THE CSS POINT

Yes We Can Do It!

Cell Division

Agha Zohaib Khan ::: www.css.theazkp.com

Cell Division:

- The process in which the cells divide and replicate. This process is the basis for growth and replication.
- There are two main types of cell division, which are as under:

1) Mitosis
2) Meiosis

Mitosis:

- A type of cell division in which a cell divides into two identical daughter cells each having same number of chromosomes as that of parent cell.

Stages Of Mitosis:

There are four stages of mitosis, which are as under:

i) Prophase
ii) Metaphase
iii) Anaphase
iv) Telophase

Mitosis

- **i) Prophase:**
  - Prophase is the first phase of mitosis.
  - Chromatin material condenses and becomes visible
  - The nucleolus of the cell disappears
  - The nuclear membrane also disappears
  - Centrioles begin to move opposite ends of the cell

ii) Metaphase:

- Metaphase is the second stage of mitosis.
- Chromosomes line up in the centre of the cell, separate and become a pair of identical chromosomes.
- The chromatids become uncoiled and apart from each other.

Mitosis

- **iii) Anaphase:**
  - It is the third phase of mitosis.
  - During this phase each set of chromosomes move towards the opposite end of the cell.

  iv) Telophase:
  - The fourth phase of mitosis is known as Telophase.
  - During this phase spindle fibres disappear.
  - Nuclear membrane appears
  - Cell divides into two daughter cells
  - Nucleolus re-appear
  - The chromosomes disperse and are no longer visible.

Significance Of Mitosis:

- 1. Growth: The number of cells within an organism increases by mitosis and this is the basis of growth in multicellular organisms.

  2. Cell Replacement: Cells are constantly sloughed off, dying and being replaced by new ones in the skin and digestive tract. When damaged tissues are repaired, the new cells must be exact copies of the cells being replaced so as to retain normal function of cells.

  3. Regeneration: Some animals can regenerate parts of the body, and productions of new cells are achieved by mitosis.

  4. Vegetative Reproduction: Some plants produce offspring which are genetically similar to themselves. These offspring are called clones.

Meiosis:

- A type of cell division in a cell divides into four daughter cells with having half number of chromosomes as compared to parent cell.

Characteristics Of Meiosis:

• Takes place in sexual reproduction at the time of formation of male and female gametes

• In animals it takes place during the formation of sperms and ova while in plants during spore formation

• Diploid cells reduce to haploid cells

• Consists of two consecutive divisions

• First division is reductional or meiotic and the second is simple mitotic division.

Stages Of Meiotic Division:

i) Prophase I
ii) Metaphase I
iii) Anaphase I
iv) Telophase I
v) Prophase II
vi) Metaphase II
vii) Anaphase II
viii) Telophase II

Prophase I:

- Prophase I consists of 5 sub stages, these are:

a. Leptotene
- Nucleus increases in size
- Chromosomes become long and uncoiled threads
- They become more visible

b. Zygotene
- Homologue (similar) chromosomes attract each other and form pairs.
- This process is called synapses

c. Pachytene
- Chromosomes become condensed due to widening of coils
- They form chiasmata i.e. cross each other in double nature or bivalents.

d. Diplotene
- Homologous chromosomes go apart from each other except at chiasmata
- Chromosomes become more short and thicker

e. Diakinesis
- The bivalents become more apart.
- Chromosomes become deeply stained
- Nucleolus and nuclear membrane disappear and spindles become distinct

Stages of Meiosis

- **Metaphase I:**
  - Chromosomes now rearrange themselves in an equatorial line
  - Spindles attach to the centrosome of the chromosomes

  Anaphase I:
  - Spindles start to contract
  - Split the tetrahedral chromosomes into two chromatids and drag them to opposite poles
  - Here the reduction takes place.

  Telophase I:
  - Spitted chromosomes reach to opposite poles
  - Nucleolus and nuclear membrane reappear
  - At the end of Telophase I, prophase II starts.

Stages of Meiosis

- **Prophase II:**
  - Chromatin network breaks into bivalent chromosomes
  - Nuclear membrane and nucleolus disappear and spindles start to reappear

  Metaphase II:
  - Bivalent chromosomes rearrange themselves at equator
  - Spindles attach to the centrosomes of each chromosome

  Anaphase II:
  - Spindles contract and split the chromosomes longitudinally into two chromatids
  - Each chromatid travel to opposite pole

  Telophase II:
  - Each chromatid reach to the opposite pole
  - Spindles disappear and nuclear membrane and nucleoli reappear
  - As a result 4 nuclei are formed

Significance Of Meiosis:

- - To allow trait inheritance in offspring
  - To maintain diploid number in each generation
  - To ensure the production of haploid gametes in sexual reproduction
  - To produce genetic variations among offspring