# The Fundamental Unit of Life Cell division

## Cell division (meiosis)

Meiosis: -

- (i) **Meiosis is also called reduction division** because the chromosomes in this division are reduced from the diploid to the haploid number.
- (ii) Meiosis occurs in all organisms which reproduce sexually.
- (iii) Meiosis produces haploid sex cells from diploid cells.
- (iv) Meiosis involves two cell division, viz., meiosis I and meiosis II.
- (v) In meiosis I, the replicated homologous chromosomes pair with each other on the spindle, cross over and then separate to either end of the spindle.
- (vi) On the other hand, in meiosis II, the chromatids of each chromosome move towards the centromere, and these chromatids separate at each end of the second spindle.
- (vii) As a result of this process, a diploid cell divides to form four haploid cells.

#### First Meiosis Division:

First meiosis division is actually the reduction division. It consists of prophase I, metaphase I, anaphase I and telophase I.

#### (a) Prophase I:

- (i) Prophase I is the longest phase of meiosis and includes five sub-phases.
- (i) Leptotene:
- (i) This is the first stage in the first meiosis prophase.
- (ii) In this stage, the chromosomes appear as separate thin and fine thread-like structures.

#### (ii) Zygotene :

- (i) Homologous chromosomes come together, or arrange themselves side by side in pairs to form bivalents.
- (ii) This **pairing of homologous chromosomes** during zygotene in the first meiosis prophase is called **synapsis**.

#### (iii) Pachytene :

- (i) The bivalents or chromosomes become shorter and thicker.
- (ii) They replicate or split into chromatids but remain linked at the centromeres.
- (iii) Each bivalent thus now consists of four chromatids.
- (iv) **Crossing over** between non-sister chromatids of homologous pair takes place.

## (iv) Diplotene :

- (i) The centromeres of paired chromosomes or bivalents move away from each other and crossing over can also be seen.
- (ii) The points in a bivalent where the two chromosomes appear to be joined and crossed over are called chiasmata.
- (iii) Chiasmata formation and crossing over are the distinguishing features of diplotene.

## (v) Diakinesis :

- (i) This is the last stage of first meiosis prophase.
- (ii) The chromosomes become shortest and thickest.
- (iv) Terminalisation of chiasmata.
- (v) Nuclear membrane starts disintegrating. Nucleolus also disintegrates. Diakinesis followed by metaphase I.

## (b) Metaphase I :

- (i) Nuclear membrane disappears completely at the beginning of metaphase I.
- (ii) Pairs of homologous chromosomes are lined up at the center.
- (iii) Spindle apparatus starts appearing. Few spindle fibres get attached with the centromeres of chromosomes.
- (iv) Metaphase I change into anaphase I.



## (c) Anaphase I :

(i) Partners of homologous chromosomes separate completely and move to opposites poles of spindle during anaphase I, which in turn changes into telophase I.

## (d) Telophase I :

(i) The separated partners of homologous chromosomes collect at the poles of the spindle and nuclear membranes form around them. Two daughter haploid nuclei are thus formed. The chromosomes lengthen as they uncoil. Nucleoli start reappearing.

#### Second Meiosis Division :

Like mitosis, the second meiosis divisions also consists of four phases, i.e. prophase II, metaphaseII, anaphase II and telophase II.

#### q Prophase II :

(i) In both the haploid nuclei, each chromosome splits up into two chromatids with a single functional centromere. The nuclear membrane and nucleolus disintegrate partially or completely.

#### q Metaphase II :

(i) The chromatids arrange themselves at metaphase plate or spindle.

## q Anaphase II :

(i) During anaphase II, the centromere splits. The two chromatids belonging to each chromosomes may now be called chromosomes and pass to the two opposite poles of spindle.

## q Telophase II :

(i) The haploid set of chromosomes at two different poles of spindle uncoil and form chromatin material. Nuclear membrane forms around each haploid set of chromosomes. Nucleolus also reappears.

#### Significance of Meiosis :

- (i) Meiosis results in the formation of haploid gametes (sperm and ovum)
- (ii) The phenomenon of crossing over provides new combinations of chromosomes and, hence new combinations of genes and also of characters in offspring.
- (iii) The four chromatids of a homologous pair of chromosomes are passed on to four different daughter cells. This is called the segregation of chromosomes. This causes genetic variations in daughter cells.
  - (iv) Failure of meiosis leads to the formation of diploid gametes which on fusion form polyploids. 4w6 u

Class-IX

## ✤ DIFFERENCE BETWEEN MITOSIS AND MEIOSIS CELL DIVISION:

## Special Note:

Besides mitosis and meiosis, there is also a third type of division. It is called

**amitosis**. It is a direct division of the nucleus by constriction.

S.No.	Mitosis	Meiosis
1	It occurs in all somatic cells.	It occurs in reproductive cells (germ cells or sex cells)
2	In the resultant daughter cells, the number of chromosomes remains the same (i.e. diploid) hence called equational division.	In resultant daughter cells the number of chromosomes reduces to half (i.e. haploid) hence, called reductional division.
3	By mitosis two daughter cells are produced.	By meiosis, four daughter cells are produced.
4	During mitosis no crossing over takes place.	During meiosis crossing over take place.
5	Daughter cells have identical chromosomes which are also identical to that of parent cell (i.e., remains constant)	Chromosomes of the daughter cells are with combined components (genes) of both parents (i.e. genetic variability occurs)