

MEIOSIS AND SEXUAL REPRODUCTION

Meiosis

Process of nuclear division that reduces the number of chromosomes in a cell by half

2 STAGES

BEFORE MEIOSIS

Meiosis I:

Homologous chromosomes are separated into separate cells

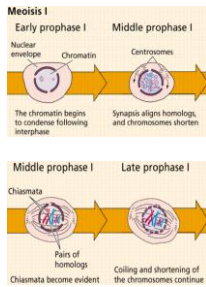
- **Complete interphase** with S phase (replication of DNA occurs)

- now cells have $2(2N) = 92$ **chromosomes**

Meiosis II:

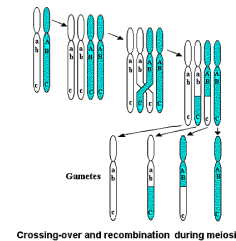
Chromatids are segregated into separate cells

MEIOSIS 1



PROPHASE I

1. DNA condenses and becomes chromosomes.
2. Spindle forms, nucleolus and nucleus disappears.
3. Homologous chromosomes line up at equator.



4. **Synapsis** occurs: parallel alignment of sister chromatids (NOW CALLED A TETRAD)

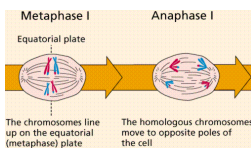
5. **Crossing over** occurs

Non sister chromatids break apart and exchange alleles and re-attach.

Result: **Recombination** (NEW COMBOS OF GENES)

METAPHASE I

Tetrads move to equator and **remain together**.



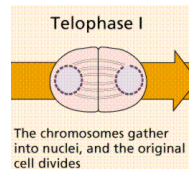
ANAPHASE I

Homologous chromosomes separate and one of each pair is pulled to opposite poles.

****chromatids still joined by centromere****

TELOPHASE I

Cytokinesis occurs.



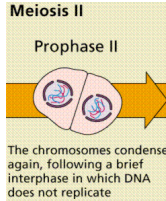
Two daughter cells formed. (do NOT have same genetic info due to crossing over)

END RESULT

Two daughter cells with **diploid #** (2N)

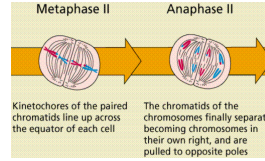
MEIOSIS II

2 (2N) cells go into meiosis II.
Chromatids are segregated into different cells.



PROPHASE II

1. chromosomes condense. (brief interphase with **NO DNA replication**)
2. nuclear membrane disappears.
3. chromosomes start to move to equator.



METAPHASE II

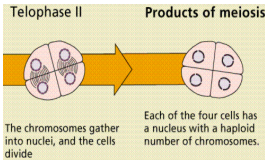
Chromosomes with sister chromatids joined by centromere line up at equator.

ANAPHASE II

Centromeres divide and each sister chromatid moves to opposite poles

TELOPHASE II

1. spindle dissolves & nuclear membrane reforms around chromosomes in each daughter cell
2. cleavage furrow or cell plate forms and cytokinesis occurs



END RESULT

Four cells with **haploid # (N)**

[Meiosis animation](#)

DIFFERENCES: MITOSIS AND MEIOSIS

Mitosis

- 1 diploid cell makes 2 diploid daughter cells
- daughter cells genetically identical to mother cell
- occurs in somatic cells

Meiosis

- 1 diploid cell makes 4 haploid cells
- resulting cells are genetically different from diploid cells and each other
- occurs in gametes

[unique features meiosis](#)

[comparison animation](#)

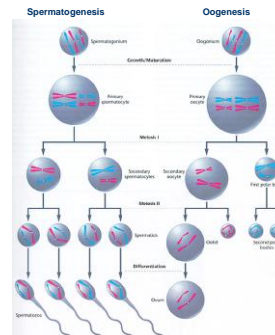
Why is it important for gametes to have the haploid number?

HOW MEIOSIS CAUSES GENETIC VARIATION

- each of the 23 pairs of homologous chromosomes segregate independently
- crossing over adds to recombination
- random joining of two gametes with new combination

GAMETOGENESIS

Meiosis is primary event in formation of gametes.



Spermatogenesis:

- Production of sperm in testes
- starts with 1 diploid germ cell
- result: 4 mature sperm cells

Oogenesis:

- Production of ova (eggs) in ovaries
- result: 1 ovum, 3 polar bodies