

Section 4.2 - Meiosis

SBI3U

MRS. FRANKLIN

Recap ...

haploid

diploid

zygote

gametes

Fertilization

Asexual Reproduction

Sexual Reproduction

Formation of Gametes

Meiosis:

The process of meiosis only occurs within gametes and is not a continuous cycle like the process of mitosis. The gametes do not further divide, but instead fuse with another gamete to make a diploid zygote.

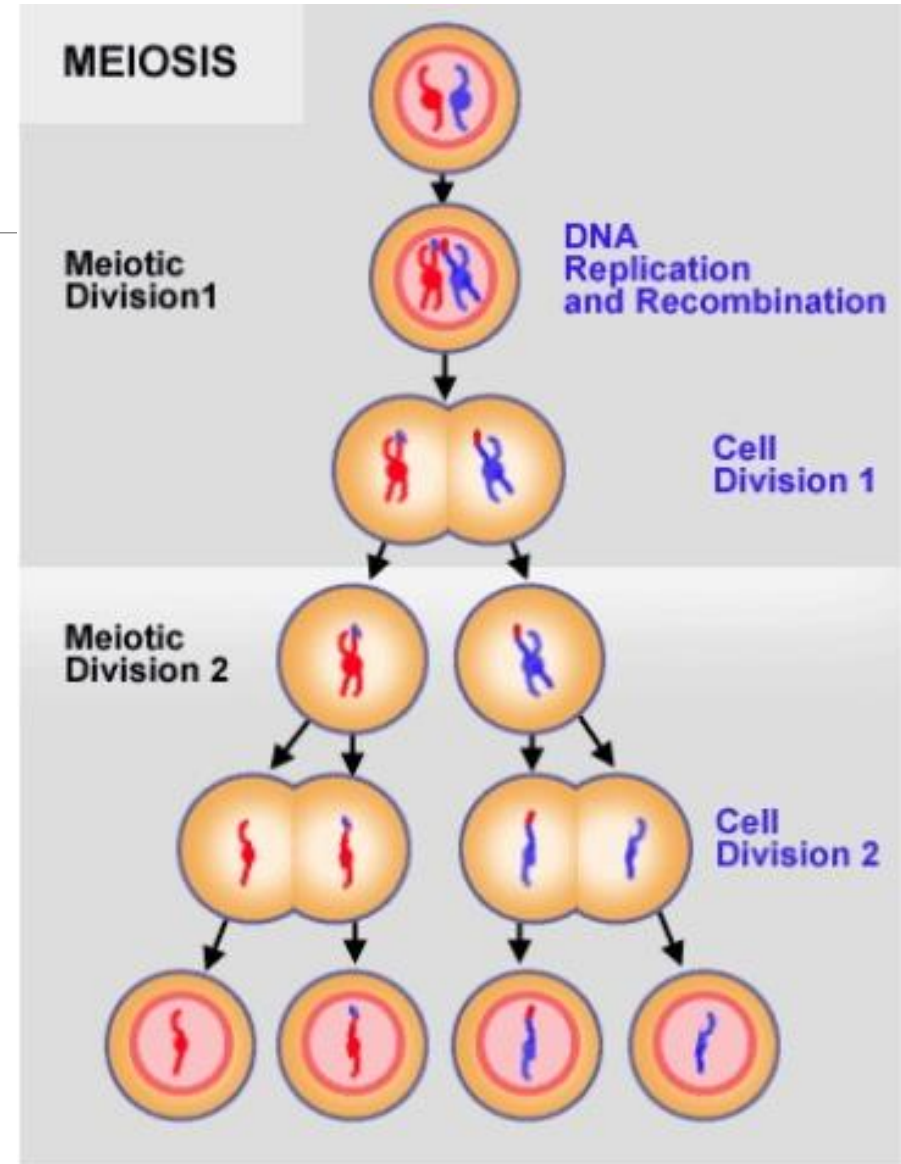
Meiosis

1. The formation of gametes
2. Genetic reduction: reduces the number of chromosomes to half
($n = 23$)
3. Genetic Recombination: different combinations of alleles are formed. Contributes to genetic variation in society

Meiosis

One cell divides twice to produce four genetically different daughter cells.

This results in half number of chromosomes (haploid) which is necessary for sexual reproduction.



Phases of Meiosis

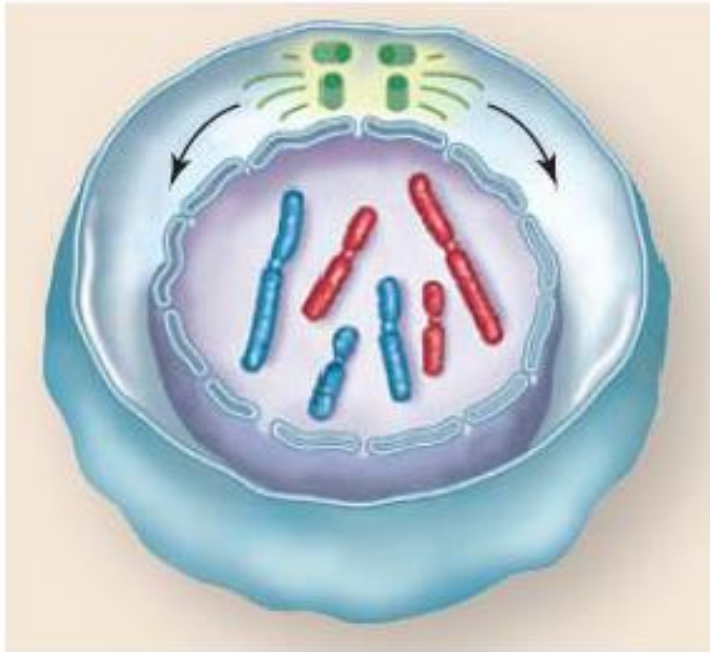
There are two phases that occur during meiosis:

Meiosis I:

Meiosis II:

** Both phases of meiosis undergo PMAT similarly to mitosis*

Phases 1: INTERPHASE



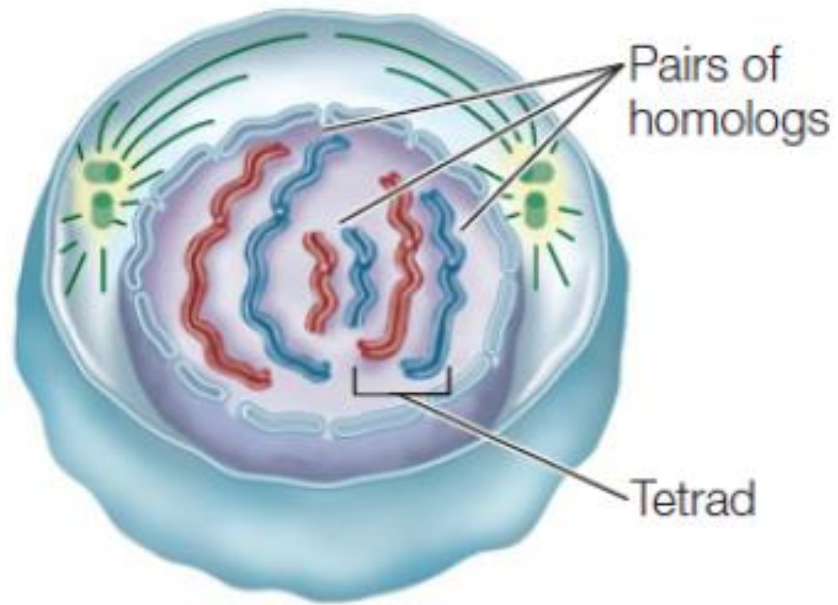
The cell goes through the G1, S and G2 stages. (similarly to Mitosis)

DNA replicates and is in the form of chromatin

Centrosome replicate and begin to migrate to opposite poles of the cell.

The parent cell is diploid and contains two sets of chromosomes

Prophase I



*When homologous chromosomes pair up they form a **tetrad**.*

Chromatin condenses into chromosomes

Centrosomes release spindle fibers.

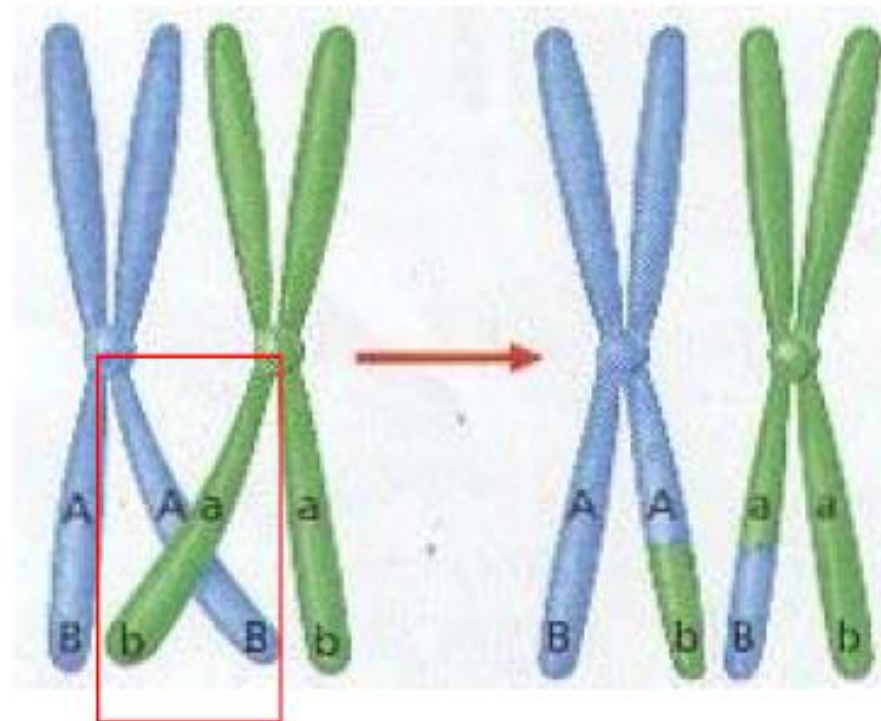
Homologous chromosomes pair up through **synapsis** (joined along their lengths)

Crossing over occurs (exchange of genetic information).

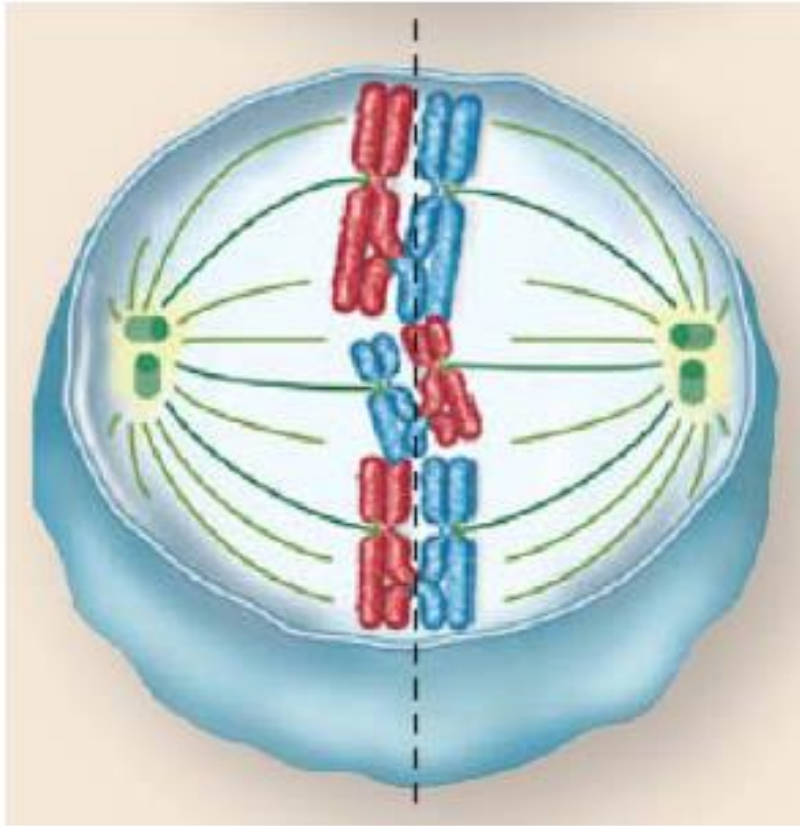
Prophase I – Crossing Over

During crossing over, different/random segments of the homologous chromosomes are exchanged with one another. This helps to increase genetic diversity.

Non sister chromatids exchange their genetic information. Now both chromatids contain different DNA than their parent cell.



Metaphase I

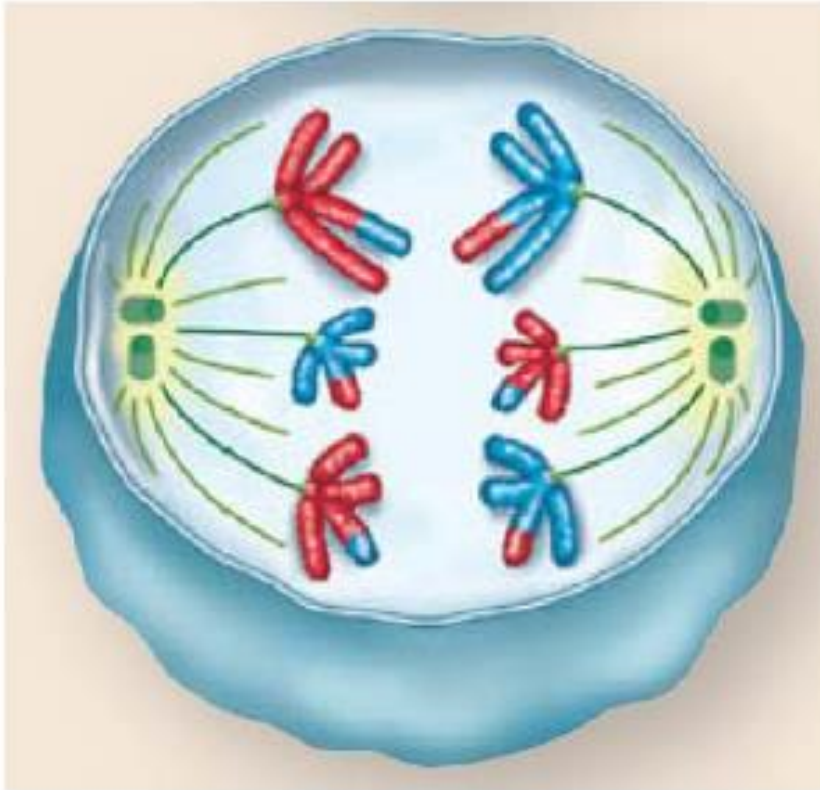


The spindle fibers attach to the kinetochore of each homologous chromosome.

The homologous chromosomes line up at the center of the cell on the metaphase plate.

*** One chromosome of each pair is facing the opposite pole*

Anaphase I



The microtubules in the spindle fibers contract and shorten to pull the homologous chromosomes apart.

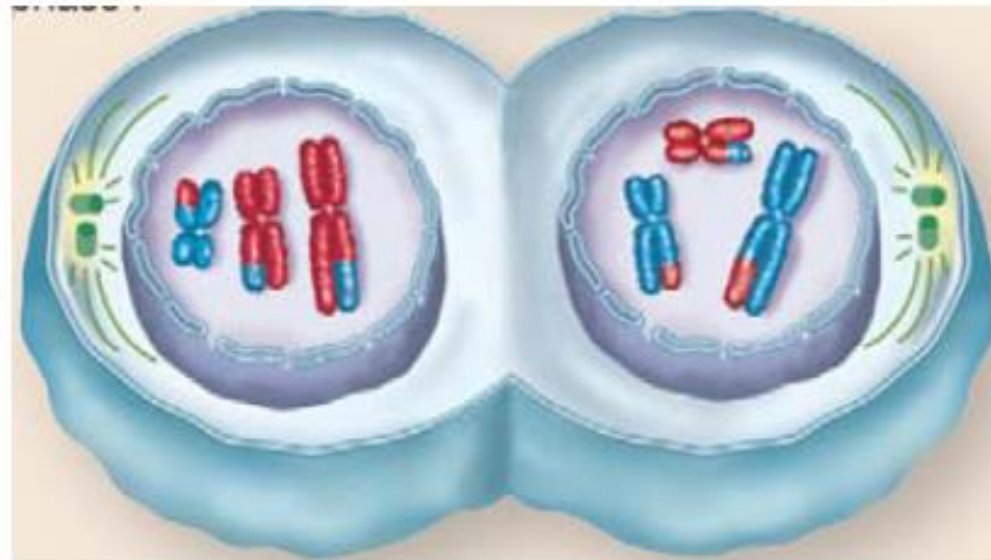
Each homologue moves towards opposite poles of the cell. The centromere and kinetochore is still present.

At this moment, the chromosome number has been reduced to haploid ($n=23$)

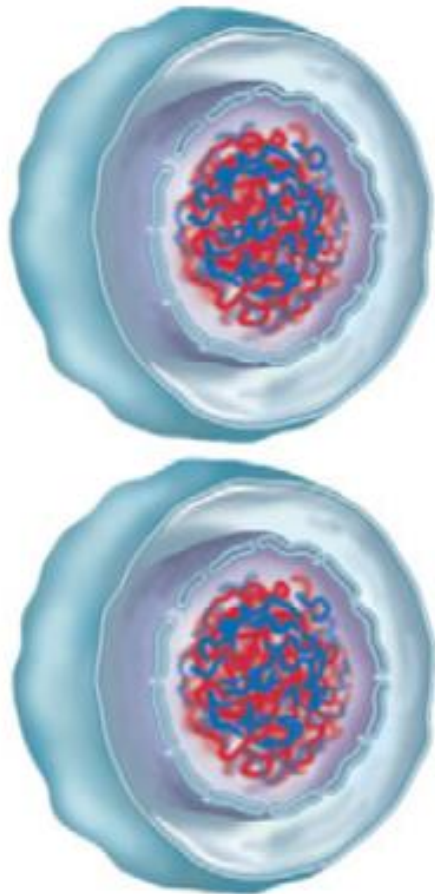
Telophase I

The spindle fibers disappear and new nuclear membranes form around each new nuclei. Cytokinesis occurs simultaneously and the cells separates into two haploid daughter cells.

The DNA uncoils to form chromatin.



Prophase II



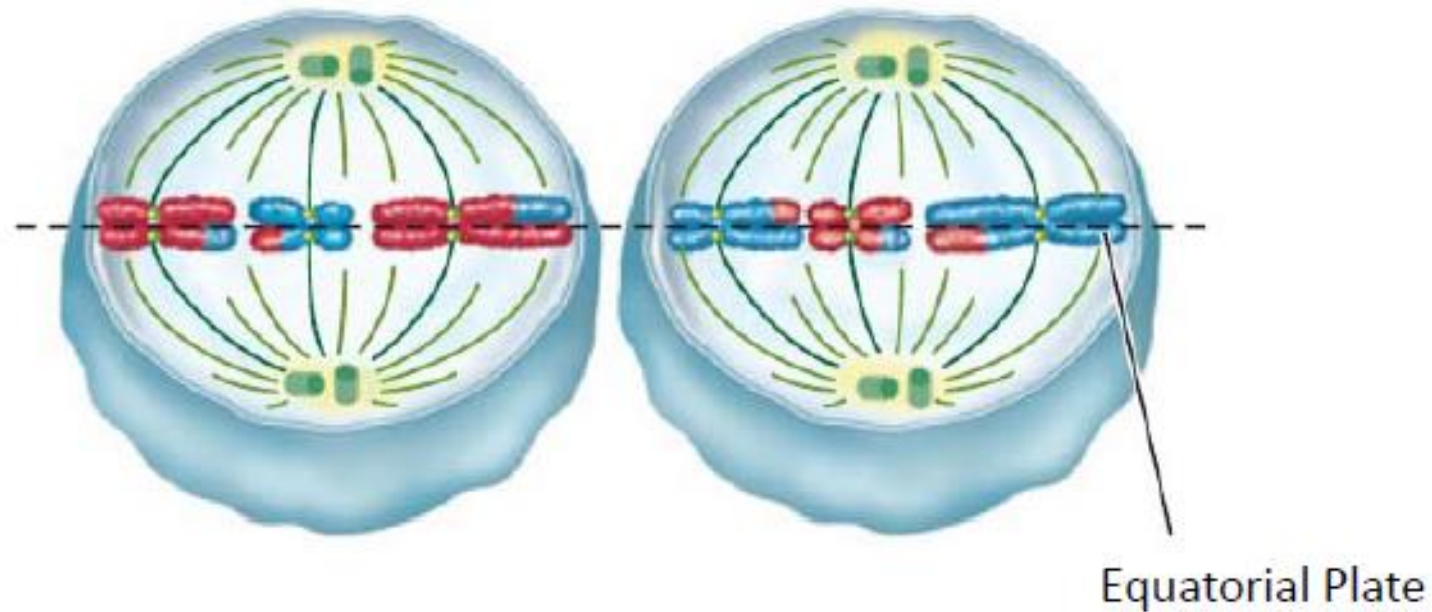
The chromatin coils to form chromosomes.

The nuclear membrane disappears and spindle fibers begin to form.

*** Both haploid daughter cells undergo the same process.*

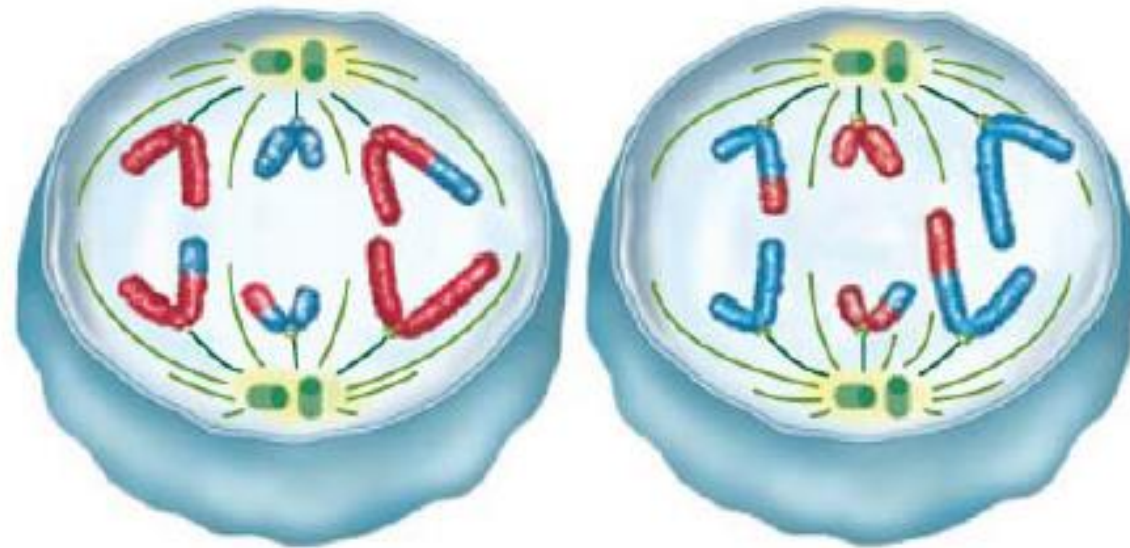
Metaphase II

The spindle fibers attach to the kinetochore of the centromere of each sister chromatid. Sister chromatids line up at the center of the cell on the equatorial plate.



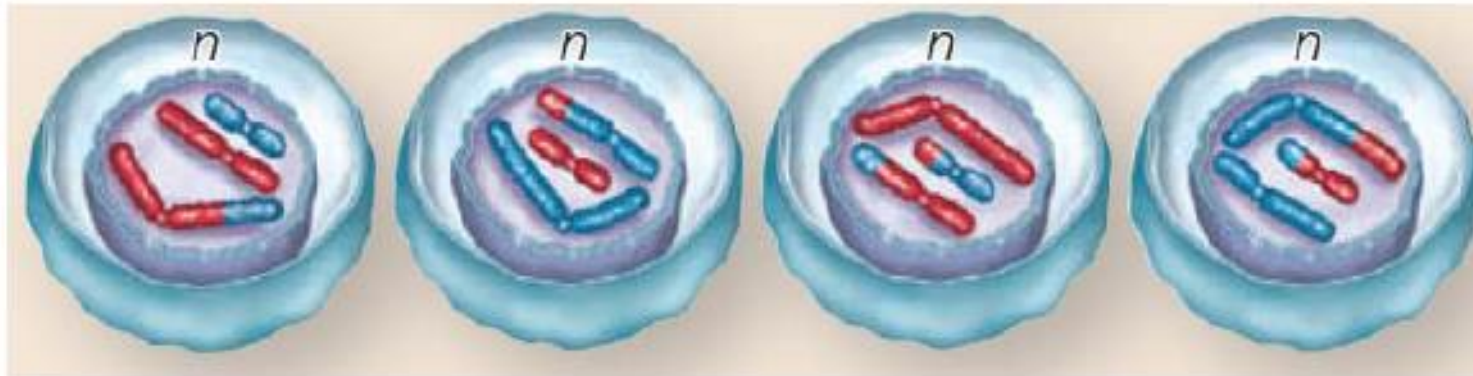
Anaphase II

The microfilaments of the spindle fibers contract and shorten to pull apart the sister chromatids to opposite poles of the cell. Both sides of the cell remain in a haploid state.



Telophase II

Both haploid cells undergo telophase and cytokinesis simultaneously and produce two haploid cells each (total of 4). A nuclear envelope forms around each nuclei and the spindle fibers disappear.



Each daughter cell is genetically different from the others due to the events of crossing over during Meiosis I.

Checking for Understanding

1. At the end of meiosis II, how many haploid cells have been formed from the original parent cell?

A) 0

B) 1

C) 2

D) 3

E) 4

Checking for Understanding

2. The somatic cells of a dog contain 78 chromosomes. Which of the following statements is false?

A) the diploid number is 78.

B) the haploid number is 39

C) sperm produced by a dog contains 39 chromosomes

D) A cell in metaphase of mitosis contains 78 chromosomes

E) A cell in metaphase II of meiosis contains 78 chromosomes.

Homework

- Complete the comparison sheet between meiosis and mitosis.
- Textbook: p. 181 # 2, 3, 4, 5 & 6