

Mitosis: The Process of Cell Division

Mitosis is a fundamental process in biology, responsible for the growth, repair, and reproduction of all somatic cells in eukaryotic organisms.



by Besir Zeneli

Main animation:

https://www.youtube.com/watch?v=5bq1To_RKEo

Alternative animation:

<https://www.youtube.com/watch?v=NwwcWqL5hhI>

The Cell Cycle Overview

Interphase

The cell spends most of its time in interphase, consisting of three phases: G1, S, and G2.

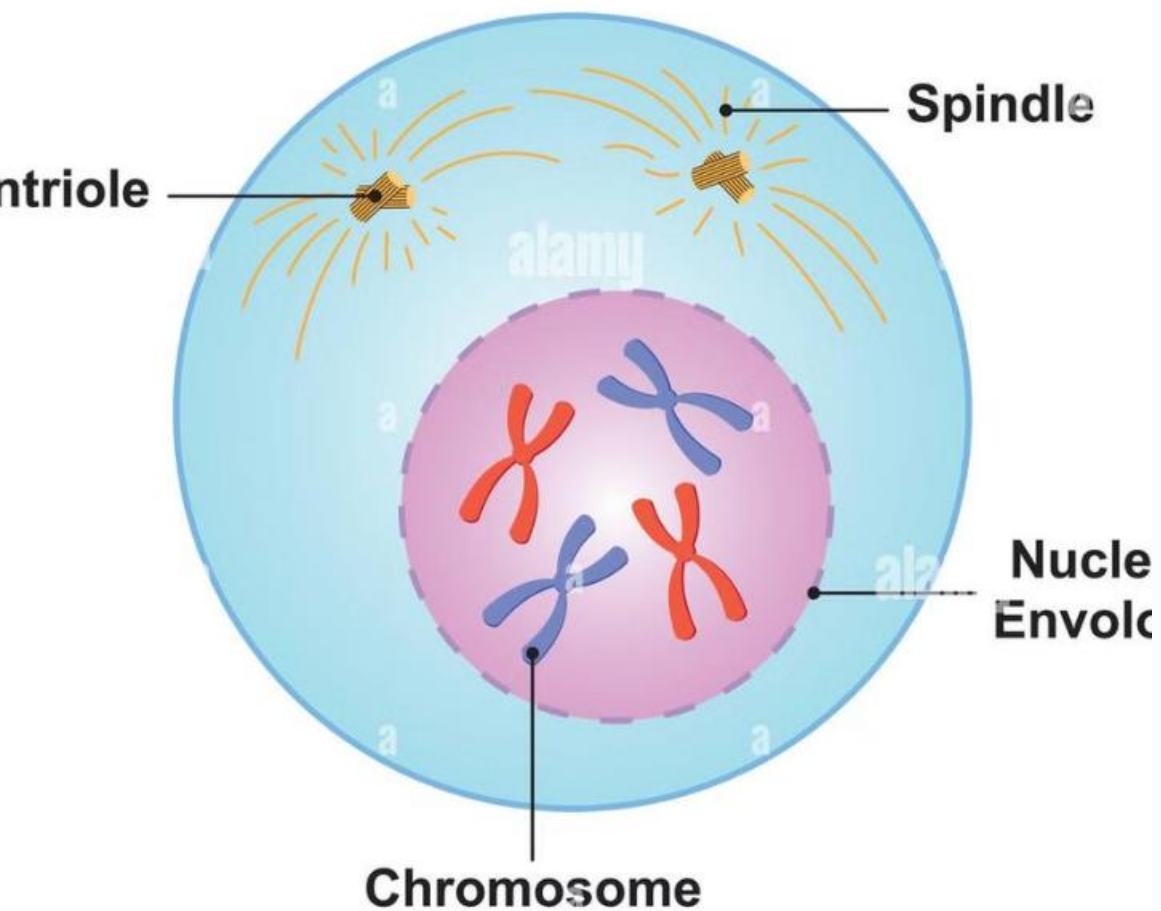
Mitotic Phase

The mitotic phase includes prophase, metaphase, anaphase, and telophase, during which the cell divides its genetic material.

Cytokinesis

Cytokinesis is the division of the cytoplasm, resulting in two distinct daughter cells.

Prophase



Prophase: The First Stage

1

Chromosomes Condense

Chromatin condense and become chromosomes.

2

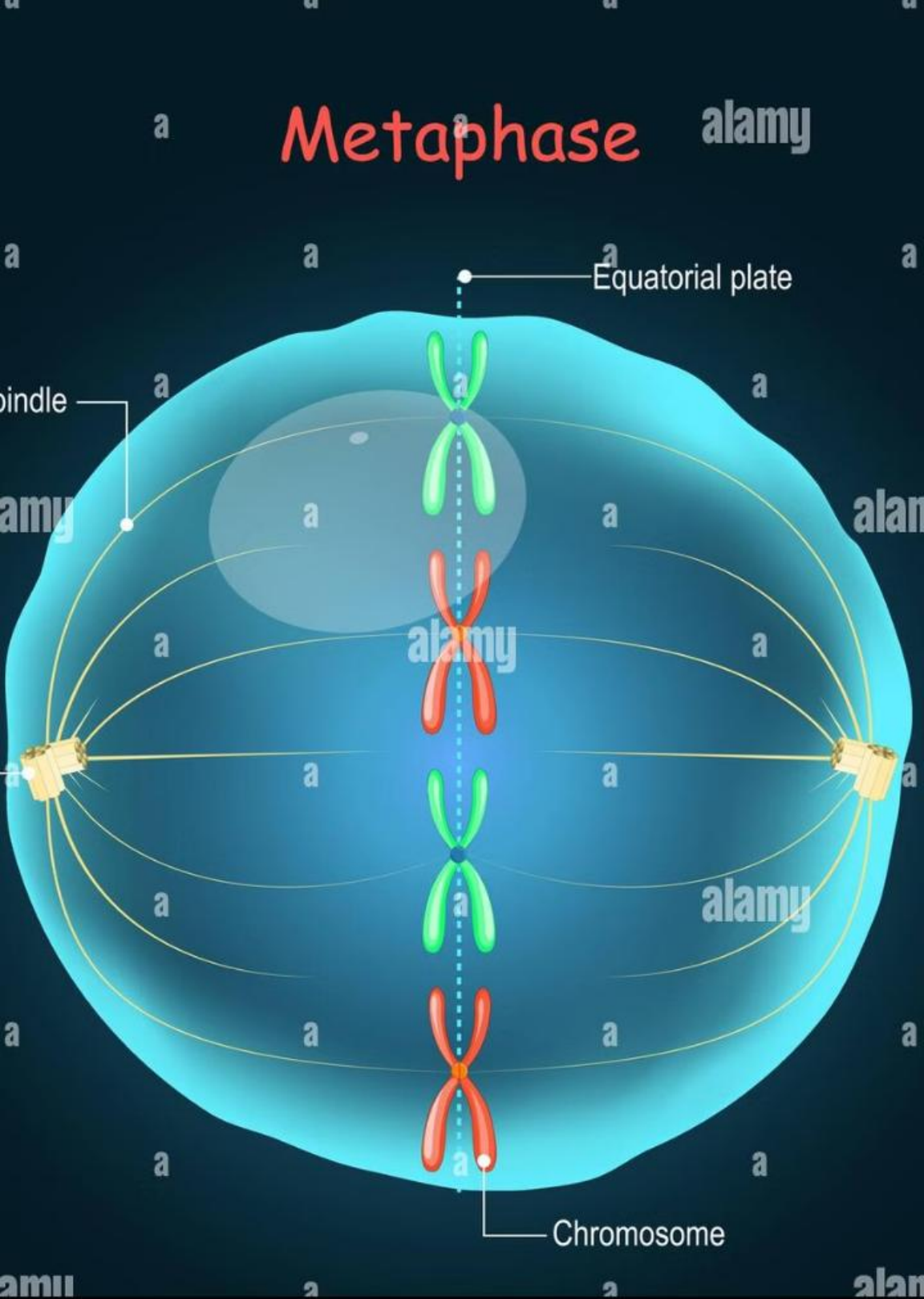
Nuclear Envelope Breakdown

The nuclear envelope disintegrates, allowing the spindle fibers to interact with the chromosomes.

3

Spindle Fibers Form

Centrioles form microtubules, which then assemble into spindle fibers and later attach to the chromosomes.



Metaphase: Aligning the Chromosomes



Chromosomes Align

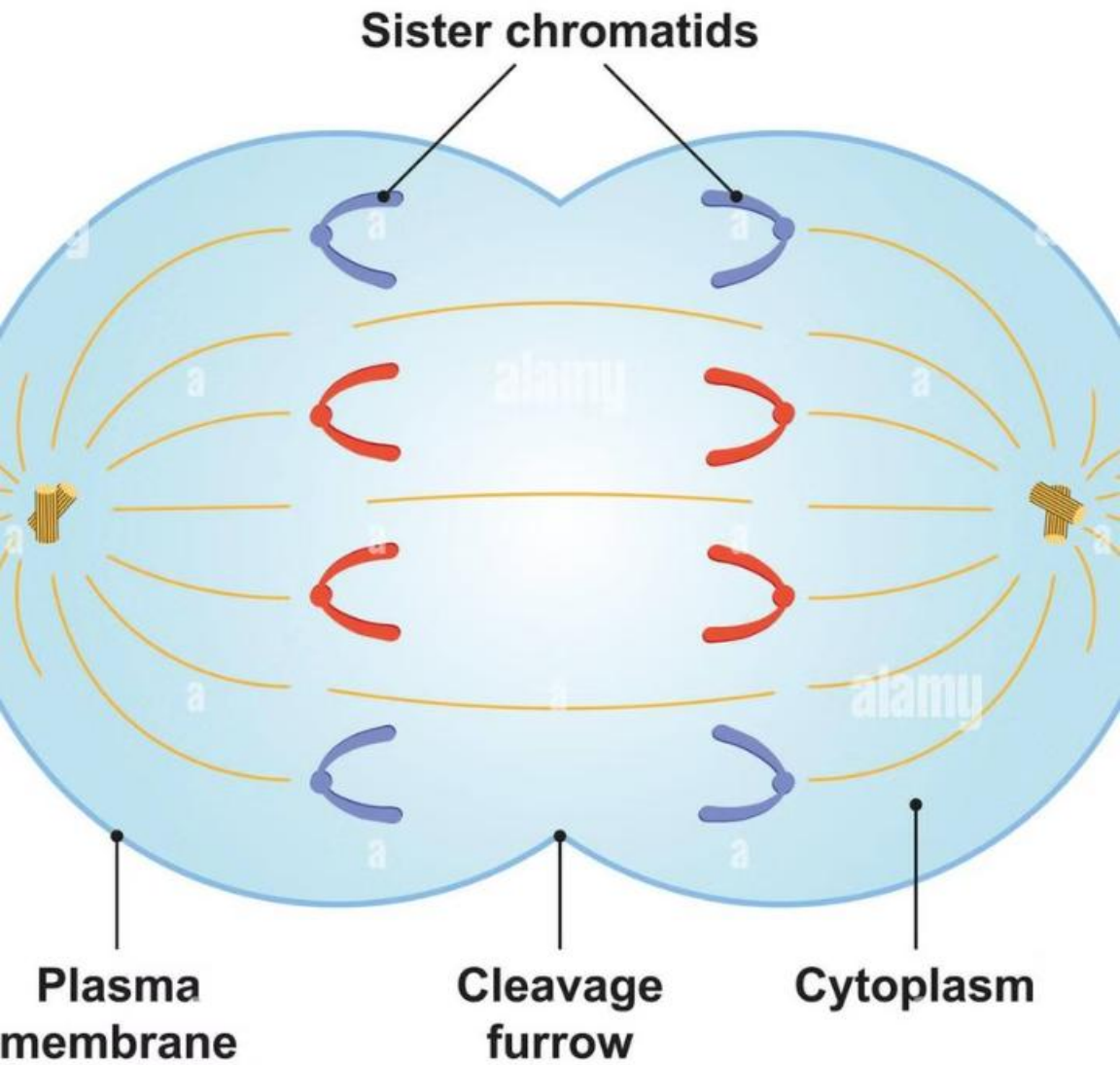
Chromosomes line up at the cell's equator, forming the metaphase plate (equatorial plate).



Spindle Fiber Attachment

Spindle fibers attach to the centromeres in chromosomes.

Anaphase



Anaphase: Separating Sister Chromatids

1

Sister Chromatids Separate

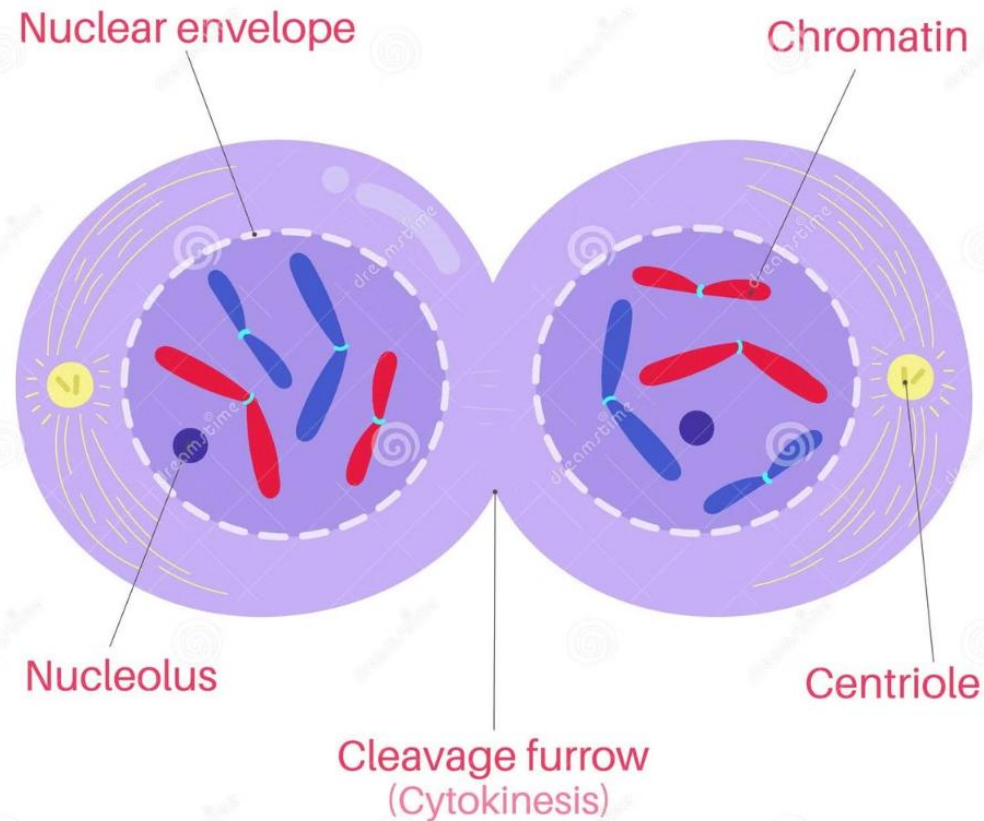
Sister chromatids, identical copies of each chromosome, are pulled apart by the spindle fibers.

2

Chromatids Migrate

Chromatids move to opposite poles of the cell, ensuring equal distribution of genetic material.

TELOPHASE



dreamstime.com

ID 262389234 © Achilichii

Telophase: Reforming Nuclear Structures

Chromosomes Decondense

Chromosomes uncoil and become less visible (becomes chromatin).

Nuclear Envelope Reforms

Nuclear envelopes form around each set of chromosomes, creating two distinct nuclei.

Nucleolus Reappear

Nucleolus, the sites of ribosome synthesis, reappear within the newly formed nuclei.

Spindle Fibers Disappear

Spindle fibers break down, marking the end of mitosis.

Cytokinesis: Dividing the Cytoplasm

1

Animal Cells

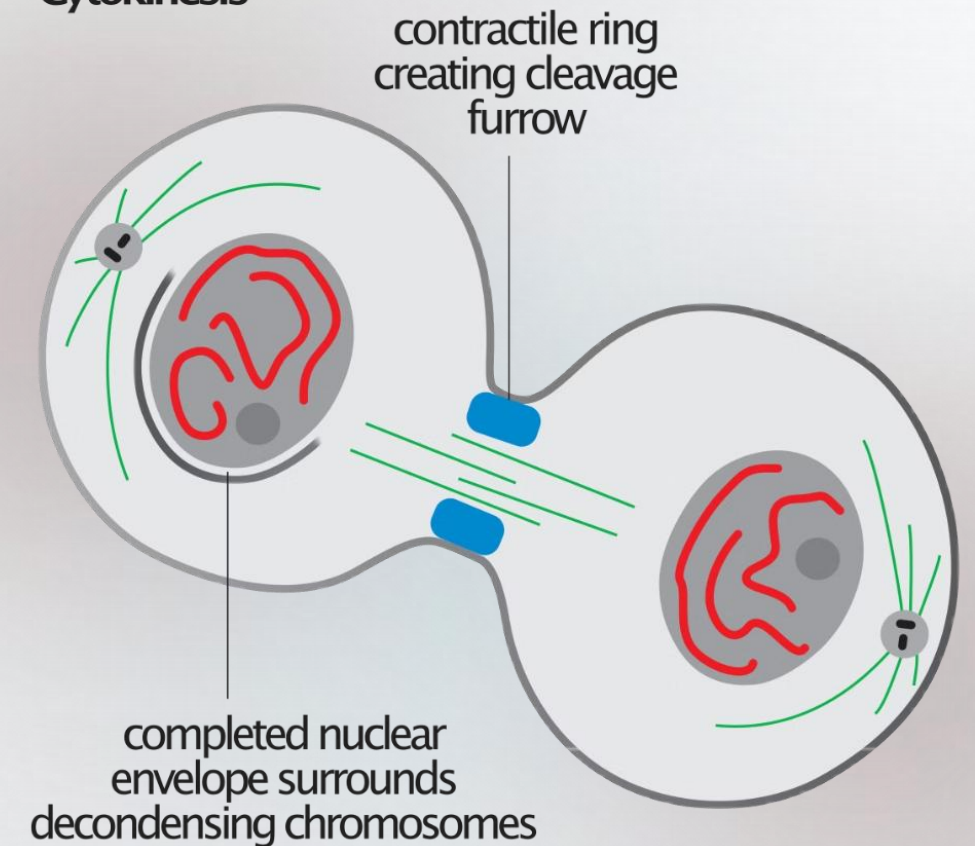
A cleavage furrow forms, pinching the cell membrane inward, eventually separating the cytoplasm.

2

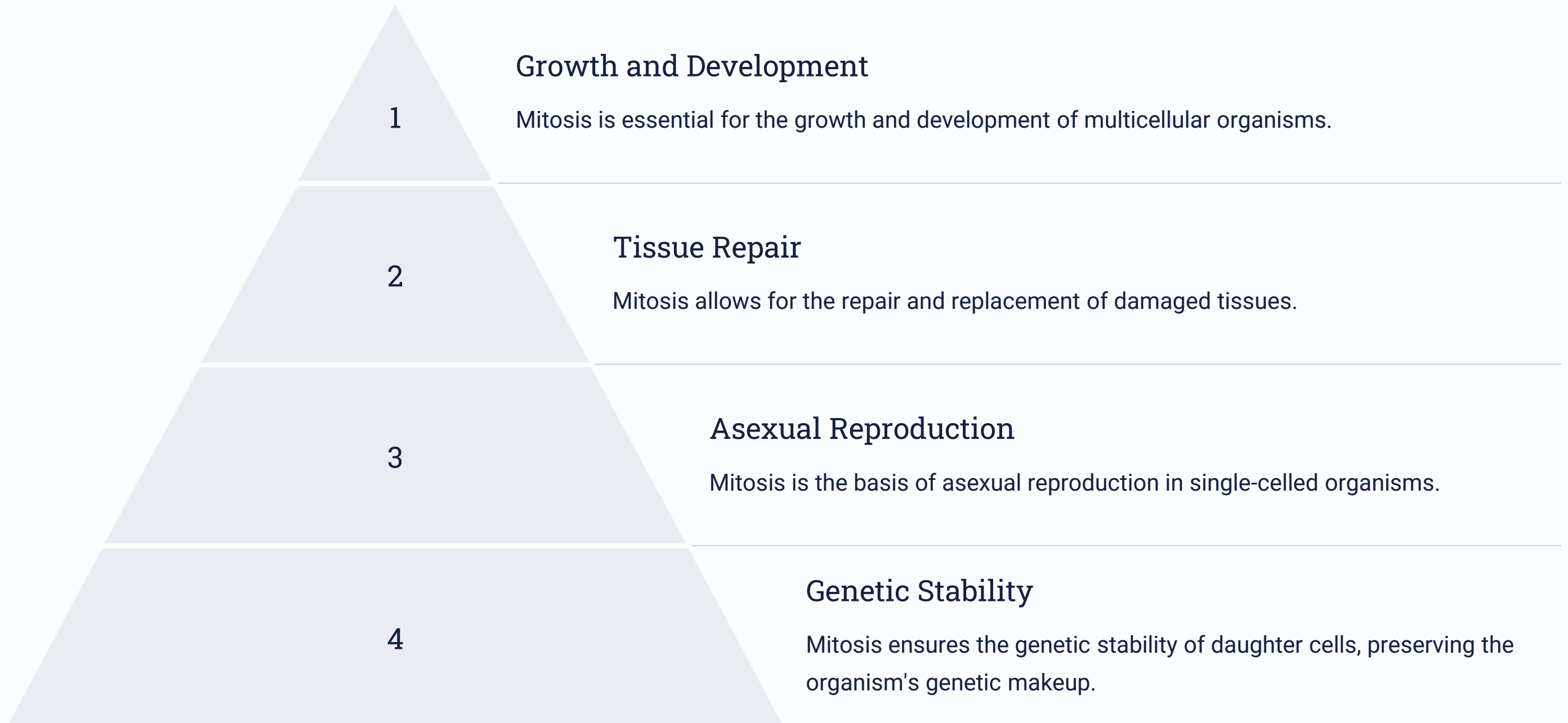
Plant Cells

A cell plate forms across the middle of the cell, eventually developing into a new cell wall, dividing the cytoplasm.

Cytokinesis



Importance of Mitosis

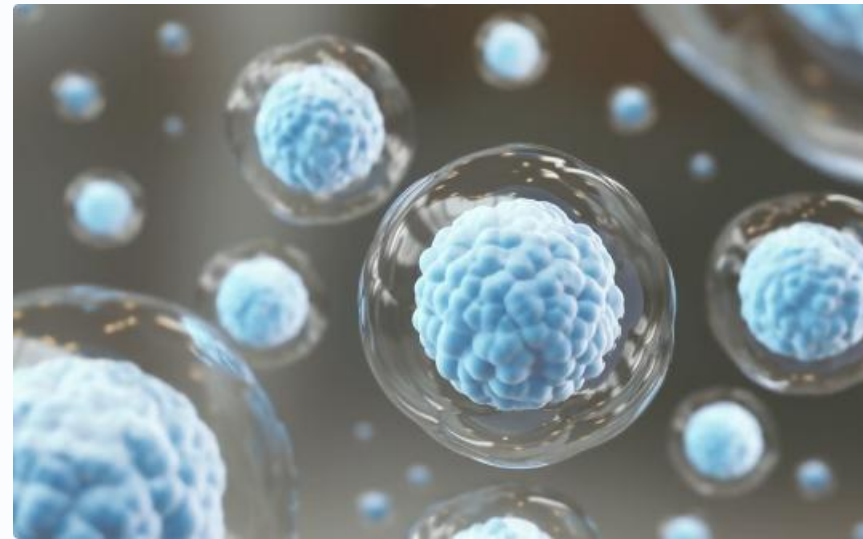


Mitosis in Action: Real-World Applications



Cancer Research

Understanding mitosis is crucial for developing treatments for cancer, a disease characterized by uncontrolled cell division.



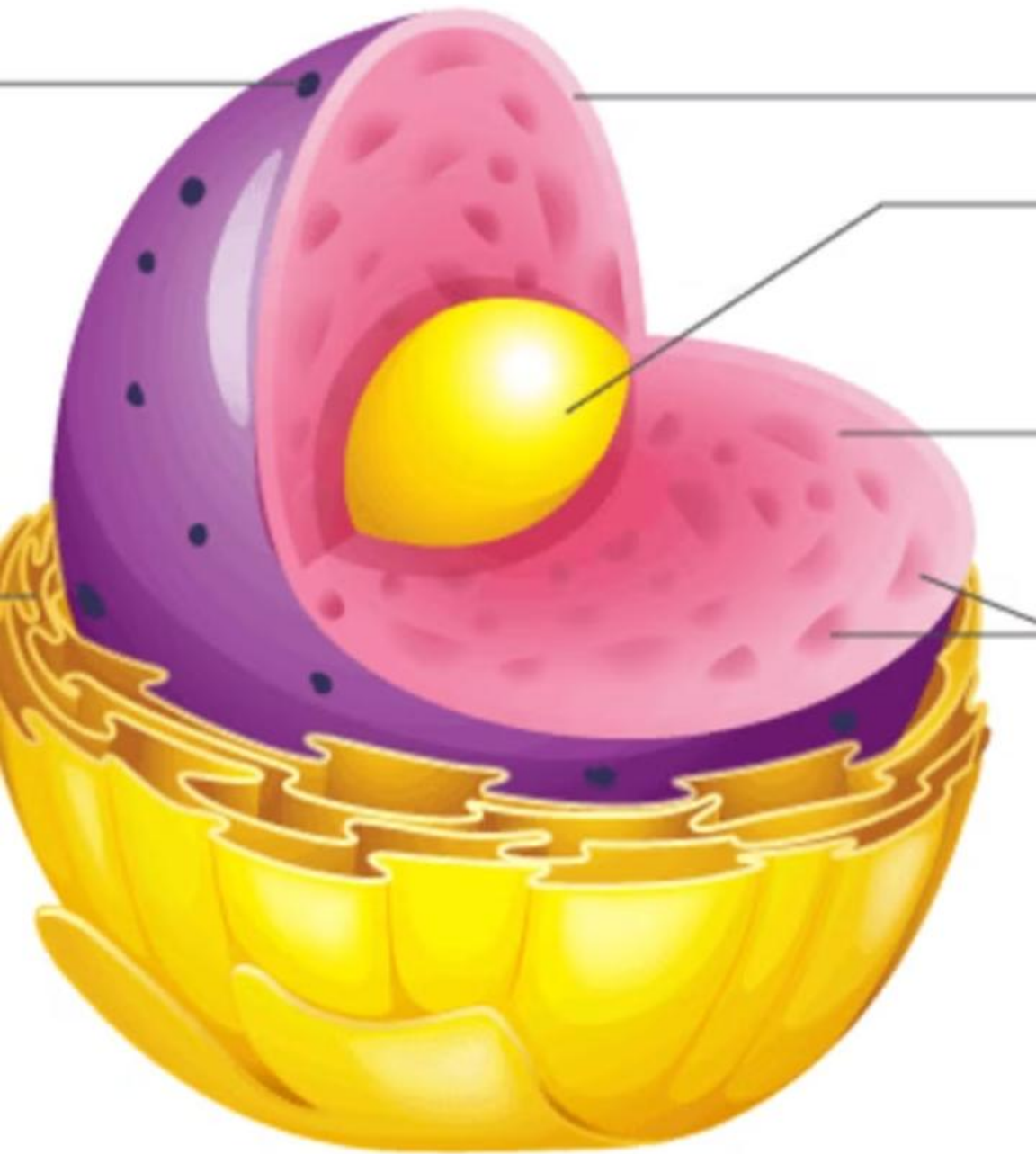
Stem Cell Therapy

Mitosis is exploited in stem cell therapy, where stem cells with the potential to differentiate into various cell types are used to regenerate tissues.



Agricultural Improvements

Mitosis is manipulated in agriculture to improve crop yields, enhancing food production.



Conclusion: The Marvels of Mitosis

Mitosis is a remarkable process that ensures the continuity of life. It's a testament to the intricate mechanisms that govern cellular function and the amazing complexity of living organisms.