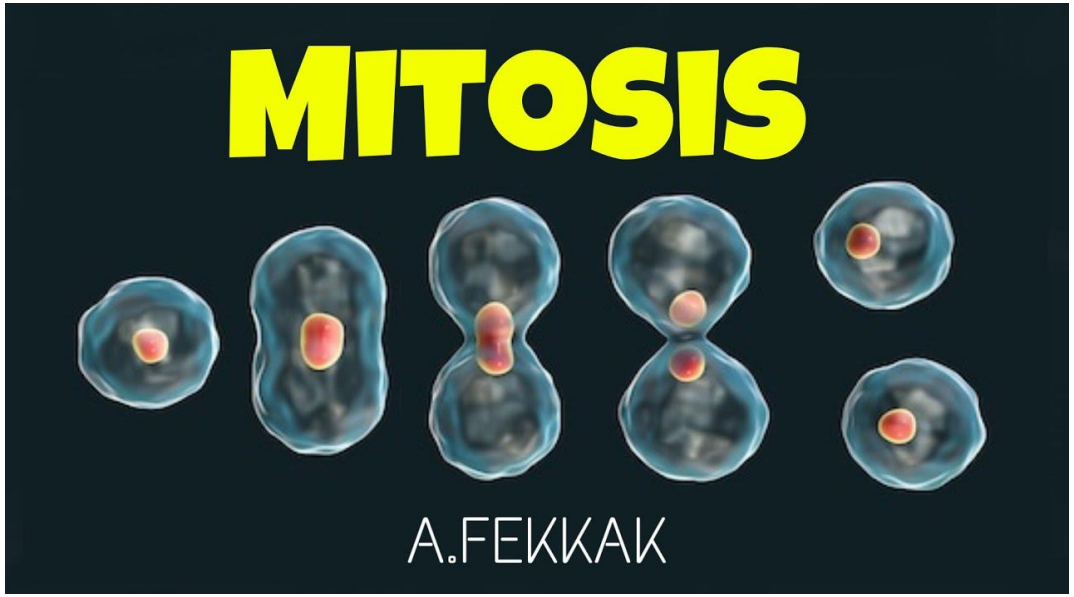
Mitotic Cell division



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Biology

First Semester

Week 5

Date 12/2/2024

Outline

- Cell division introduction
- Importance of cell division
- Types of cells according to cell division

Objectives

- Understanding the role of cell division
- Explaining the cell cycle
- Making difference between cell division and reproduction
- Explaining the stages of cellcycle

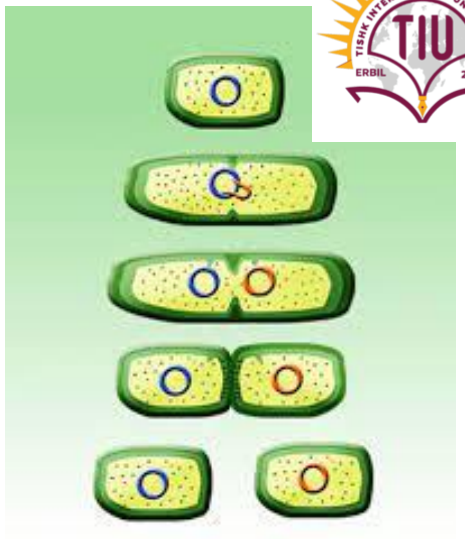
Cell Division

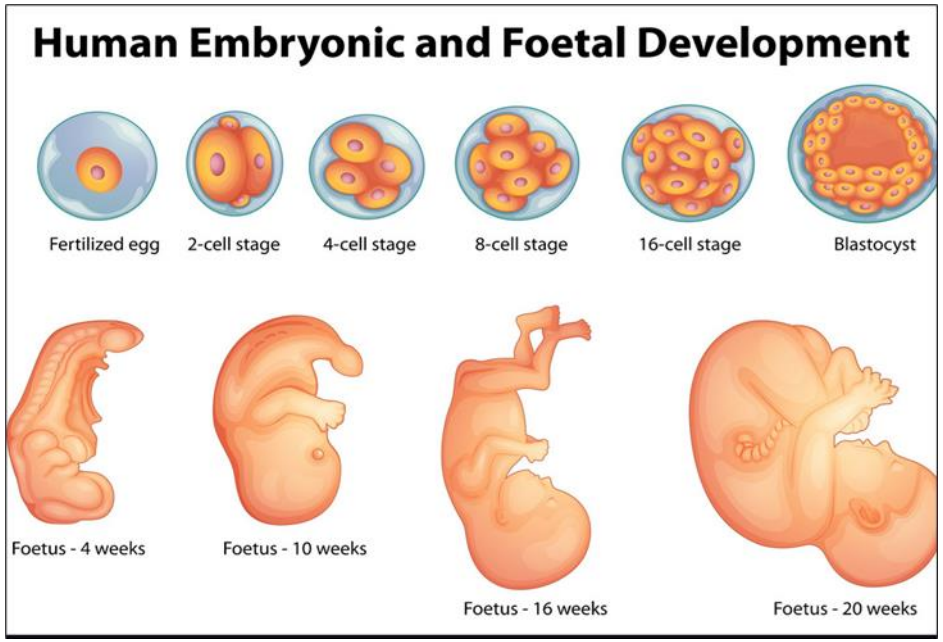
- **Cell division** is the process by which new cells are formed for growth, repair, and replacement in the body. This process includes division of the nuclear material and division of the cytoplasm

- **The continuity** of life is based on the reproduction of cells, or cell division

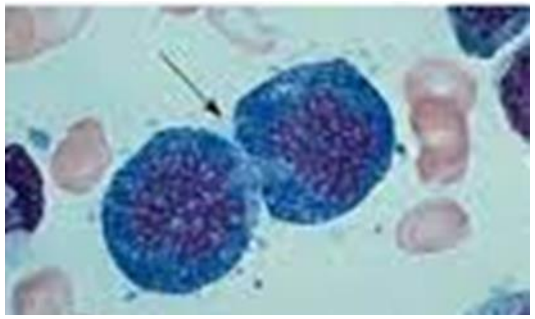
Cell division plays several important roles in life.

1. The division of one prokaryotic cell reproduces an entire organism. The same is true of a unicellular eukaryote
2. Cell division also enables multicellular eukaryotes to develop from a single cell, like the fertilized egg that gave rise to the two-celled embryo.





3. After an organism is fully grown, cell division continues to function in renewal and repair, replacing cells that die from normal wear and tear or accidents. For example, dividing cells in your bone marrow continuously make new blood cells



Function of cell division

- **Reproduction**
- **Growth and development**
- **Tissue renewal**

Q/ What is differences between Cell division and reproduction ?

Depending on division, cell divided into:-

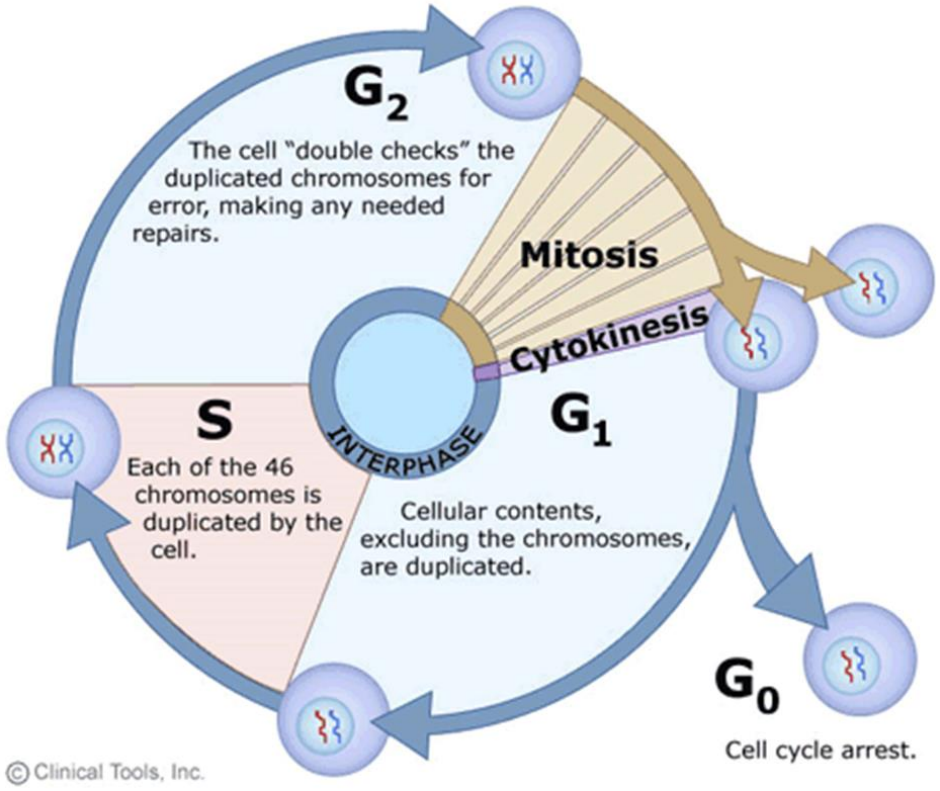
1. **Undifferentiated cell** (divided cell): ex…Bone marrow, Skin cell, embryonic cells).
2. **Semi-differentiated cells:**

   Cells lost their ability to divide but under certain condition return their ability to divide like Liver cell, Lymphatic cells.

3. **Differentiated cells:** This type of cell lost their ability for division, and they never divide like Nerve cells.

Cell cycle (the life of the cell)

- The cell division process is an integral part of the **cell cycle:** the life of a cell from the time it is first formed from a dividing parent cell until its own division into two daughter cells.
- There are two types of cell division **Mitosis** and **meiosis**.

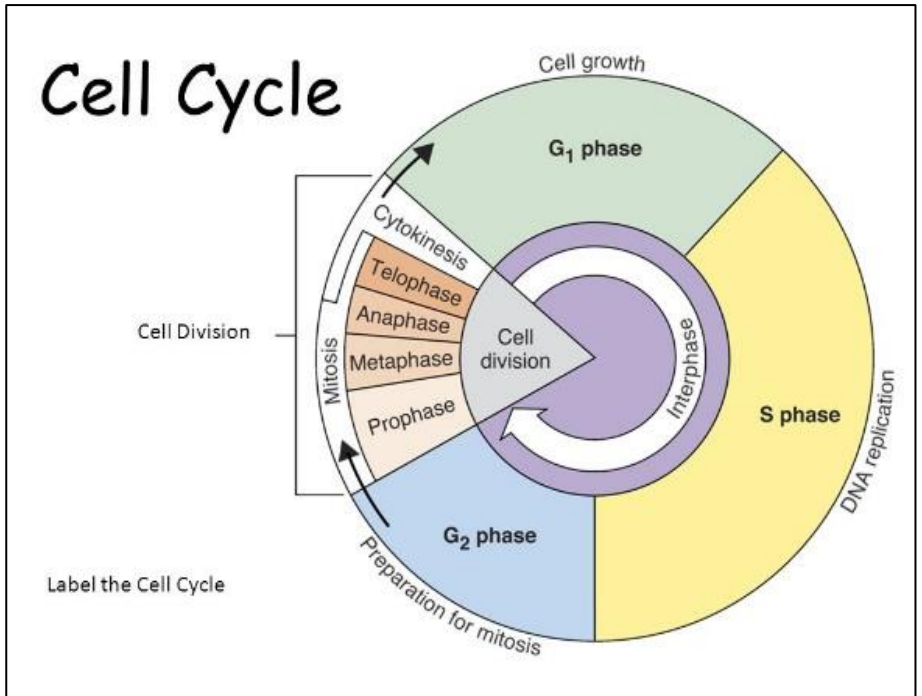


Phases of the Cell Cycle

The cell cycle consists of

1. **Interphase** – During interphase, a cell that is about to divide grows and copies its chromosomes in preparation for cell division
2. **The mitotic phase** – cell division **mitotic (M) phase**, which includes both **mitosis** and **cytokinesis**, is usually the shortest part of the cell cycle

In fact, the mitotic (M) phase, is usually the shortest part of the cell cycle. Mitotic cell division alternates with a much longer stage called **interphase**, which often accounts for about 90% of the cycle

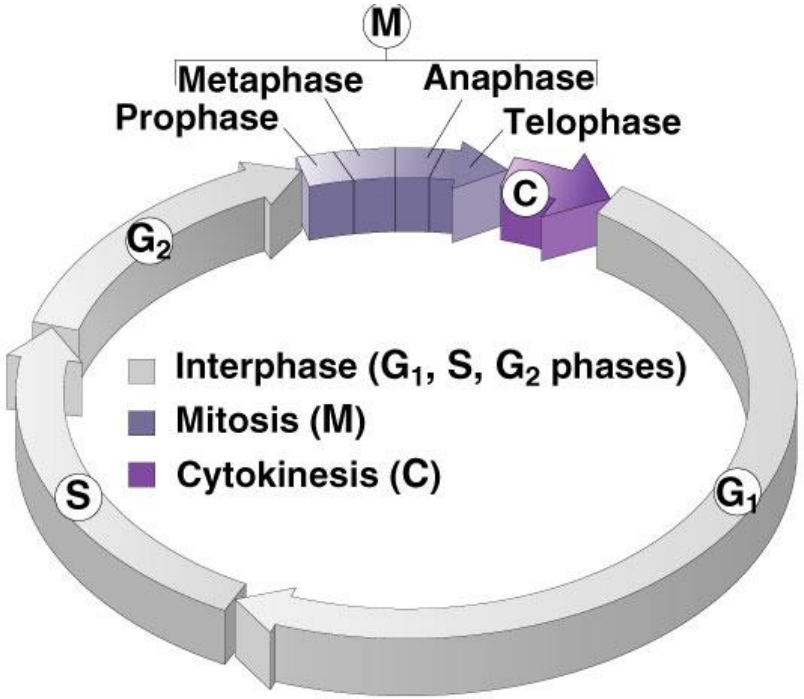


Phases of the Cell Cycle

Interphase, which often accounts for about 90% of the cycle.

During interphase, a cell that is about to divide grows and copies its chromosomes in preparation for cell division. Interphase can be divided into subphases:

- G1 - primary gap phase
- S – synthesis; DNA replicated
- G2 - secondary growth phase



2- Mitotic (M) phase

Mitosis in eukaryotic include

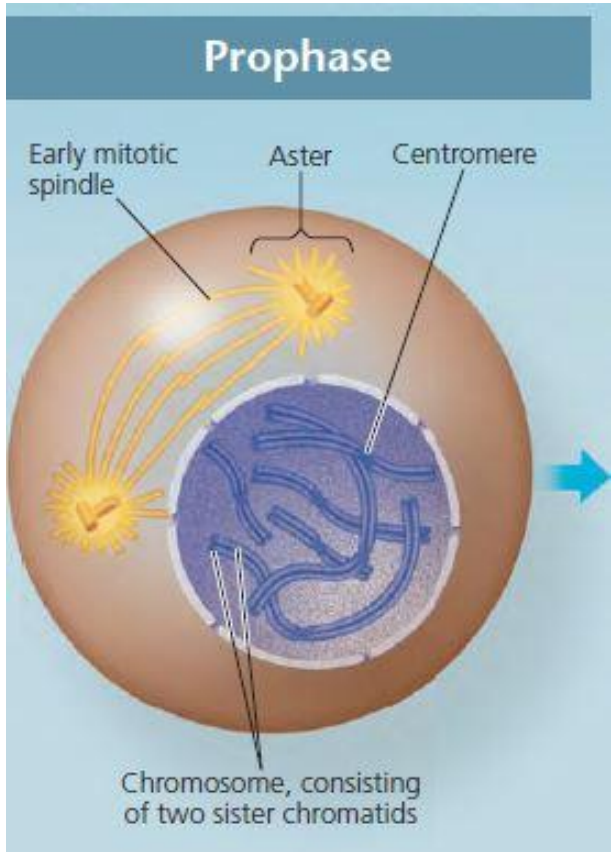
a) Division of the nucleus (karyokinesis)

- **a) Prophase**
- **b) Metaphase**
- **c) Anaphase**
- **d) Telophase**

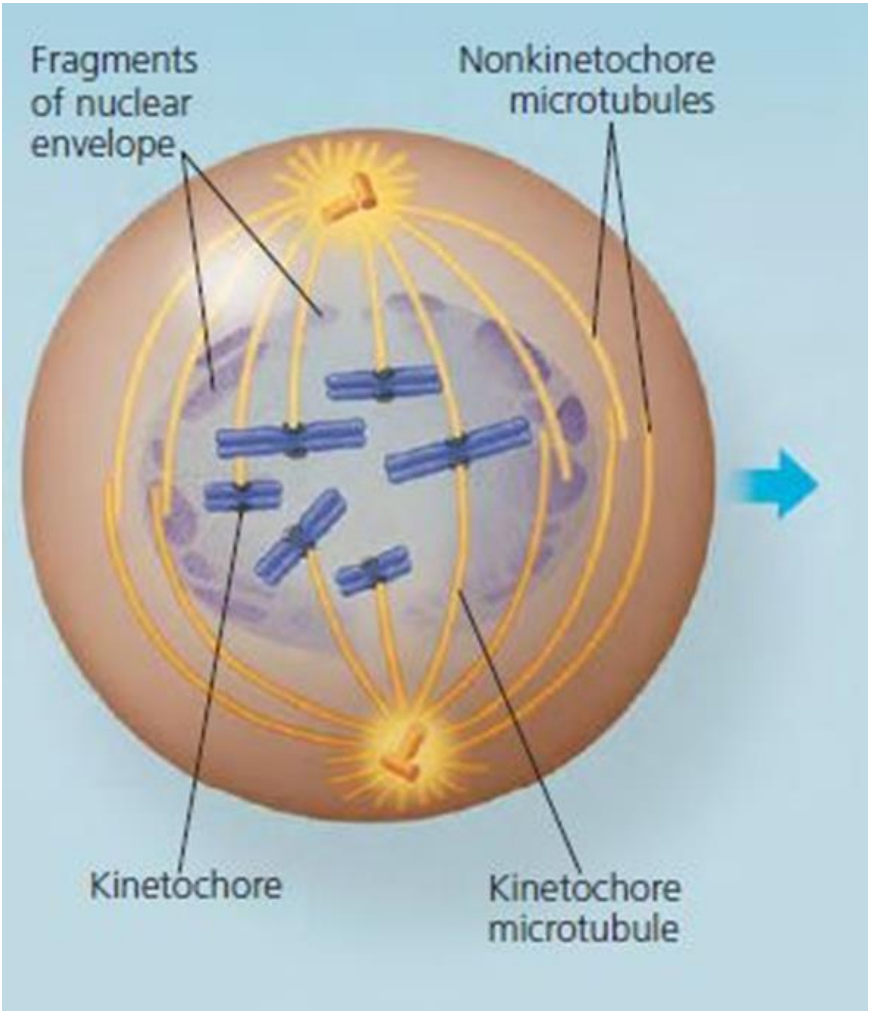
b) Division of cytoplasm (cytokinesis)

1. Prophase

- The chromatin fibers become more tightly coiled, condensing into discrete chromosomes
- Each duplicated chromosome appears as two identical sister chromatids joined at their centromeres
- Nuclear membrane & nucleoli are broken down
- The mitotic spindle (named for its shape) begins to form. It is composed of the centrosomes and the microtubules that extend from them
- The centrosomes move away from each other

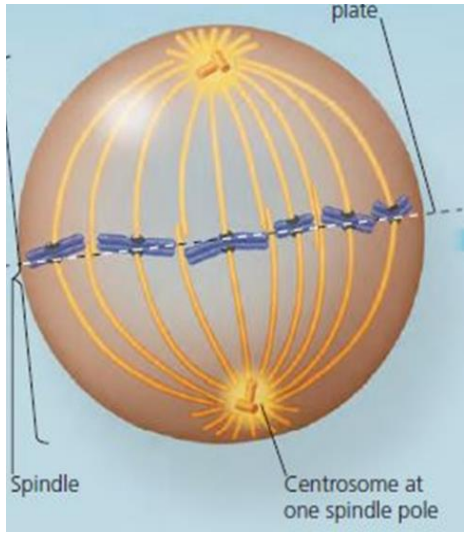


- The microtubules extending from each centrosome can now invade the nuclear area.
- The chromosomes have become even more condensed.
- Some of the microtubules attach to the kinetochores (specialized protein structure at the centromere), becoming “kinetochore microtubules,” which jerk the chromosomes back and forth



2. Metaphase

- The chromosomes lined up at the **metaphase plate**, an imaginary plane that is equidistant between the spindle's two poles..
- The centrosomes are now at opposite ends of the cell.



3. Anaphase

- Anaphase begins when the two sister chromatids of each pair suddenly part.
- The two liberated chromosomes begin moving toward opposite ends of the cell, Each chromatid thus becomes a full- fledged chromosome
- The cell elongates, by the end of anaphase, the two ends of the cell have equivalent—and complete—collections of chromosomes
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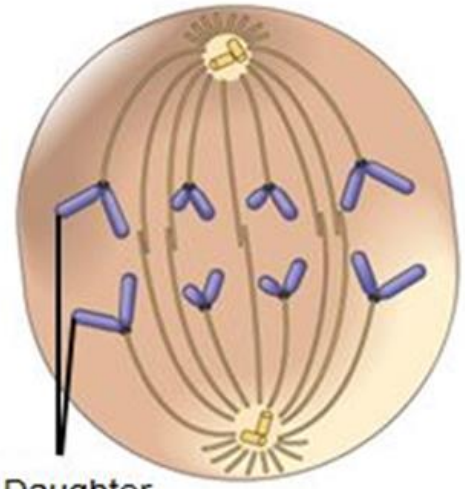
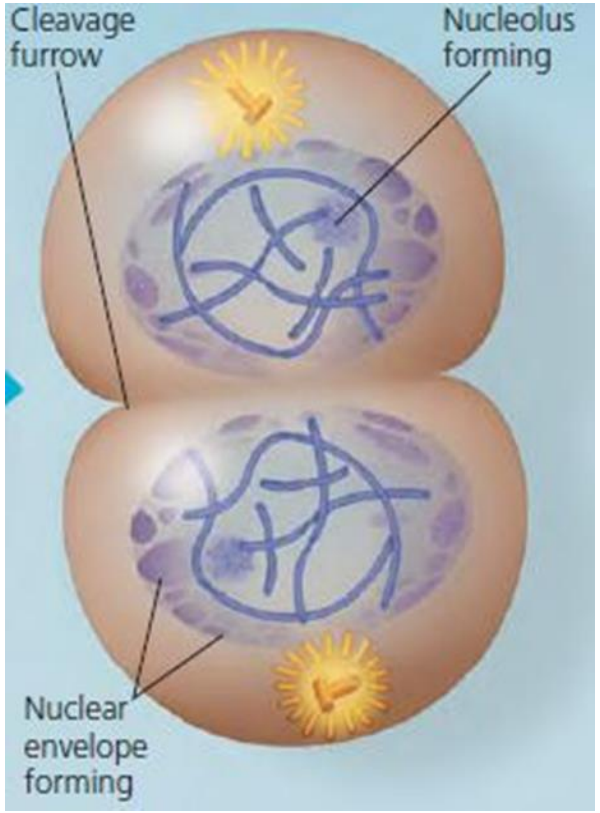


4. Telophase

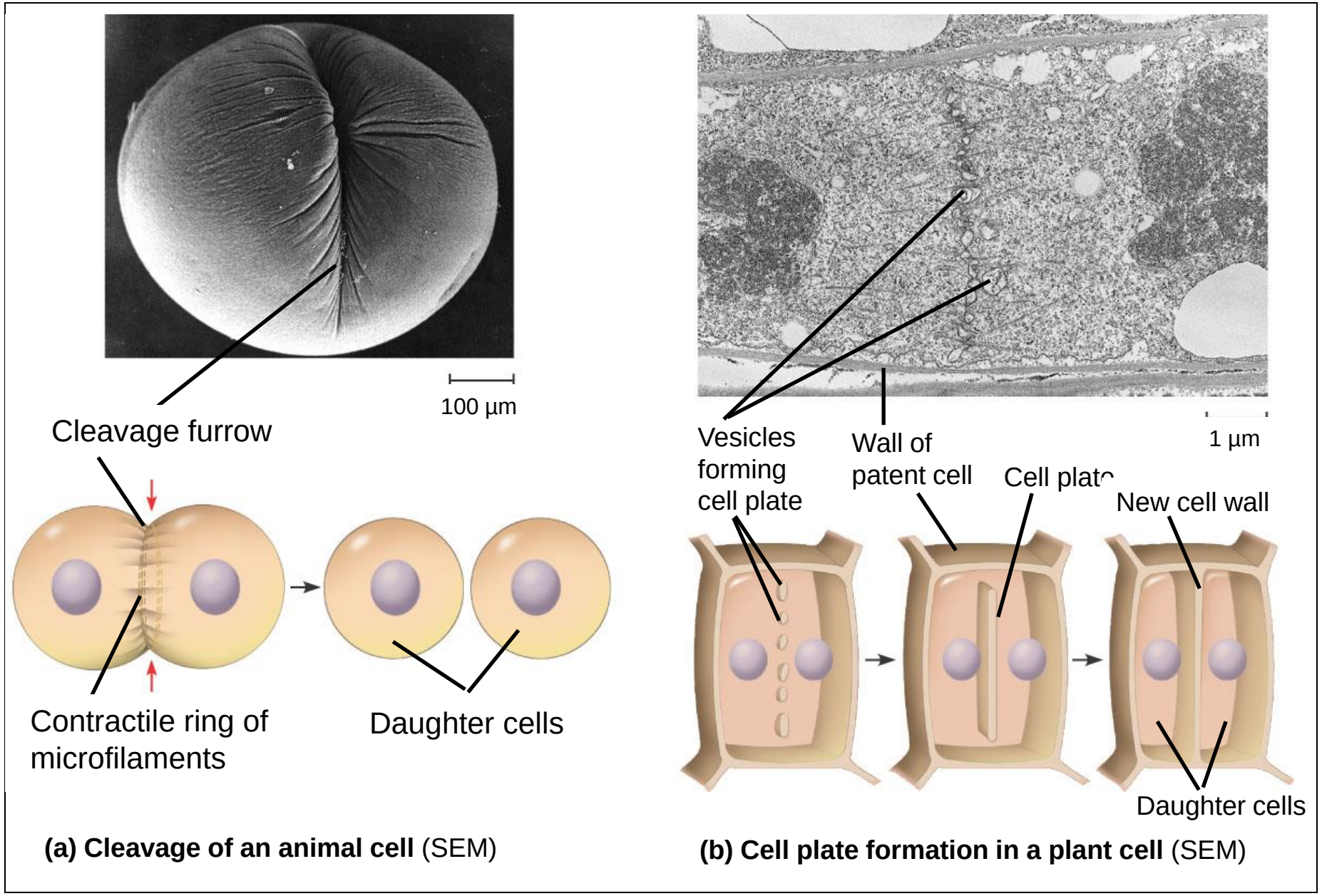
- The chromosomes are at opposite poles
- Spindle disassembles
- Nuclear envelope forms around each set of sister chromatids
- Nucleolus reappears
- CYTOKINESIS occurs
- Chromosomes are decondensed and are reappear as chromatin

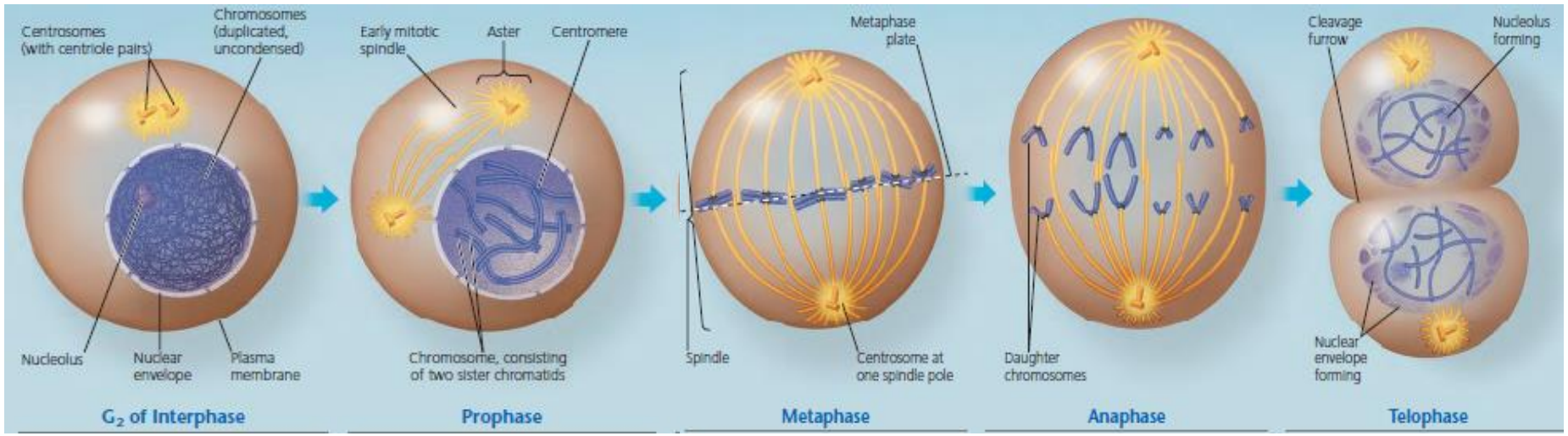


Cytokinesis

- Means division of the cytoplasm
- Division of cell into two, identical halves called daughter cells
- In plant cells, cell plate forms at the equator to divide cell
- In animal cells, cleavage furrow forms to split cell

Cytokinesis In Animal And Plant Cells




Centrosomes (with centriole pairs)
Chromosomes (duplicated, uncondensed)
Nucleolus
Nuclear envelope
Plasma membrane
G2 of Interphase
Early mitotic spindle
Aster
Centromere
Chromosome, consisting of two sister chromatids
Prophase
Metaphase plate
Spindle
Centrosome at one spindle pole
Metaphase
Daughter chromosomes
Anaphase
Cleavage furrow
Nucleolus forming
Nuclear envelope forming
Telophase

References

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