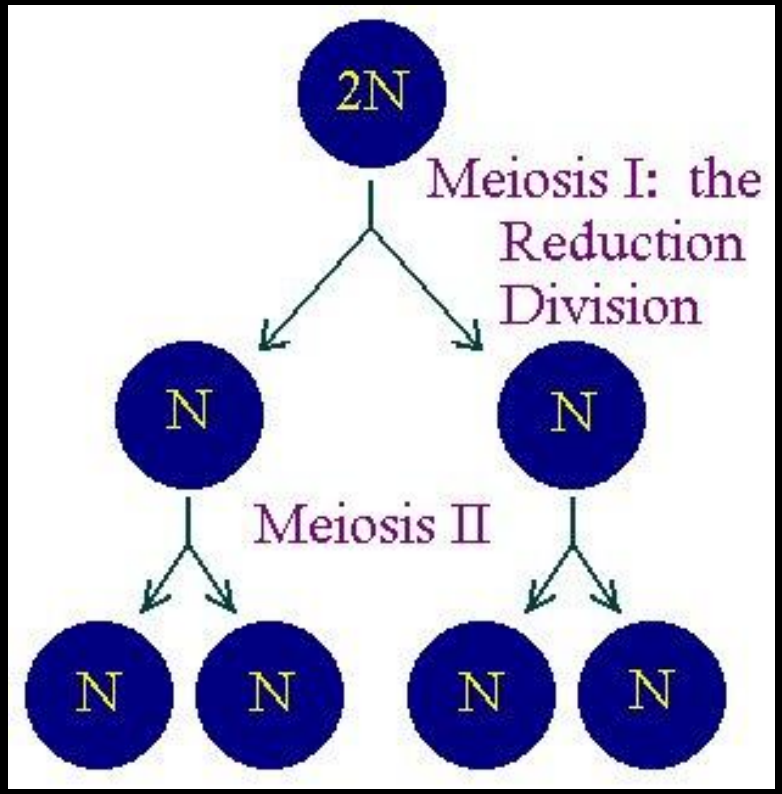
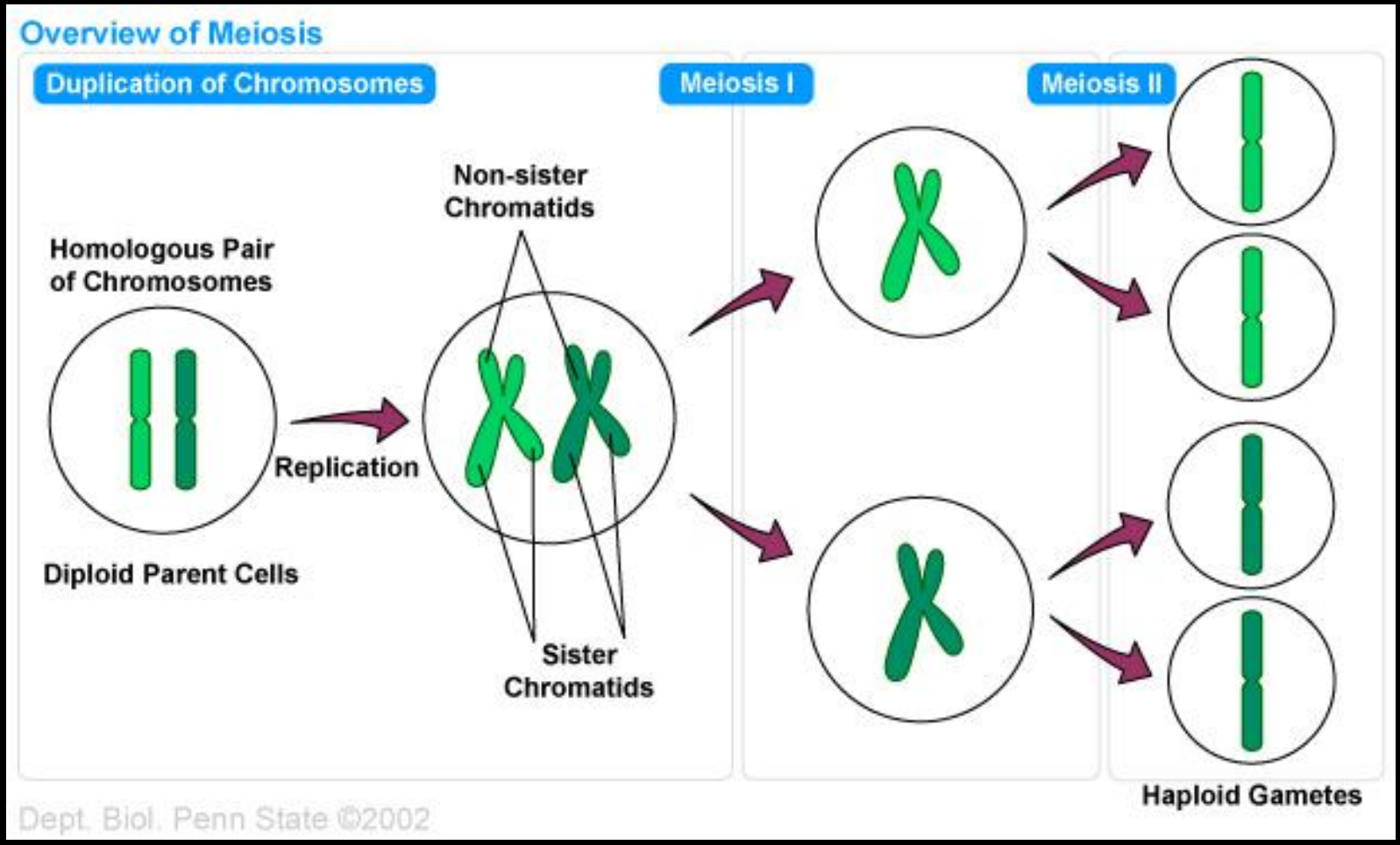
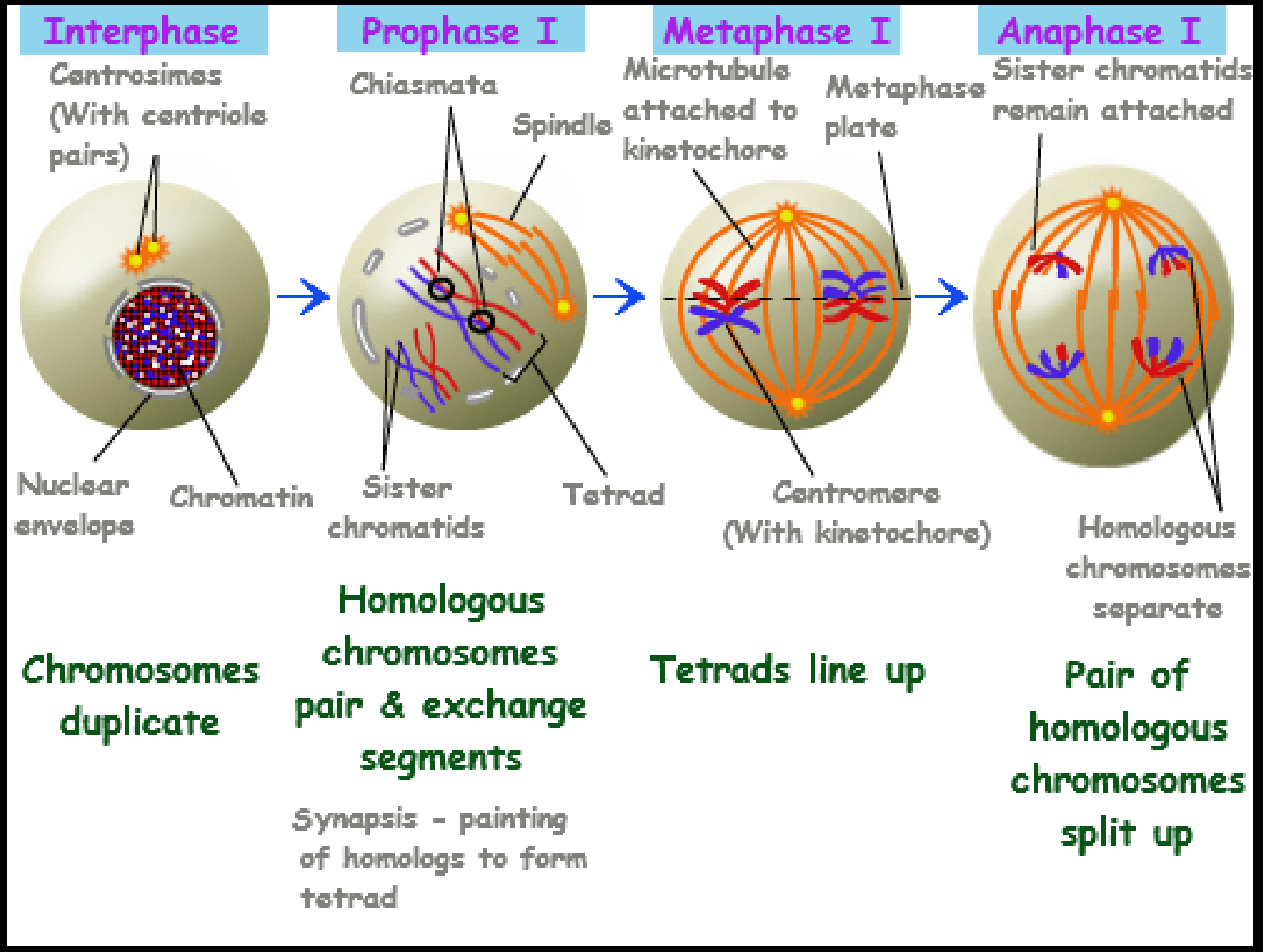
Meiosis



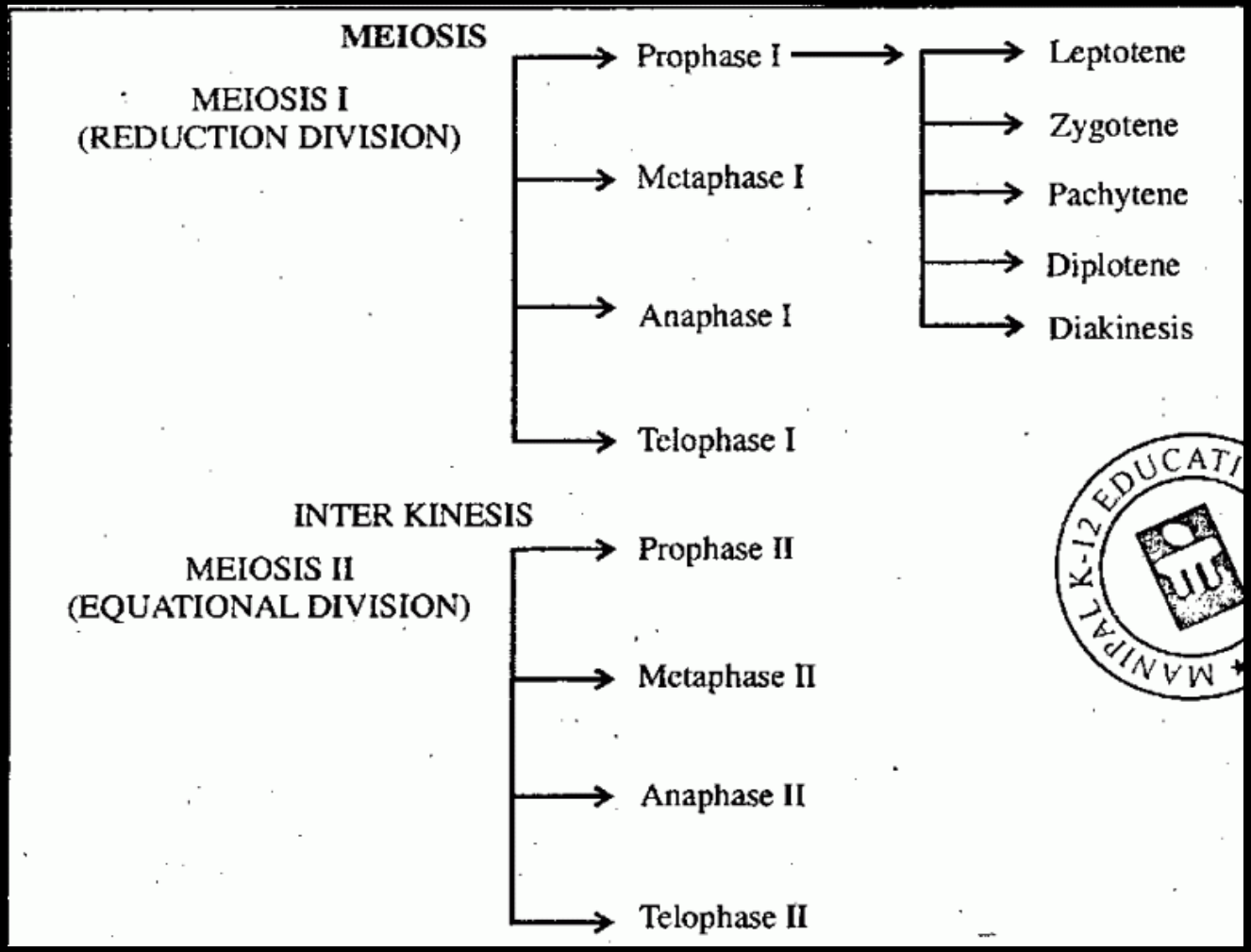


http://biology.tutorvista.com/cell/meiosis.html


Interphase
Centrosimes (With centriole pairs)
Nuclear envelope
Chromatin
Chromosomes duplicate
Prophase I
Chiasmata
Spindle
Sister chromatids
Tetrad
Homologous chromosomes pair & exchange segments
Synapsis - painting of homologs to form tetrad
Metaphase I
Microtubule attached to kinetochore
Metaphase plate
Centromere (With kinetochore)
Tetrads line up
Anaphase I
Sister chromatids remain attached
Homologous chromosomes separate
Pair of homologous chromosomes split up

MEIOSIS

- It is a type of cell division in which the chromosome number is halved from the diploid number (2n) to a haploid number (n). Like mitosis it involves DNA replication during the interphase in the parent cell, but this is followed by 2 cycles of nuclear division called meiosis I and meiosis II. thus a single diploid cell gives rise to four haploid cells.


MEIOSIS
MEIOSIS I
(REDUCTION DIVISION)
Prophase I
Leptotene
Zygotene
Pachytene
Diplotene
Diakinesis
Metaphase I
Anaphase I
Telophase I
INTER KINESIS
MEIOSIS II
(EQUATIONAL DIVISION)
Prophase II
Metaphase II
Anaphase II
Telophase II

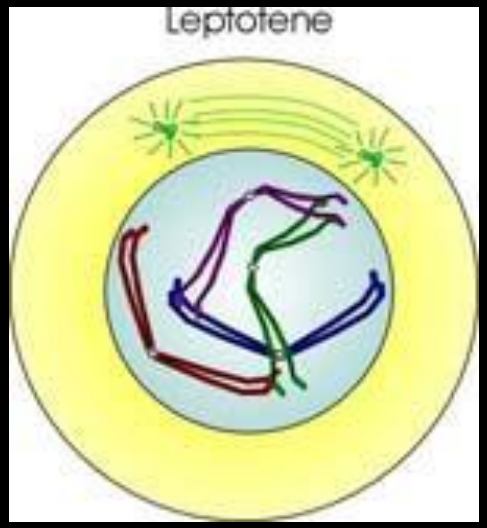
. Meiosis I or First Meiotic Division

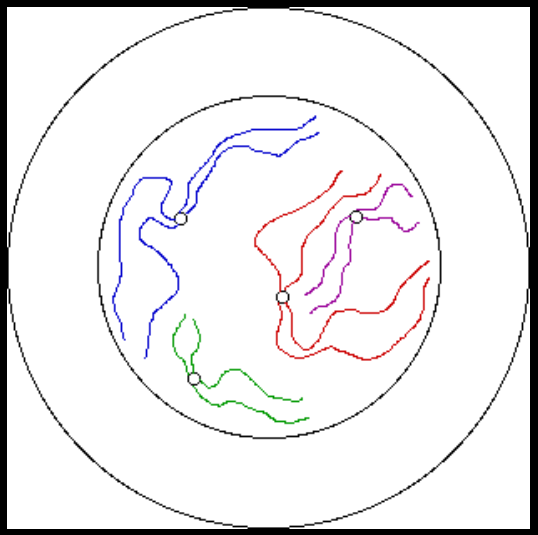
- In this division the two homologous chromosomes of each pair separate from each other and go to separate daughter cells. This reduces the number of chromosomes from diploid to haploid. There are four substages of Meiosis I.

(1) PROPHASE I:

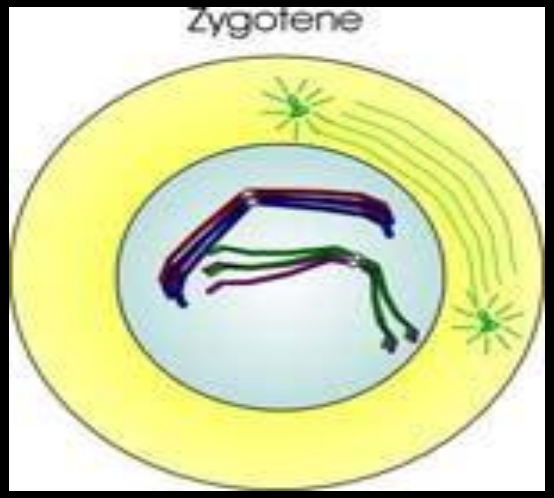
- It is the longest phase and is divided into five substages: Leptotene, Zygotene, Pachytene, Diplotene and Diakinesis.

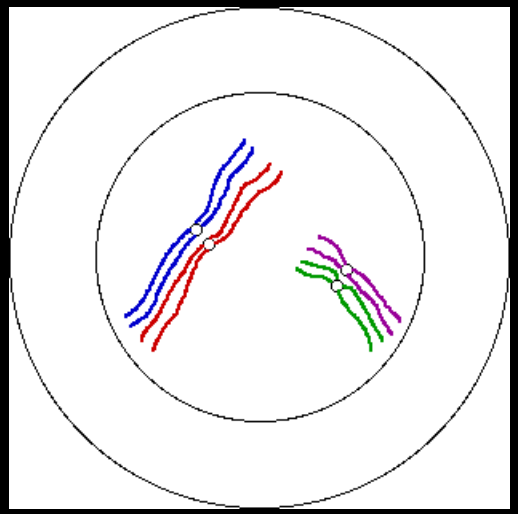
- **(a) Leptotene** or **leptonema**: It occurs after interphase-Chromosomes appear as long slender threads with many bead- like **chromomeres** along their length.



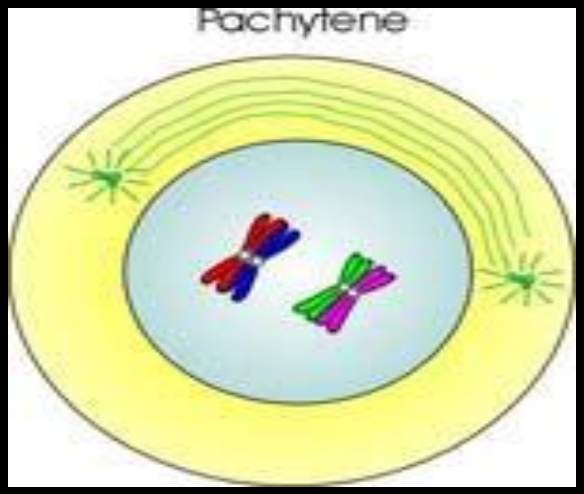


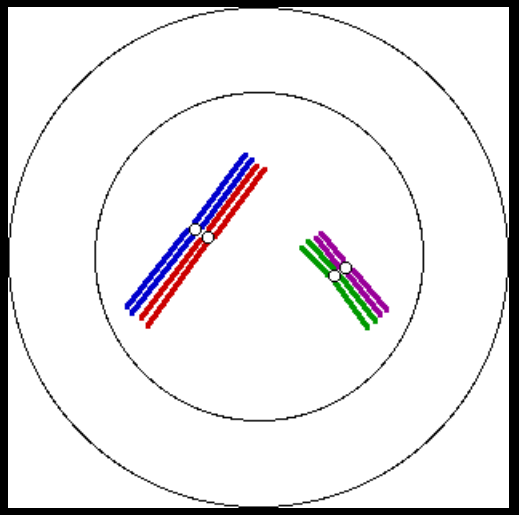
- **(b) Zygotene** or**Zygonema**: During this stage homologous chromosomes attract each other and form pairs **(synapsis).** Pairing occurs in a zipper-like fashion and starts at. centromere and extends towards the end of chromosome.



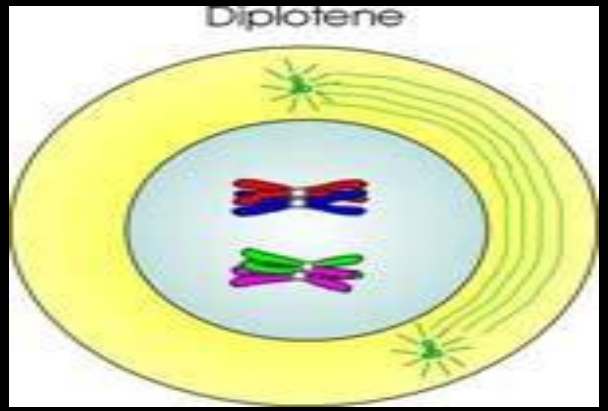


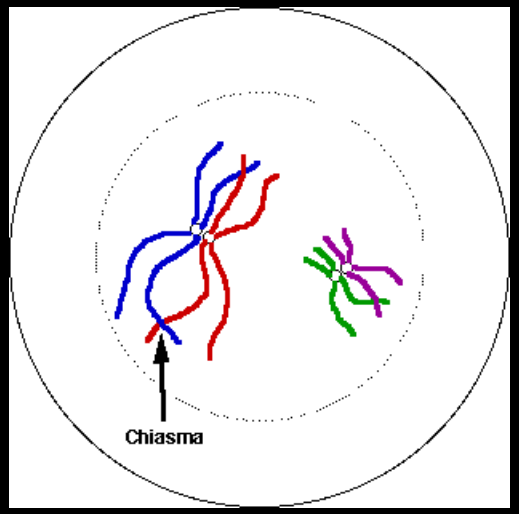
- **(c) Pachytene orpachynema:** Chromosomes in this stage undergo shortening and coiling. The two sister chromatids of a homologous chromosome associated with two sister chromatids of their homologous partner. This group of four chromatids is known as **tetrad.** A series of exchanges of genetic material (exchange of segments of chromatids) occur between non-sister homologous chromatids. It is called **crossing over** or **recombination.**



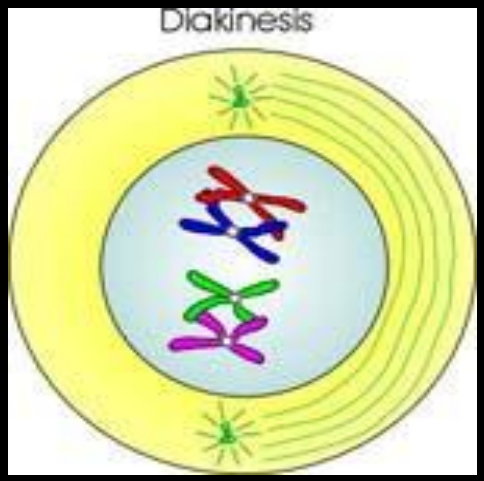


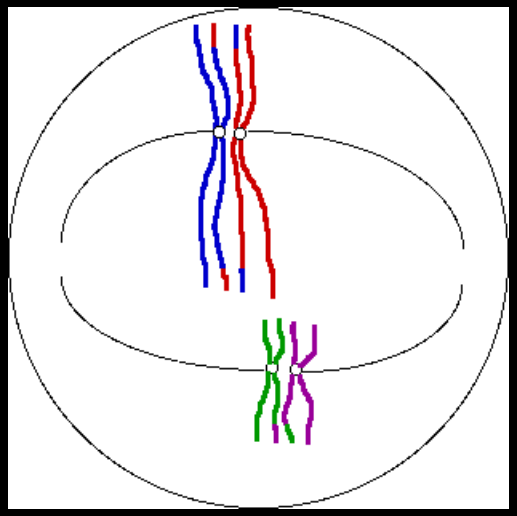
- **(d) Diplotene** or **diplonema:** Chromosomes further shortened and coiled. Homologous pair of chromosomes starts separating from one another. Homologous chromosomes are visible crossing each other at certain points along the length. Such points of crossing between homologous chromosomes are called **chjtasmata** (singular chiasma). These are the places of crossing over and appear X-shaped, i.e., exchange of chromatids segments.





- **(e) Diakinesis :** Coiling and contraction of chromosomes continue until they are thick. In this process bivalents usually migrate close to nuclear membrane and become evenly distributed. Nucleolus now disappears. In the later part of this stage, nuclear membrane dissolves





- **Crossing over:**
- It is an important genetic phenomenon which takes place, during the prophase I of meiosis I. It occurs between two non-sister chromatids of homologous chromosomes. During the process there is a mutual exchange of parts of chromatids. The point of crossing over is known as chiasma. The chromatids may break at the chiasma. When the chromosomes separate there may have been an exchange of segments. This results in recombination of genes.

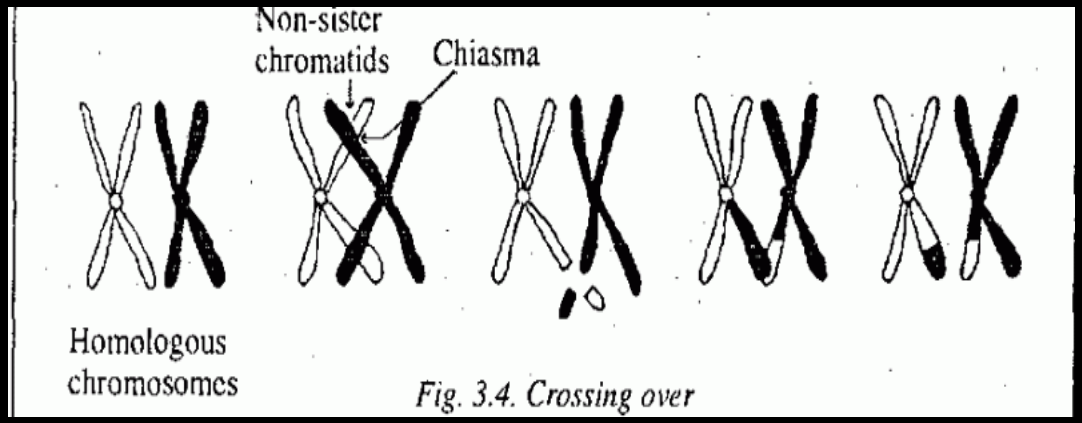
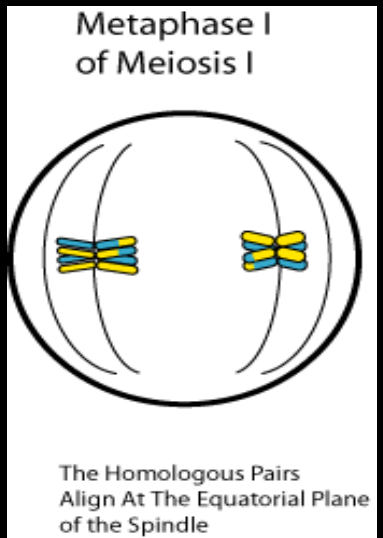


Fig. 3.4. Crossing over

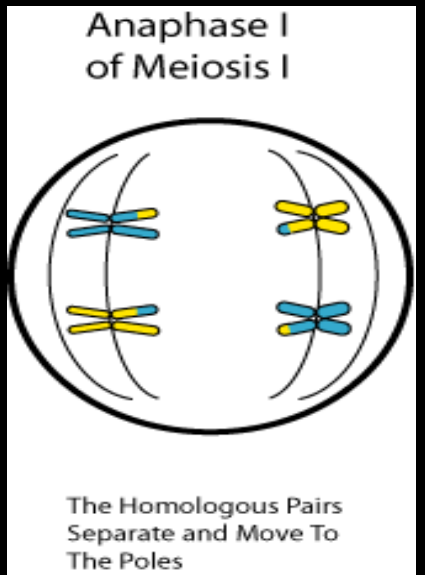
(2) Metaphase I

- Chromosomes are in most condensed stage. Chiasmata that had appeared during diplotene have now moved towards the ends of each chromosome **(terminalization),** leaving only the single terminal attachment between the paired arms of homologous chromosomes. These remaining chiasmata prevent the separation of homologous chromosomes which now lie on each side of equatorial plate of the spindle stretched by their respective centromeres towards opposite poles.



(3) Anaphase I

- The chromosomes of a bivalent move towards poles from equatorial plate. Here sister chromatids do not separate but go to the same pole. It is called **reductional** division. At the end of 1st anaphase, each pole of the cell has half the number of chromosomes in comparison to parent cell.

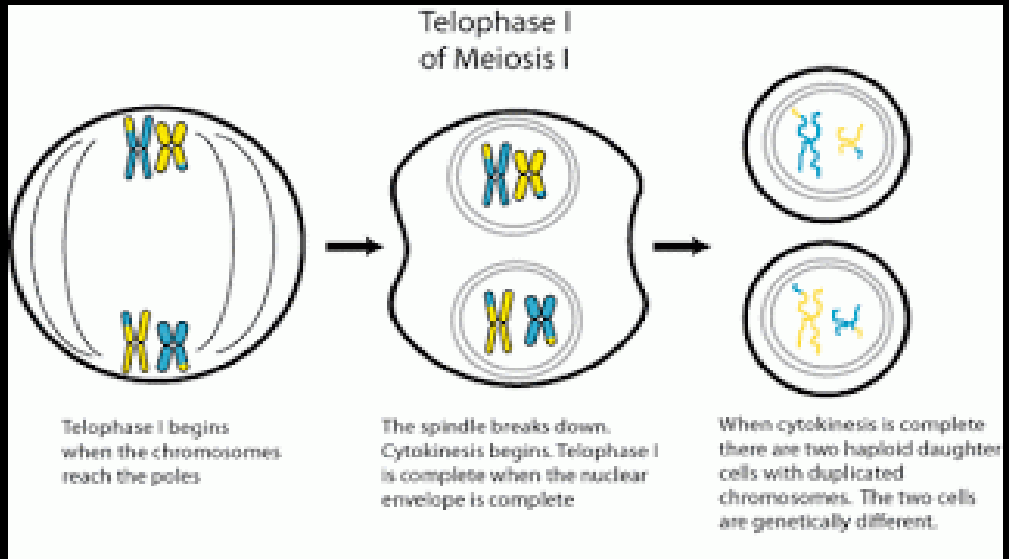


(4) Telophase I

Nuclear membrane is formed around the group of chromosomes at either pole.. In plant .

CYTOKINESIS:

may occur during this stage or may be postponed until simultaneous formation of four daughter cells at the end of second meiotic division.

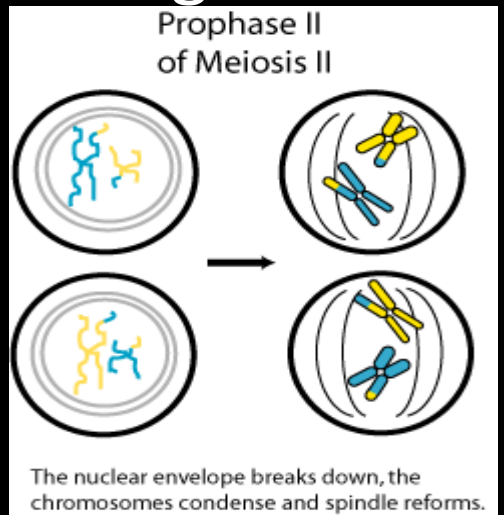


II. Meiosis II or Second Meiotic Division

It is an *equational division* like mitosis and takes place simultaneously, in both the nuclei in which chromosomes divide or duplicate to form four haploid nuclei.

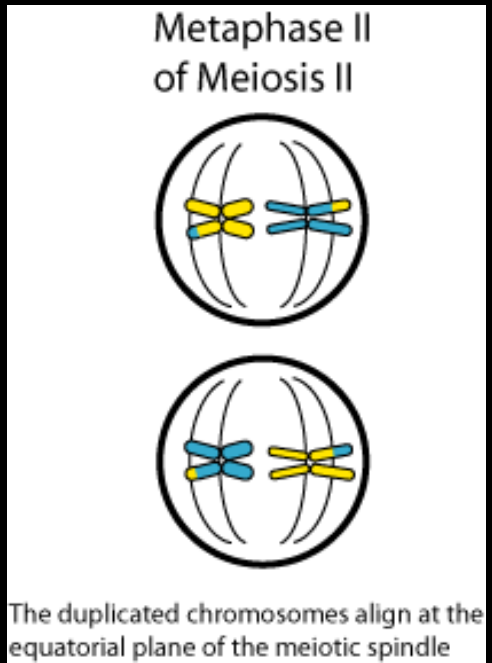
(1) Prophase II:

The chromosomes again become discernible each consisting of two sister chromatids still attached at centromeres, The nuclear membrane and nucleolus disappear and spindle fibres begin to appear.



(2) Metaphase II:

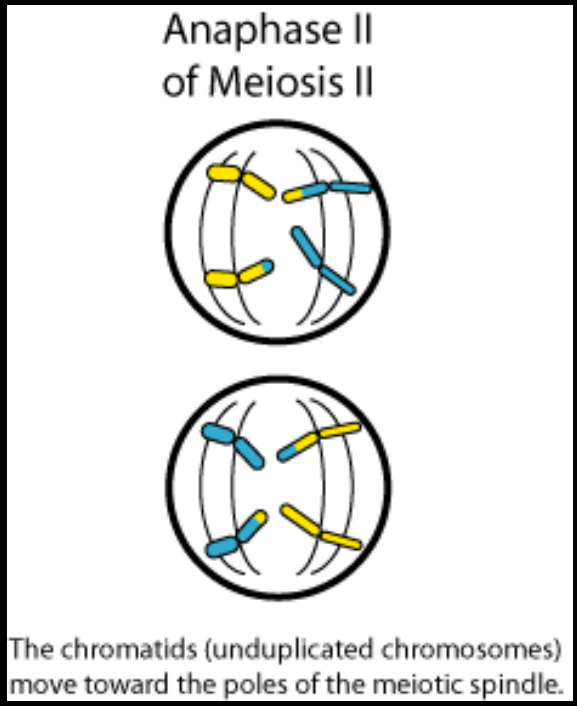
Spindle is completely formed and all chromosomes get arranged in the equatorial plate with centromeres attached to the spindle fibres.



The duplicated chromosomes align at the equatorial plane of the meiotic spindle

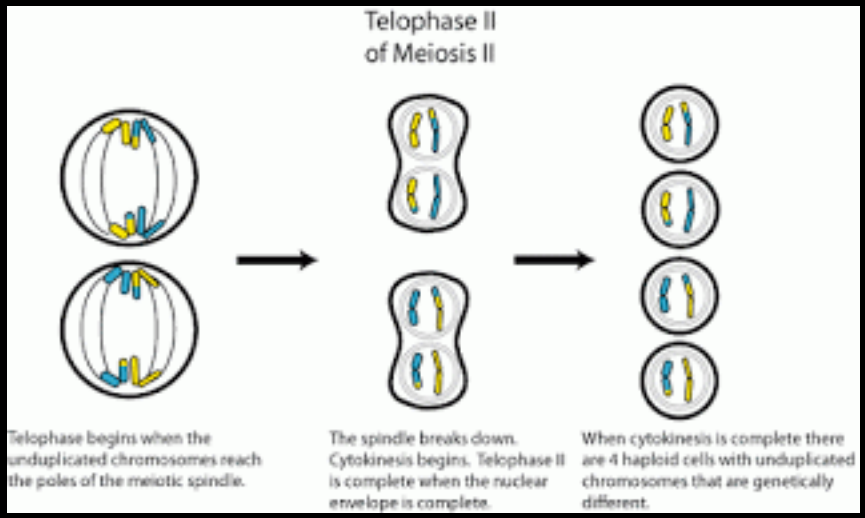
(3) Anaphase II:

The centromere of each chromosome now divides for the first time and sister chromatids travel to the opposite poles.



(4) Telophase II:

The set of daughter chromosomes at each pole elongates, becomes indistinct and nuclear membrane and nucleolus reappear organising into nucleus. The cytokinesis further divides each cell into two, thus forming four cells each containing half the number of chromosomes.



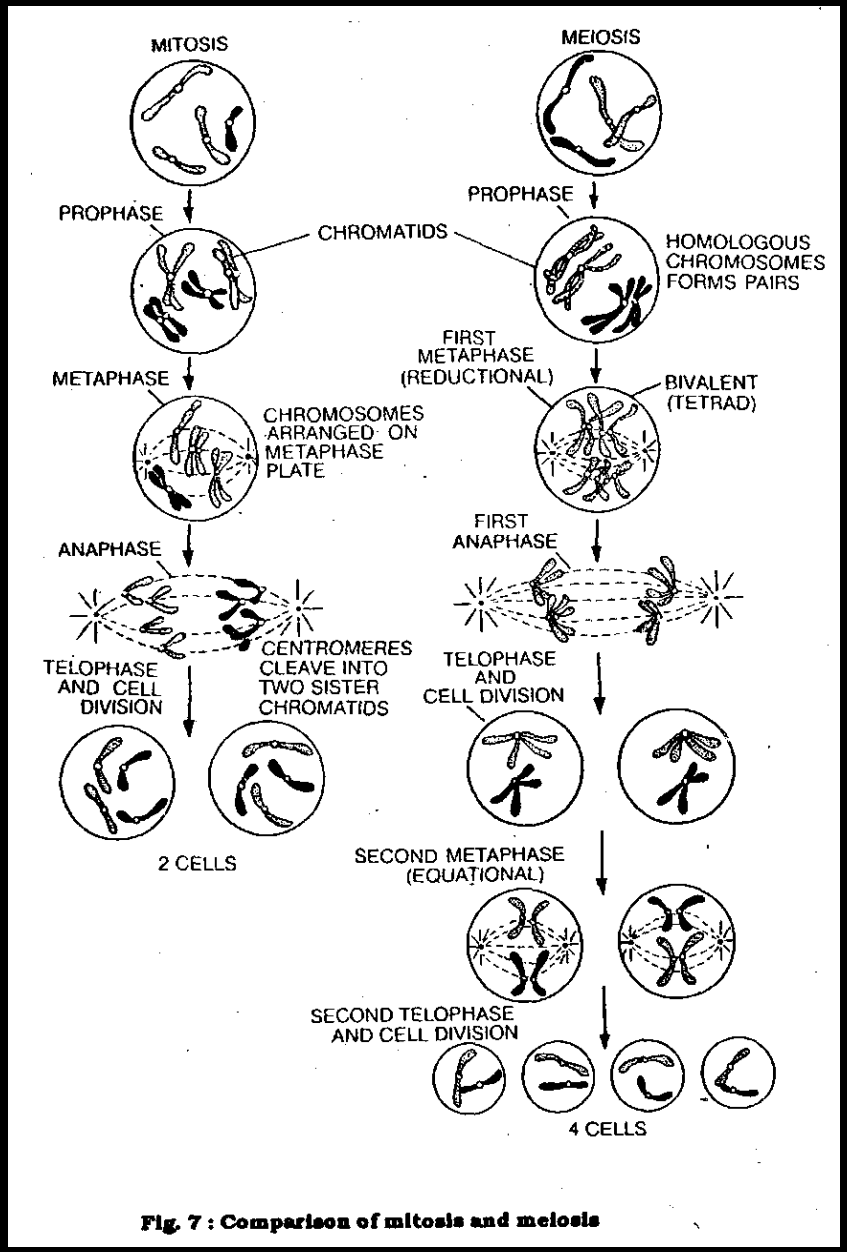


Fig. 7 : Comparison of mitosis and meiosis

http://www.biologycorner.com/APbiology/inheritance/10-1_meiosis.html