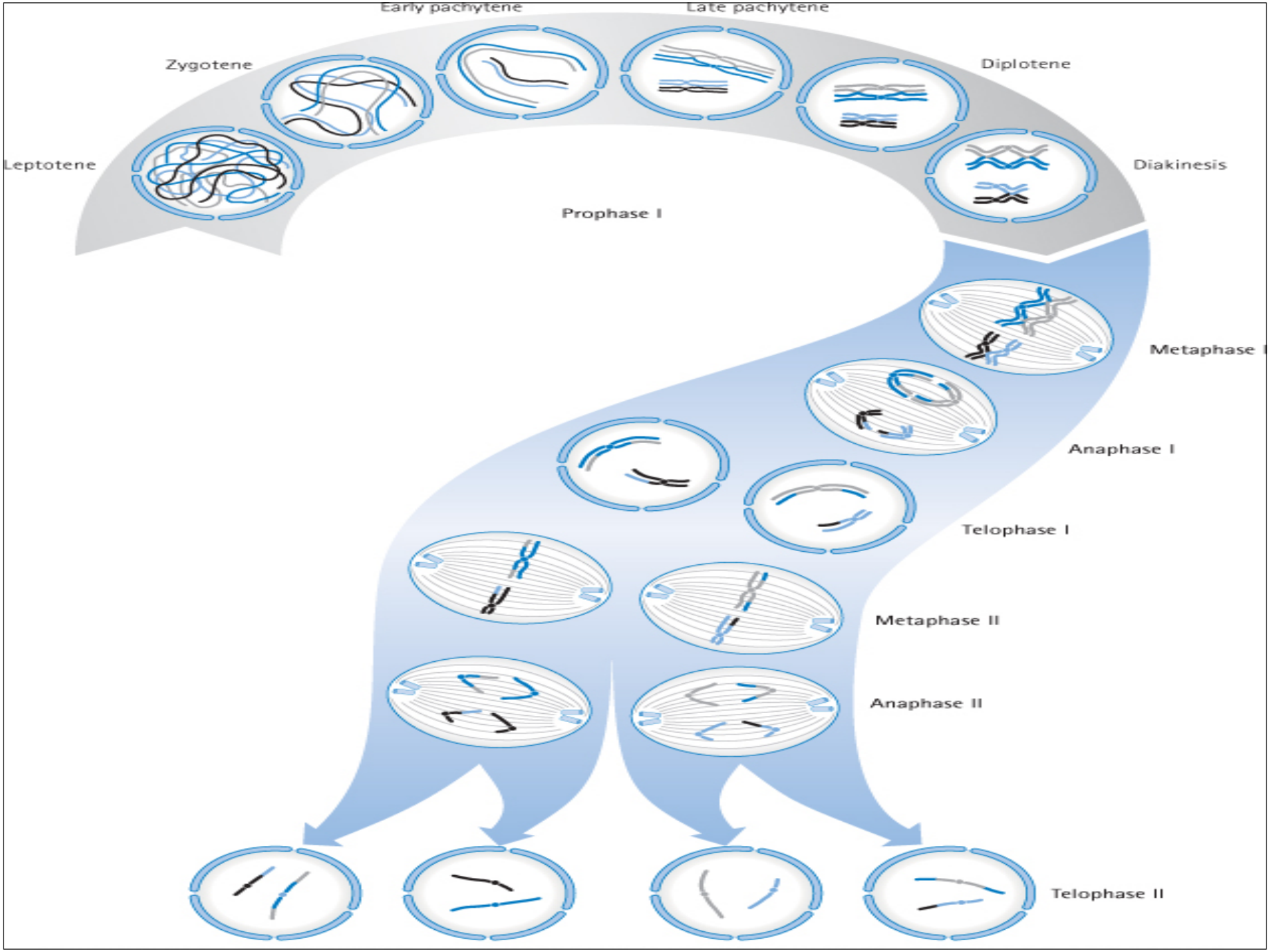
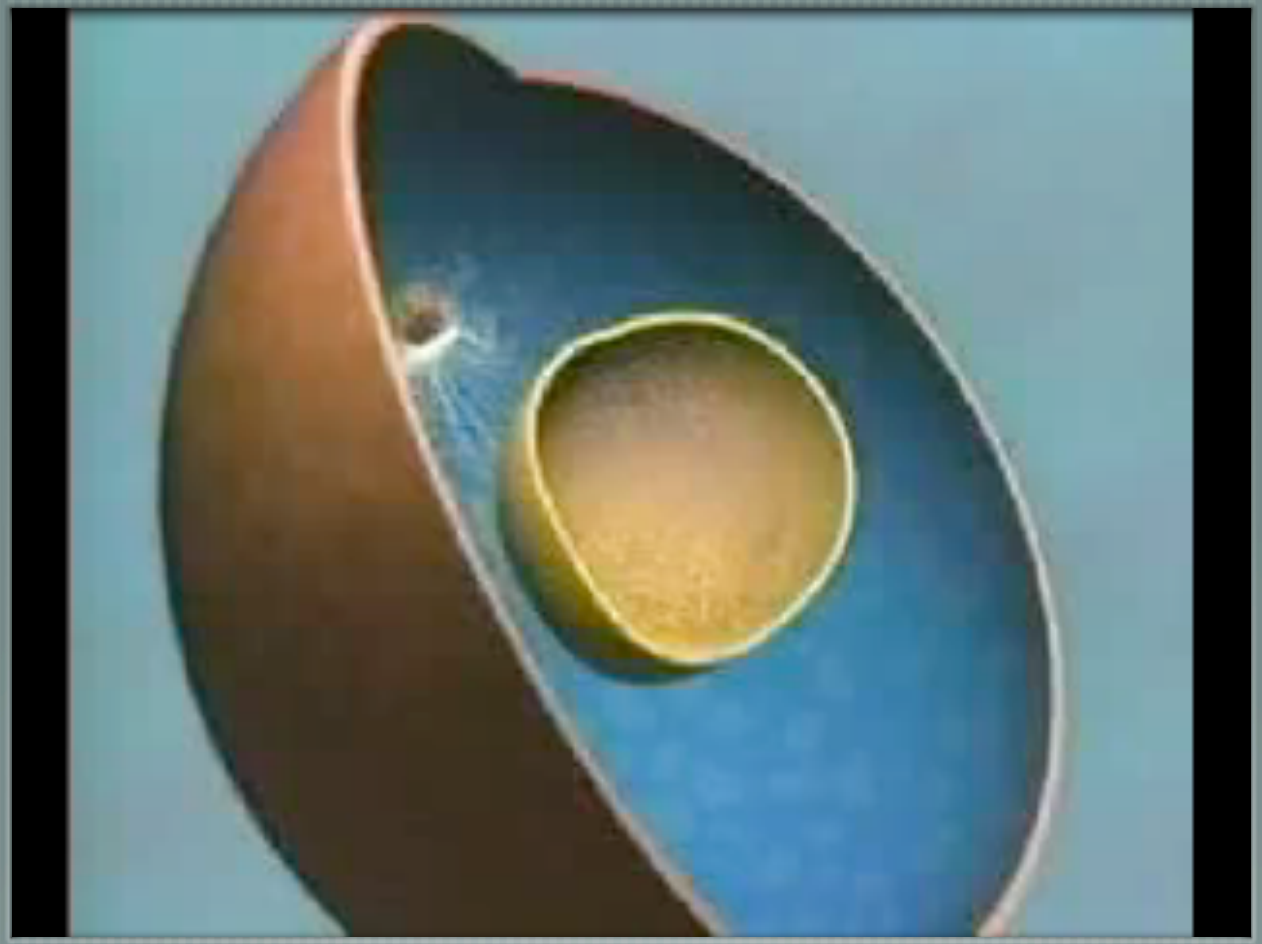
Meiosis

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



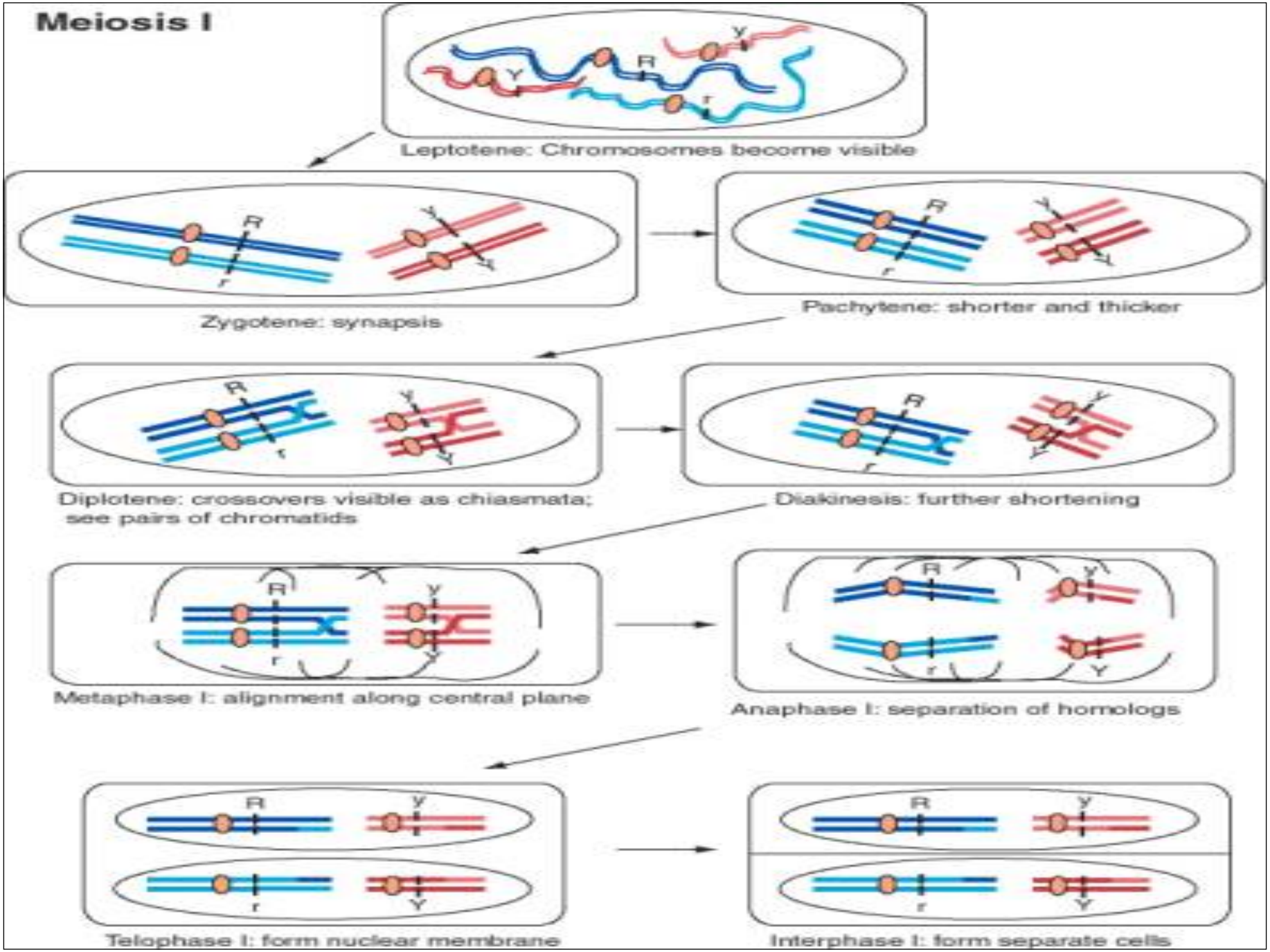
Meiosis

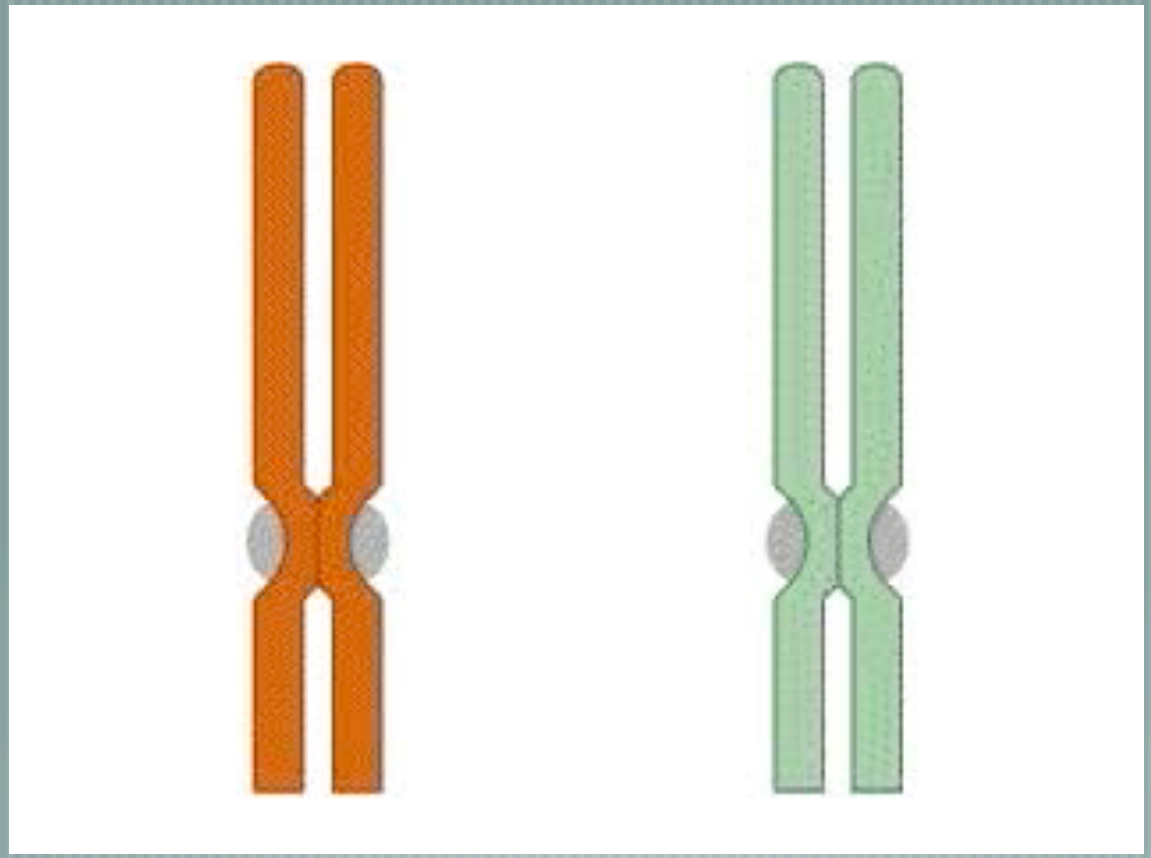
Meiosis I

- 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
R
Y
r
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



Crossing Over

Prophase I: Leptotene

- The chromosomes become visible as they start to condense.

Prophase I: Zygotene

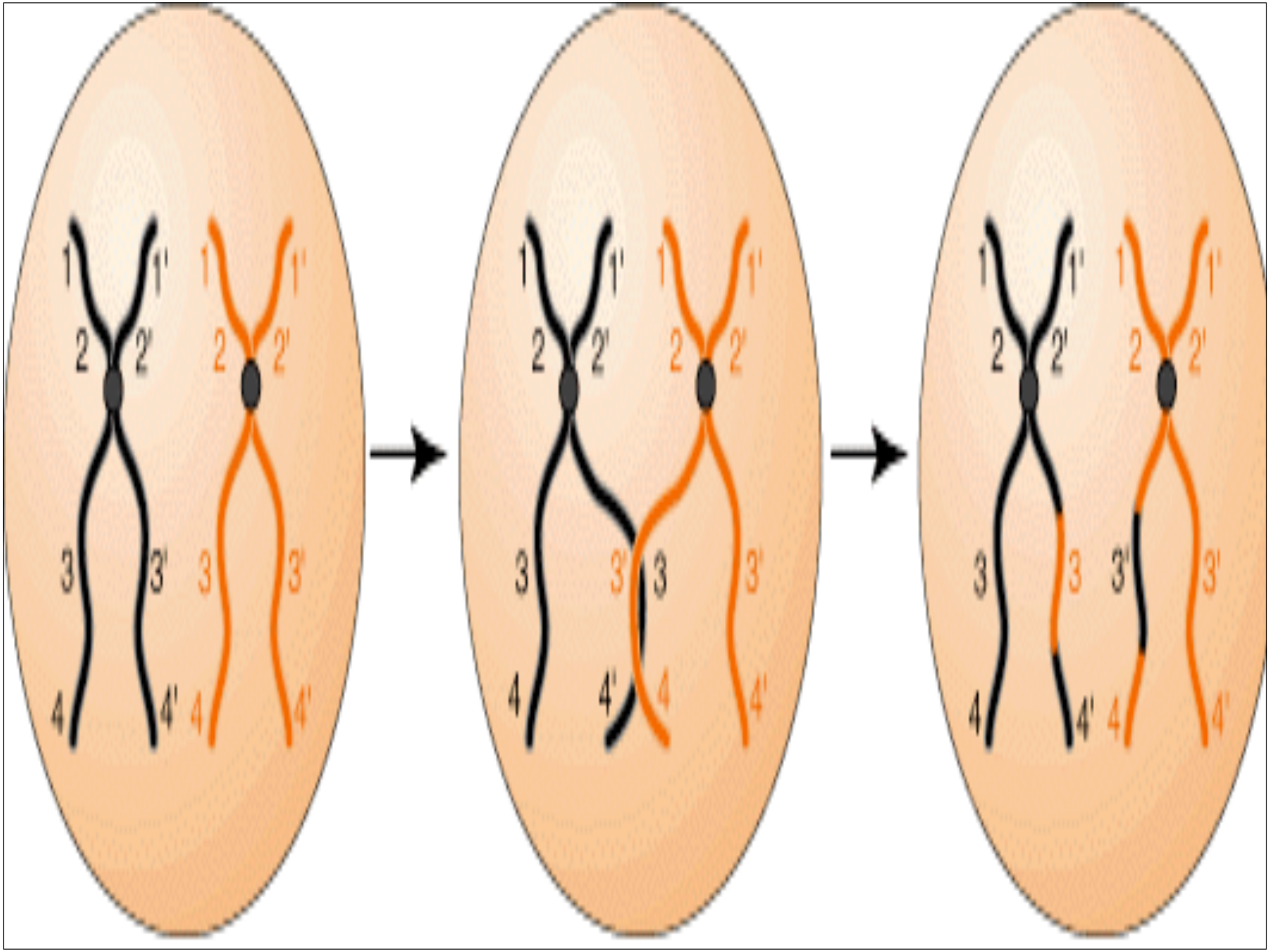
- Homologous chromosomes align directly opposite each other and are held together at several points along their length.

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 where crossing over has occurred.


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

Prophase I: Diakinesis

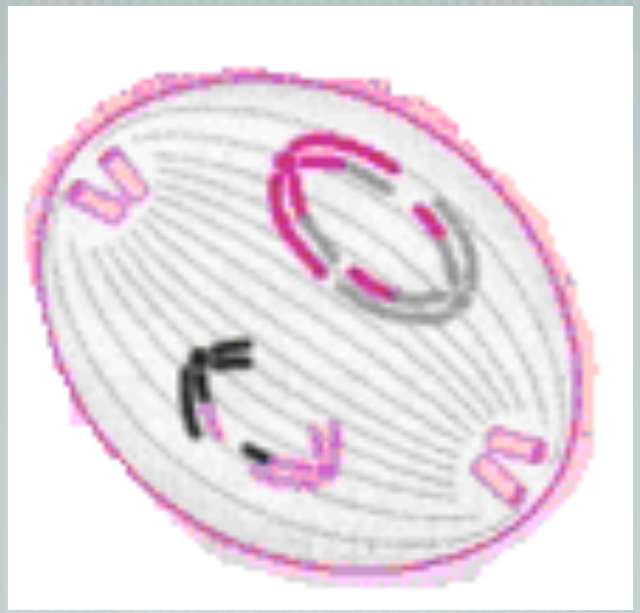
- Separation of the homologous chromosome pairs proceeds as the chromosomes become maximally condensed.

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.

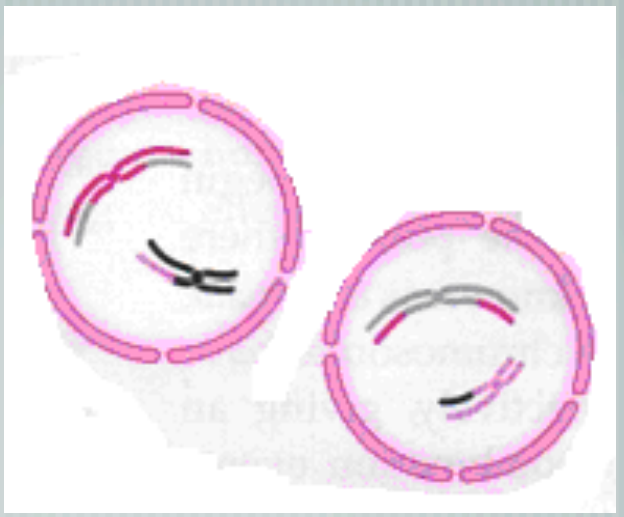
Anaphase I

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



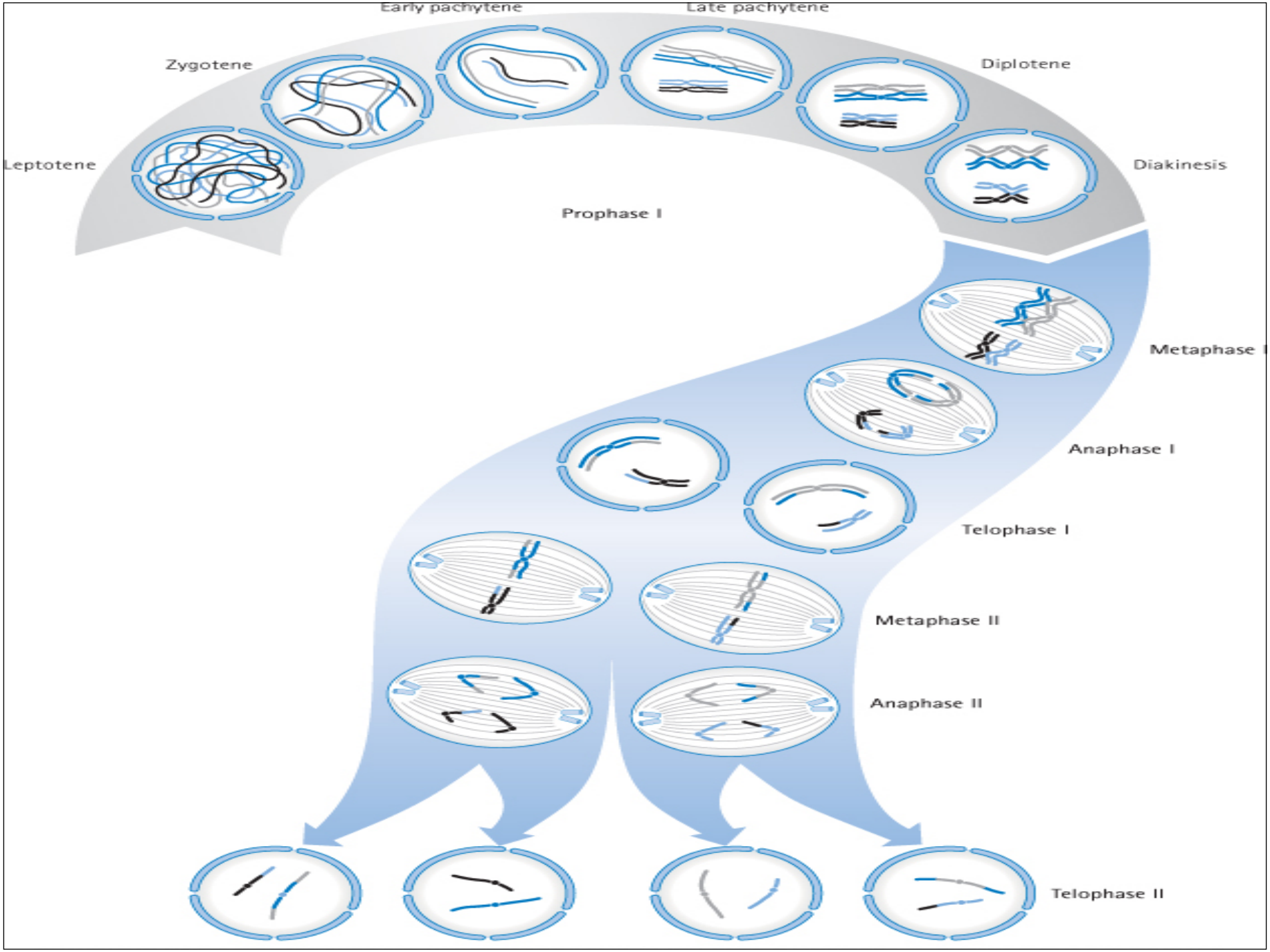
Telophase I

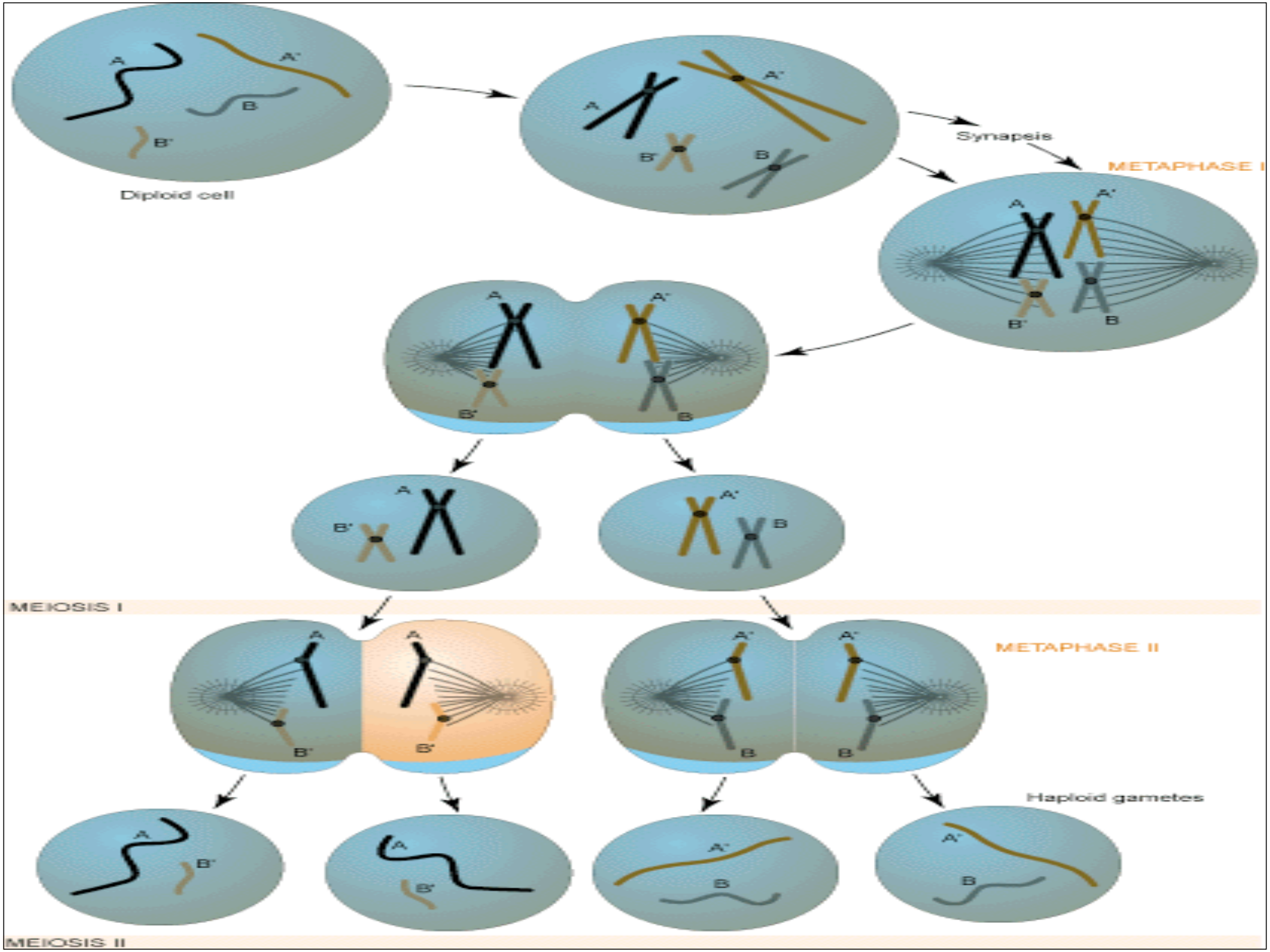
- Each set of haploid chromosomes has now separated completely to opposite ends of the cell which cleaves into two new daughter gametes, so-called oocytes.



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.


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


A
A'
B
B'
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

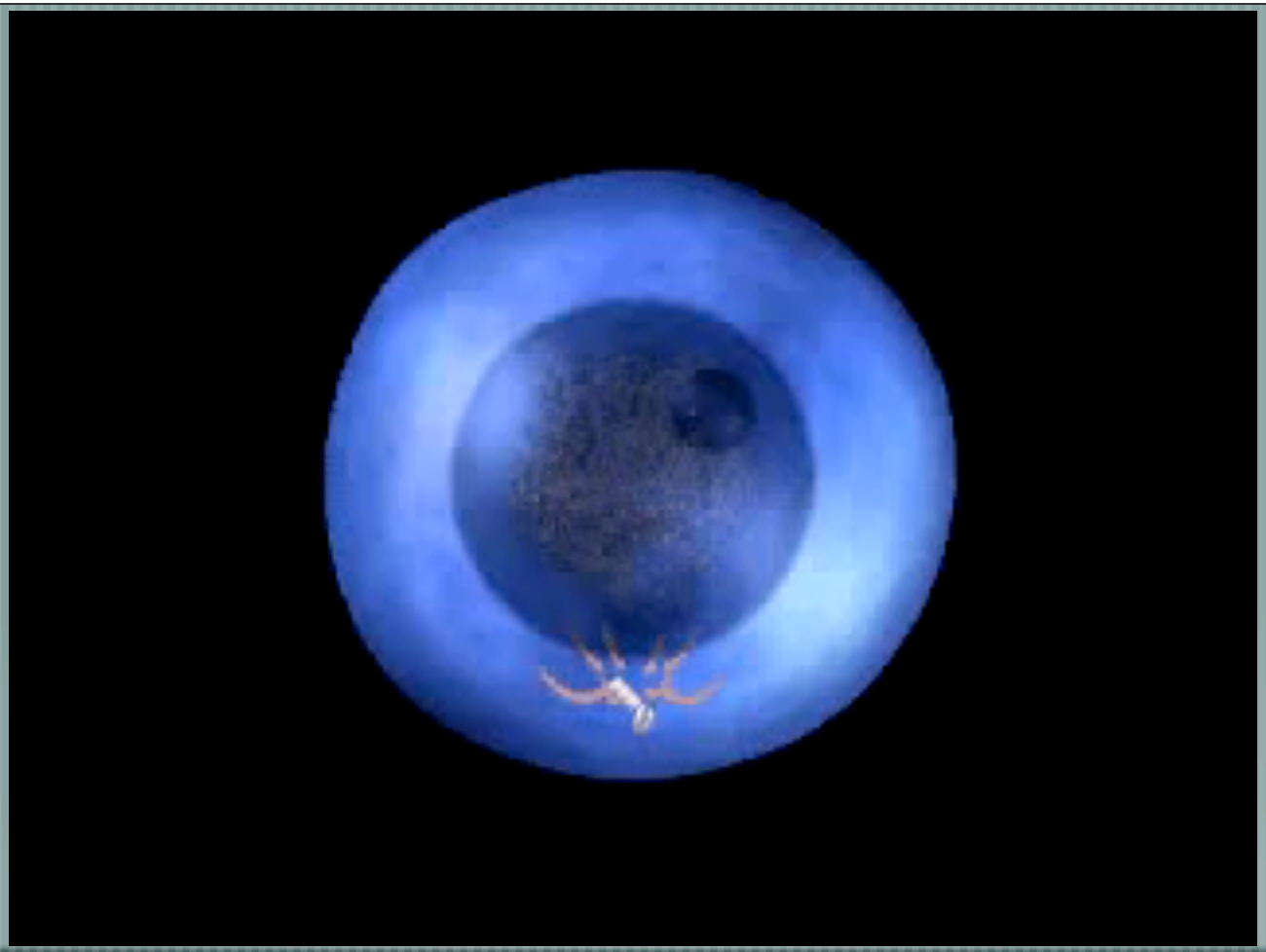
- Meiosis differs from mitosis in three fundamental ways:

1- Mitosis results in each daughter cell having a diploid chromosome complement (46). Where as in meiosis the mature gamete have a haploid complement of 23 chromosomes.

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.



Meiosis