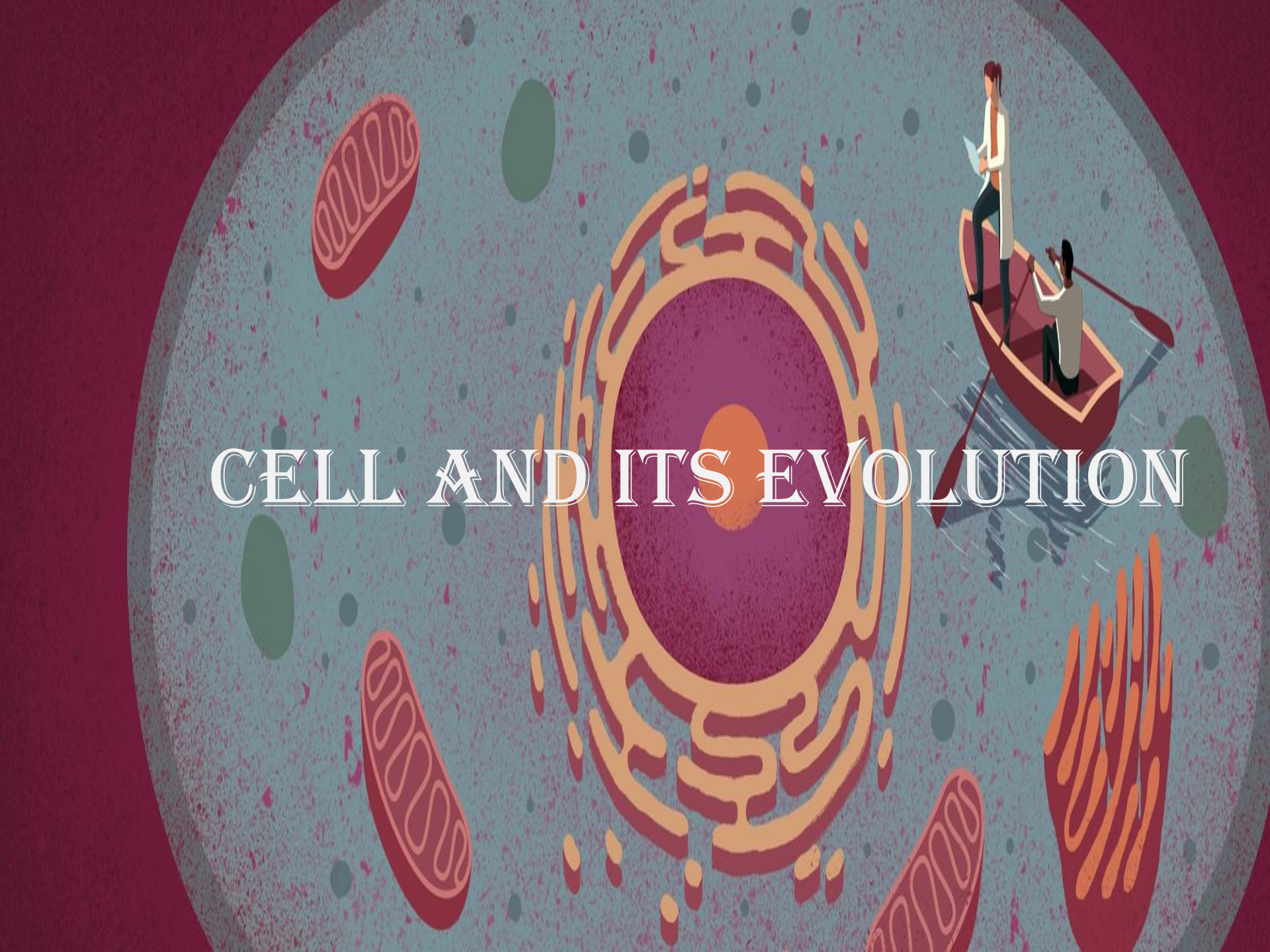
CELL AND ITS EVOLUTION

INTRODUCTORY BIOCHEMISTRY

Chapter: 3
Cell and Its Evolution
Lecture - 12

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The Cell Cycle

The process by which new cells arise from other living cells is called cell division.

Cell division does not stop with the formation of the mature organism but continues in certain tissues throughout life

Although cell division occurs in all organisms, it takes place very differently in prokaryotes and eukaryotes

Eukaryotic version.

Two distinct types of eukaryotic cell division

Mitosis - production of cells that are genetically identical to their parent

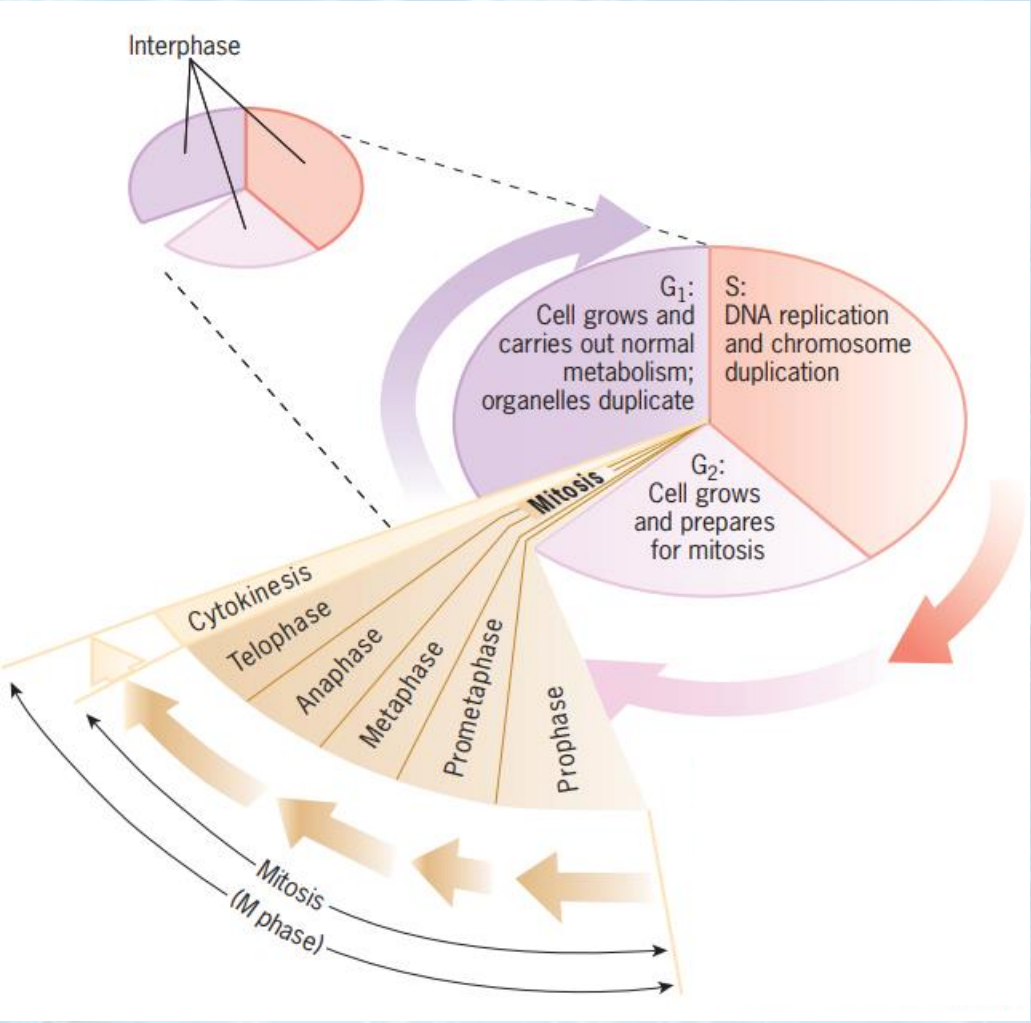
Meiosis -production of cells with half the genetic content of the parent

Phases of the Cell Cycle

The cell cycle can be divided into two major phases based on cellular activities

: M phase and interphase

Phases of the Cell Cycle



M phase includes

(1) the process of mitosis :
during which duplicated chromosomes are separated into two nuclei

(2)cytokinesis
during which the entire cell divides into two daughter cells.

Interphase

the period between cell divisions, is a time when the cell grows and engages in diverse metabolic activities

Interphase is divided into G_1, S, and G_2 phases, with S phase being equivalent to the period of DNA synthesis

Whereas M phase usually lasts only an hour or so in mammalian cells, interphase may extend for days, weeks, or longer, depending on the cell type and the conditions.

Cell Cycles in Vivo

We can recognize three broad categories of cells:

1. **Cells, such as neurons, muscle cells, or red blood cells, that are highly specialized and lack the ability to divide**.

Once these cells have differentiated, they remain in that state until they die.

2. **Cells that normally do not divide but can be induced to begin DNA synthesis and divide when given an appropriate stimulus**.

Included in this group are liver cells, which can be induced to proliferate by the surgical removal of part of the liver, and lymphocytes, which can be induced to proliferate by interaction with an appropriate antigen.

3. **Cells that normally possess a relatively high level of mitotic activity.**

Included in this category are stem cells of various adult tissues, such as hematopoietic stem cells that give rise to red and white blood cells and stem cells at the base of numerous epithelia that line the body cavities and the body surface.

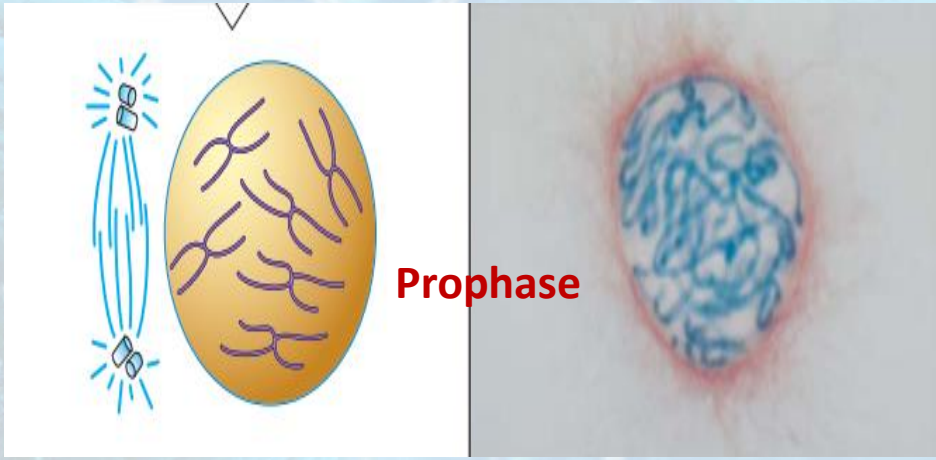
Mitosis

Prophase
Prometaphase
Metaphase

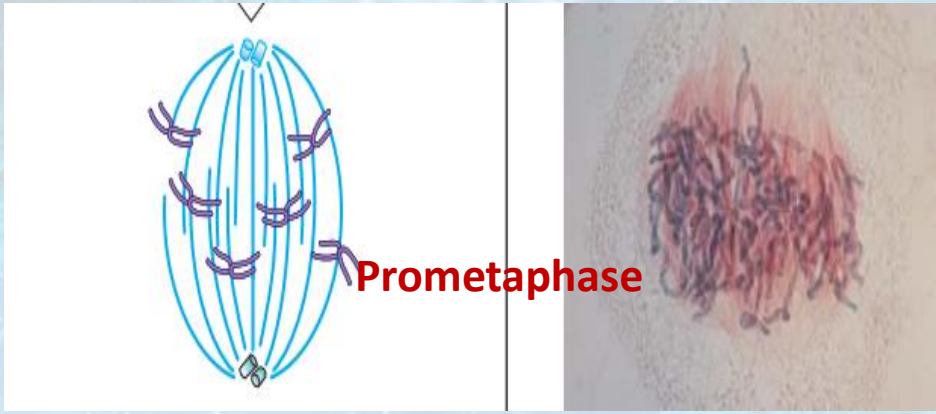
Anaphase

Telophase

1. Chromosomal material condenses to form compact mitotic chromosomes. They are seen to be composed of two chromatids attached together at the centromere.
2. Cytoskeleton is disassembled, and mitotic spindle is assembled.
3. Golgi complex and ER fragment. Nuclear envelope disperses.



1. Chromosomal microtubules attach to kinetochores of chromosomes.
2. Chromosomes are moved to spindle equator.



The stages of mitosis in an animal cell (left drawings) and a plant cell (right photos).

SOURCE: Micrographs Courtesy of Andrew Bajer.

Mitosis

The stages of mitosis in an animal cell (left drawings) and a plant cell (right photos).

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1. Chromosomes are aligned along metaphase plate, attached by chromosomal microtubules to both poles.

1. Centromeres split, and chromatid separate.
2. Chromosomes move to opposite spindle poles. 3. Spindle poles move farther apart.

1. Chromosomes cluster at opposite spindle poles.
2. Chromosomes become dispersed.
3. Nuclear envelope assembles around chromosome clusters.
4. Golgi complex and ER reforms.
5. Daughter cells formed by cytokinesis.