

CELL CYCLE AND DIVISION

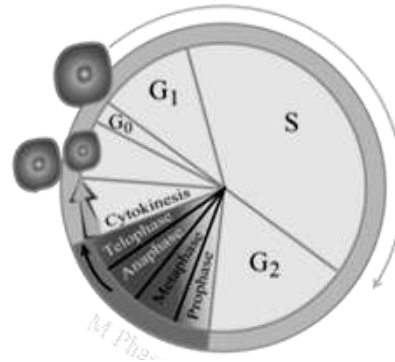
Chapter

CELL CYCLE AND DIVISION

Day - 1

CELL CYCLE

- Cell cycle completed into two phases.
- **Interphase**
- G₀ Phase
- G₁ Phase
- S Phase
- G₂ Phase
- **Division phase or M phase**
- Karyokinesis
- Cytokinesis



INTERPHASE

- Interphase is phase between two cell division.
- In this phase cell prepares itself for division so, called preparatory phase.
- It is longest phase of cell cycle. It covers approx. 95% of cell life.
- It is also called resting phase but extremely active.
- In this phase synthesis of DNA, RNA and protein takes place

G₁ - PHASE (6 – 15 HR.)

- Most variable phase for duration.
- Cell growth occurs in this phase, so most probably it is longest stage of interphase.
- Mitochondria, Chloroplasts (plants), Lysosomes, Ribosome, Endoplasmic Reticulum Golgi Complex, Vacuoles etc. are produced.
- In nucleus m-RNA, t-RNA and r-RNA synthesized.
- Structural and functional proteins are formed.
- Metabolic rate of the cell becomes very high.

S - PHASE (6-10 HR.)

- Longest phase in human interphase.
- Replication of DNA takes place. (DNA get doubled)
- Histones are synthesized that cover each strand of DNA.
- Centrosome (Centriole) replicate is late S-phase.
- This phase indicated cell is ready for cell division.

G₂ - PHASE (3 - 12 HR.)

CELL CYCLE AND DIVISION

- Tubulin protein synthesis start for spindle formation.
- This phase may be called post DNA synthesis phase.
- Duplication of Mitochondria, Chloroplast and Golgi Body take place.
- Cell division involves enormous expenditure of energy thus cell stores ATP in G₂ phase
- After G₂ phase cell enters in division or M-phase

CAUSE OF CELL DIVISION

Kern plasm theory: (Hertwig)

- Mitosis occurs due to disturbance in karyoplasmic index (KI) of cell.

$$KI = \frac{V_n}{V_c - V_n} \quad KI \propto \frac{1}{\text{Volume of cytoplasm}}$$

Where: V_n = Volume of nucleus

V_c = Volume of cell

V_c - V_n = Volume of cytoplasm

- Small cell → less cytoplasm → High KI ® No division
- Large cell ® More cytoplasm ® Low KI □ → Division occur.

SURFACE AREA VOLUME RATIO

- It says that when cell grows in size its volume increases but surface area remain less so it affect metabolic activity of cell which result into division of cell.
- Note: Above two hypothesis regarding the division of cell are completely discarded because new concept give the genetic control of cell division.

CELL DIVISION CONTROL

- A cell reproduces by performing an orderly set sequences of irreversible events, In which it duplicates it's contents & then divides into two, these events are known as cell cycle.
- Molecular biologists, identifying the biomolecules, that control or drive the cell cycle, many biologists, some of whom worked with invertebrate or frog egg's others with yeast cell or cell culture.
- Scientists concluded that the activity of enzymes, known as cyclin dependant kinases. (Cdk's) regulates the cell cycle.
- They are activated when they combined with key protein called cyclin.
- Kinase is an enzyme that removes a phosphate group from ATP & add to another protein.
- At check points (G₁ ® S phase and G₂ ®M phase) a kinase enzyme combines with cyclin & this moves the cell cycle forwardly.
- S-kinase is capable of starting the replication of DNA after it combined with S-cyclin (G₁ - Cyclin). After some time S-cyclin is destroyed & S-kinase is no longer active.
- M-kinase is capable of turning on mitosis after it has bind with M-cyclin, (G₂-cyclin).
- The detail of cell cycle varied from organism to organism & different time in an organism. However certain characteristics are universal component of cell cycle control.

DIVISION PHASE / M-PHASE

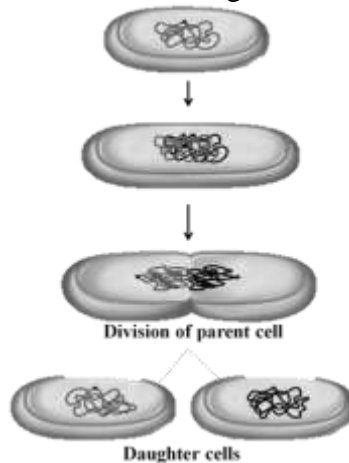
- In this phase nuclear and cytoplasmic division takes place.
- Karyokinesis - Nuclear division.

CELL CYCLE AND DIVISION

- Cytokinesis - Cytoplasmic division.
- In organisms three type of division take place
- Amitosis
- Mitosis
- Meiosis

AMITOSIS (NO SPINDLE, NO CHROMOSOME)

- It is the simplest mode of cell division.
- This type of division starts with elongation of nucleoid.
- Nucleoid becomes dumbbell shaped, and get divided into two daughter nucleus.
- Nucleus division is followed by the division of cytoplasm its results in formation of two daughter cells. e.g. PPLO, BGA, Bacteria.
- Eukaryotic cells e.g. **Yeast-budding occurs by amitosis**, Ameoba multiple fission occurs by amitosis, Paramecium division of mega-nucleus.



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