

# Meiosis and Gamete Formation

- In the gonads, meiosis division the nuclei of the germ cells twice to form the gametes.
  - Meiosis is the basis for sexual reproduction.
  - It reduces the parental chromosomes number by half so called reduction division .
  - The daughter cells are genetically different from the parent because of crossing over and gametes receive a random assortment of maternal and paternal chromosomes.
  - Meiosis consists of two consecutive nuclear divisions (**meiosis I and meiosis II**)
    - \* So, one meiotic division results in four daughter haploid cells.
  - Before meiosis I , cell just left the interphase , " **chromosomes has already duplicated**"
- which one actually reduction division? Meiosis I or II ?

## Meiosis I

During meiosis I, the **homologous chromosomes separate** and two daughter haploid (n) cells result.

### Prophase I:

- Chromosomes condense.
- Centrioles move to the opposite pole of the cell.
- Spindle appears.
- The nuclear envelope breaks and disappears.
- The homologous chromosomes twist, **pair up and crossing over occurs.**

### Crossing over:

- **During prophase I**, **nonsister chromatids** of a pair of homologous chromosomes break and exchange corresponding segments.
- The **recombination** of parental and maternal **genes** leads to **variation in the inherited traits** in the offspring.

### Metaphase I:

- the homologous chromosomes pairs **line up as two rows along the equatorial plate.**
- **Each chromosome** is attached to one spindle pole and **its homologous** is attached to the **other pole.**

### Anaphase I:

- Homologous chromosomes** of each pair **separate** and move to opposite poles.

## Telophase I:

- Chromosomes reach the spindle poles .
- Spindle disappears.
- Chromosomes Decondense
- New nuclear envelopes reformed around the two clusters of chromosomes
- Two **haploid (n) nuclei** result; each nucleus has one of each type of chromosomes
- Cytokinesis occurs & two haploid cells result.

## Meiosis II

- Chromosomes are still the duplicated state.
- No duplication of chromosomes occur between meiosis I&II.
- Meiosis II resembles mitosis but the cells that start are haploid and the results are gametes
- During meiosis II, the **two sister chromatids separate** and **four daughter haploid (n) cells** result.

## Prophase II:

- Chromosomes .....
- Centrioles .....
- Nuclear envelop .....
- Spindle .....

## Metaphase II:

- All duplicated chromosomes are .....
- How are the chromosomes attach to the spindle fibers?

## Anaphase II:

- The centromeres split and **sister chromatids separate**.
- The separated chromosomes moves to the opposite region.

## Telophase II:

- The spindle .....
- Chromosomes .....
- New nuclear envelop .....
- After cytokinesis , **four daughter haploid cells result with unduplicated chromosomes** .
- These cells will become gamete.

Look at text book page 336 "find: in meiosis 1 .... Paragraph"

# Gametogenesis (Gamete formation)

- Is the process by which gametes are formed and mature within gonads (testes and ovaries).
- Gametogenesis the only process that involves meiosis.

## 1. Spermatogenesis: (meiosis and gamete formation in males)

- Is the process by which **sperms are formed in the seminiferous of male testes.**
- It always results in 4 immature cells that become mature sperms.

### Stages of spermatogenesis

Spermatogenesis:	male germ cell, diploid , divided by mitosis and grows.
Primary spermatocyte (1):	large immature diploid cell replicates its DNA and undergoes meiosis I.
Secondary spermatocyte (2):	immature haploid cell, undergoes meiosis II.
Spermatids (4):	immature haploid cell, non dividing changes in shape.
Spermatozoa (sperms) (4):	mature non dividing haploid cell (gamete) with head, midpiece and tail

## 2. Oogenesis: (meiosis & gamete formation in females)

- Is the process by which eggs (ova) are formed from germ cell in the female ovaries.
- It produces only **one egg** and three **polar bodies.**
- Only one egg is produced because the egg is sedentary and the sperms do most of the work in fertilization.

## Stages of oogenesis

Oogonium :	female germ cell, diploid , divides by mitosis and grows .
Primary oocyte (1):	large diploid cell, replicates its DNA and undergoes meiosis I.
Secondary oocyte (2):	haploid cell , undergoes meiosis II after fertilization .
Ovum (egg) (1):	haploid cell (gamete).
Polar bodies (3):	haploid cell.

### Polar bodies:

- Haploid cell (n) like egg but they are smaller.
- They are small because of unequal cytoplasmic division.
- They do not function as gametes and they degenerate.
- The extra chromosomes are systematically "discarded" in polar bodies during meiosis I and meiosis II.

### Fertilization:

Sperm (n, haploid)+ ovum (n, haploid)= Zygote (2n, diploid)

- Fertilization restores the diploid number of the chromosomes in zygote.
- Zygote divides by .....