Single layer of cube like cells. This is commonly called found tall and slender cells. Their nuclei are located at the base. Free surface may have microvilli. They are found in the lining of stomach and intestine and help in secretion and absorption. If the columnar or cuboidal cells bear cilia on their free surface they are called ciliated epithelium. Their function is to move particles or mucus in a specific direction over the epithelium. They are mainly present in the inner surface of hollow organs like bronchioles and fallopian tubes.

- Some of the columnar or cuboidal cells get specialised for secretion and are called 'glandular' epithelium. They are mainly of two types: unicellular consisting of isolated glandular cells and multicellular, consisting of cluster of cells.

- Compound epithelium is made of more than one layer of cells and thus one layer of cells and thus has a limited role in secretion and absorption. Their main function is to provide protection against chemical and mechinal stresses. They cover the dry surface of the skin, the moist surface of buccal cavity, pharynx, inner lining of ducts of salivary glands and of pancreatic ducts.

Epithelial tissues are classified into :-

(a) Stratified squamous keratinized epithelium :- Stratified squamous epithelium is characterised by multiple layers of cells with typical flattened squamous cells at the free surface of the sheet. The presence

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(b) Stratified
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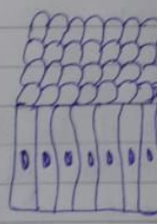

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(f) **Matrix** :- Matrix is composed of protein called ossein. "The matrix forms thin plates called lamella.

- lamellae are of three types. (1) Haversian lamella.
  (2) Concentric or circumferential lamellae.
  (3) Interstitial lamellae.

(g) **Bone marrow** :- Bone marrow is a specialized type of soft, diffuse, connective tissue called "Myeloid tissue.

It is of two types :- (1) Red blood marrow (2) Yellow bone marrow

(h) **Blood corpuscles** : Blood corpuscles from 40-50% of the blood and are of three types viz. RBC, WBCs and platelets.

(3) **Muscle Tissue** :- Each muscle is made of many long, cylindrical fibres arranged in "Vel arrays. These fibres are composed of numerous fine fibrils called myofibrils.

- Muscles are of three types :- Skeletal (2) Smooth and cardiac

(1) **Skeletal** :- These muscle tissue is closely attached to skeletal bones. In a typical muscle such as the biceps, striated, skeletal muscle fibres and bundled together in a "Vel fashion.

(2) **Smooth** :- These smooth muscle fibres taper at both ends and do not show striations. Cell junctions hold

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→ As each chromosome moves away from the equatorial plate, the centromere of each chromosome is towards the pole and hence the leading edge, with the arms of the chromosome trailing behind.

→ The two new daughter chromosome begin moving toward opposite ends of the cell as their kinetochore microtubule are attached at the centromere region, the centromere are pulled ahead of the arms (Pulling)

→ The cell elongates as the nonkinetochore microtubules lengthen.

Anaphase stage is characterized by following key events :-

- Centromeres split and chromatid separate.
- Chromatids move to opposite poles.

Anaphase Telophase Interphase

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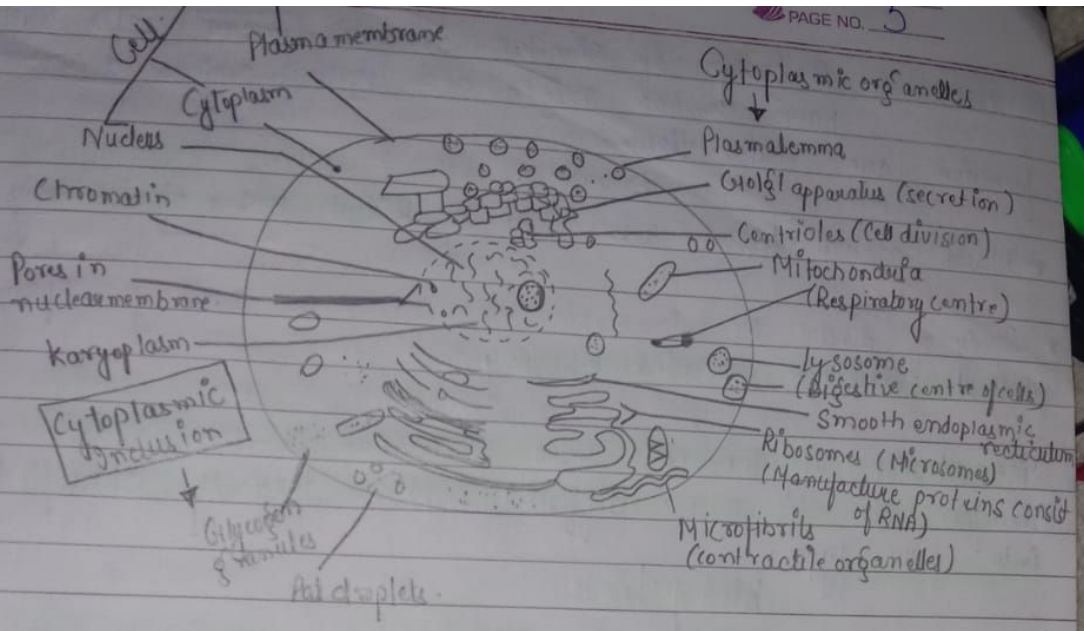


Eukaryotic cell

membrane, and cell organelles, like the nucleus, mitochondria and endoplasmic reticulum.

| | Animal cell | Plant cell. |
|---|---|---|
| • Cell wall | • Absent | • Present. |
| • Shape | • Round (Irregular shape) | • Rectangular shape (fixed). |
| • Vacuole | • One or more small vacuoles. (much smaller than plant cells). | • One, large central vacuole taking up to 90% of the cell vol. |
| • Centrioles | • Present in all animal cells. | • Only present in lower plant. |
| • Chloroplast | • Absent | • Plant cells have chloroplasts to make their own food. |
| • Cytoplasm | • Present | • Present. |
| • Ribosomes | • Present | • Present. |
| • Mitochondria | • Present | • Present. |

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in a monastery. Cell theory, first developed in 1839 by Matthias Jakob Schleiden and Theodor Schwann, states that all cells are the fundamental unit of structure and function in all living organisms, and that all cells come from pre-existing cells. Cells emerged on Earth at least 3.5 billion years ago.

There are two types of organisms based on cell type :- Prokaryotic and Eukaryotic. Prokaryotic cells are divided into the domains, Bakteri and Archaea.

* Prokaryotic Cell Definition :- Prokaryotic cells are cells that do not have a true nucleus or membrane - bound organelles. Organisms within the domains Bacteria and Archaea have prokaryotic cells, while other forms of life are eukaryotic. However organism with prokaryotic cells are abundant and makeup much of Earth's biomass.

Organisms that have prokaryotic cells are unicellular and are called prokaryotes. Prokaryotic cells can be contrasted with eukaryotic cells, which are more complex. Eukaryotic cells have a nuclear membrane and also have other organelles that perform specific functions in the cells. A prokaryotic cell contains only a single membrane, which surrounds the cell as an outer membrane.

Characteristics of prokaryotic cells are :-

- Membrane bound cell organelles such as Mitchondria, Golgi apparatus, Chloroplast are absent.
- A membrane bound well defined nucleus is absent.

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- They range from soft connective tissues to specialised types, which include cartilage, bone, adipose and blood.
- The fibres provide strength, elasticity, and flexibility to the tissue.
- These cells also secrete modified polysaccharides, which accumulate between cells and fibres and acts as matrix.
- Connective tissue are classified into three types :-

1. loose connective tissue
2. Dense connective tissue.
3. Specialized connective tissue.

- It contains fibroblasts, macrophages and mast cells.
- Fibres and fibroblasts are compactly packed in the dense connective tissue.

(a) Collagenous fibres :- These are the most abundant fibrous element of areolar and other connective tissues. These are long, unbranched fibres of a soluble and shining collagen protein.

- These fibres are of more strength and provide maximum tensile strength.
- Collagen protein is the most abundant protein, of the body constitutes 25% the total body protein.
- Collagen fibre can be stained by eosin, e.g. Bone and tendon.

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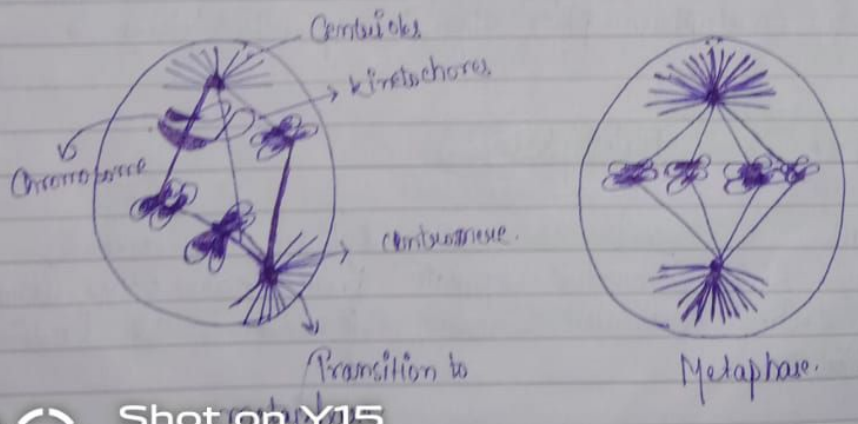
- Cell at the end of prophase when view under the microscope, do not show golgi complexes, endoplasmic reticulum, nucleolus and nuclear envelope.

(2) **Metaphase** :- • The complete disintegration of the nuclear envelope marks the start of the second phase of mitosis, hence the chromosome are spread through the cytoplasm of the cell.

- By this stage, condensation of chromosomes is completed and they can be observed clearly under the microscope. This then, is the stage at which morphology of chromosomes is most easily studied.

- At this stage, metaphase chromosome is made up of two sister chromatids, which are held together by the centromere. Small disc-shaped structure of at the surface of the centromeres are called kinetochores. These structures serve as the sites of attachment of spindle fibres to the chromosome that are moved into position at the centre of the cell.

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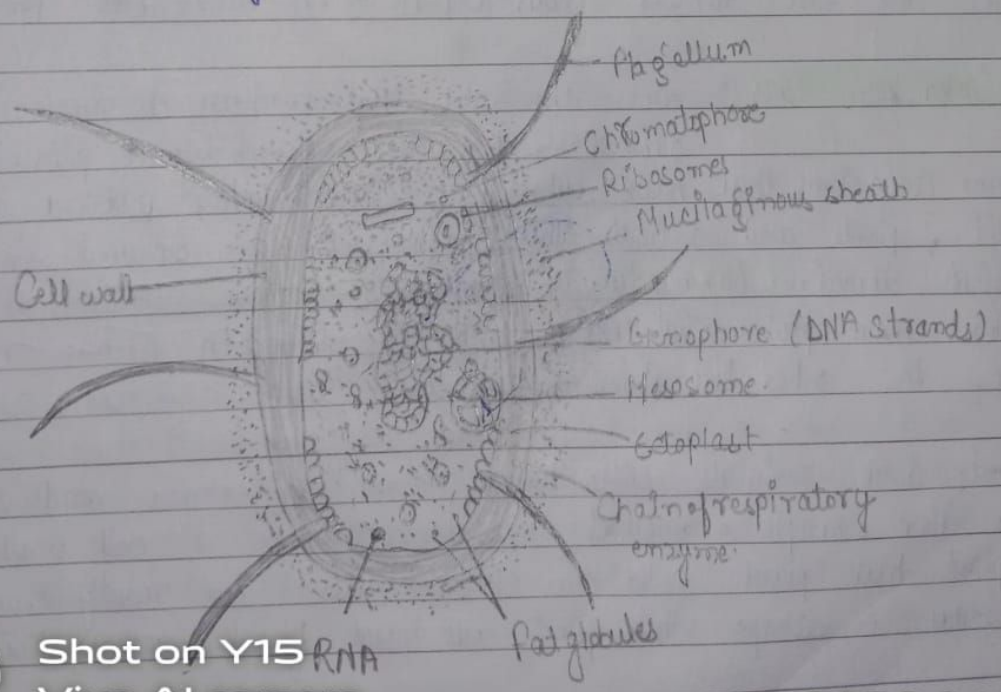
- Genetic material is circular DNA and naked in the cell cytoplasm.
- The cell size ranges from 0.1 to 5.0 micrometre in size.

* Prokaryotic cells have the following features :-

- The genetic material (DNA) is localized to a region called the nucleoid which has no surrounding membrane.
- The cell contains large numbers of ribosomes that are used for protein synthesis.
- At the periphery of the cell is the plasma membrane.




Prokaryotic cells.

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of interphase, now begins to move towards opposite poles of the cell.

→ formation of astral ray occurs due to gelatin of protein around centrioles in animal cells.

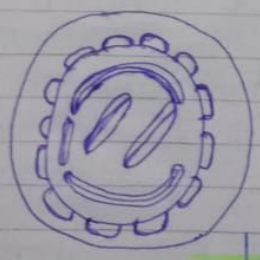
→ Anastral and Amphiastral Mitosis :- In higher plants, centrioles are absent and no asters are formed. Mitosis without asters is known as anastral mitosis. In animals, the asters are present and the mitosis is described as amphiastral or astral mitosis.

→ The completion of prophase can thus be marked by the following characteristic events.

- Chromosomal material condenses to form compact mitotic chromosomes. Chromosomes are seen to be composed of two chromatids attached together at the centromere.

- Centrosome which had undergone duplication during interphase, begin to move towards opposite poles of the cell. Each centrosome radiates out microtubules called asters. The two asters together with spindle fibres forms mitotic apparatus.

Early prophase



Late prophase.

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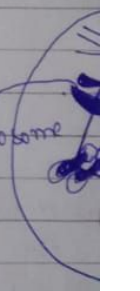


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them together and they are bundled together in a connective tissue sheath. The wall of internal organs such as the blood vessels, stomach and intestine contains this type of muscle tissue. Smooth muscles are 'involuntary' as their functioning cannot be directly controlled.

- Cardiac muscles tissue is a contractile tissue present only in the heart. Cell junctions fuse the plasma membranes of cardiac muscles cells and make them stick together.

- Communication junctions at some fusion points allow the cells to contract as a unit i.e when one cell receives a signal to contract, its neighbours are also stimulated to contract.

(4) Neural tissue :- Neural tissue exerts the greatest control over the body's responsiveness to changing conditions.

(1) Neurons, the unit of neural system are excitable cells.

(2) The neuroglial cells which constitute the rest of the neural system protect and support neurons.

(4) Neuroglia makes up more than one half the volume of neural tissue in our body.

* Connective tissue :- In connective tissue, blood is a fluid connective tissue containing plasma, red blood cells (RBC), white blood cells (WBC) and platelets. It is the important circulating fluid that helps in the transportation of various substances.

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⇒ Hence, the metaphase is characterized by all chromosomes coming to lie at the equator. with one chromatid of each chromosome connected by its kinetochore to spindle fibres from the opposite pole. The plane of alignment of the chromosomes one pole and its sister chromatid connected by its kinetochore to spindle fibres from the opposite pole. The plane of alignment of the chromosomes at metaphase is referred to as the metaphase plate.

⇒ Chromosomal fibres and supporting fibres continous (non-kinetochore which run from pole to pole) arrange in cell.

⇒ Centromere lies at equator and arms of chromosomes remain directed towards poles.

⇒ The key features of metaphase are :-

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

③ Anaphase : (Shortest phase) :

① Centromere of each chromosome splits simultaneously lengthwise. Sister chromatids separate from each other (and separated each chromatid is now refferred to as individual chromosome.

② Number of chromosome become double in size. (cell)

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Anaphase stage

- Centromeres s
- Chromatids

Anaphase

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## Subtopic : 3.3.

**Cell division :-** Introduction :- Growth and reproduction are characteristics of cells, indeed of all living organisms. All cells reproduce by dividing into two, with each parental cell giving rise to two daughter cells each time they divide. These newly formed daughter cells, can them selves grow and divide, giving rise to a new cell population that is formed by the growth and division allow a single cell to form a structure considered consisting of million of cells.

Cell is division is of two types :-

① Mitosis ② Meiosis.

* **Cell Cycle :-** Cell division is a very important process in all living organisms. During the division of a cell, DNA replication and cell growth also take place.

② All these processes i.e cell division, DNA replication, and cell growth and hence, have to take place in a coordinated way to ensure correct division and formation of progeny cells containing intact genomes.

③ The sequence of events by which a cell duplicates its genome synthesises the other constituents of the cell eventually divides into two daughter cells is termed by cell cycle.

Although cell growth is a continous process, DNA synthesis occurs only during one specific stage in the cell cycle.

[illegible] chromosomes (DNA) are then distributed to daughter nuclei by a complex series of events during cell division. These events are themselves under genetic control.

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Cell cycle

① Interphase.
② Division phase

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→ The specialised kind of cell division that reduces the chromosomes number by half results in the production of haploid daughter cells. This kind of division is called meiosis.

→ Meiosis ensure the production of haploid phase in the life cycle of sexually reproducing organisms whereas fertilisation restores the diploid phase. Meiosis occurs during gametogenesis leads to the formation of haploid gametes.

The key features of meiosis are as follows :-

- Meiosis involves two sequential cycles of nuclear and cell division called meiosis I and meiosis II but only a single cycle of DNA replication.

Meiosis I :- • Heterotypic division or reduction division. It leads to reduction in chromosome numbers. Division of chromosome does not occurs in meiosis I and only segregation of homologous chromosomes takes places

- Meiosis I is initiated after the parental chromatids have replicated to produce identical sister chromatids at the S phase.

- Meiosis I involves pairing of homologous chromosomes and recombination between non - sister chromatids of homologus chromosomes.

→ Meiosis II :-

[illegible] division or equitional division. It does [illegible] chromosome number.

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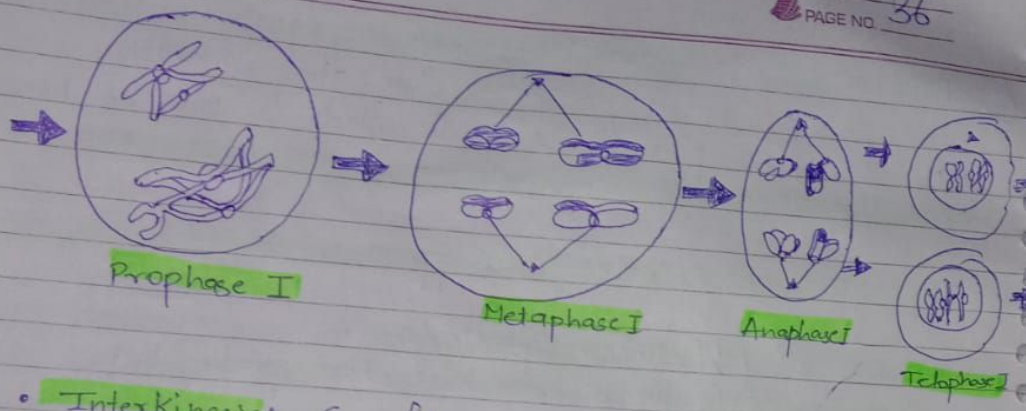


- Interkinesis:- Gap b/w meiosis I and meiosis I and meiosis II is called Interkinesis. Preparations of meiosis II occur during interkinesis. It is like interphase of mitosis but replication of DNA is absent in interkinesis.

- Interkinesis is generally short lived. Interkinesis is followed by prophase - II, a much simpler prophase than prophase-I.

Stages of Meiosis - II

1. Prophase II:

- Meiosis II is initiated immediately after cytokinesis, usually before the chromosomes have fully elongated. In contrast to meiosis I, meiosis II resembles a normal mitosis. The nuclear membrane disappears by the end of prophase II. The chromosomes again become compact.

2. Metaphase II:

At this stage the chromosomes align at the equator and the microtubules from opp. poles of the spindle get attached to the kinetochores of sister chromatids.

3. Anaphase II:

- It begins with
of each chromosome
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4. Telophase II:

- Meiosis ends wit
chromosomes once
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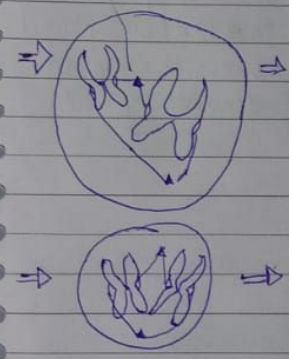
four haploid daughte



Prophase II

Significance of

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② Metaphase - I :- Bivalents arrange on equator of cell to form metaphase plate. The microtubules from the opposite poles of the spindle attach to pair of homologous chromosome with one kinetochore of each chromosome.

⇒ Two types of spindle fibres appears in the cell :-

(i) Chromosomal / kinetochore Spindle fibre.
(ii) Supporting / Continuous / non-kinetochore spindle fibres

③ Anaphase I:

- Due to shortening of kinetochore / chromosomal fibres homologous chromosomes segregate from each other and move towards the opposite poles. Sister chromatids remain associated at their centromeres (i.e. chromosomes remain in double chromatid stage).

- Anaphase I is characterised by segregation or disjunction of chromosomes. Division of centromere is absent.

④ Telophase I:

- The nuclear membrane and nucleolus reappear. Although in many case the chromosomes do undergo some dispersion, but they do not reach the extremely extended state of the interphase nucleus.

- Cytokinesis follows telophase-I and a diploid (2n) cell divides [illegible] daughter cells. This is called as dyad of cell.

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→ Crossing over is an enzyme mediated process and the enzyme involved is called recombinase.

→ Recombination between homologus chromosome is completely by the end of pachytene, leaving the chromosomes linked at the sites of crossing over.

→ Crossing over (d) Diplotene :- The begining of diplotene is recognised by dissolution of synaptonemal complex. Homologus chromosomes start repulsing each other so X- shape structure appeared called chiasmata.

→ Diplotene may last long up to months or years in oocytes of some vertebrates.

(e) Diakinesis :- It is the final stage of meiotic prophase I. Marked by terminalisation of chiasmatata.

→ Chromosome are fully condensed and meiotic spindle is assembled to prepare the homologus chromosome for separation.

→ Centrioles move towards the opposite poles.

→ By the end of diakinesis nucleolus disappear and the nuclear envelop also breakdown.

→ Diakinesis represents nucleolus disappear and the nuclear envelop also breakdown.

→ Diakinesis represents transition to metaphase.

(2) Metaphase - I:

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(i) Chromosomal
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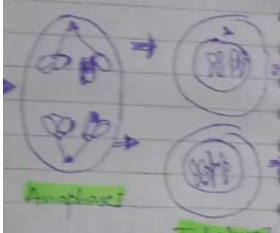


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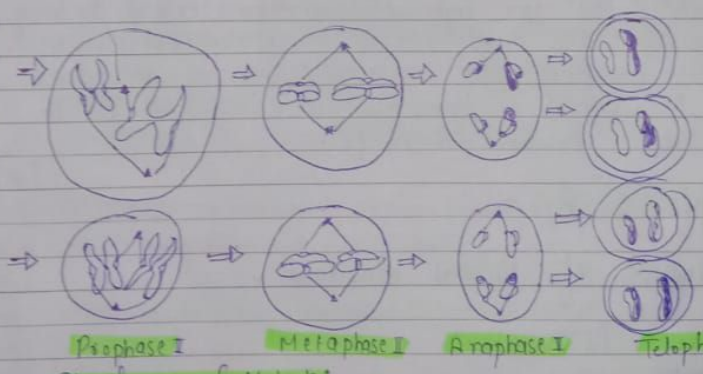
3. Anaphase II :-

- It begins with the simultaneous splitting of the centromeres of each chromosomes (which was holding the sister chromatids together), allowing them to move toward opp poles of the cell by shortening of microtubules attached to kinetochores.

4. Telophase II :-

- Meiosis ends with telophase II in which the two groups of chromosomes once again get enclosed by a nuclear envelope, cytokinesis follows resulting in the formation of tetrad of cells i.e four haploid daughter cells.




Significance of Meiosis :-

O Meiosis is the mechanism by which conservation of specific chromosome no. of each species is achieved across generation in sexually reproducing organisms, even though the process (specifically) results in reduction of chromosome no. by half.

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(a) Lepto tene → Chromatin threads condense to form chromosomes. Chromosomes are longest and thinest. Chromosome become gradually visible under the light microscope.

→ At the chromosomes in nucleus remain directed towards centriole so group of chromosomes in nucleus appears like a bouquet stage (Bouquet stage).

(b) Zygotene or Synapto tene : Zygotene is characterised by pairing of homologus chromosomes (synapsis). Pairs of homologous chromosomes are called Bivalents or tettads. However these are more clearly visible at next stage (pachytene). A structure develops in between homologous chromosomes. Which is termed as synaptonemal complex.

→ The 1st two stages of phase I is relatively short lived compared to the pachytene.

(c) Pachytene or (Thick thread) :- Due to increased attraction, homologous chromosome tightly coil around each other. Both the chromatids of each chromosomes become distinct and are called sister chromatids.

→ During this stage, the four chromatids of each bivalent chromosome become distinct and clearly appeared as tetrad.

→ Recombination nodules between non sister chromatids of homologus pair develop and [illegible] exchange their parts i.e crossing over.

→ Crossing over [illegible] two chromosomes [illegible]

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Howard and Pelc classified interphase into three stages :-

① $G_1$ phase or Pre DNA synthesis phase (1st Gap phase)-

- $G_1$ phase corresponds to the interval between mitosis and initiation of DNA replication. During $G_1$ phase the cell is metabolically active and continously grows.

- During $G_1$ - most of cell organelles increase in the cell and cell rapidly synthesizes different types of RNA and proteins. Due to availability of protein, synthesis of new protoplasm takes place in cell and it starts growing in size. Cell grows maximum in $G_1$ stages.

② S-phases (DNA synthesis phase) :- ① Replication of nuclear DNA and synthesis of histone protein takes places in S-phase. Replication of cytoplasmic DNA may occur in any stages of cell cycle.

② During this time the amount of DNA per cell doubles. If the initial amount of DNA is denoted as 2C then it increases to 4C. However, there is no increase in the chromosome number. If the cell had diploid or 2n no. of chromosomes at $G_1$, even after S phase the number of chromosomes remains the same i.e 2n.

③ S-phase marks the phase of DNA replication and chromosomes duplication.

④ In animal cells, during the S phase, DNA replication begins in the nucleus, and the centriole duplicates in the cytoplasm

③ $G_2$- phase (Pre mitosis)

→ Actual pre this phase es Bed in $G_2$ spindle fibres

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(b) Yellow elastin fibres :- Formed of elastin protein, these fibres are less numerous, thinner branched, and of a pale yellow colour.

- These are very elastic and remain stretched due to tension in the areolar tissue.

(c) Yellow fibrous tissue :- The matrix is with numerous and closely packed yellow or elastic fibres which are similar to but thicker than those of areolar connective tissues.

- It is elastic and flexible.
- It also forms sheets in ligaments.

(d) Adipose tissue :- It is modified form of areolar tissue made up of specialised large spherical fat cells or adipocytes.

- Adipose tissue chiefly acts as "food reserve" or fat depot for storage and metabolism of lipids.

(e) White fibrous tissue :- (1) It is modified form of areolar tissue. Only collagen fibres are present in the matrix and cells are mainly fibroblasts, presents at the joints between skull bones and makes them immovable also found in the dermis of higher mammals.

(2) Cartilage, bone & blood are various type of specialised connective tissue.

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(c) Stratified columnar epithelium :- It is protective epithelium has multiple layers of columnar cells, only the most superficial cells are truly columnar in appearance. Epithelium of this type is rare. It is found in male urethra and in the mucous layer near the anus. It also lines mammary gland ducts and epiglottis.

(d) Transitional epithelium (Urothelium) :- It is often consists four or more layers thick. It lacks germinative layer; basement membrane. Stratified transitional epithelium is typically found in the body areas such as the wall of urinary bladder ureter and renal pelvis. It is located in all the hollow viscera subjected to stress and protects organ wall from tearing.

(2) Neurosensory epithelium :- Olfactory mucosa, called Schneiderian membrane, lining of internal rang retina of eyes and epithelial covering of tongue containing taste bud are examples of neurosensory epithelia. The sensory cells bear, at their free ends, slender "sensory hairs" to receive specific stimuli.

(f) Pigmented epithelium :- The epithelical cells of the basal layer of retina contain pigment. Hence this layer is often referred to as a pigmented epithelium. For e.g :- Pigmented layer of retina, iris and skin.

(g) Germinal epithelium :- Specialized cuboidal cells capable of producing gametes as found in gonads. Germinal epithelium produces gametes e.g. ova and sperms.

[illegible] are held together with little intercellular [illegible]

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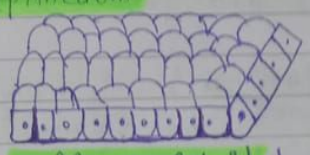
of keratin in these cells contribute to the protective quality of skin covering the body surface. Keratin is dead and water proof so it protects the underlying tissues from abrasion and infection. e.g epidermis of the skin of land vertebrates

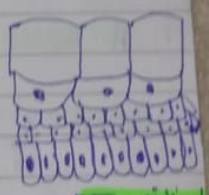
(b) Stratified squamous non-keratinised epithelium. It is free surface is moist, and the outer epithelial cells, unlike those found in the skin, do not contain keratin. This type of epithelium serves a protective function. It is found lining the oral cavity, pharynx, oesophagus and anal, lower part of urethra, vocal cords, vagina, cervix, and cornea of eyes

Types of Epithelium.

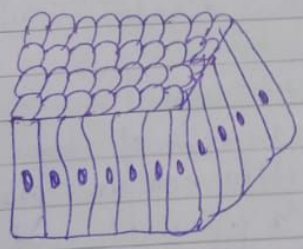
Simple Squamous



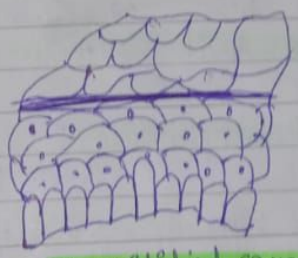
Simple Cuboidal



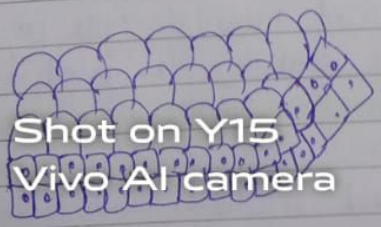
Transitional

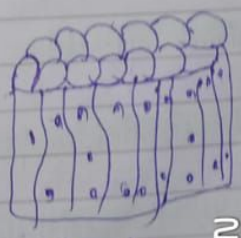


Simple Columnar.



Stratified squamous





Pseudostratified columnar

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cytoplasm

(8) $G_2$ - phase (2nd - Gap phase) or Post DNA synthesis phase (Pre mitosis phase)

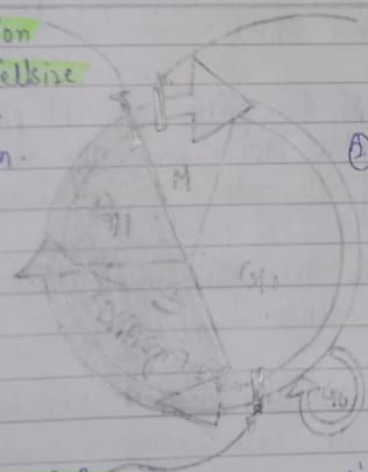
→ Actual preparation (Final preparation) of M-phase occurs during this phase. Special materials required for M-phase are synthesised in $G_2$ phase e.g. Tubulin protein - (Required for formation of spindle fibres) (cell growth continues.

$G_0$ phase is in next page.

CHECKpoints of cell cycle :- (1) Cell cycle is running by a group of special proteins "cyclins and CDKs (MPF) (Nurse, T. Hunt & Hartwell 2001 studies on saccharomyces).

$G_2$-M Transition

Influenced by · Cell size
· DNA damage.
· DNA replication.




Metaphase Anaphase Transition

Influenced by :- (1) Chromosome attachments to spindle.
(2) After attachment of spindle fibres to chromosomes, anaphase promoting factors (APC) is activated.

· This APC is involved in
(i) Separation of sisterchromatids.
(ii) Decondensation of chromosome and reassembly of nuclear membrane.

$G_1$-S Transition

Influenced by · Growth factors.
· Nutrients
· Cell size
· DNA damage.

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# Unit :- III.

1. Classification of Animal kingdom.
2. Cell, Tissue, Organ, Electron Microscopic structure of a function of a cell.
3. Cell division and its significance.

## Subtopic :- 5.2 :- Cell, Tissue, Organ, E.M.S. of a function of cell.

Ans :- **Cell** :- The cell from latin cella, meaning "small room" is the basic structural, functional and biological unit of all known organisms. A Cell is the smallest unit of life. Cells are often called the "building blocks of life". The study of cells is called cell biology, cellular biology or cytology.

Cells consists of cytoplasm enclosed within a membrane, which contains many biomolecules such as protein & and nucleic acids. Most plant and animal cells are only visible where under a microscope, with dimensions between 1 and 100 micrometres. Organisms can be classified as unicellular or multicellular. Most unicellular organisms are classed as microorganisms.

The no. of cells in plants and animals varies from species to species, it has been estimated that humans contain somewhere around 40 trillion cells. The human brains accounts for around 80 billion of these cells.

Cells were discovered by Robert Hooke in 1665, who named them for their resemblance to cells inhabited by Christian monks

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(2) Cell cycle is running by a group of special proteins "Cyclins and Cdks"

(3) The activity of enzymes, known as cyclin dependant kinases (Cdk's) regulates the cell cycle. Kinase is an enzymes that removes a phosphate group from ATP and add to another protein. The kinases involved in the cell cycle are called Cdks because they are activated when they combined with key protein called cyclin.

(4) At some check point. ($G_2 \rightarrow S/M$) a kinase enzyme contains combines with cyclin & this moves the cell cycle forwardly

(5) $G_2$ - M transition is triggered by maturation promoting factor (MPF) formed by M-cyclin + $CDK_2$.

(2) DIVISION PHASE :- Division phase or M-phase or mitotic phase lasts for only about an hours in the 24 hours duration of cell cycle of a human cell.

→ The M- phase represents the phase when the actual cell division or mitosis occurs.

→ In animals, mitotic cell division is restricted or only seen in diploid somatic cell except in some social insects. Against this, the plants can show mitotic division in both in both haploid and diploid cells.

→ This is the most dramatic period of the cell cycle, involving a major reorganisation of virtually all components of the cell. Since [illegible] of chromosomes in the parent and

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(1) Prophase.
(2) Metaphase.
(3) Anaphase.
(4) Telophase.

(1) PROPHASE :- P
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② **Connective Tissues** :- These are the most abundant and widely distributed in the body of complex animals.

- They are named connective tissues because of their special function of linking and supporting other tissues of the body.

Connective Tissues.

- Connective tissues proper
- Skeletal tissues
  - Cartilage
    - Hyaline Cartilage
    - Fibrous Cartilage
      - White fibrocartilage
      - Elastic cartilage
    - Calcified Cartilage
  - Bone
    - Compact Bone
    - Spongy bone
- Vascular tissues
  - Blood
  - Lymph.

- Epithelial tissues
- Blood tissues
- White fibrous tissues
- Yellowelastic tissues
- Reticular tissues

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(9) Telophase (Reverse prophase) :- At the beginning of the final stage of karyokinesis i.e telophase, the chromosome that have reached their respective poles decondense and loss their individuality. The individual chromosome can no longer be seen and chromatin material tends to collect at each of the two poles. This is the stage which shows the following key events.

- Chromosomes cluster at opposite spindle poles and their identity is lost as discrete elements.
- Nuclear envelope develops around the chromosome cluster at each pole forming two daughter nuclei.
- Nucleolus, golgi complex and ER reform.

## CYTOKINESIS :-

- Mitosis accomplishes not only the segregation of duplicated chromosome into daughter nuclei (karyokinesis) but the cell itself is divided into two daughter cells by the separation of cytoplasm called cytokinesis at the end of which cell division get completed.
- In animals cytokinesis occurs by constriction and furrow formation. Microtubules and microfilaments arrange on equator to form midbody and at the periphery of the equator a contractile ring is formed that is made up of actin and myosin. Due to interaction between actin and myosin ring contracts thus furrow forms from outside to inside in cell. Furrow deepens continuously and ultimately a cell division into two

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② **Tissue** :- A group of similar or dissimilar cells which have common origin and together perform a common function are called tissue.

* Word animal tissue was coined by Bichat - Father of histology.

* Study of tissue or microscopic examination or anatomy of any animal structure is called Histology.

The structure of the cells vary according to their function. Therefore, the tissues are different and are broadly classified into four types.

Kind of Tissue

- Epithelial
- Connective
- Muscular
- Neural

**Kinds of Tissues** :- On the basis of function and location the tissues are of four types :-

① **Epithelial Tissue** :- • Tissues have a free surface, which faces either a body fluid or the outside environment and thus provides a covering of or lining for some part of the body. The cells are compactly packed with little intercellular matrix.

• There are two types of epithelial tissues namely :-

- Simple epithelium
- Compound epithelium.

• **Simple epithelium** :- [illegible] composed of a single layer [illegible]

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The characteristics of prokaryotic cell are :-

- Membrane bound cell organelle such as mitochondria, Golgi apparatus, Chloroplasts are absent.

- A membrane bound well defined nucleus is absent.

- Genetic material is circular DNA and occurs naked in the cell cytoplasm. It is attached to the cell membrane and called nucleoid.

- The cell wall is a rigid structure which is made up of Polysaccharides.

- The cell size ranges from 0.1 to 5.0 micrometer in size.

(2) Eukaryotic Cell :- are the cells that contain a nucleus and organelles, and are enclosed by a plasmic membrane. Organisms that have eukaryotic cells include, protozoa and fungi, plants and animals. These organisms are grouped in to the biological domain Eukaryota. Eukaryotic cells are larger and more complex than prokaryotic cells, which are found in Archae and Bacteria, the other two domains of life.

Plant and animals cells have several differences and similarities. For example, animal cells donot have a cell wall or chloroplast but plant cells do. Animal cells are mostly round and irregular in shape while plant cells have fixed, rectangular shapes

Plant and animals cells are both eukaryotes cells, so they have several features in common, such as the presence of a cell

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- Division of chromosome or centromere occurs during meiosis II.

- Four haploid cells are formed at the end of meiosis II. All the four daughter cells produced by meiosis are generally genetically different from each other and also differ from the mother cell.

- In meiosis, division of nucleus takes place twice but division of chromosome occurs only once in meiosis II.

Meiotic events can be grouped under the following phases :-

| Meiosis I | Meiosis II |
|---|---|
| Prophase I | Prophase II |
| Metaphase I | Metaphase II |
| Anaphase I | Anaphase II |
| Telophase I | Telophase II |

→ Interphase :- same as in mitosis.

Stages of meiosis I.

(1) Prophase I :- Typically longer and more complex when compared to phase of mitosis. Prophase I is classified in the substages based on chromosomal behavi

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and functions as a lining for body cavities, ducts and tubes.

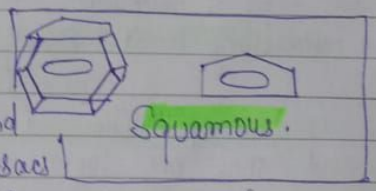
- **Compound epithelium** :- It is consists of two or more cell layers and has protective function as it does in our skin.

- On the basis of structural modification of the cells, simple epithelium is further divided into three types.

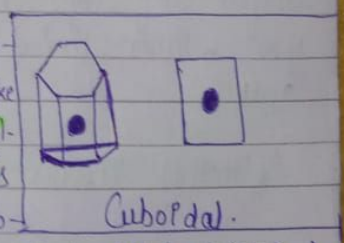
These are the three types are :-

- Squamous
- Cuboidal
- Columnar.

- The squamous epithelium is made of a single thin layer of flattened cells with irregular boundaries. They are found in the walls of blood vessels and air sacs of lungs and are involved in a functions like forming a diffusion boundary.




- **Cuboidal** :- The cuboidal epithelium is composed of a single layer of cube-like cells. This is commonly found in ducts of glands and tubular parts of nephrons in kidneys and its main functions are secretion and absorption. The epithelium of proximal convoluted tubule (PCT) of nephron in the kidney has microvilli.




- Colum[illegible] columnar epithelium is comp[illegible]

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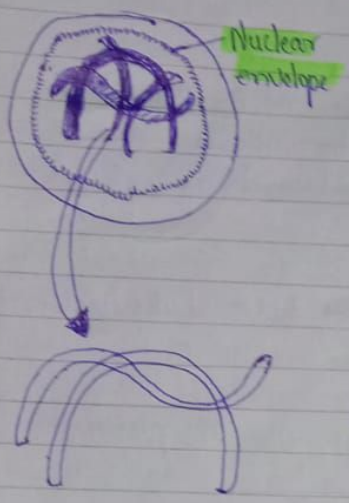
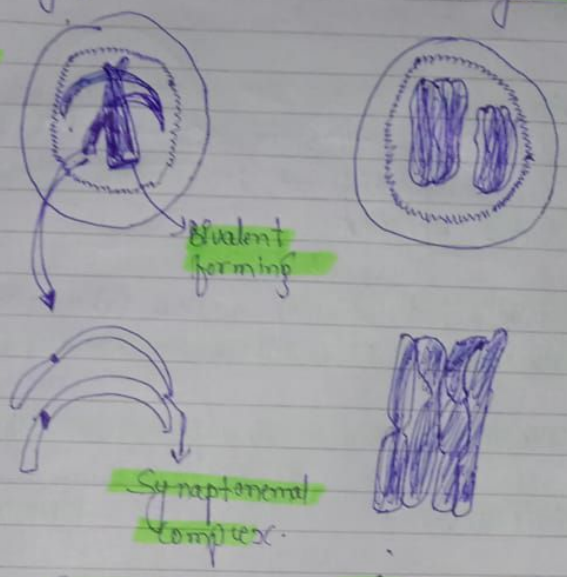
# Prophase I.

## Leptotene




Duplicated Chromosome

## Zygotene




Synapsis form

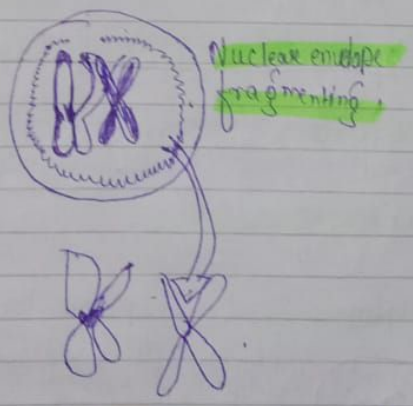
## Pachytene

Crossing over occurs.

## Diplotene

Synaptonemal complex disappearing & chiasmata visible.

## Diakinesis.

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(2) Plasma : It constitutes about 5% of body weight. It represents matrix of blood. Plasma is slightly alkaline and transparent. It forms 55-60% by volume of blood. Plasma contains : Water (91-92%), solid (8-9%).

(1) Blood corpuscles : Blood corpuscles from 40-50% of the blood and are of three types viz. RBCs, WBCs and platelets.

(1) Red blood corpuscles :- (RBCs or Erythrocytes) : These occur only in vertebrates and are the most abundant (99%) of blood corpuscles, imparting the characteristics red colour to the blood.

- The shape, size and structure of RBCs vary in diff. types of vertebrates, but their function is the same in all, namely to transport respiratory gases, especially the oxygen ($O_2$).

(2) White blood corpuscles (WBCs) or leucocyte :-

(1) They are nucleated, colourless and complete cells.

(2) They are bigger than RBC but their number is less.

(3) WBCs show least constancy in shape. The number of WBC is is 5,000 to 10,000 per cubic mm.

(4) They are formed in RBlood bone marrow, spleen, thymus and lymph nodes from myelocytes and the process is called as myelocytosis.

(5) The life span of WBC is of 15 hrs to 8 days.

(3) Blood pl

(6) Platelets
arising from
bone marrow

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(1) These are
of blood.

(5) Platelets are

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(2) LYMPH

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