

## **MODULE 2**

### **Aim**

The aim of this module is to provide students with an introduction Cell division.

### **Content and objectives**

On completion of this module student will be able to:

1. Describe cell division.
2. Explain the various phases of cell cycle (mitosis and meiosis).
3. Understand the significances of both mitosis and meiosis.
4. Differentiate between mitosis and meiosis.

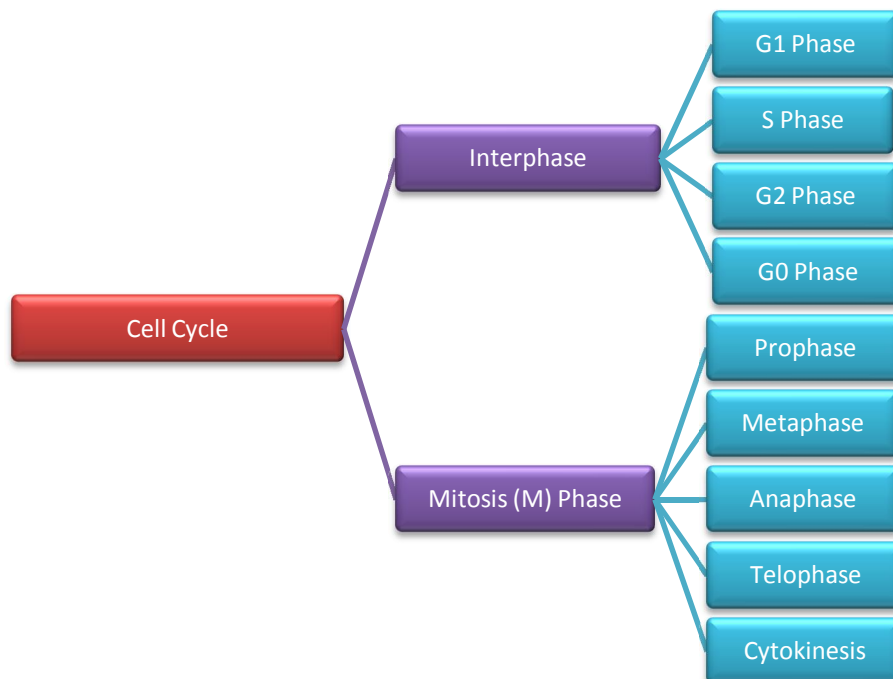
## Introduction to Cell Cycle

- Cell division is a process which leads to the formation of genetically identical daughter cells from a parental cell.
- Cell division results in
  1. DNA replication
  2. Cell growth

This entire process is carried out in such a way that at the end of cell division each daughter cell receives an exact copy of DNA.

## Phases of cell division

All eukaryotic cells take approximately 24 hours to divide.



Cell cycle is divided into 2 main phases:

### **1. Interphase**

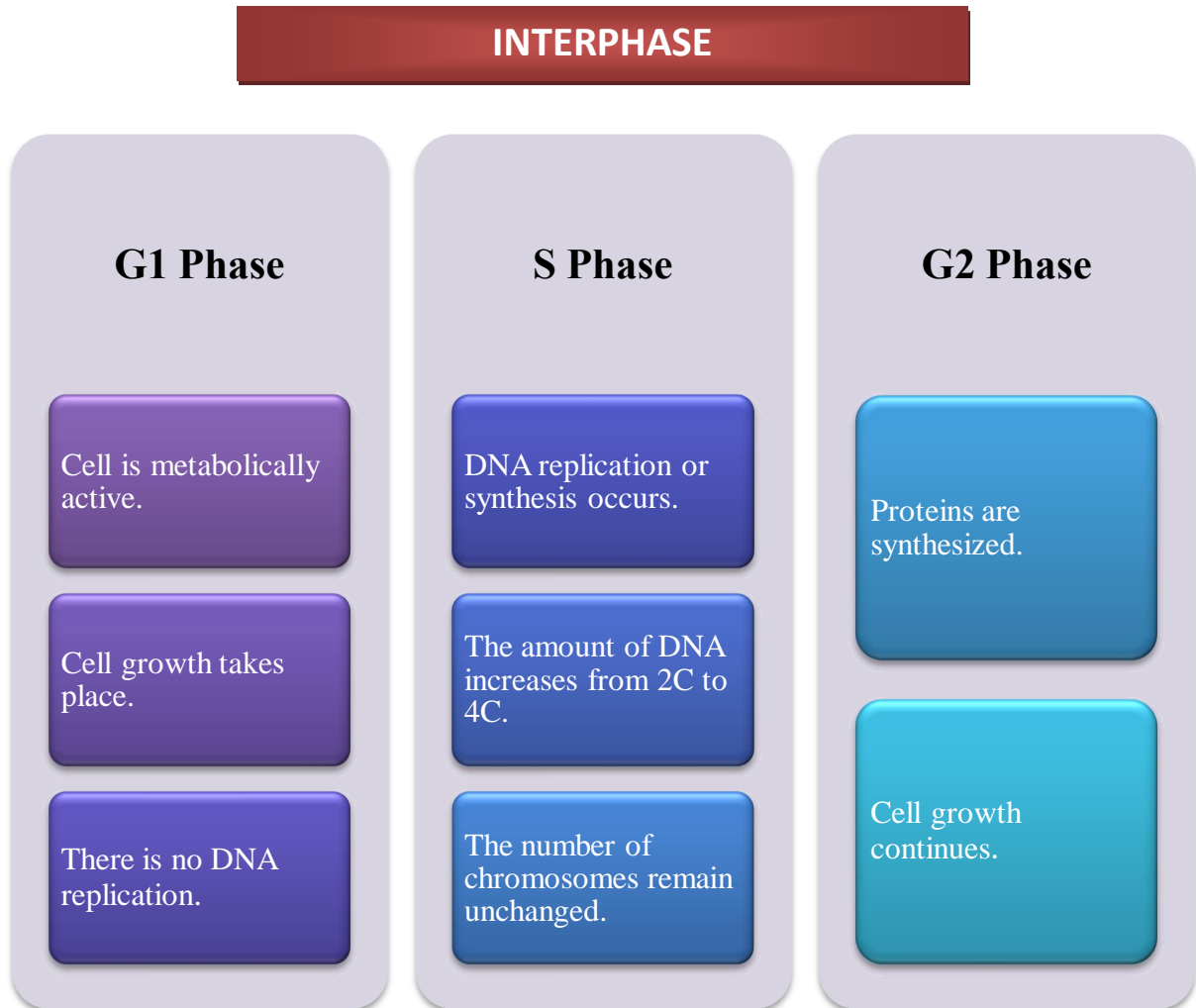
This phase is further divided into three sub-phases:

G1 phase- This phase lies between the M phase and DNA replication (S phase). During this phase cell carries out metabolism and grows continuously.

S phase- This phase marks the initiation of replication of DNA. The amount of DNA increases from 2C to 4C. But the number of chromosomes remain the same throughout, i.e., the number of chromosomes remain 2n before and after the cell division.

G2 phase- Proteins are synthesized for the cell growth during this phase.

Some cells in an adult animal are terminally differentiated and do not participate in cell division. These cells remain in inactive stage also known as quiescent stage (G0).



## 2. Mitotic (M) Phase

This phase consists of 2 main sub-phases- Mitosis and cytokinesis.

Mitosis is also known as equational division because the number of chromosomes in parent and daughter cells remain unchanged.

It is further divided into 6

**Prophase**- This is the first stage of mitosis. This phase is marked by the condensation of chromosomal material. Chromosomes are composed of two chromatids which are attached together at the centromere.

**Metaphase-** This phase starts once the nuclear envelope has disintegrated completely. The chromosomes are spread throughout the cytoplasm of the cell. Chromosomes at this stage can be easily observed with the help of a microscope. During this stage the chromosomes come to lie at the equator with one chromatid of each chromosome connected by its kinetochore to spindle fibers from one pole and its sister chromatid connected by its kinetochore to spindle fibers from opposite pole.

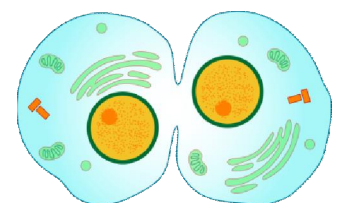
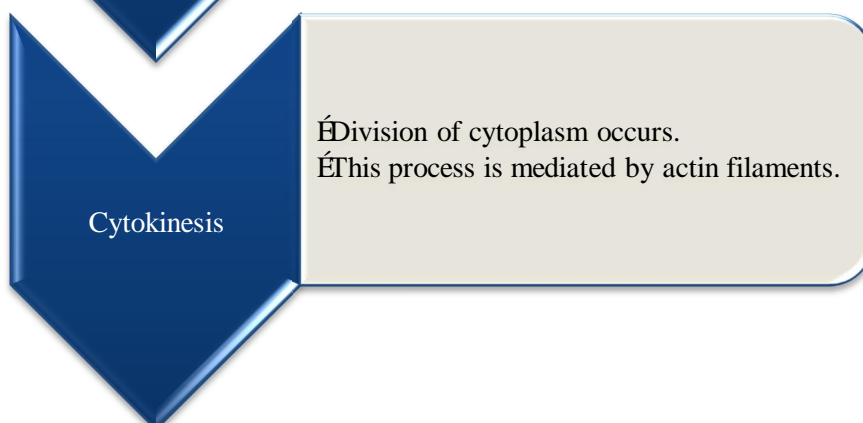
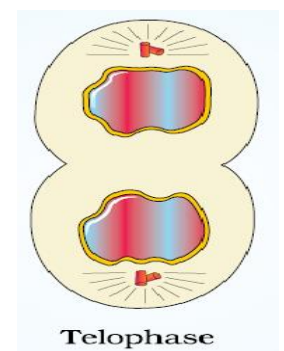
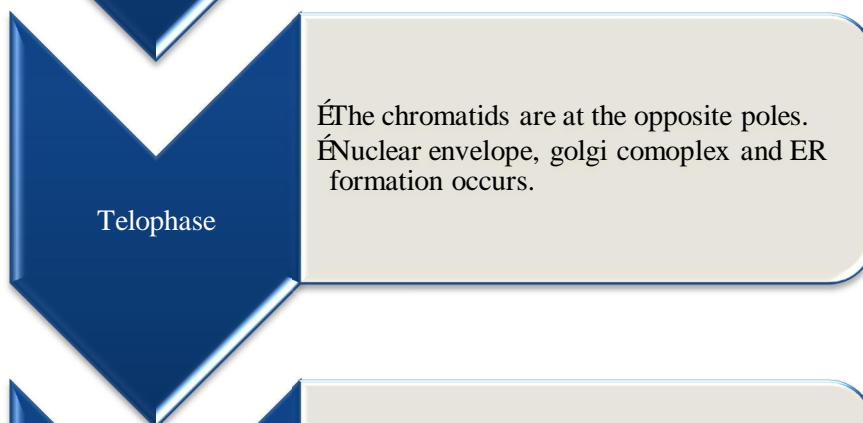
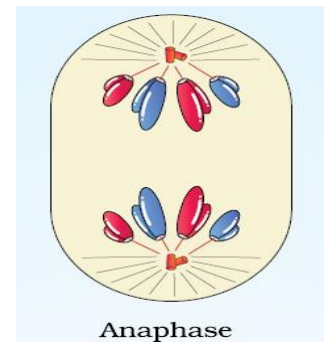
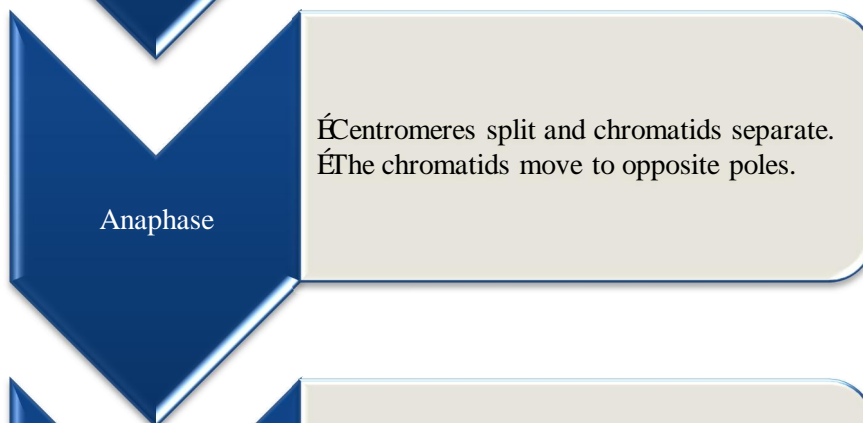
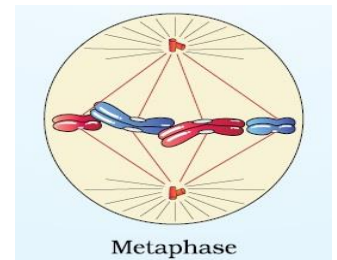
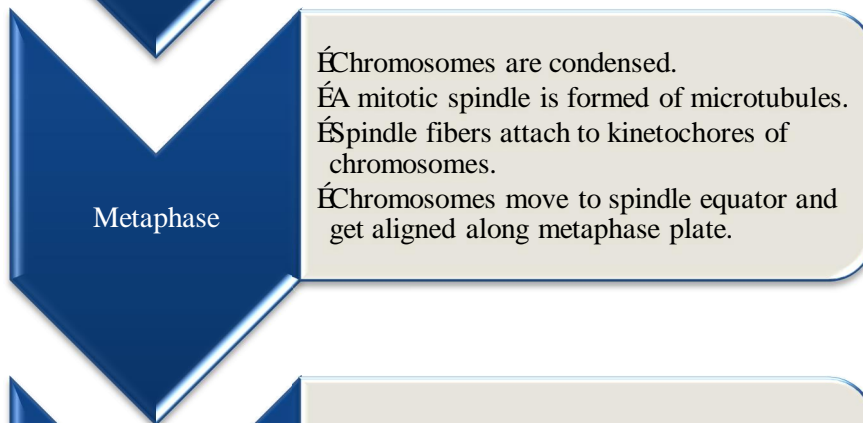
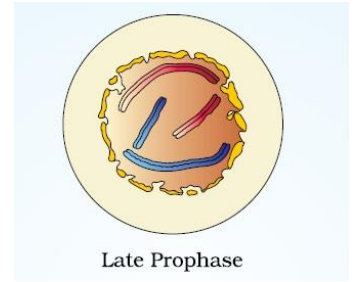
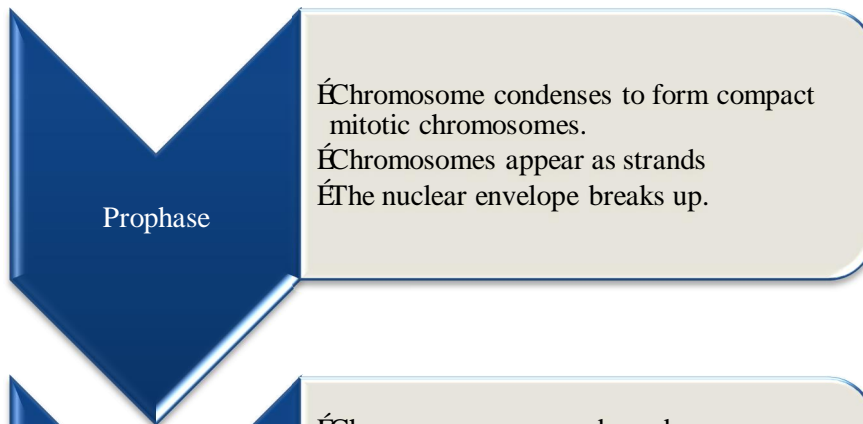
**Anaphase-** During this phase of mitosis, the chromosomes split and the two daughter chromatids migrate towards the opposite poles.

**Telophase-** This is the final stage of mitosis during which the chromosomes decondense after reaching their respective poles. Chromosomes are not seen at this stage and the nuclear envelope, golgi complex and ER are formed again.

**Cytokinesis-** It is the process of division of cytoplasm at the end of mitosis (or meiosis) which results in the separation of two daughter cells.

In an animal cell, this is achieved by appearance of a furrow in the cell membrane which gradually deepens and ultimately joins in the centre thereby dividing the cell into two.

On the contrary, in plant cells there is a rigid and inflexible cell wall which surrounds the plasma membrane. Thus, in these cells the cell wall formation starts in the centre which grows outwards to meet the existing lateral walls. Plant cells achieve this by constructing a cell plate in the middle of the cell.



## **Significance of Mitosis**

**Mitosis tends to maintain same number of chromosomes as the parental cell.**

**Daughter cells are genetically identical to the parental cell.**

**It ensures growth in multicellular organisms.**

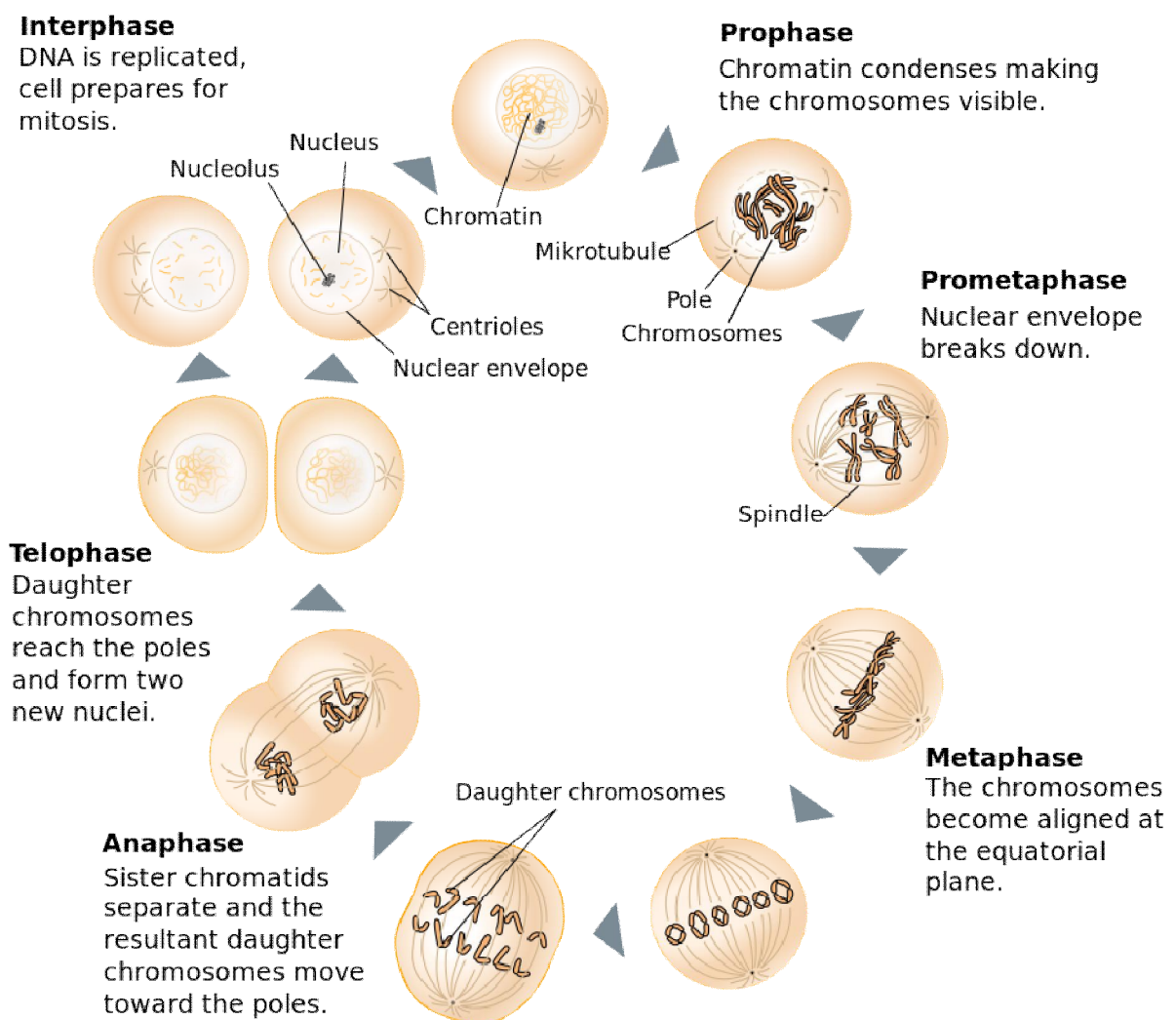
**It helps in replacement of damaged cells and tissues.**

**Some organisms are able to regenerate their body parts by the help of mitosis.**

**It also plays a significant role in asexual reproduction.**

## Differences Between Mitosis In Plant Cell And Animal Cell

- Plant cells do not have centrioles but animal cells have centrioles.
- In plant cells, cytokinesis occurs by growth of cell plate which is formed as result of fusion of vesicles.
- In animal cells cytokinesis occurs by the constriction of microtubules.



**A schematic diagram of Mitosis**

