

KARACHI EDU COACHING CENTER | CLASS 9 BIOLOGY

Chapter 5: Cell Cycle

High-detail coaching notes on Interphase, Mitosis, Meiosis, Apoptosis, and Necrosis according to Sindh Textbook Board.

Introduction to Cell Cycle

Definition

The series of events through which a cell grows, replicates its genome, and divides into two daughter cells.

Main Phases

- 1. Interphase:** Non-dividing metabolic phase of preparation.
- 2. Division Phase (M-phase):** Nuclear and cell division (Mitosis/Meiosis).

Detailed Breakdown of Interphase

G1 Phase (First Gap)

Cell increases volume, synthesizes structural proteins, and replicates organelles.

S Phase (Synthesis)

DNA replication occurs; exact copies of chromosomes (sister chromatids) form.

G2 Phase (Second Gap)

Final protein synthesis and microtubule production for spindle apparatus assembly.

Mitosis: Karyokinesis (Prophase & Metaphase)

1. Prophase

Chromatin condenses into distinct visible chromosomes.

Nucleolus and nuclear envelope disappear; mitotic spindle fibers form.

2. Metaphase

Chromosomes align precisely at the equator (metaphase plate).

Spindle fibers attach securely to chromosome kinetochores.

Mitosis: Anaphase & Telophase

3. Anaphase

Sister chromatids split apart at the centromere.

Daughter chromosomes pull toward opposite poles by spindle fibers.

4. Telophase

Two new nuclear envelopes reform around separated chromosomes.

Chromosomes uncoil back into chromatin; nucleoli reappear.

Cytokinesis in Plants vs. Animals

Animal Cells (Cleavage Furrow)

Plasma membrane pinches inward via a contractile ring of microfilaments, forming a cleavage furrow that deepens until the cell splits.

Plant Cells (Cell Plate)

Golgi vesicles fuse along the equatorial plane to form a cell plate, which expands outward to form the new cell wall and middle lamella.

Significance of Mitosis

Genetic Stability

Produces identical daughter cells with exact chromosome numbers.

Growth & Development

Enables multicellular organisms to grow from a single zygote.

Repair & Regeneration

Replaces damaged, worn-out, or dead cells across tissues.

Meiosis: Reductional Division

Overview & Purpose

Occurs in germ cells to produce gametes (sperm and egg). Reduces chromosome number by half (diploid to haploid: $2n$ to n).

Key Events

Synapsis & Crossing Over: Exchange of genetic material during Prophase I.

Generates immense genetic variation in offspring.

Apoptosis vs. Necrosis

Apoptosis (Programmed Death)

Controlled, orderly cell suicide. Cells shrink, chromatin condenses, and fragments are engulfed by phagocytes without inflammation.

Necrosis (Accidental Death)

Uncontrolled cell death due to injury, toxins, or ischemia. Cells swell and burst, spilling contents and causing inflammation.

End of Chapter 5 Notes

KARACHI EDU COACHING CENTER — Biology Department
