CHAPTER

2 Cell Cycle and Cell Division

- All sexually reproducing organisms start their life from a single cell called zygote. This zygote divides to make complete body of an organism, by cell division.

Cell Cycle

- The sequence of events by which a cell duplicates its genome, synthesizes the other constituents of the cell and eventually divides into two daughter cells is termed cell cycle. Although cell growth (in terms of cytoplasmic increase) is a continuous process, DNA synthesis occurs only during one specific stage in the cell cycle. The replicated chromosomes (DNA) are then distributed to daughter nuclei.
- Duration of cell cycle is different in different organisms. For examples, a typical human cell in culture takes 24hrs to divide and a yeast cell divides in about 90 minutes.
- The cell cycle is divided into Interphase and M-Phase (Mitosis phase).

Interphase	❖ Lasts for more than **95%** time of cell cycle called the resting phase, is the time during which the cell is preparing for division by undergoing both cell growth and DNA replication in an orderly manner. ✦ G_1 Phase: cell grows but DNA doesn't replicate. ✦ S-phase: DNA replication occur; amount of DNA doubles but no. of chromosome remains same. ✦ G_2 Phase: proteins are synthesized in preparation for mitosis while cell growth continues. ❖ G_0/Quiescent Phase: some cells that do not divide further exit G_1 phase to enter an inactive stage called G_0 where the cells remain metabolically active but no longer proliferate unless called on to do so.
M-phase	❖ Most **dramatic** period of the cell cycle; called equational division. ❖ **Karyokinesis** / Nuclear division ✦ **Prophase:** Chromosomal material condenses to form compact mitotic chromosomes; Centrosome begins to move towards opposite poles; centrosome radiates out microtubules called asters; golgi complexes, endoplasmic reticulum, nucleolus and the nuclear envelope disappears. ✦ **Metaphase:** Spindle fibres attach to kinetochores of chromosomes; metaphasic plate is formed. ✦ **Anaphase:** Centromeres split and chromatids separate; Chromatids move to opposite poles. ✦ **Telophase:** Chromosomes cluster at opposite spindle poles and their identity is lost as discrete elements; Nuclear envelope develops around the chromosome clusters at each pole forming two daughter nuclei; Nucleolus, golgi complex and ER reform. ❖ **Cytokinesis**/ cell division: Cell plate is formed in case of plants and cell furrow in case of animals.

❖ **Meiosis:** It is called reductional division where chromosome number reduces to half; it involves two sequential cycles of nuclear and cell divisions called meiosis I and meiosis II but only a single cycle of DNA replication.

Meiosis-I	❖ **Prophase-I:** longer and complex; divided into 5 subphases. ✦ **Leptotene:** chromosomes become gradually visible under the light microscope; compaction of chromosomes continues throughout. ✦ **Zygotene:** chromosomes start pairing together and this process of association is called synapsis; synaptonemal complex formed. ✦ **Pachytene:** characterised by the appearance of recombination nodules; tetrad is clearly visible; crossing over and recombination occurs. ✦ **Diplotene:** dissolution of the synaptonemal complex; chiasmata remain. ✦ **Diakinesis:** terminalisation of chiasmata, N.M. & nucleous dissapear. ❖ **Metaphase-I:** 2 metaphasic plates formed. ❖ **Anaphase-I:** homologous chromosomes separate, while sister chromatids remain associated at their centromeres. ❖ **Telophase-I:** nuclear membrane and nucleolus reappear, cytokinesis follows and this is called as dyad of cells; interkinesis is followed by meiosis-I.
Meiosis-II	❖ Similar to Mitosis (equational division).