

## Quadrant II – Transcript and Related Materials

**Programme: Bachelor of Science (Third Year)**

**Subject: Botany**

**Paper Code: BOC-108**

**Paper Title: Cytogenetics and plant breeding**

**Unit: Cell cycle**

**Module Name: Mitosis & its significance**

**Name of the Presenter: Rajendra Shetye**

---

**Notes:**

**Cell cycle:**

The sequence of phases, by which actively dividing eukaryotic cell duplicates its genome, increases its other cellular content and eventually divides into 2 identical daughter cells is termed as cell cycle.

**Phases of cell Cycle:**

It shows 2 main phases i.e. Interphase & Mitotic phase.

**Interphase:** It's the longest phase of cell cycle & lasts for about 18-22 hours. In this phase cell prepares itself for division by increasing all its cellular content.

**It shows 3 different stages such as:**

**G1 phase/Gap 1 phase:** This is the first stage of Interphase which lasts for about 10-12 hours. In this stage cell grows in size by active synthesis of all cellular content except DNA.

**S phase/Synthesis phase:** G1 phase is followed by S-phase which lasts for about 5-6 hours. Replication of DNA occurs during this phase.

**G2 phase/Gap 2 phase:** This is the last stage of interphase which lasts for about 3-4 hours. Cell continuous to grow in this stage and makes final preparation for entering into mitotic phase.

**Mitotic phase/M-phase:** In this stage cell divides itself into 2 genetically identical daughter cells. It lasts for about 2-6 hours.

It shows 2 different stages i.e. Mitosis & cytokinesis.

**Mitosis:** It is a type of cell division seen in eukaryotes in which parent cell divides to form genetically identical 2 daughter cells. Karyokinesis occurs in this

stage resulting in formation of two daughter nuclei containing exactly same number & Kind of chromosomes as that of parent cell.

In general cells which mitosis occurs are called as Mitocytes. In plants it occurs in meristematic cells. Duration of mitosis varies from organism to organism. Normally it takes about 30 minutes to 120 minutes.

### **Stages of mitosis:**

It shows 4 different stages i.e. Prophase, Metaphase, Anaphase & Telophase.

**Interphase:** In this phase cell grows in size by increasing its cellular content. Nucleus appears as dark staining body. Chromatids shows minimum degree of condensation & remains dispersed in nuclear sap in the form of chromatin network. Distinct nuclear envelop and nucleolus is seen.

**Prophase:** It is the longest stage of cell division. It may last from few minutes to several hours. In beginning of prophase chromatin network starts condensing & chromosomes starts appearing as thin, thread like, uncoiled structures. Further each chromosome gets coiled, shortens up and appears distinct. In late prophase chromosomes splits into 2 sister chromatids but remains attached at centromere. This stage of chromosome is called **dyad**. At the end of prophase, spindle formation begins outside the nucleus at the 2 poles. Nuclear envelop and nucleolus disappears.

**Metaphase:** In the beginning of metaphase, some spindle fibers called **chromosomal fibers** extend from 2 poles and get attached to centromere of each chromosome. Some spindle fibers called **continuous fibers** extend from one pole to other pole without attaching to centromeres of chromosomes. Later these chromosomic fibers direct all chromosomes in center of cell. They line up in center to form metaphasic plate or equatorial plate.

In late metaphase centromere of each chromosome divides and each sister chromatid gets its own centromere.

**Anaphase:** As soon as daughter chromatids gets its own centromere, a kind of repulsive force is produced between 2 daughter centromeres followed by contraction of spindle fibers. Due to this 2 daughter chromatids moves away from each other closer to poles. Each separated chromatid with its own centromere is now referred as daughter chromosome. In this phase chromosome appears V- shaped (metacentric), L- shaped (sub-metacentric) or J- shaped (acrocentric).

**Telophase:** Process of reconstruction of nucleus occurs in this stage. Chromosomes undergo decondensation, nuclear membrane is reconstructed and nucleolus reappears. At the end of telophase 2 genetically identical daughter nuclei are formed with same number & kind of chromosomes as that of parent cell.

**Cytokinesis:** Karyokinesis is followed by cytokinesis in which division of cytoplasm occurs. It begins at late anaphase. In plants it occurs by cell plate method. In this method the Golgi vesicles fuse at the centre to form **phragmoplast**. It grows centrifugally till it meets with plasma membrane. The contents of phragmoplast solidify to form the **cell plate**. The daughter protoplast secretes primary cell wall materials on both sides of the cell plate resulting in formation of 2 identical daughter cells with same number of chromosomes.

### **Significance of Mitosis:**

- Brings about growth and development of organisms.
- Ensures that genetic constitution remains same qualitative and quantitative wise in daughter cells as that of parent cell.
- Helps in replacement of lost cells from the body.