Umm AL Qura University

Meiosis

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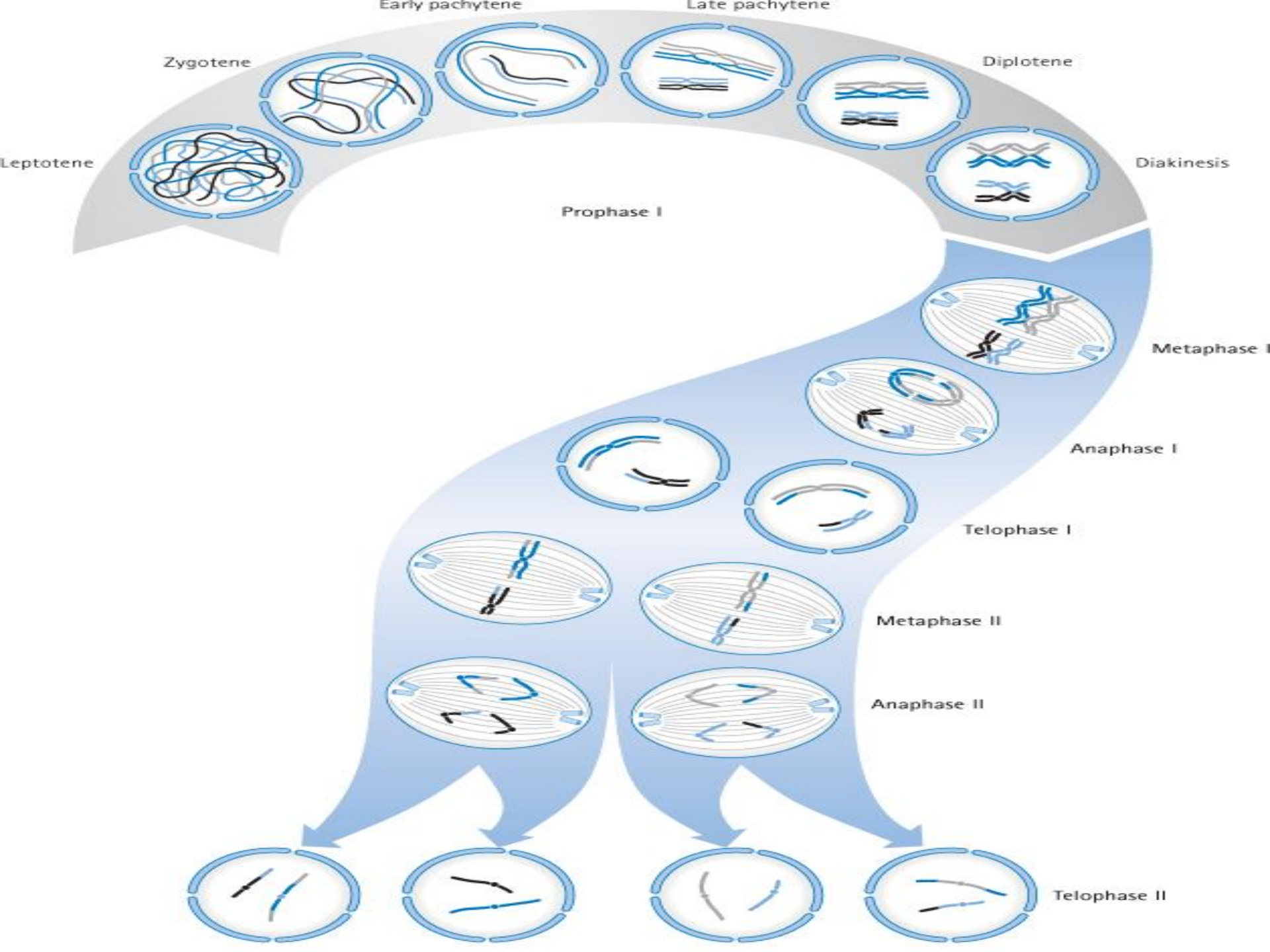
Meiosis

- Meiosis is the process of nuclear division which occurs during the final stage of gamete formation.
- Meiosis is consist of two cell divisions
  - Meiosis I (reduction phase)
  - Meiosis II


Early pachytene
Late pachytene
Zygotene
Diplotene
Leptotene
Diakinesis
Prophase I
Metaphase I
Anaphase I
Telophase I
Metaphase II
Anaphase II
Telophase II

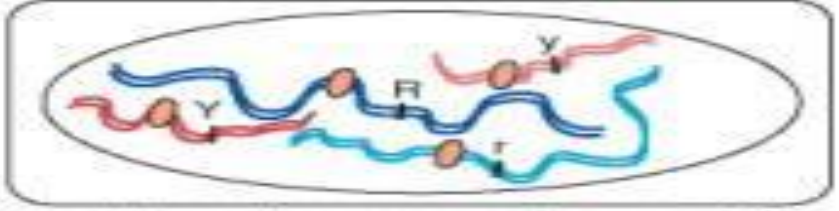
Meiosis I

- This is sometimes referred to as the reduction division because it is during the first meiotic division that the chromosome number is reduced from 46 to 23.
- Meiosis I consist of four stages: prophase I, metaphase I, anaphase I, and telophase I.

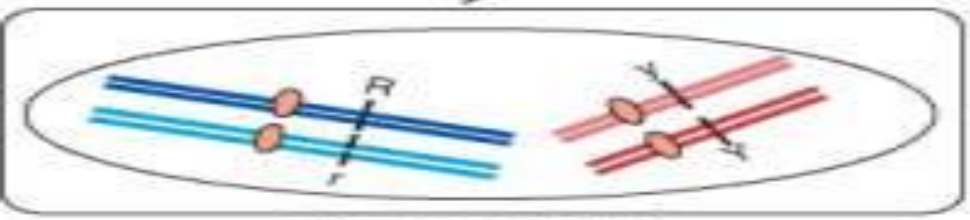
Meiosis I: Prophase I

- The prophase stage of meiosis I is relatively long and can be subdivided into five stages.
  - Leptotene
  - Zygotene
  - Pachytene
  - Diplotene
  - Diakinesis

Meiosis I



Leptotene: Chromosomes become visible

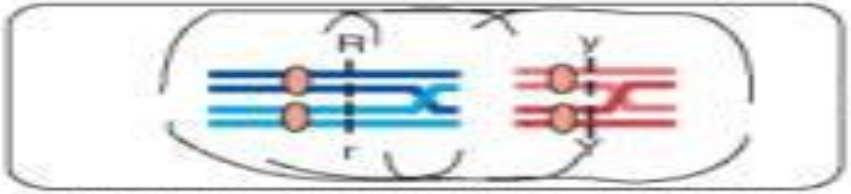


Zygotene: synapsis

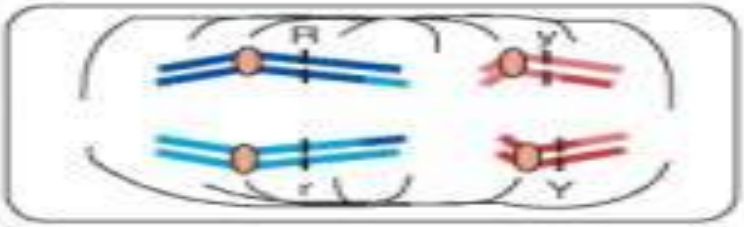
Pachytene: shorter and thicker

Diplotene: crossovers visible as chiasmata; see pairs of chromatids

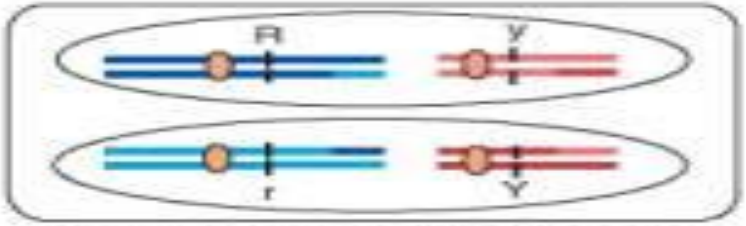
Diakinesis: further shortening



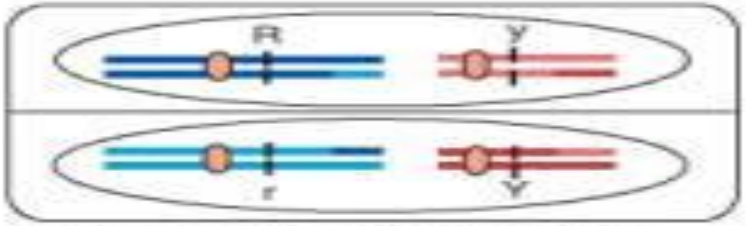
Metaphase I: alignment along central plane



Anaphase I: separation of homologs



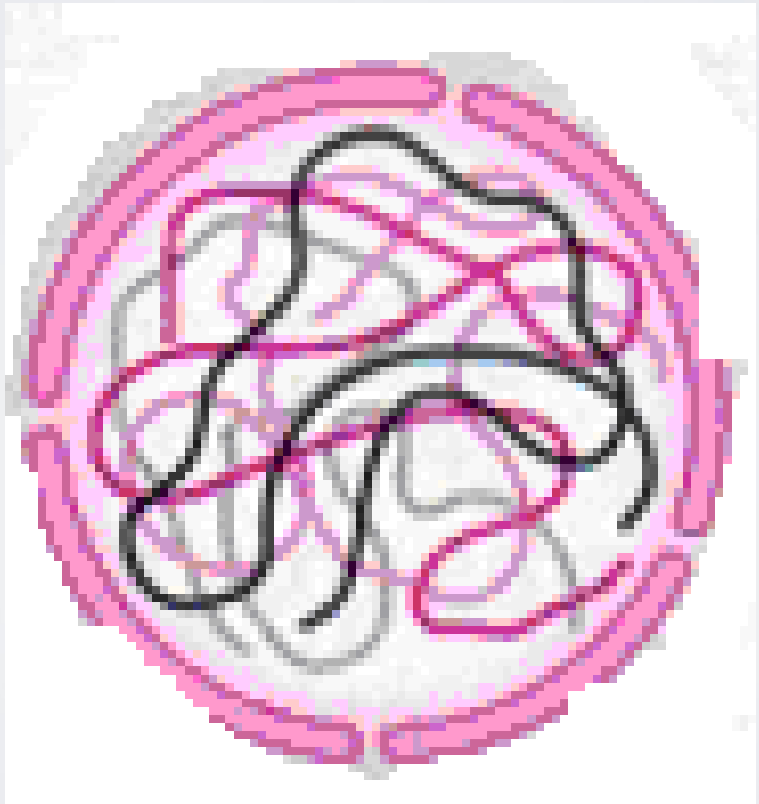
Telophase I: form nuclear membrane



Interphase I: form separate cells

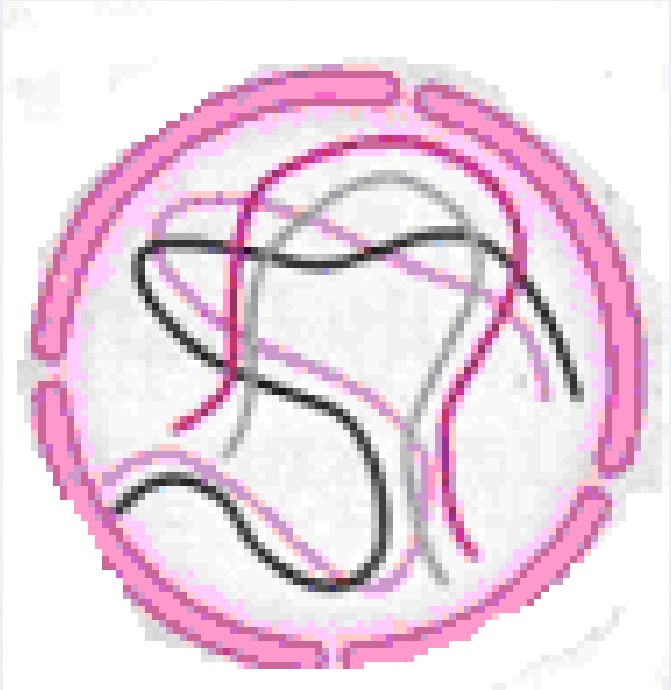
Prophase I: Leptotene

- The chromosomes become **visible** as they **start to condense**.



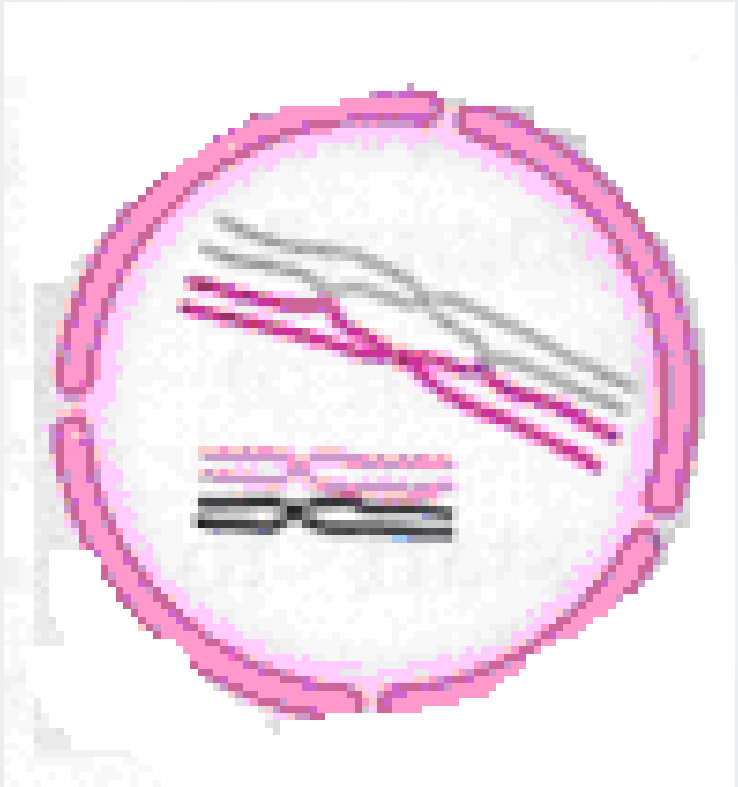
Prophase I: Zygotene

- **Homologous** chromosomes align directly **opposite each other** and are held together **at several points** along their length (synapsis).



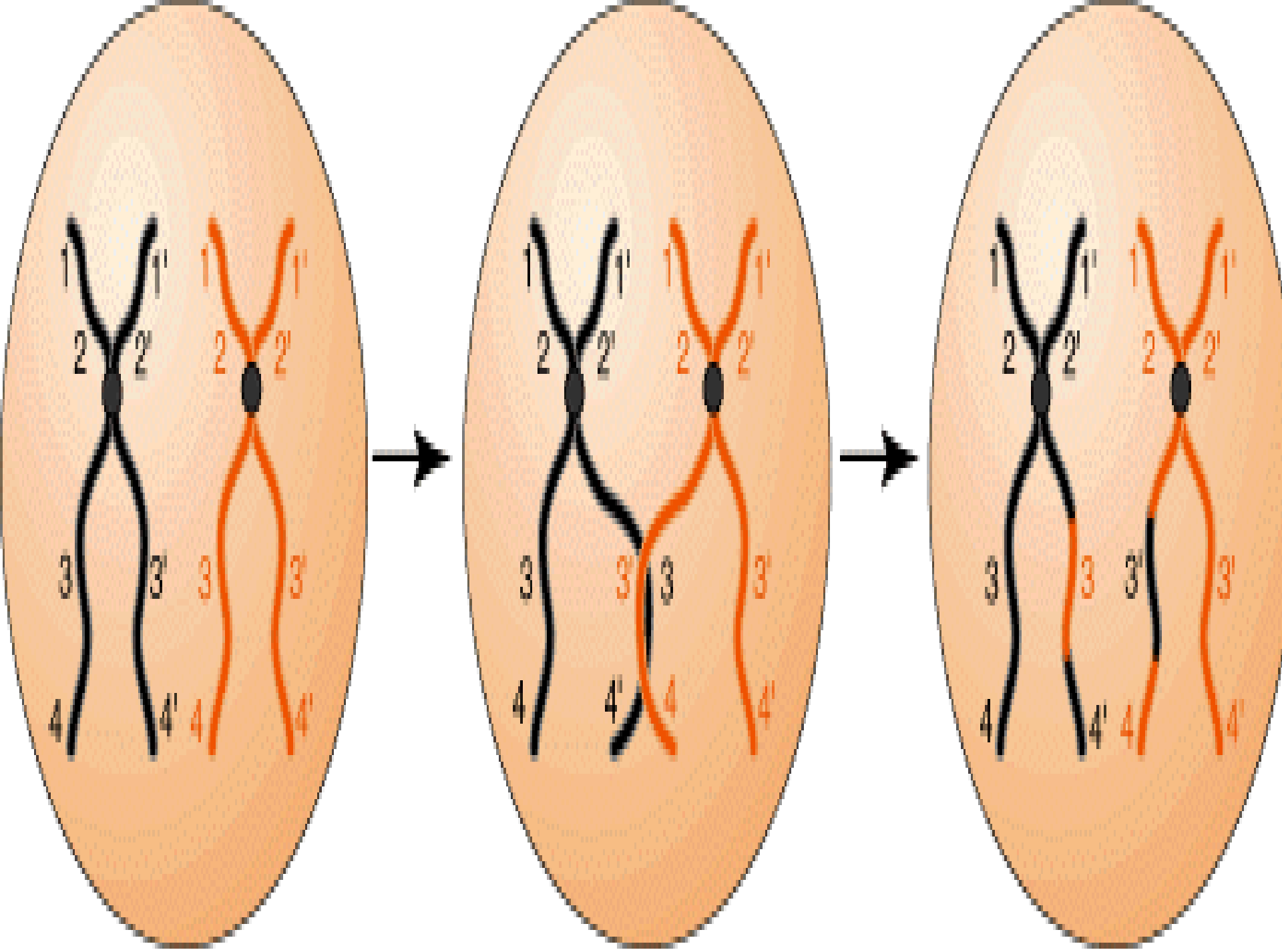
Prophase I: Pachytene

- Each pair of **homologous chromosomes** becomes **tightly coiled**.



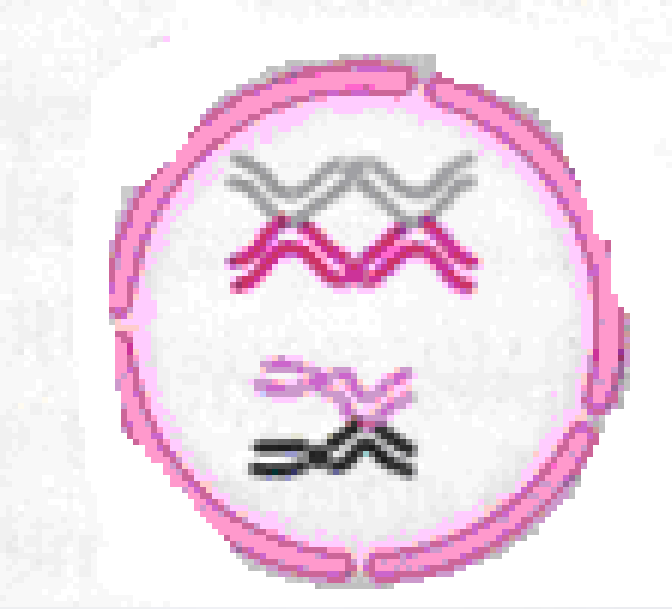
Prophase I: Diplotene

- The **homologous** recombinant chromosomes now **begin to separate** but **remain attached** at the points (Chiasmata) where **crossing over** has occurred.


1
1'
2
2'
3
3'
4
4'

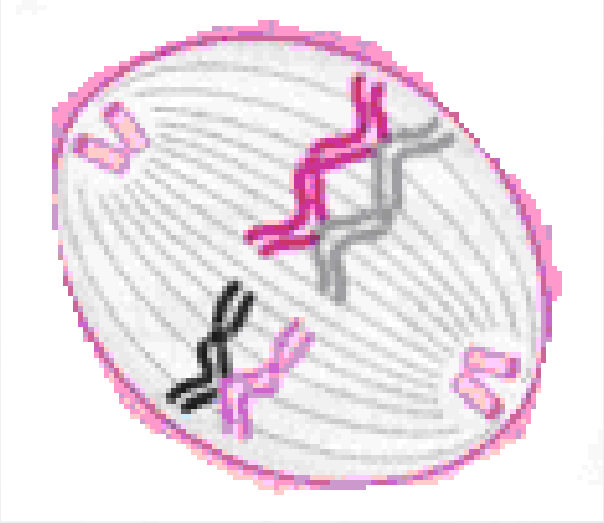
Prophase I: Diakinesis

- **Separation** of the **homologous chromosome** pairs proceeds as the chromosomes become **maximally condensed**.



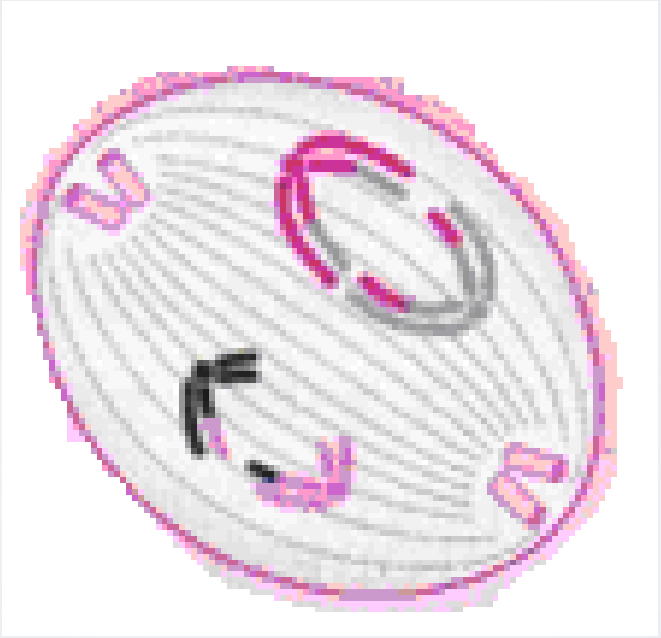
Metaphase I

- The **nuclear membrane disappears** and the chromosomes become aligned on the equatorial plane of the cell where they have become attached to the **spindle as in metaphase of mitosis**.



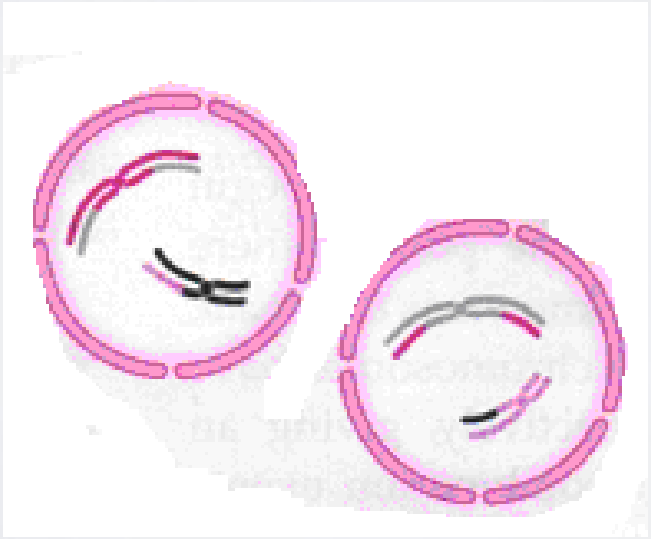
Anaphase I

- The chromosomes now **separate** to opposite poles of the cell as the spindle contracts.



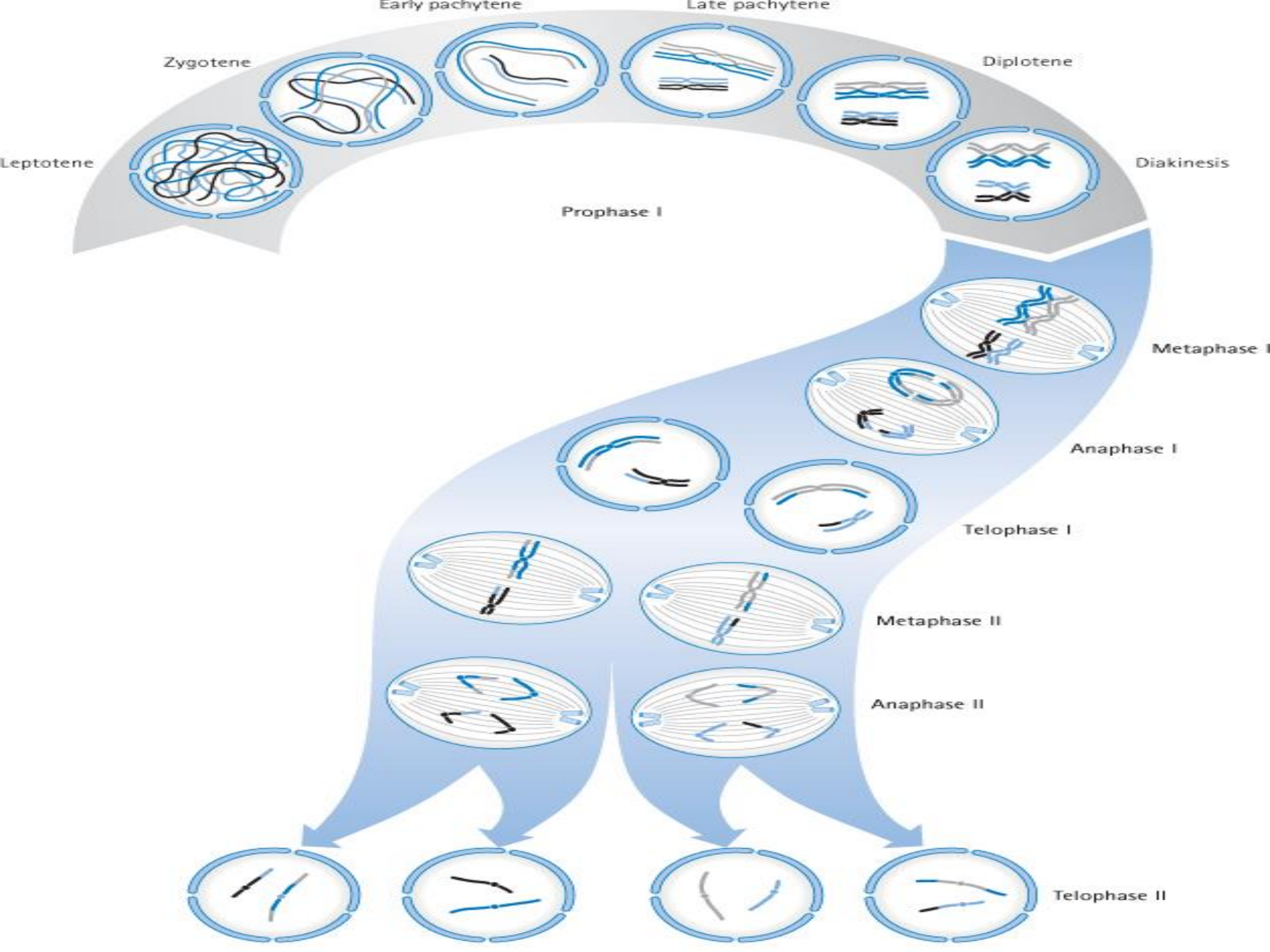
Telophase I

- Each set of haploid chromosomes has now **separated completely** to opposite ends of the cell which cleaves into **two new daughter gametes**, so-called **oocytes and Spermatocytes**.



Meiosis II

- This is essentially similar to an ordinary mitotic division.
- Each chromosome, which exists as a pair of chromatids, becomes aligned along the center of the cell and then splits leading to the formation of two new daughter gametes, known as spermatids or ova.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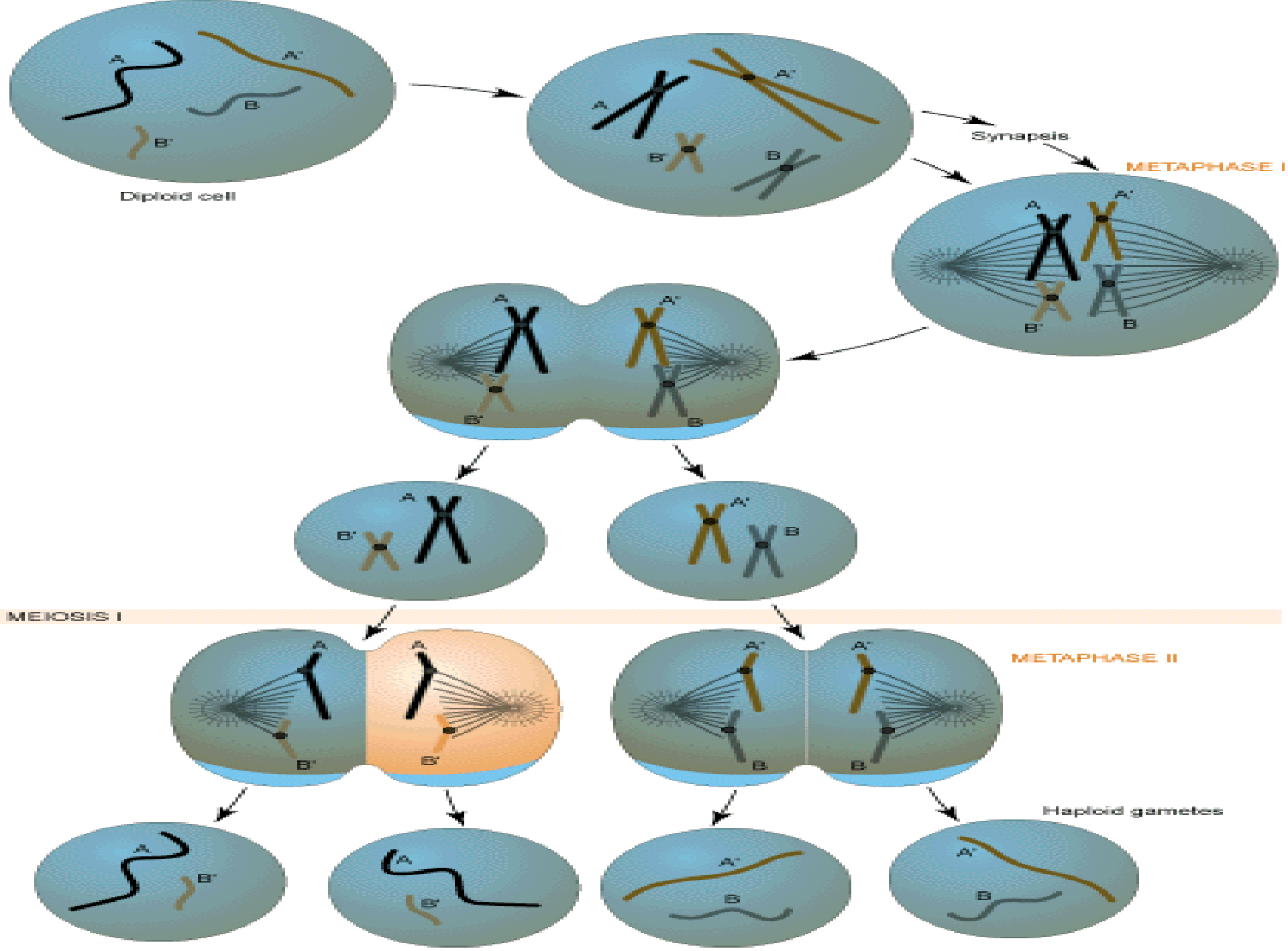
Diploid cell
Synapsis
METAPHASE I
MEIOSIS I
METAPHASE II
Haploid gametes
MEIOSIS II

Mitosis vs. Meiosis

	Mitosis	Meiosis
Site	Somatic cell	Germ cell
Cell division	Single division	Two division
Chromosomes	46	23

Mitosis vs. Meiosis

- Meiosis differs from mitosis in three fundamental ways:

- 1- Mitosis results in two diploid daughter cells (46 chromosomes).

  Where as meiosis results is 4 haploid cells (23 chromosomes) called gametes.

Mitosis vs. Meiosis

- 2- Mitosis takes place in somatic cells and during the early cell divisions in gamete formation. Meiosis occurs only at the final division of gamete maturation.
- 3- Mitosis occurs as a single one-step process. Meiosis can be considered as two cell divisions known as meiosis I and meiosis II, each of which can be considered as having prophase, metaphase, anaphase and telophase stages as in mitosis.