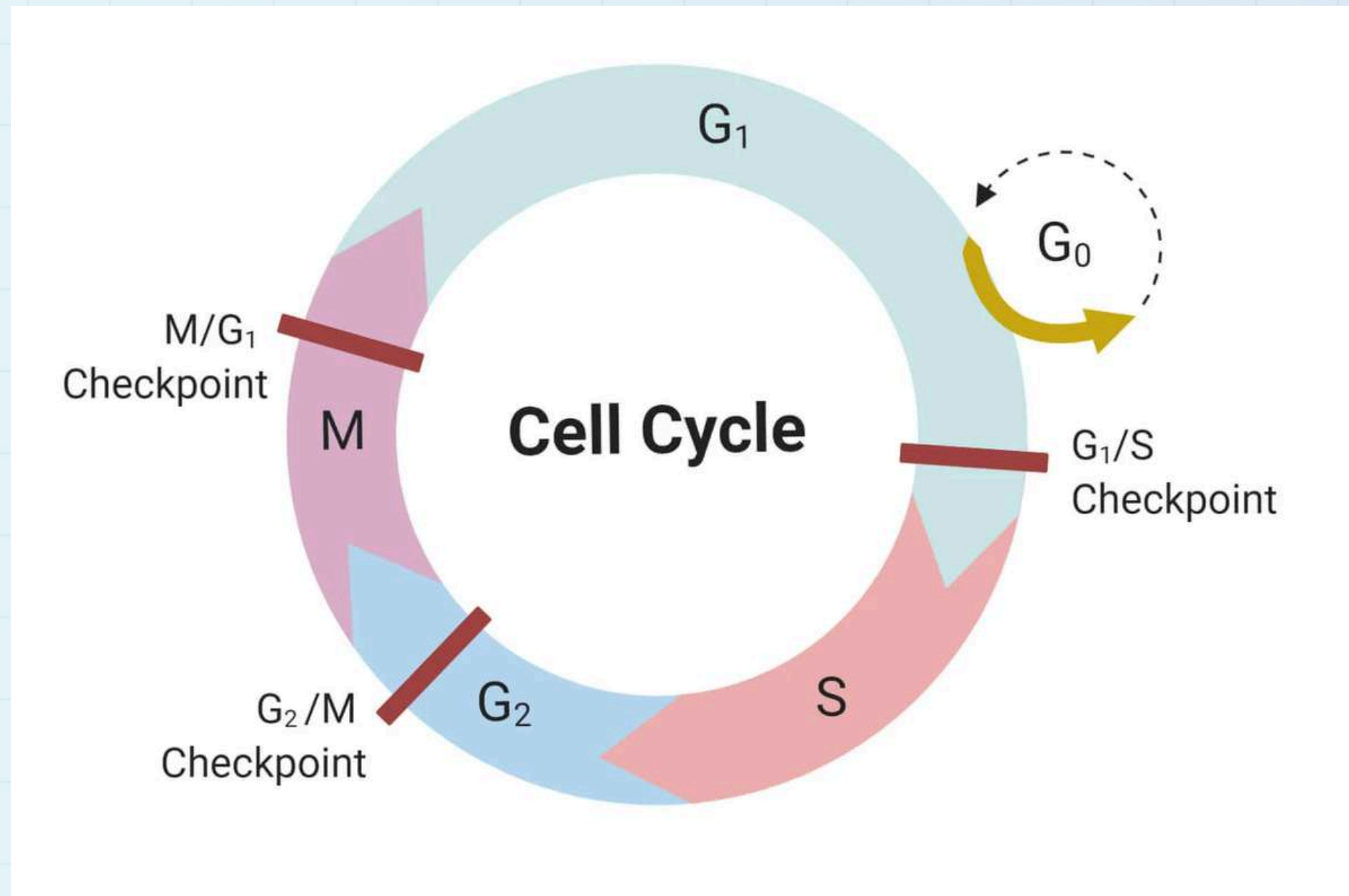
REGULATION OF THE CELL CYCLE

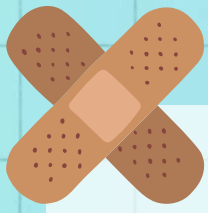
- The cell cycle is a carefully controlled process.
- It ensures proper cell growth and division.
- Checkpoints monitor the cell cycle at specific stages.
 - Verify DNA integrity.
 - Ensure completion of essential processes.
- Regulatory proteins control the cell cycle.
 - Cyclins and cyclin-dependent kinases (CDKs) are key examples.
 - Coordinate transitions between cell cycle phases.



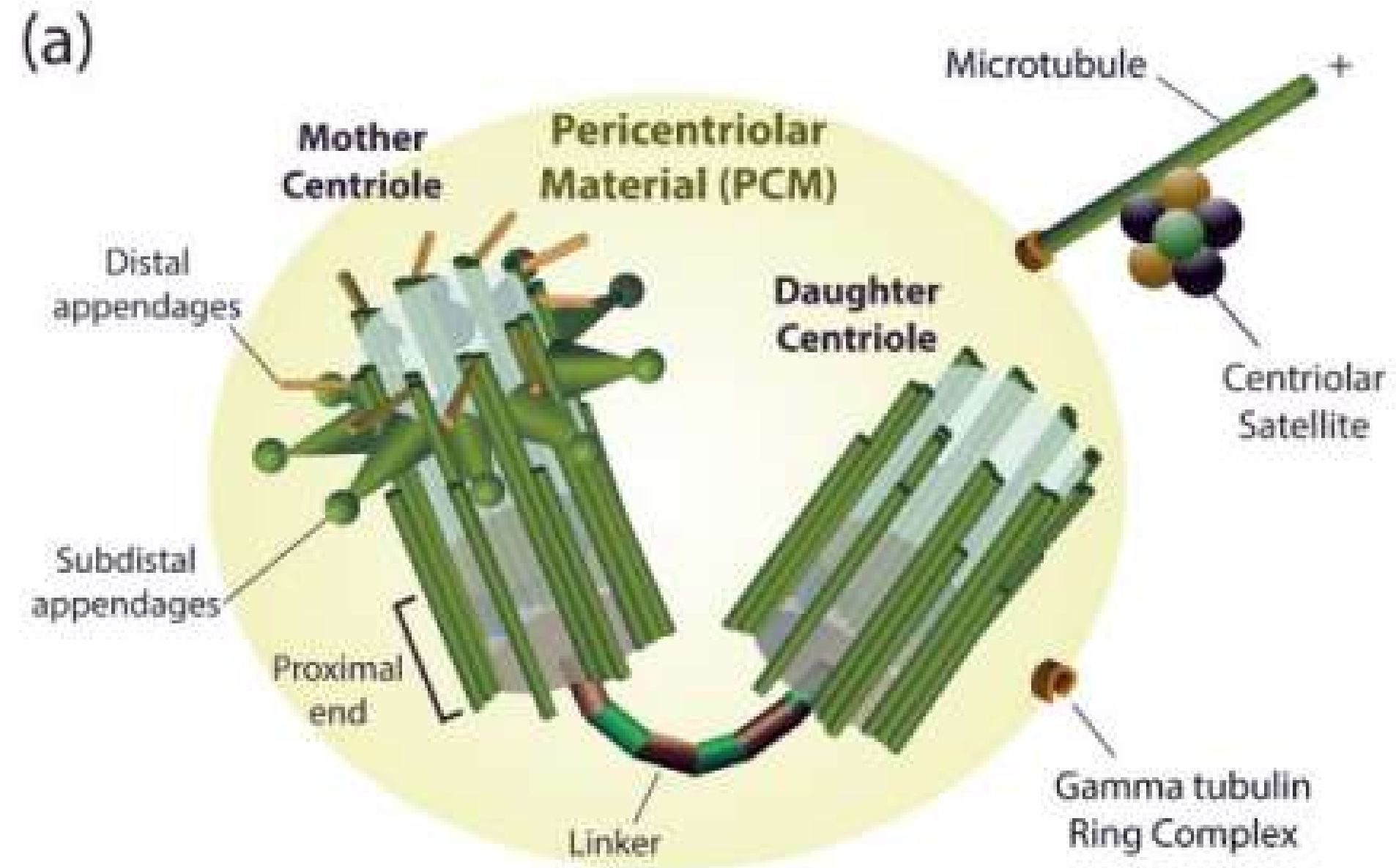


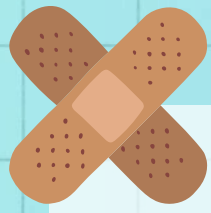
REGULATION OF THE CELL CYCLE





MTOC



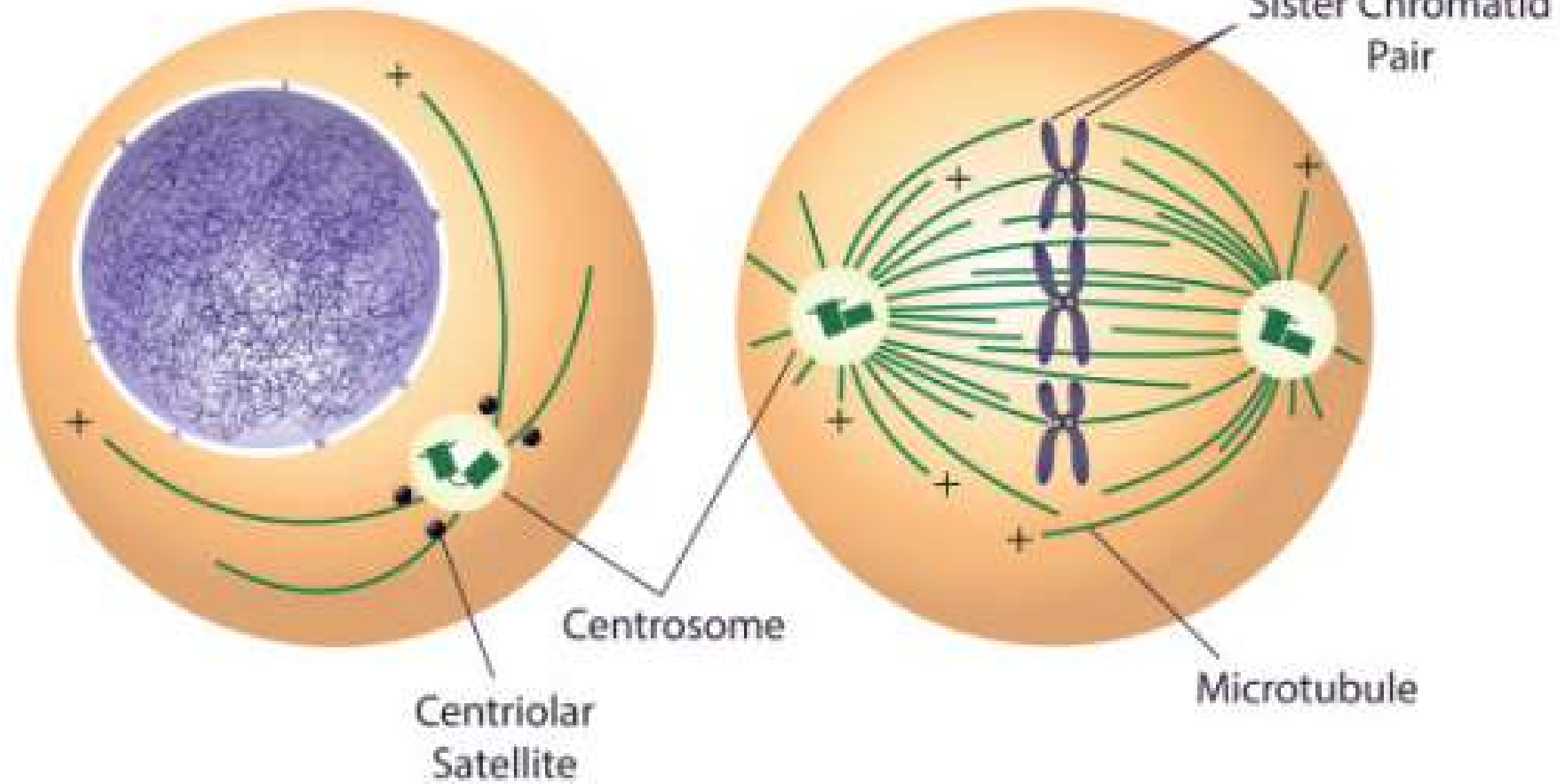


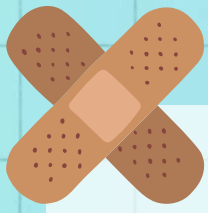
MTOC

(b)

Interphase

Mitosis

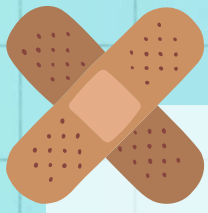




Why is this important?

- Proper regulation of the cell cycle is crucial for maintaining normal cell function.
- Dysregulation of the cell cycle can lead to uncontrolled cell growth and division.
- Uncontrolled cell growth and division can result in conditions such as cancer.
- Understanding the intricacies of the cell cycle is essential for developing targeted therapies.
- Targeted therapies and treatments can help address various diseases related to cell cycle dysregulation.





Summary

The Cell Cycle

Interphase

The cell grows and copies its DNA

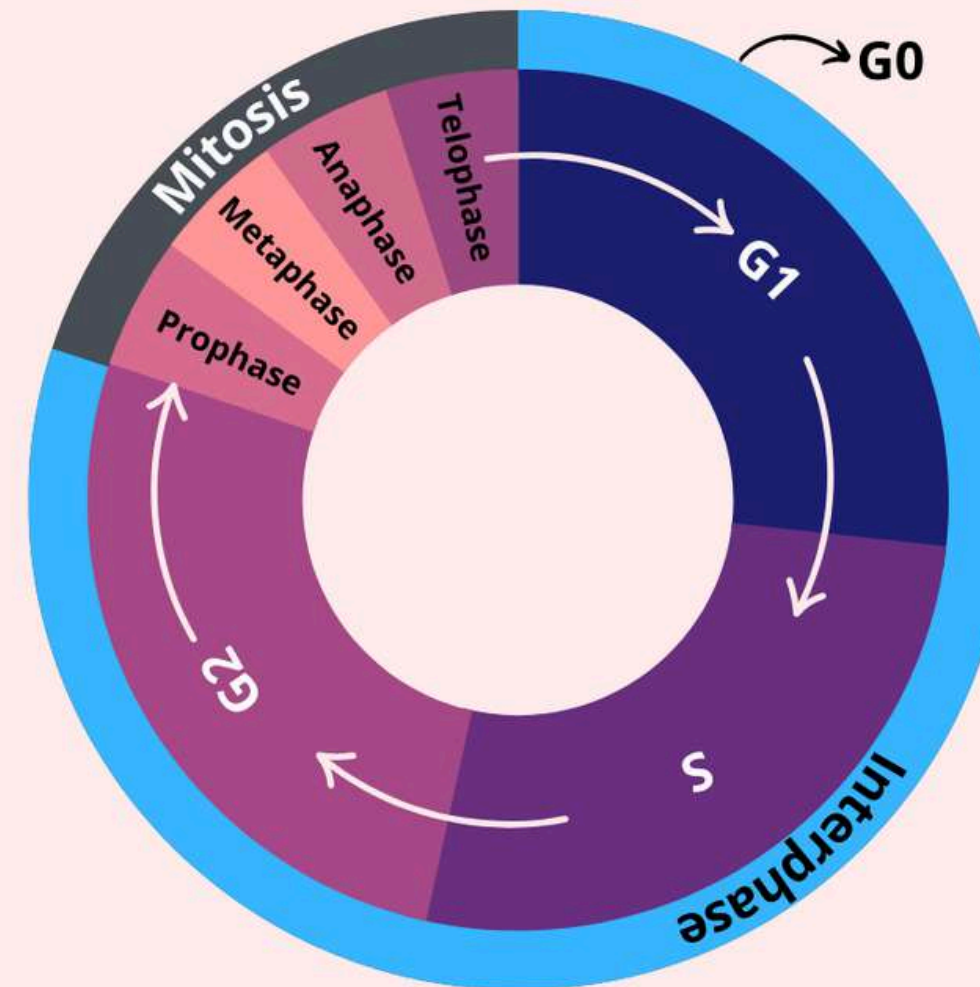
- **G₁**: Cell growth
- **S**: DNA synthesis
- **G₂**: More growth, preparation for mitosis

Mitosis

The cell divides its DNA and cytoplasm, forming two new cells

- **Prophase**
- **Metaphase**
- **Anaphase**
- **Telophase**

G₀: Resting state where the cell performs its functions and is not preparing to divide



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ANY QUESTIONS?

MESSAGE ON WHATSAP

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