

MEIOSIS

We know that every organism is produced by the fusion of two opposite gametes. These organisms possess same number of chromosome as that of parent for example a cell from pea plant possess 14 chromosomes. So the offspring produced by the union of male and female cells should possess 28 chromosomes. But it is not actually so because at the time of gamete formation, when reproductive cell divides, the number of chromosomes get reduced to half and when such two opposite gametes unite, the resulting embryo possess same number of chromosomes as available in parent cell. This type of division is called meiosis division. Thus meiosis may be defined as — "Meiosis is such a type of cell division which occurs in maturing germinal cells and due to which a cell is divided into four daughter cells. Each of the daughter cells thus produced contains half of the total number of chromosomes present in parent cell."

Stages of Meiosis → Meiotic division consists of two successive divisions of cell, so that as a result of one complete meiotic division four cells are produced.

1. Heterotypic or Reduction division or Meiosis I
This division is accompanied with reduction in chromosome number without any division of chromosome.
2. Homotypic or Equational division or Meiosis II \rightarrow This division involves separation of chromatids.

① Heterotypic or Reduction division or Meiosis I

Reduction division is more important than second meiotic division, since it is the division in which number of chromosomes in daughter cells get reduced to half and crossing over takes place. For the sake of convenience, the whole duration of Reduction division is divided into four stages, however, it is a continuous process.

- (A) Prophase I
- (B) Metaphase I
- (C) Anaphase I
- (D) Telophase I

(A) Prophase I \rightarrow It is of fairly long duration and again this stage is divided into several sub stages as follows.

(i) Leptotene \rightarrow

(ii) chromosomes are thin, long and coiled.

These structures are called chromonemata.

(ii) These threads ~~like~~ do not break longitudinally as in mitosis. Chromosomes are clearly seen on these threads.

(iii) Number of chromosomes is diploid.

(iv) In plants, there does not take place Polarization of chromosomes ends. Perhaps it is due to absence of centriole.

However, in certain plants like liliun, the chromosomes are densely clamped to one side, no chromatin material being seen in rest of the nucleus. This phenomenon is called "synizesis".

(v) Although it is believed that duplication of chromosomes takes place during leptotene but under light microscope there is hardly any evidence of double nature of chromosomes. However, as we know, DNA synthesis actually takes place during S-phase of Premeiotic interphase.

(ii) Zygotene →

(i) Homologous chromosomes come together and get arranged into pairs. These pairs are called bivalents or dyad and the process of pairing of homologous chromosomes is called Synapsis.

The pairing is brought about in a zipper like fashion and may start at centromere, at chromosome ends or at any other position.

As regards the factor responsible for synapsis, Darlington (1930) has explained this mechanism in form of his precocity theory. "According to this theory meiosis is a Precocious mitosis as a result of which the chromosomes which have not yet duplicated, have to enter Prophase. This is responsible for chromosome pairing. However, recent work has shown that DNA synthesis is completed before the onset of meiosis. Therefore, Precocity theory is longer tenable. Recently Stern & Hotta (1969) have shown that Premeiotic S-phase, unlike Premitotic one, does not include total chromosomes replication. About 0.3% DNA, forming a significant component replicates only at about zygotene and is believed to control chromosome pairing.

(iii) After synapsis, centromere and even chromomeres of homologous chromosomes lie face to face

(E) **Cytokinesis** → In the middle of each cell a plate like structure called cell plate is formed. This cell plate increases gradually at its both ends. Finally cell plate reaches at the periphery of cell and thus two equal daughter cells are formed.

Significance →

1. A cell divides two times giving rise to four daughter cells. This type of division takes place in maturing germinal cells.

2. As a result of division haploid gametes are formed in which number of chromosomes is half in comparison to that of parent cell.

3. Two such opposite gametes when fuse diploid zygote results consisting of same number of chromosomes as in parent cell.

4. Thus identity of organism is maintained.

5. Due to crossing over, new combination of parental threads results. This novelty in parental threads are produced.