

Meiosis I

- In the first meiotic division, the reduction of chromosome number takes place and thus, two haploid cells are resulted by this division.
 - The first meiotic division is also known as the heterotypic or reduction division.
 - Like mitosis, it is studied under four stages - Prophase, metaphase, anaphase and telophase.
- ### Prophase I

- It is more complicated & prolonged as compared to the similar stage of mitosis.
 - Prophase I is divided into 5 sub-phases - leptotene, zygotene, pachytene, diplotene & diakinesis.
 - Another sub-phase called Pteleptonema is sometimes recognised prior to leptotene.
- In this phase chromosomes are not distinguishable because of their thinness but sex chromosomes (if present) are often seen as heterochromatic bodies.

1. Leptotene or Leptonema

(Grk. leptos - slender, tainia - band, nema - thread)

- Nucleus enlarges
- The chromatin fibres of interphase nucleus shorten & elongated chromosomes become clear.
- They possess a string of swollen areas called chromomeres, which are often believed to represent genes.
- The chromosomes at this stage take up a specific orientation inside the nucleus; the ends of the chromosomes converge towards one side.

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of the nucleus, that side where the centrosome lies (the bouquet stage)

- The centriole duplicates & each daughter centriole migrate towards the opposite poles of the cell.
- 2. Zygotene or Zygonema
(Gk. zygon - yoke or tied, tainia - band)
- In this stage, the pairing of homologous chromosomes takes place.
- The homologous chromosomes which come from the mother (by ova) & father (by sperm) are attracted towards each other & their pairing takes place.
- The pairing of homologous chromosomes is known as synapsis & this begins at one or more points along the length of the homologous chromosome.
- Depending upon the place of origin of pairing, synapsis is Procentric (starting from centromeres & proceeding towards ends), Proterminal (starting from ends & proceeding towards centromeres) & Intermediate (at various places in between centromeres & ends).
- It produces a complex known as Synaptonemal complex in which ribonucleoprotein core has a tripartite structure, one central & two lateral longitudinal elements which are connected by lateral elements. Central element lies between the two homologous chromosomes.
- On account of synapsis, chromosomes form pairs or bivalents. The no. of bivalents is half the no. of the total chromosomes.

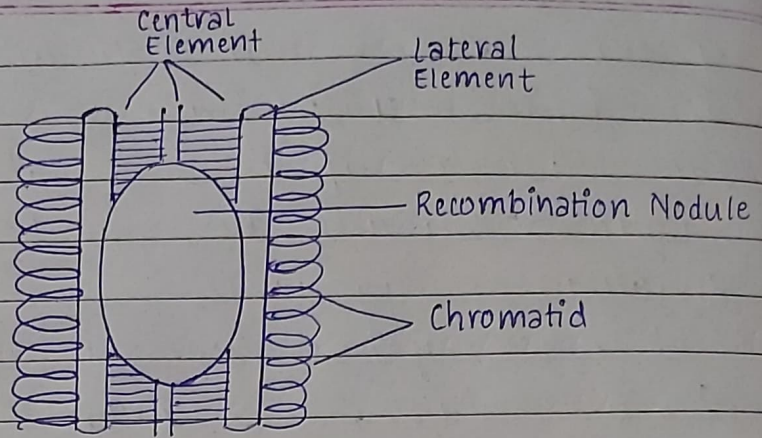


Fig : Recombination nodule & Synaptonemal ^{complex}

3. Pachytene or Pachynema

(Gk. pachys - thick, tainia - band)

- In this stage the paired chromosome or bivalent shortens.
- Dense areas appear here & there over the bivalent. They are called recombination nodules.
- Nodules contain multienzyme complex called recombinase, which is made up of endonuclease, exonuclease, unwinding, R-protein, etc.
- Endonucleases develop breaks in the individual chromatids by process called as Nicking.
- Separation of chromatid segments occurs in b/w two gaps by U-protein or enzyme Unwinding.
- Separated segments of non-sister chromatids exchange position & this phenomenon is called crossing over.
- These separated chromatid segments soon get re-united with the help of enzyme k/as R-protein & process is called re-annealing.

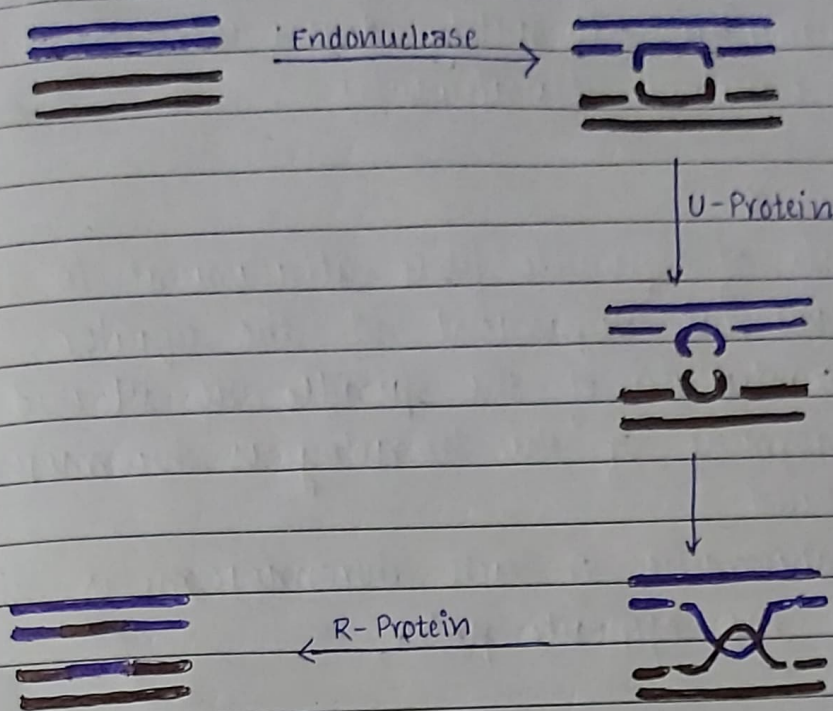


Fig : Steps in Pachytene of Prophase I

4. Diplotene or Diplonema

(Gk. diplos - double, tainia - band)

- The synaptonemal complex dissolves partially. Therefore, the homologous chromosomes separate except in the region of crossing over.
- The chromatids also become distinguishable (tread stage).
- The points of attachment b/w the homologous chromosomes after the partial dissolution of synaptonemal complex are called chiasmata.

5. Diakinesis

(Gk. dia - through, kinesis - movement)

- Chiasmata shift towards the end of chromosomes & the phenomenon is called terminalisation.
- The bivalent of satellite chromosomes remains

united with the nucleolus for some time.

- The nucleolus ultimately degenerates. Simultaneous nuclear envelope disintegrates.

Metaphase I

- It consists of spindle fibre attachment to chromosomes & chromosomal alignment at the equator.
- The microtubules of the spindle are attached with the centromere of the homologous chromosomes of each tetrad.
- The centromere of each chromosome is directed towards the opposite poles.

Anaphase I

- The homologous chromosomes break their connections & separate out & the process is named as disjunction.
- The separated chromosomes or univalents are also called dyads.
- The chromosomes move towards the spindle poles & at the end of anaphase I, two groups of chromosomes are produced, with each group having half the no. of chromosomes present in the parent nucleus.

Telophase I

- The polar groups of chromosomes arrange themselves into haploid or dyad nuclei.
- The chromosome elongate & the nucleolus is formed.
- It is followed by the appearance of nucleoplasm & nuclear envelope.

Significance of Meiosis I

1. It separates the homologous chromosomes & reduces the chromosome no. This is essential for sexual reproduction.
2. Crossing over occurs during this division. It introduces new combinations of gene or recombination & it results in variations.
3. There is random distribution of paternal & maternal chromosomes into daughter cells. It is a sort of independent assortment & produces variations.
4. Due to disturbance in disjunction, chromosomal & genomic mutations takes place.
5. Meiosis I induces the cells to form spores or gametes.