

Spinnwebse





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19/5/19

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# INDEX

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# Introduction

Mass rearing of Honey Bee for commercial production of Honey is called Apiculture.

Newton is called father of modern apiculture of India.

Apiculture is breeding honey bees for the production of honey (bee) and bee wax using modern scientific and commercial method.

Apiculture - 'Apis'

# Honey Bee

Classification:

Phylum: **ARTHROPODA**

Class: **INSECTA**

Sub-class: **PTERYGOTA**

Order: **HYMENOPTERA**

Family: **APIDAE**

Genus: **APIS**

Species of Honey Bee:

There are four species of Honey Bee -

1. *Apis dorsata*
2. *Apis Indica*
3. *Apis florea*
4. *Apis mellifera*

## APIS dorsata

- commonly called as **Sarang/Rock bee**.

largest bee of about 20mm, called the

- They form hives of very large size from places of 1200 metres altitude of the plain.

- a worker bee can suck juices from 20 flowers in a minute.

- due to their swarming nature they can't stay at a place for more than 5-6 months and travel a large distance for next stay.

## APIS indica

- commonly called as **Indian bee**.

- They form many hives at dark and lonely places like holes in tree trunks, stems, rocks and corners of house.

- Slightly smaller than Apis dorsata.

- 2-3 kg of honey produced every year.

- Production of honey is 6-7 pounds per comb, which is much less than the first one.

- **Robbing and absconding tendencies are common in Indian honey bee.**



### APIS florea-

- called as the Red dwarf.
- smaller than the both species.
- These are stinging and swarming bee and do not stay at a place for more than 5-6 months.
- They forms their hives in open places on branches and shrubs.
- Each hive produces 200-500 gm honey.

### APIS mellifera-

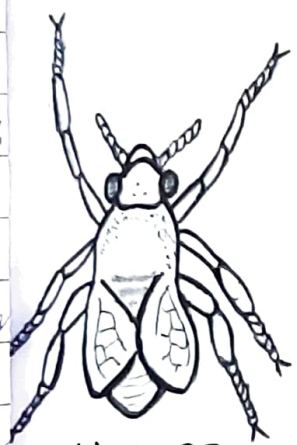
- It is also called as Italian/European bee.
- It is morphologically similar to Indian Apis Indica so much that it is difficult to differentiate them.
- They are easy to be reared and store honey in large amount.
- 50-200 kg of honey can be obtained every year from a hive.
- They make parallel hives like Indian honey bee.

# Castes of Honey Bee.

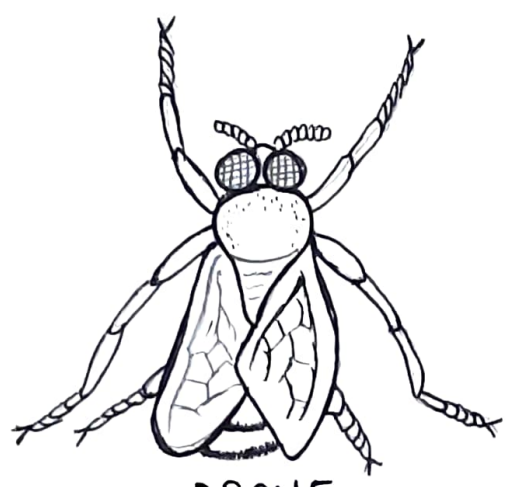
There are three castes of honey bee -

1. Drone
2. Queen
3. workers.

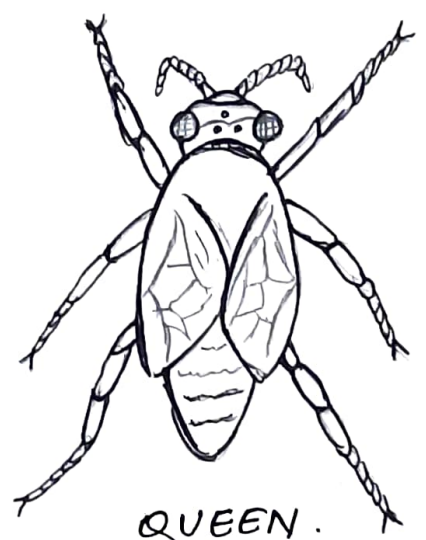
## 1. Drone:-



WORKER



DRONE



QUEEN.

## 2. Queen:-

- It is fertile female produced from fertilized eggs.
- usually only one queen resides in a colony.
- Size of the queen is the largest (15-20mm long).
- It has short legs and wings.
- Its sole function is to lay eggs for which



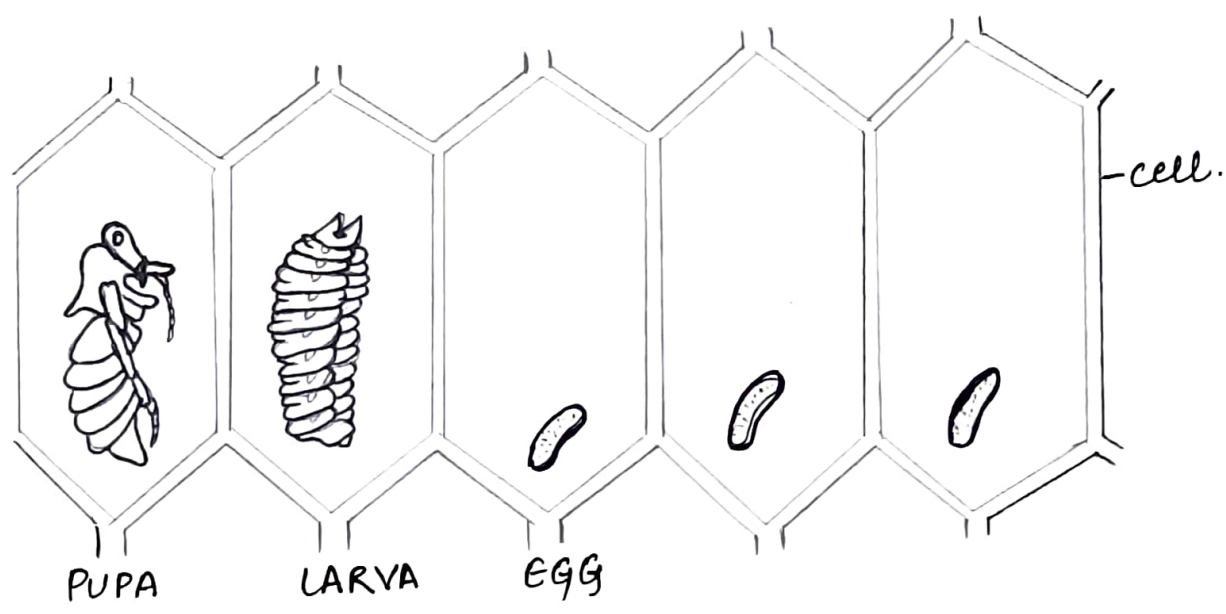
- it has sting-cum-ovipositor.
- Its life span is 2-5 years.
  - During copulation the queen stores nearly 2 crores sperms in her spermatheca which may live for 3 years.
  - Queen return to its colony after copulation
  - Queen lay two types of egg - fertilized and unfertilized.
  - Fertilized eggs, queen and workers develop depending upon their larva feeding on royal jelly whereas fertile males or drones develop from unfertilized eggs.

### 3. WORKERS -

- workers are actually sterile females developed from the fertilized eggs.
- They are smallest of all the castes of bees but largest in number.
- They have undeveloped sex organ hence they cannot lay eggs. They feed on honey mixed pollen.
- They have life span of 6 weeks.
- They are specialized to do all the works of the colony such as formation of hive, collection of pollen grains, water and nectar from flower cleaning, nursing the developing embryos and caring larva, pupa and queen and fanning colony to maintain temperature.
- workers are provided with pharyngeal gland on head whose liq. secretion after mixing with honey forms Royal jelly.

# Life History.

Queen honey bee lay two types of egg:-  
 fertilized one with 32 chromosomes give raise to queen and workers.  
 unfertilized one with 16 chromosomes produced drone by parthenogenesis.



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 19

workers.

Royal jelly constituents	%
Protein	45.15%
Fat	33.55%
sugar (glucose, levulose)	20.39%
minerals and vitamins (all B group vitamins).	2-3%



- First 3 days all larvae feed on Royal jelly, thereafter prospective queen larvae are fed on royal jelly for next five days but the larvae to be developed as drones and workers are fed on pollen mixed controlled diet for next 6-7 days.
- Male brood cell seal is protruded upwards whereas seals of other brood cells are flat.
- Larvae develop into pupa in these sealed brood cells.
- After 2 weeks of pupal stages, young honey bees emerge out of the cells.
- Thus complete metamorphosis occur in honey bees.

# METHODS.

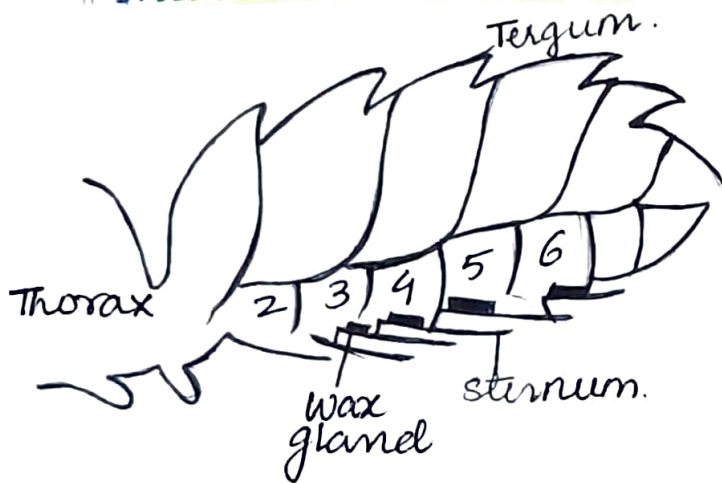
- Swarming -**  
When colony is overcrowded by honey bees, queen flies with some males and workers and forms new hives at another place and they start living there to develop a new colony. This process is called **Swarming**.
- Supersedure -**  
When the queen of the colony ceases to lay eggs, or she dies, her position is taken over by a new and strong queen bee. This process is called **Supersedure**.
- Abscinding -**  
In adverse conditions, all the members of the colony leave the place and reach at other place. This process is called **Abscinding**.
- Air conditioning -**  
During winter when temp. is low, the worker bees densely cover the hive and rub their legs to produce heat so as to maintain the temp. of the hive. In summer when temp. is high the worker bee sprays water drops over the hives and start fanning the hive with their wings so as to bring the temp. down by the process of evaporation. This process is called **Air conditioning**.



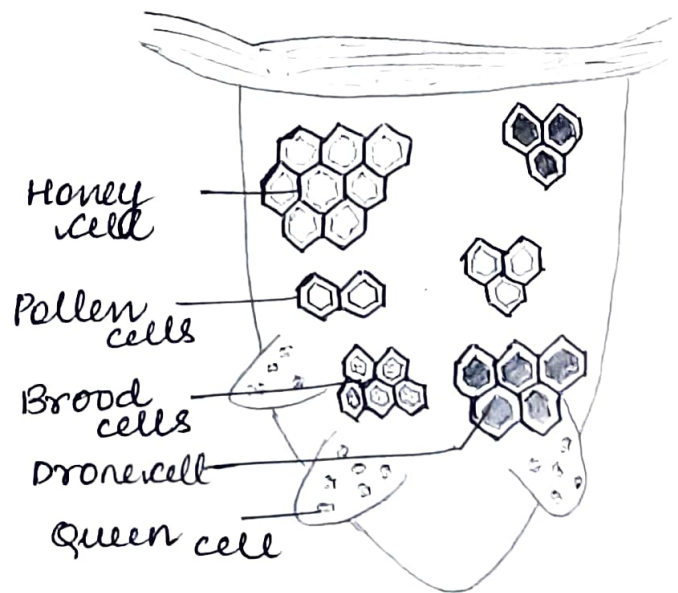
5. when there is scarcity of food in the vicinity of the colony, its members attack other colonies and forcefully take out honey from them. This process is called Robbing.

6. Hive - Hive making is an ex. of high quality architecture of honey bee. Hive is formed by workers with wax secreted from the wax glands situated on ventral surface of their abdomen. cells of upper portion of the hives are used for storing honey and those situated immediately below are for collecting pollens.

The cells of the lower portion are of three varying size and are used for rearing of egg and larvae. These cells are called brood cells.



location of wax gland.



A Bee showing different types of cell.

# Pollen Collection.

Pollen collection were carried out with the help of their legs which are modified accordingly. Each legs consist of coxa, trochanter, femur, tibia, a tarsus made of five tarsomeres and Pentarsus.

a groove is present on the outer surface of the tibia which is covered by spines and is called **POLLEN BASKET**.

A row of strong spines is present on the terminal end of tibia and is called **RAKE**.

on the flat inner surface of the basitarsus, a present rows of spines which help in collecting pollens. these spines are called **POLLEN COMBS**.

Pollen grains are separated from the pollen comb by rakes of hind limb and with the help of pollen press they are transferred to pollen basket.

There is a notch on the metatarsus of the mid leg which is surrounded by spines around its boundary.

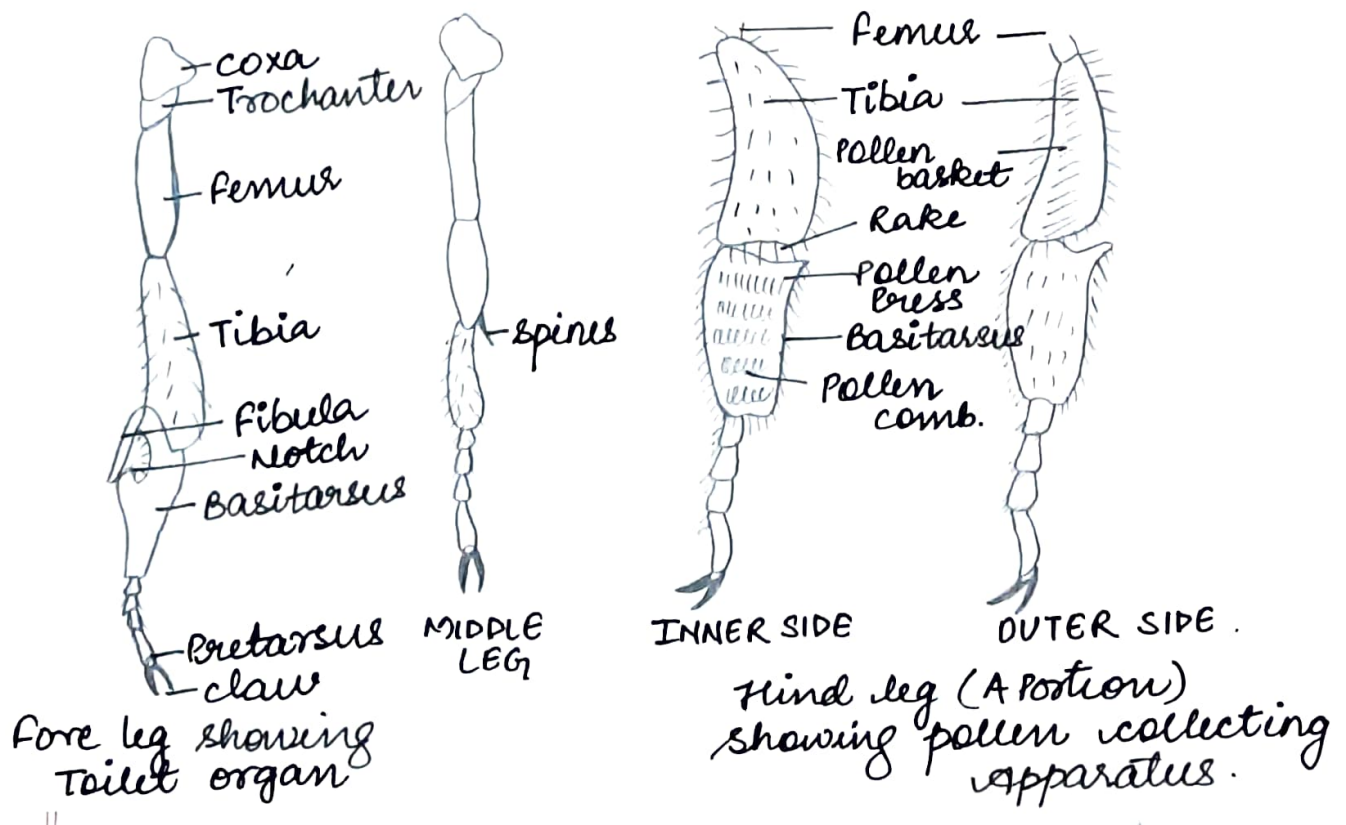


A flat protuberance coming out from the terminal end of the tibia called **PIBULA** fits into the notch of metatarsus.

Thus a ring like structure is formed which is called **TOILET ORGAN**.

This toilet organ is used to remove pollens stuck to antenna and mouthparts.

### Legs of Honey bee.



# Products of Honey Bee.

## Honey:

Workers bee form honey from nectar secreted by nectar glands of flowers.

Saliva secreted by salivary glands, mixes with nectars.

Enzyme present in the saliva changes nectars into honey by chemical Rxn.

Honey is a viscous fluid with sweet taste. It is **colourless or light brown**. Its smell varies with diff. flower sources.

## Granulation:

After long storage, granulation (formation of granules from glucose and water) occurs in honey which is the proven characteristic of honey. Levulose is less soluble in water hence remains on upper surface.

constituents	Percent
water	17
Fructose/ levulose	38
Glucose	32
sucrose	1.3
Other sugars	9
all acids	0.57
ash	0.17
nitrogen	0.64
others	2.92.
(enzymes, vitamins, salts etc).	

## Fermentation:

Fermentation in honey is brought about by yeasts present in air, pollen and soil. It occurs by the **chemical action of some enzymes like invertase on the sugars of honey**.



### USES:

- Honey also has antibiotic property.
- Honey is used as a medicine.
- Honey is used as an antiseptic and antibiotic ointment over cut or burn skin.
- It is also used in baking and confectionary industries.
- It is used for making the skin beautiful and delicate.

WAP. —

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SRI SATHYA SAI COLLEGE FOR WOMENS  
BHOPAL (M.P)  
CCE 1  
2021-2022

ZOOLOGY PAPER-II

TOPIC - CELL DIVISION

SUBMITTED BY:-

DIMPLE KHAIRWAR

BSC 1<sup>st</sup> YEAR



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# SYNOPSIS

1. Introduction

2. Interphase

3. Mitosis

i) Prophase

ii) Metaphase

iii) Anaphase

iv) Telophase

v) Cytokinesis

4. Meiosis

A. Meiosis I

i) Prophase I

a. Leptotene

b. Zygotene

c. Pachytene

d. Diplotene e. Diakinesis

ii) Metaphase I

iii) Anaphase I

iv) Telophase I

B. Meiosis II

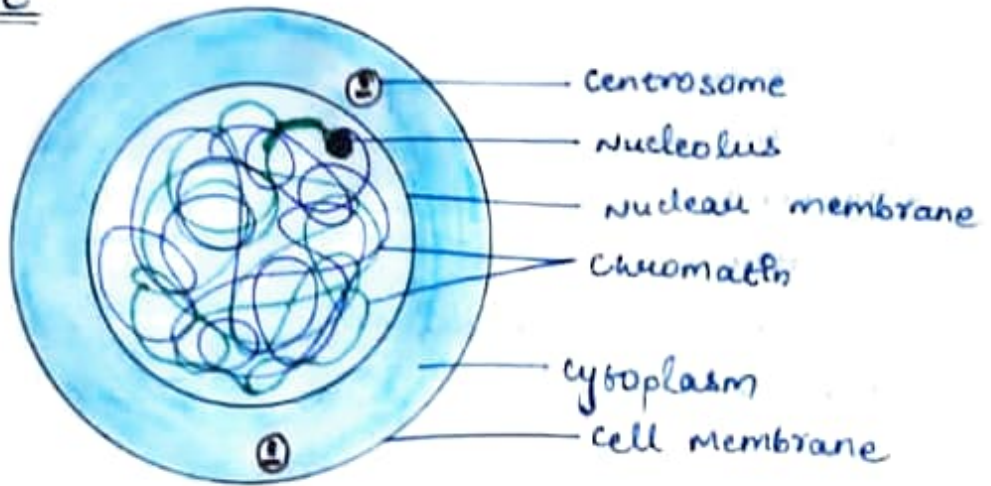
i) Prophase II

ii) Metaphase II

iii) Anaphase II

iv) Telophase II

# INTERPHASE





## 1. INTRODUCTION

Cell division is the process by which a parent cell divides into two or more daughter cells. Cell division usually occurs as a part of a larger cell cycle. Cell division gives rise to genetically identical cells in which the total number of chromosomes is maintained.

There are two types of cell division: Mitosis and Meiosis.

In general Mitosis is preceded by the S stage of Interphase and is followed by telophase and cytokinesis.

## 2. INTERPHASE

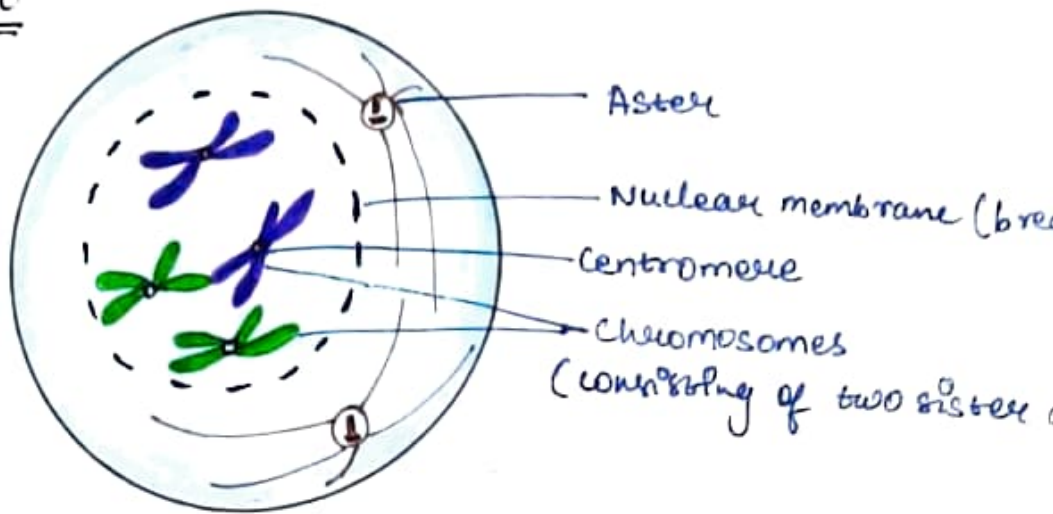
The interphase though called the resting phase, is the time during which the cell is preparing for division by undergoing cell growth and DNA replication. The interphase is divided into three phases.

(i)  $G_1$  Phase (Gap 1) - corresponds to the interval between mitosis and initiation of DNA replication. During this phase cell is metabolically active.

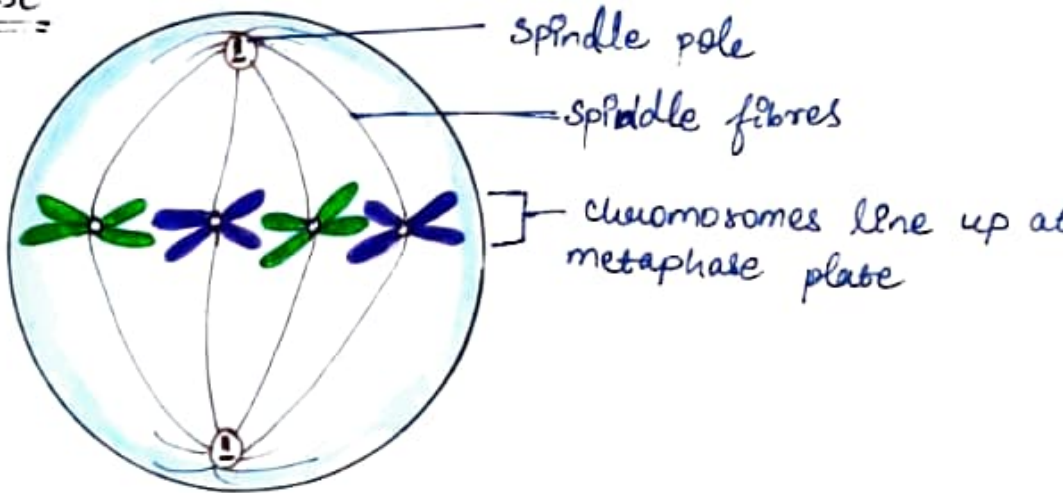
(ii) S or Synthesis phase - DNA replication or synthesis takes place. This time the amount of DNA per cell doubles.

(iii)  $G_2$  phase (Gap 2) - proteins are synthesised in preparation for mitosis while cell growth continues.

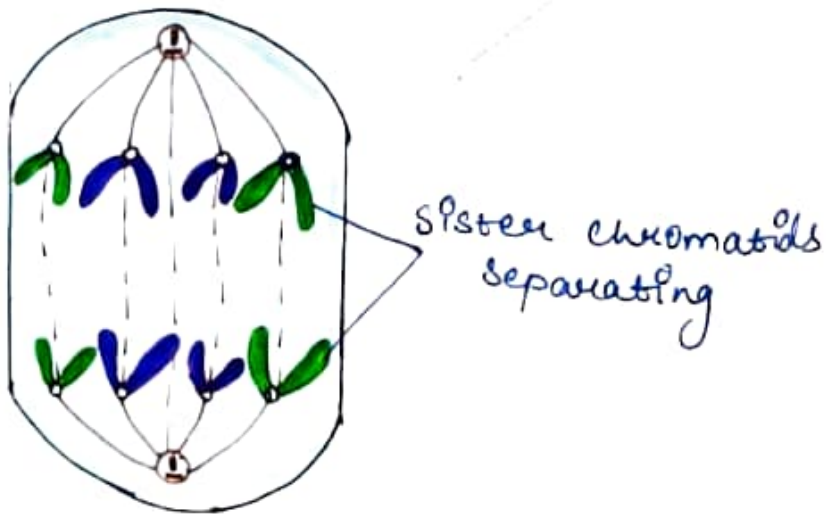
# PROPHASE



# METAPHASE



# ANAPHASE





### 3. MITOSIS

The process in which parent cell gives rise to two genetically identical daughter cells. It adds new cells during development and replaces old and worn-out cells throughout our life.

Mitosis is divided into four stages:-

#### 1). Prophase

- Chromosomes begin to condense. Each chromosome is composed of two sister chromatids.
- Spindle fibres begin to form and centrosomes move to opposite poles.
- At the end of prophase, Nuclear envelope breaks down and nucleolus starts to disappear.

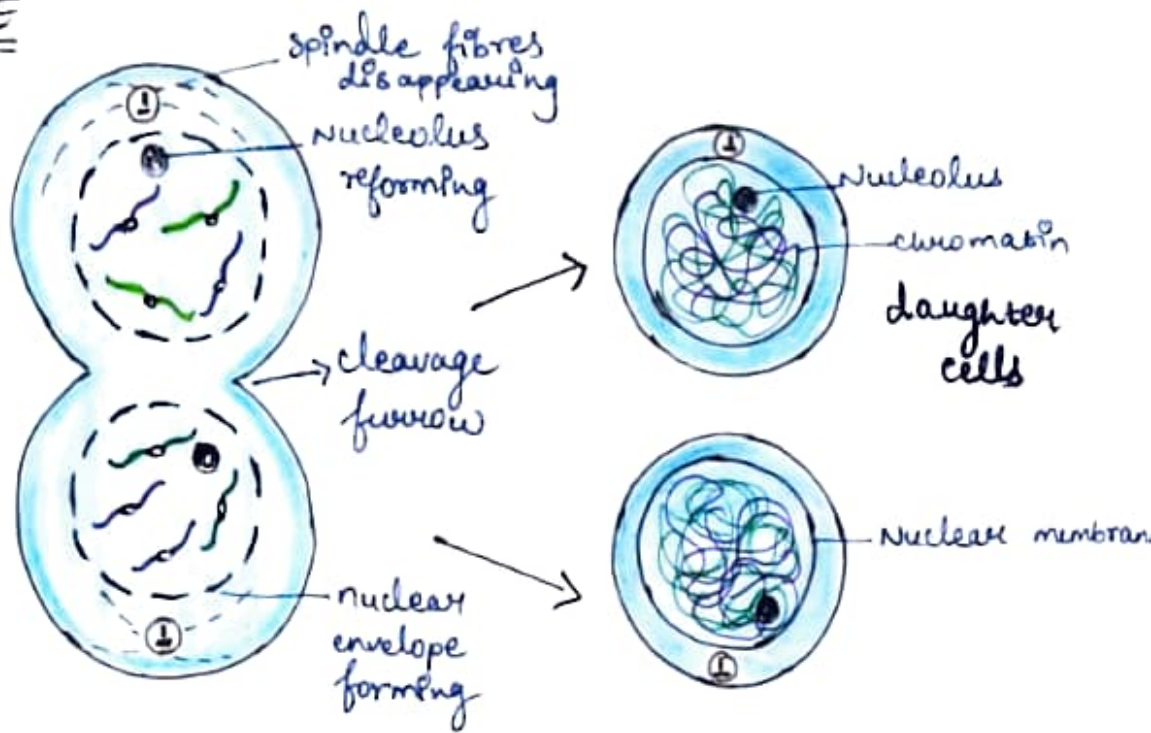
#### 2). Metaphase

- Spindle fibres attach to kinetochores of chromosomes.
- The chromosomes are moved to spindle equator and get aligned along metaphase plate through spindle fibres to both poles.

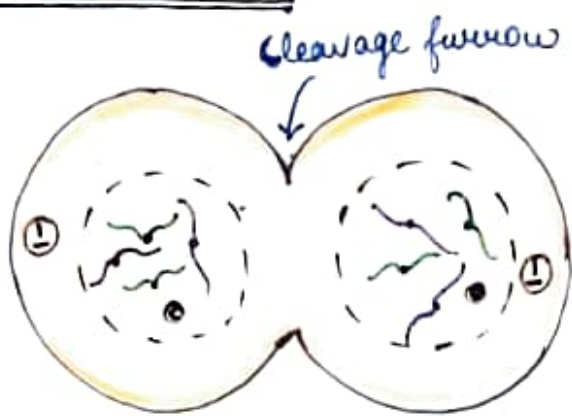
#### 3). Anaphase

- It is the shortest stage of cell cycle.
- Centromere splits.
- ~~Two sister~~ chromatids separate and move to opposite poles.

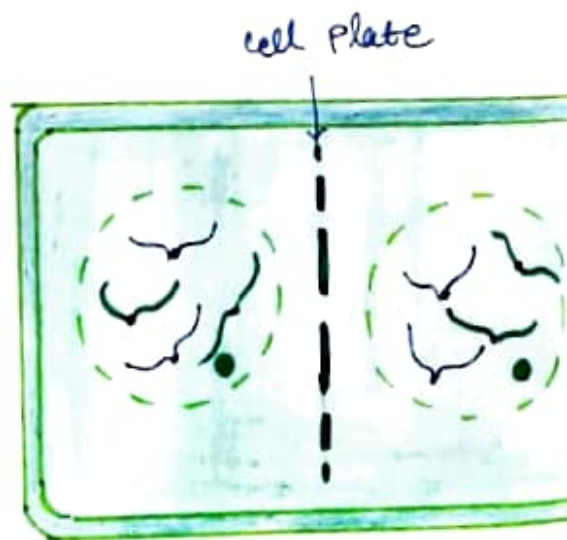
# OPHASE



# CYTOKINESIS



Animal cell



Plant cell



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Pv). Telophase

- Chromosomes cluster at opposite poles and begin to decondense
- Nuclear envelope reforms around chromosome clusters.
- Mitotic spindle breaks down.

✓). Cytokinesis

- It is the division of cytoplasm to form new cells.
- In animal cells, a cleavage cleavage or furrow separates the daughter cells.
- In plant cells, a cell plate forms down the middle of the cell splitting it into two.

4. MEIOSIS

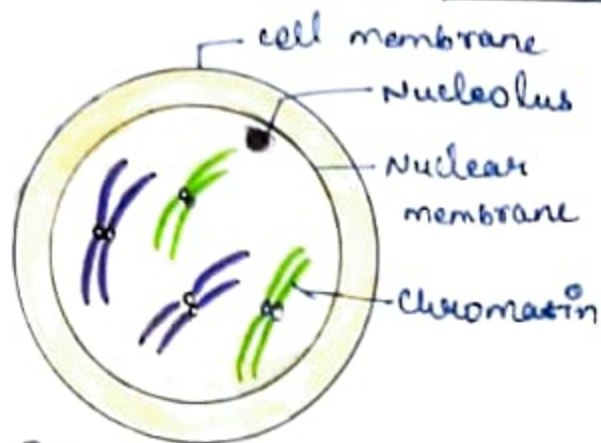
The process in which a single cell divides twice to produce four cells containing half the original amount of genetic information. These cells are our sex cells - sperm in males and eggs in females.

Meiosis is composed of two rounds of cell division namely Meiosis I and Meiosis II

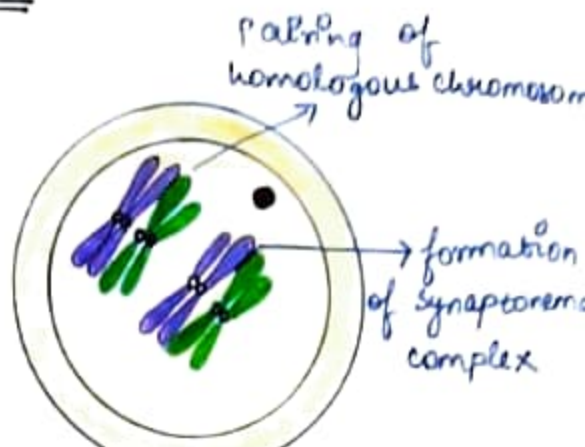
Four haploid cells are formed at the end of Meiosis

DNA replication occurs only once in S phase before Meiosis

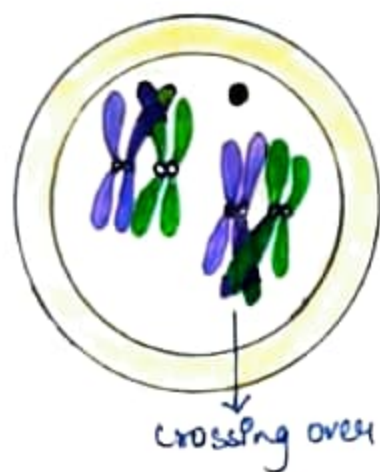
# PROPHASE I



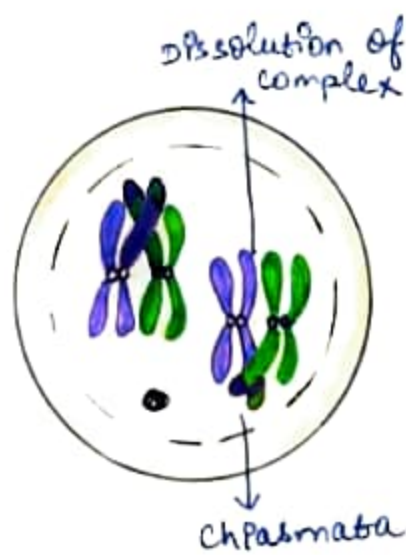
LEPTOTENE



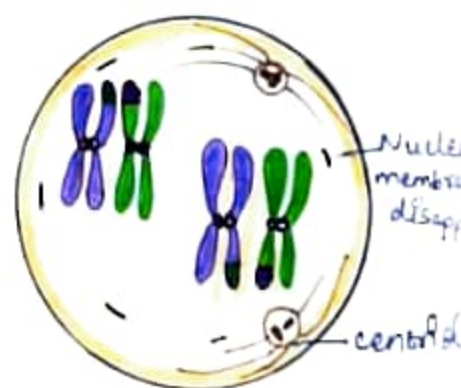
ZYGOTENE



PACHYTENE

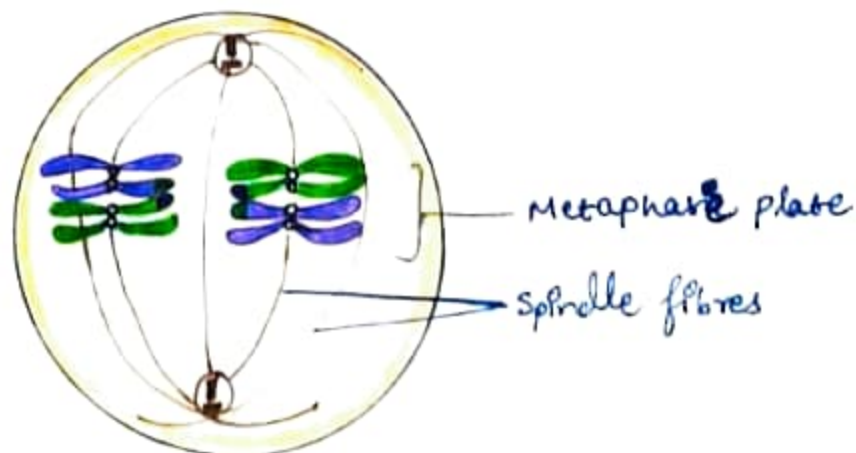


DIPLOTENE



DIAKINESIS

# METAPHASE I





## Meiosis I

Before entering meiosis I, a cell must <sup>first</sup> go through interphase. In Mitosis.

### Prophase I

It is typically longer & more complex than mitotic prophase.

It is further divided into five phases:-

Leptotene: Chromosomes begin to condense and attain a compact structure

Zygotene: Pairing of homologous chromosome starts known as chromosomal synapsis, accompanied by the formation of complex structure synaptonemal complex. A pair of synapsed homologous chromosome forms a complex known as bivalent or tetrad.

Pachytene: Crossing over takes place between non-sister chromatids for exchange of genetic material. between two crossing over is an enzyme-mediated process and the enzyme involved is called recombinase.

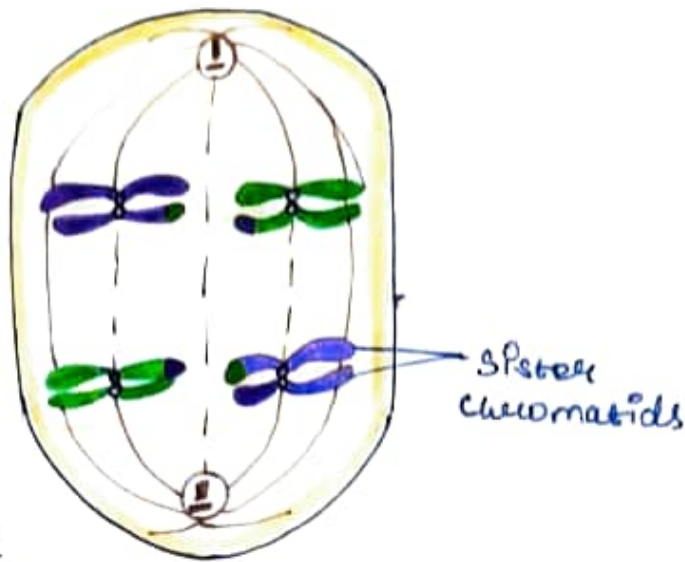
Diplotene: Dissolution of synaptonemal complex and separation of homologous chromosomes of bivalents except at the sites of cross over. The X-shaped structure formed during separation are called chiasmata

Diakinesis: Termination of chiasmata. The nucleolus ~~breaks~~ disappears and nuclear envelope breaks down

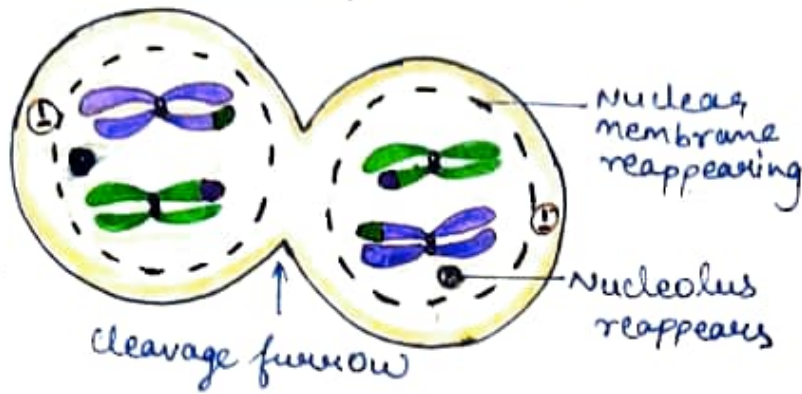
### Metaphase I

Bivalent chromosomes align at equator & homologous chromosomes attach to spindles from opposite poles.

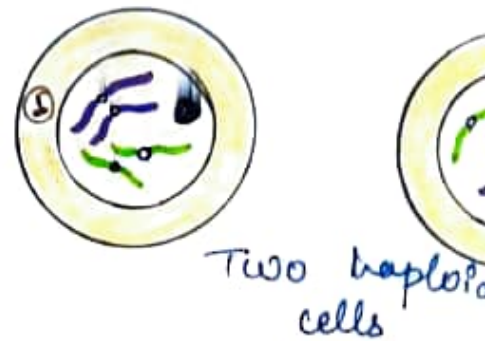
ANAPHASE I



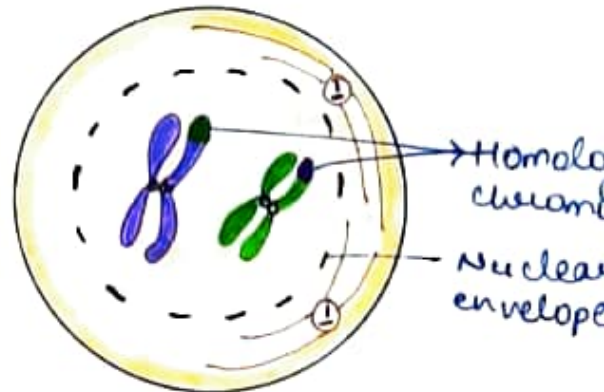
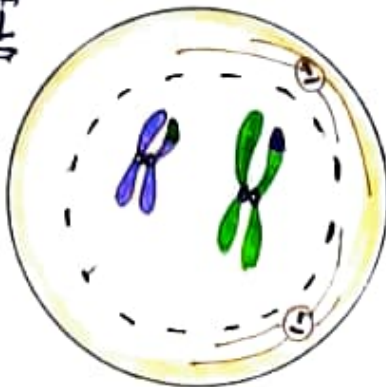
TELOPHASE I



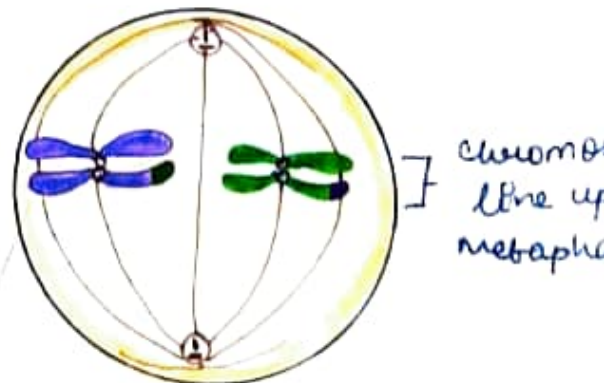
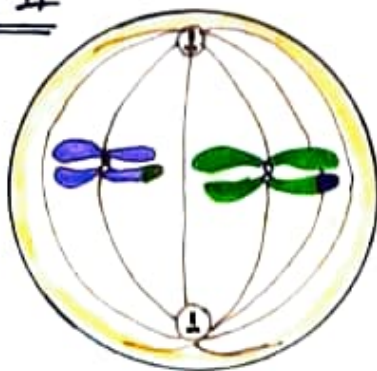
CYTOKINESIS



PROPHASE II



METAPHASE II





## Anaphase I

The homologous chromosomes separate but sister chromatids remain attached at centromeres to each other.

## Telophase I

The chromosomes gather at poles. The nuclear membrane reforms and nucleolus reappears.

Cytokinesis follows forming two haploid cells.

The stage between two meiotic divisions is called Interkinesis & is generally short lived.

## Meiosis II

Meiosis II resembles a normal mitosis

### 1) Prophase II

The nuclear membrane disappears by the end of prophase II. The chromosomes become compact.

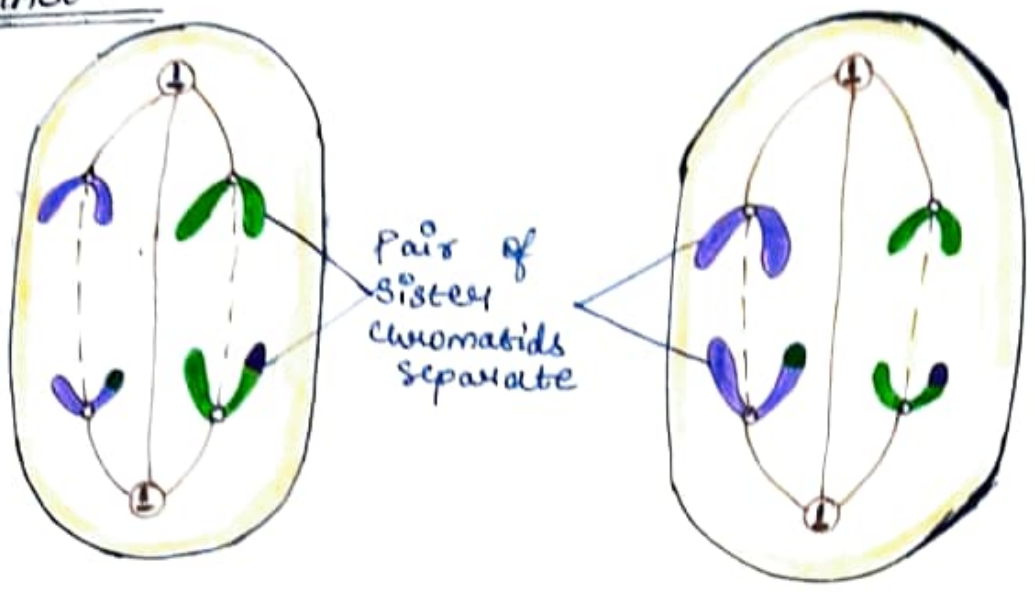
### 2) Metaphase II

The chromosomes align at the equator and the microtubules from opposite poles of spindle get attached to the kinetochores of sister chromatids.

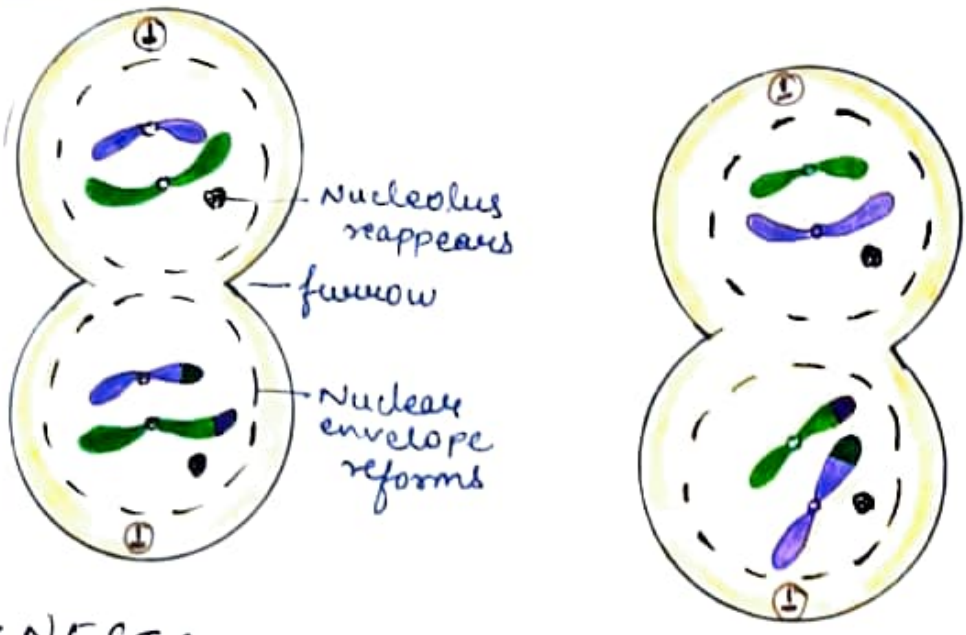
### 3) Anaphase II

Simultaneous splitting of centromere of each chromosome and sister chromatids move towards opposite poles.

## ANAPHASE II



## TELOPHASE II



## TOKINESIS

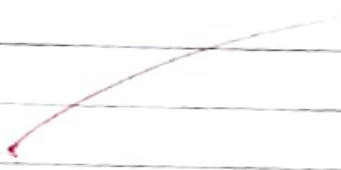


4 haploid daughter cells  
Each daughter cell has half the no. of chromosomes as the parent cell



## Telophase II

The chromosomes get enclosed by a nuclear envelope. Cytokinesis follows resulting in the formation of tetrad of cells i.e., four haploid cells daughters.



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