

# Goel Institute of Pharmacy And Science.

## Assignment

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Subject :- Human Anatomy and Physiology

Subject code :- BP 101 T

Topic :- Cell Division

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# ASSIGNMENT No:- 1

## CELL DIVISION

### Cell Growth

- In order to grow an organism can follow two methods first by increasing the size of the cells or by increasing the number of cells.
- Now, a cell division can result in identical copy of parent cell or into a half copy of the parent's cell, depending on whether a cell under a mitotic division or a meiotic division, respectively.

### Mitosis

The genetic material (DNA) in cell is duplicated and divided equally between two cells. The dividing cell cycle series of events called the cell cycle. The mitotic cell cycle is initiated by the presence of certain growth factors or other signals that indicate that the production of new cell is needed. Somatic cells of the body replicate by mitosis. Mitosis is necessary to replace dead cells, damaged cells, or cells that have short life spans.

## Meiosis

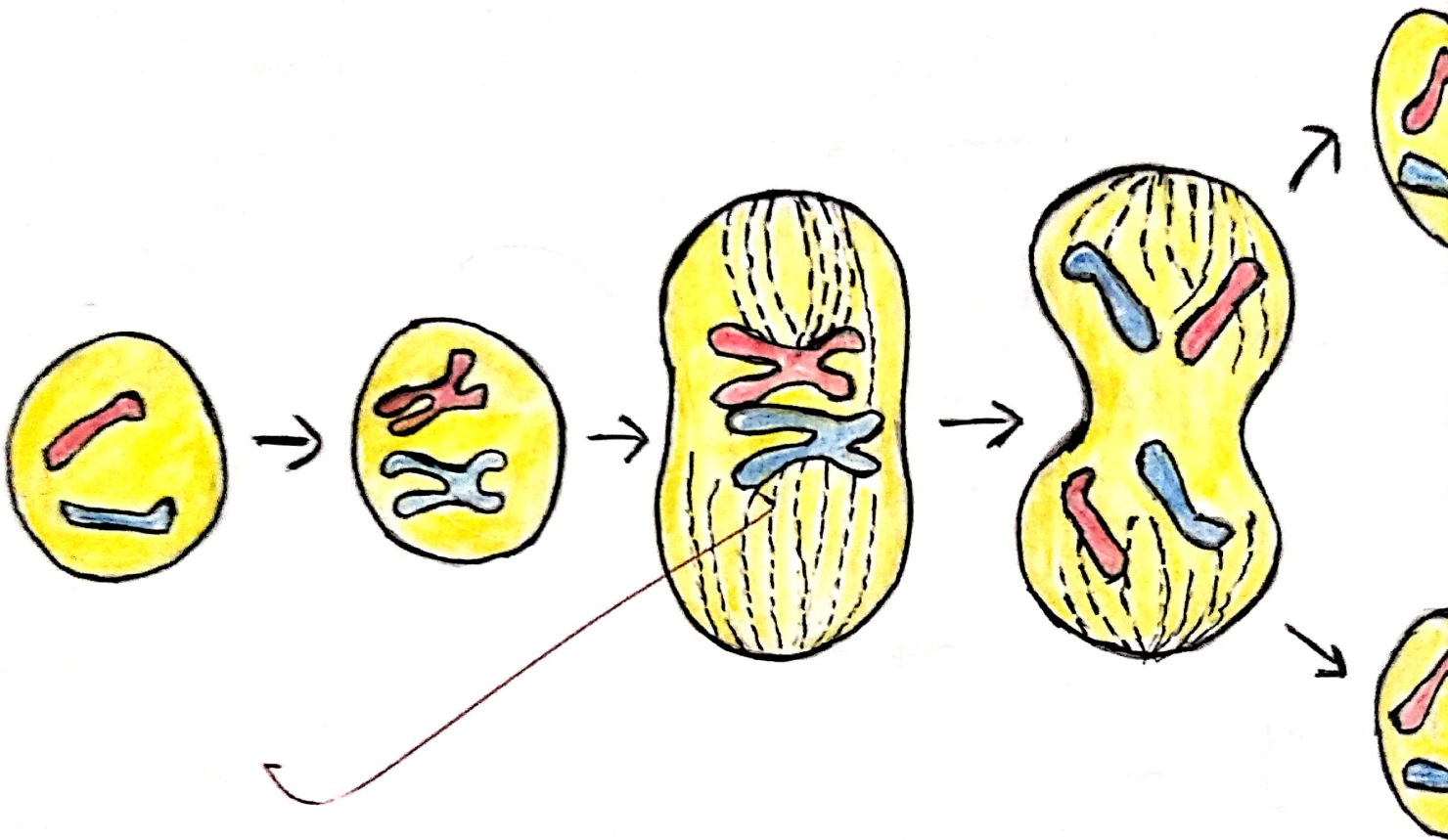
Gametes (sex cells) are generated in organisms that reproduce sexually. Gametes are produced in male and female gametophytes and contain one-half the number of chromosomes as the original cell i.e. are haploid in nature. Meiosis lead to the generation of new gene combinations due to genetic recombination take place during the process. Thus, unlike the two genetically identical cells produced in mitosis, the meiotic cell cycle produces four cells that are genetically different.

## Ploidy

- Haploid and diploid are terms referring to the number of sets of chromosomes in a cell.
- Diploid ( $2n$ ) means the cell contains two set of chromosomes. While, Haploid ( $n$ ) organisms / cells have only one set of chromosomes. Organisms with two sets of chromosomes are termed polyploid.

Chromosomes :- A chromosomes is a DNA molecule that carries all or part of the hereditary information of an organism. In eukaryotic cells, the DNA is

Mitosis



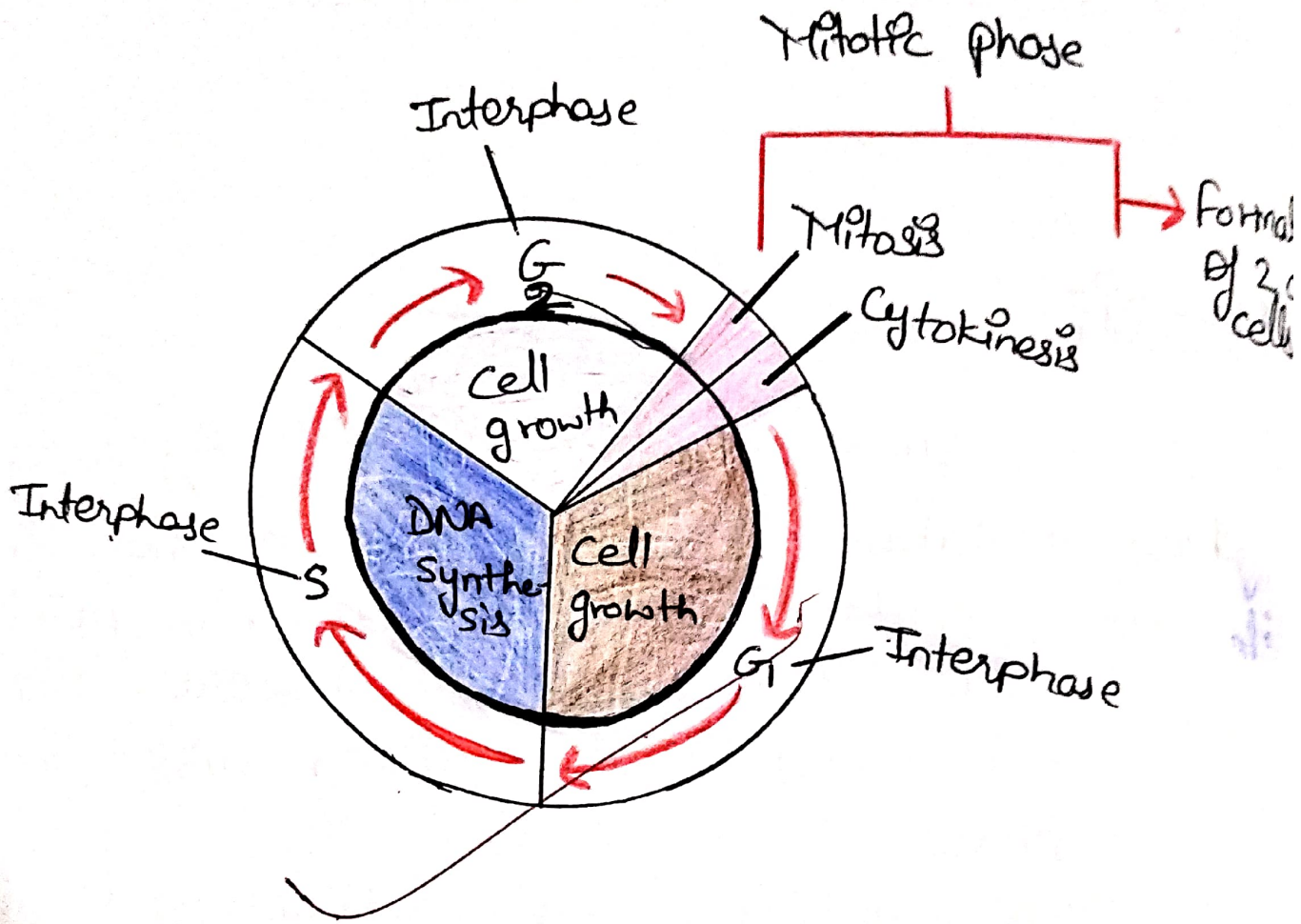
packaged with proteins in the nucleus, and varies in structure and appearance at different parts of the cycle. Chromosomes were first described by Strasburger (1815), and the term 'chromosome' was first used by Waldeyer in 1888.

## Mitosis

A mitosis cell cycle consists of following stages.

- G<sub>1</sub> phase. Metabolic changes prepare the cell for division. At a certain point - the restriction point after cell ensure it has all the necessary requirements of division - it commits to division and movement into the S phase.
  - S phase DNA Synthesis take place and chromosomes replicates themselves. Each chromosome consists of two sister chromatids at the end of S phase.
  - G<sub>2</sub> phase. Accuracy of DNA synthesis ensured and metabolic changes to assemble the cytoplasmic materials necessary for cell division take place.
  - M phase. A nuclear division (mitosis) followed by a cell division (cytokinesis).
- The period between two mitotic division - that is, G<sub>1</sub>, S and G<sub>2</sub> - is known as interphase.

# Interphase



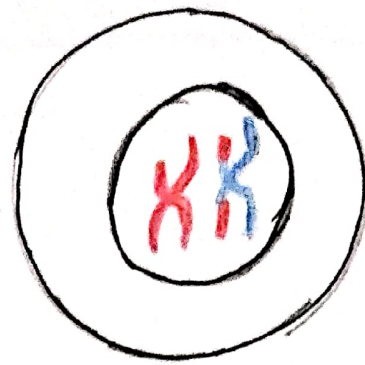
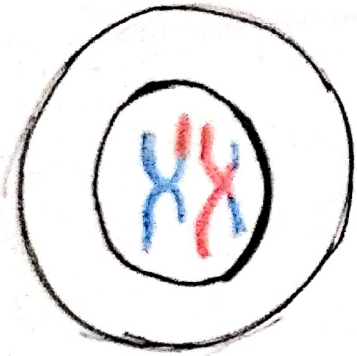
## Substages of Mitosis phase of cell cycle

- Prophase - chromosomes condense; each chromosome consists of identical sister chromatids joined at the centromere.
- Metaphase - chromosomes line up at the middle of the cell, along the plane of cell division, pushed and pulled by microtubules of the spindle apparatus.
- Anaphase - sister chromatids separate and migrate towards opposite ends of the cell.
- Telophase - chromatids cluster at opposite ends of the cell and begin to decondense
- Cytokinesis - The membrane pinches in to divide the two daughter cells

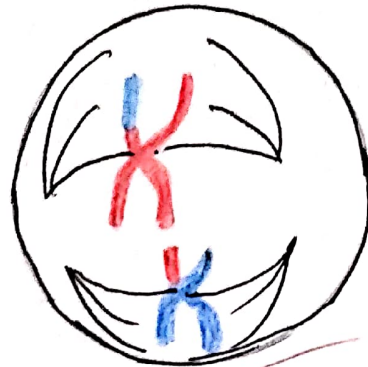
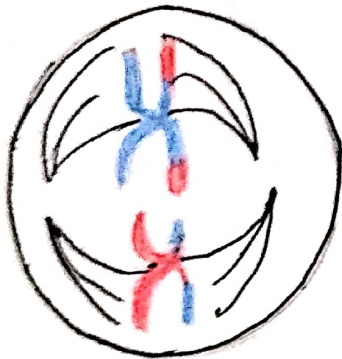
## Meiosis / Reduction division

Meiosis is the form of eukaryotic cell division that produces haploid sex cells or gametes (which contain a single copy of each chromosome). The process takes the form of one DNA replication followed by two successive nuclear and cellular divisions (Meiosis I and Meiosis II)

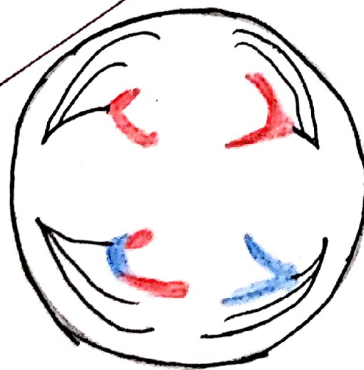
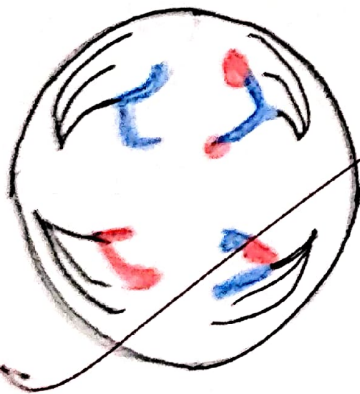
Meiosis



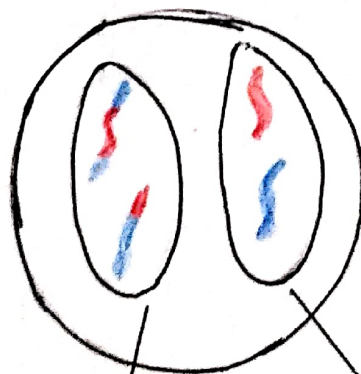
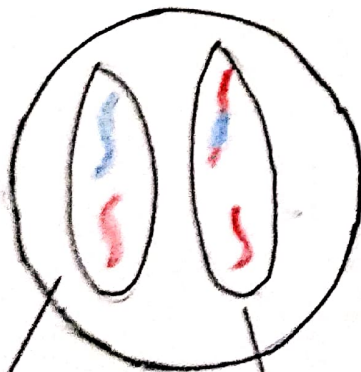
Prophase II



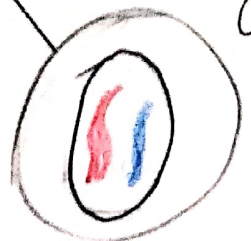
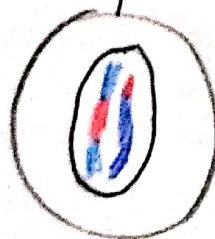
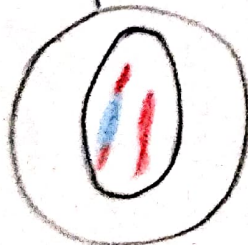
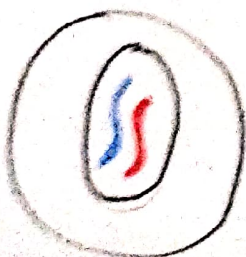
Metaphase II



Anaphase II



Telophase



Cyto



As in mitosis, meiosis is preceded by a process of DNA replication that converts each chromosome into two sister chromatids.

## Meiosis I

- homologous chromosomes pair up and align end-to-end (synapsis) in prophase I
- crossing over occurs between homologous chromosomes in prophase I, before chromosomes line up at the metaphase plate
- homologous chromosomes separate to daughter cells (sister chromatids do not separate) in the first division, creating haploid ( $1N$ ) cells.
- the separation of each pair of homologous chromosomes occurs independently, so all possible combinations of maternal and paternal chromosomes are possible in the two daughter cells - this is the basis of Mendel's law of independent Assortment.
- the first division is when daughter cells become functionally or genetically haploid.

## Prophase I

- The homologous chromosomes pair and exchange DNA to form recombinant chromosomes. Prophase I is divided into five phases.

- Leptotene :- chromosomes start to condense
- Zygotene :- homologous chromosomes become closely associated (bivalents) (synapsis) to form pairs of chromosomes consisting of four chromatids (tetrads)
- Pachytene :- crossing over between pairs of homologous chromosomes to form chiasmata (sing. chiasma)
- Diplotene :- homologous chromosomes start to separate, and chiasmata move to the ends of the chromosomes.

### Prometaphase I

- Spindle apparatus formed, and chromosomes attached to spindle fibres by kinetochores.

### Metaphase I

- Homologous pairs of chromosome (bivalents) arranged as a double row along the metaphase plate.

### Anaphase I

- The homologous chromosome in each bivalent are separated and move to the opposite poles of the cell.

### Telophase I

- The chromosomes become diffuse and the nuclear membrane reforms.

## Cytokinesis I

The final cellular division to form two new cells, followed by Meiosis II, Meiosis I is a reduction division of each chromosome; the newly formed haploid cells have one copy of each chromosome.

The events of Meiosis II are analogous to those of a mitotic division, although the number of chromosomes involved has been halved.

## Meiosis generates genetic diversity through:

- The exchange of genetic material between homologous chromosomes during Meiosis I
- The random alignment of maternal and paternal chromosomes in Meiosis I.
- The random alignment of the sister chromatids at Meiosis II.

~~Anish~~ 17/11/2012



Good