

ULTRA STRUCTURE OF CELL

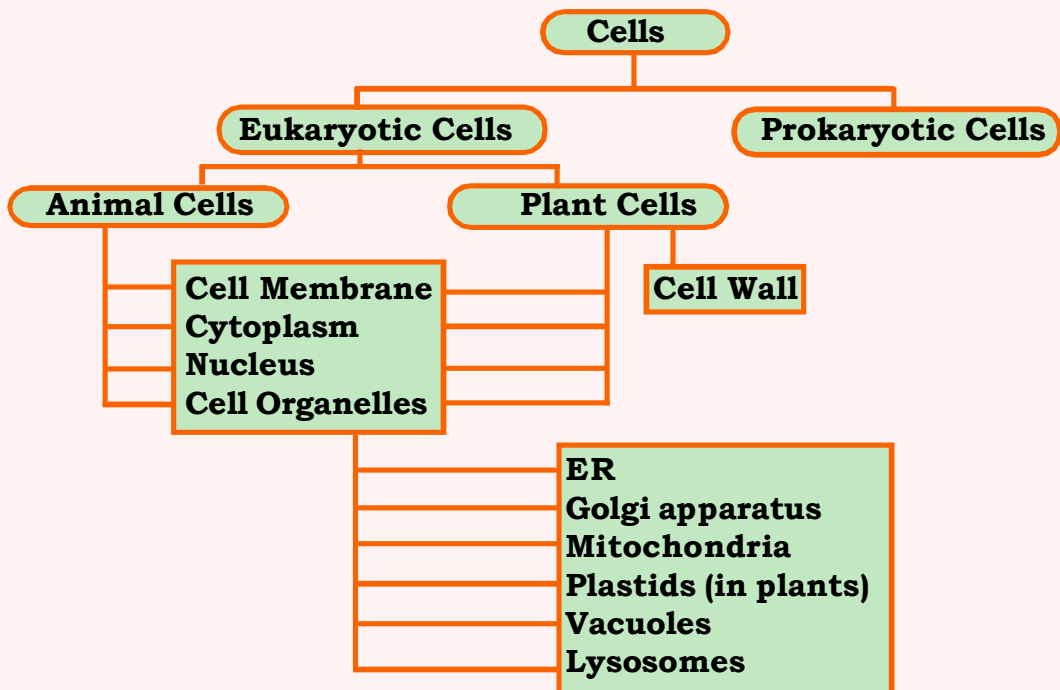
Robert Hooke was born on 18 July 1635 in Fresh water, United Kingdom. He was a scientist, natural philosopher, and architect.

The existence of microscopic organisms was discovered during the period 1665-83 by two Fellows of The Royal Society, Robert Hooke and Antoni van Leeuwenhoek.

In 1655, Hooke discovered his law of elasticity, which states that the stretching of a solid body is proportional to the force applied. He applied these studies in his designs for the balance springs of the watches.



CONCEPT MAP



CONCEPT 1.1**Introduction:**

The cell is the fundamental, structural, and functional unit of living organisms. The science that deals with cells and their organelles is called cell biology. The term 'cell' was first used by Robert Hooke in 1665. He initially described the cell as 'cella,' meaning a hollow space. Robert Hooke observed cells in a section of cork. In 1831, Robert Brown observed the nucleus in plant cells. In 1858, Rudolf Virchow stated that new cells arise from pre-existing cells.

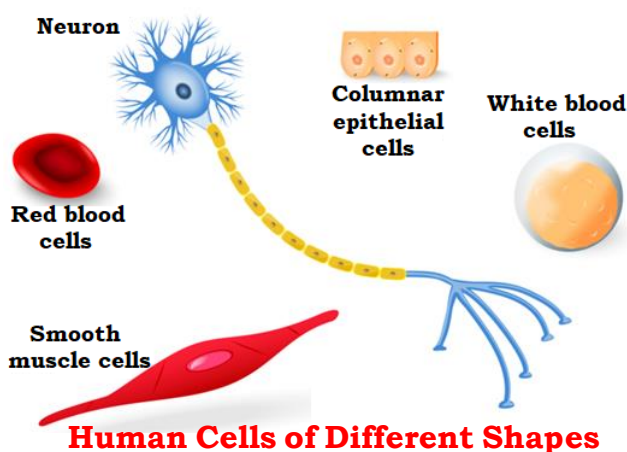
"Omnis cellula e cellula" is a Latin phrase meaning "All cells arise from pre-existing cells." Schleiden, a German botanist, described cell theory with regard to plant cells in 1838. Theodor Schwann, a German zoologist, described cell theory with regard to animal cells in 1839. Cell theory states that 'The cell is the structural and functional unit of life.'

The cell is the fundamental and structural unit of life.

Shape and Size of the Cell:

The shape of cells is variable. The cells of unicellular organisms, leukocytes, and bacteria exhibit a variety of shapes, while those of multicellular organisms show even greater variation. Their shapes may be rounded, cylindrical, irregular, triangular, or tubular.

Cell size is extremely variable, ranging from one micron to 175 mm. The ostrich egg cell is 176 mm in diameter, making it visible to the naked eye. Nerve cells in mammals may reach a length of 3 to 3.5 feet. The smallest cells are those of Pleuropneumonia-like organisms.

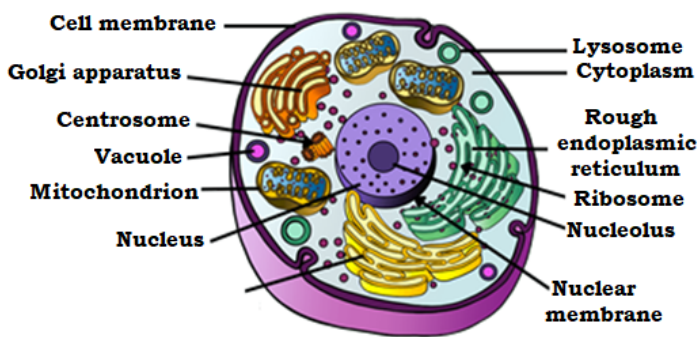


Human Cells of Different Shapes

Plasma membrane:

The cytoplasm is surrounded by a porous membrane called the plasma membrane. Electron microscopic studies reveal that the plasma membrane is composed of outer and inner protein layers with a double layer of lipids in between. J David Robertson referred to the plasma membrane as the 'unit membrane'.

The main function of the plasma membrane is to regulate the entry and exit of substances.

**Cytoplasm:**

The part of the protoplasm outside the nucleus is known as the cytoplasm. It is divided into an outer, non-granular, thick ectoplasm and an inner, granular, thin endoplasm. Many organelles are present within the cytoplasm.

Cell Organelles:

Many cell organelles are present in the cytoplasm. A cell keeps its content separated from the external surrounding with the help of membrane. Cell organelles are membrane bound little structures present within cells and have specific functions to carry out.

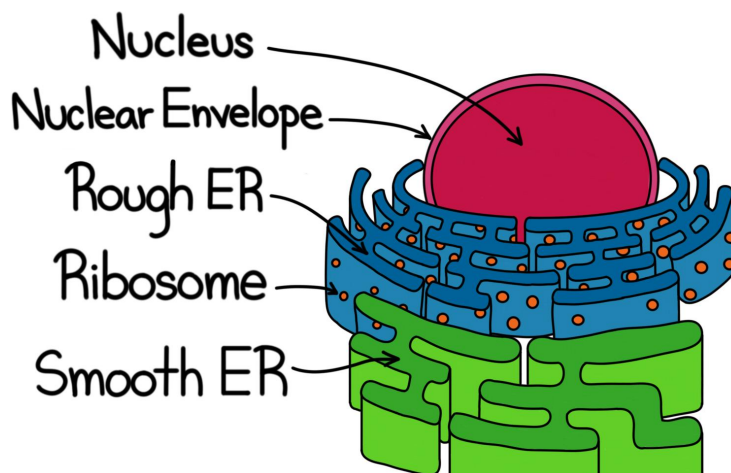
Centrosome:

It is the centre of the cell, discovered by Theodor Boveri and Walther Flemming. It is located near the nucleus and includes a specialized portion of the cytoplasm called the centrosome.

Its matrix is called kinoplasm, in which two centrioles are embedded. Each centriole consists of nine fibrillar units, and each fibrillar unit contains three microtubules. The function of centrioles is to form the spindle during cell division.

Endoplasmic reticulum:

In the cytoplasm, a network of tubules is present, called the endoplasmic reticulum. This network of tubules is of two types:

**i. Smooth endoplasmic reticulum (SER):**

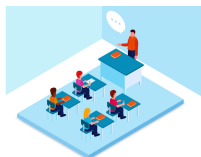
Ribosomes are absent on the surface of these tubules, hence they are called smooth endoplasmic reticulum or agranular endoplasmic reticulum.

ii. Rough endoplasmic reticulum (RER):

Ribosomes are present on the surface of these tubules, giving them a rough appearance. This is called rough endoplasmic reticulum or granular endoplasmic reticulum. The endoplasmic reticulum connects the protein synthesis, nucleus, and other organelles.

Functions:

1. It provides support to the cell.
2. Rough endoplasmic reticulum produces proteins.
3. The smooth endoplasmic reticulum produces lipids.
4. It serves as a site for many biochemical reactions in the cell.
5. Some of these proteins and lipids help in building the cell membrane.



CLASSROOM DISCUSSION QUESTIONS

CDQ
1.1

1. **Who first used the term "cell"?**
 - (A) Robert Brown
 - (B) Rudolf Virchow
 - (C) Robert Hooke
 - (D) T. Schwann
2. **Which scientist observed cells in the section of cork for the first time?**
 - (A) Rudolf Virchow
 - (B) Robert Brown
 - (C) Robert Hooke
 - (D) T. Schwann
3. **What did Rudolf Virchow state about cells in 1858?**
 - (A) Cells are the structural and functional unit of life.
 - (B) New cells arise from pre-existing cells.
 - (C) Cells are made up of plasma membrane.
 - (D) Cells are only found in animals.
4. **What is the main function of the plasma membrane?**
 - (A) Production of proteins
 - (B) Regulating the entry and exit of substances
 - (C) Providing structural support to the cell
 - (D) Forming the nucleus
5. **What is cytoplasm?**
 - (A) Part of the nucleus
 - (B) Outer membrane of the cell
 - (C) Part of the protoplasm outside the nucleus
 - (D) Part of the mitochondria
6. **What is the function of the centrioles?**
 - (A) Producing lipids
 - (B) Forming the spindle at the time of cell division
 - (C) Regulating the entry of substances
 - (D) Providing strength to the cell
7. **Which type of endoplasmic reticulum lacks ribosomes on its surface?**
 - (A) Smooth endoplasmic reticulum
 - (B) Rough endoplasmic reticulum
 - (C) Granular endoplasmic reticulum
 - (D) Agranular endoplasmic reticulum
8. **What is the function of granular endoplasmic reticulum?**
 - (A) Producing proteins
 - (B) Producing lipids
 - (C) Regulating cell division
 - (D) Forming the plasma membrane
9. **How does endoplasmic reticulum contribute to the cell's structure?**
 - (A) Forms the nucleus
 - (B) Forms the cytoskeleton
 - (C) Forms the plasma membrane
 - (D) Produces cell organelles
10. **Which organelle acts as the center of the cell and forms the spindle during cell division?**
 - (A) Mitochondria
 - (B) Golgi apparatus
 - (C) Centrosome
 - (D) Lysosome

MARK YOUR ANSWERS WITH PEN ONLY. Time Taken in Minutes

1 A B C D	2 A B C D	3 A B C D	4 A B C D	5 A B C D
6 A B C D	7 A B C D	8 A B C D	9 A B C D	10 A B C D

CONCEPT 1.2

Ribosomes:

- It is a small particle present in the cytoplasm. Ribosomes may be attached to cell organelles or freely distributed in the cytoplasm.
- In a eukaryotic cell, 80S ribosomes are present. Each ribosome consists of two subunits: 40S and 60S.
- Ribosomes are composed of proteins and RNA, with a diameter ranging from 150 to 200 Å.
- Ribosomes combine with mRNA to produce proteins. A group of ribosomes attached to mRNA is called a polysome (polyribosome).

Golgi complex:

The Golgi complex was first described by Camillo Golgi. It is also called dictyosomes (in plant cells), lipochondria, the 'traffic police' of the cell, and idiosomes. The Golgi complex consists of three main structures:

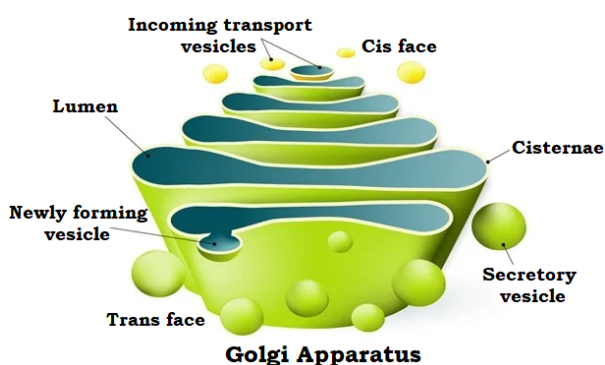
a. Cisternae: These are flat, membrane-bound sacs arranged one above the other. They measure 150 nm in length and 60 Å in thickness.

b. Vacuoles: Central vacuoles is a large, oval-shaped structure and store nutrients.

c. Vesicles: These are small, spherical structures that occur in groups. Together, these components form the Golgi complex.

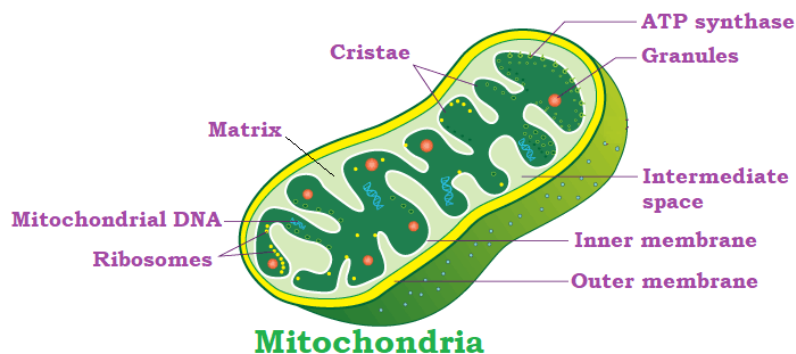
Functions: The Golgi complex is involved in secretory functions. It stores and modifies proteins and lipids for transport within and outside the cell.

Example: Lysosomes and plasma membrane.

**Mitochondria:**

Mitochondria were first described by Altmann as 'bioplasts' in 1894 and were later named 'mitochondria' by Benda in 1897.

They are filamentous or rod-shaped structures surrounded by two membranes. The inner membrane is folded inward, forming structures called cristae, which increase the surface area for biochemical reactions. Oxyosomes, which are involved in ATP synthesis, are present on these cristae.



Functions of Mitochondria:

- i) The central matrix of mitochondria contains respiratory enzymes responsible for carrying out Krebs cycle reactions.
- ii) The inner membrane houses electron transport chain enzymes, which play a key role in energy production.
- iii) Mitochondria are involved in the oxidation of food materials to release energy in the form of Adenosine Triphosphate (ATP), hence they are called the "powerhouses of the cell."
- iv) Mitochondria contain circular DNA, allowing them to synthesize some of their own proteins, which is why they are also known as semi-autonomous organelles.

Lysosomes:

Lysosomes were first described by De Duve. Each lysosome is round in shape and measures approximately 0.4 to 0.8 microns in diameter. It is surrounded by a lipoprotein membrane and contains hydrolytic enzymes. Lysosomes play a crucial role in intracellular digestion and the autolysis of cells.

Functions:

- i) Lysosomes help in the digestion of food.
- ii) During starvation, lysosomes digest cell organelles.
- iii) Lysosomes can dissolve the entire cell, a process known as autolysis. Hence, lysosomes are called the "suicidal bags" of the cell.

Vacuoles:

The vacuole in plants was discovered by Spallanzani. It is a non-living reservoir, bounded by a differentially or selectively permeable membrane called the tonoplast. The vacuole is filled with cell sap or tonoplast, which contains water, minerals, and anthocyanin pigments.

Some protozoans have contractile vacuoles that enlarge by accumulating fluid and collapse by expelling it from the cell. Vacuoles may be classified as sap vacuoles, contractile vacuoles, or gas vacuoles (pseudo-vacuoles).

Functions of vacuoles: Vacuoles maintain the osmotic balance of the cell, which helps in the absorption of water. The turgidity and flaccidity of a cell depend on the concentration of sap in the vacuole.



CLASSROOM DISCUSSION QUESTIONS

CDQ
1.2

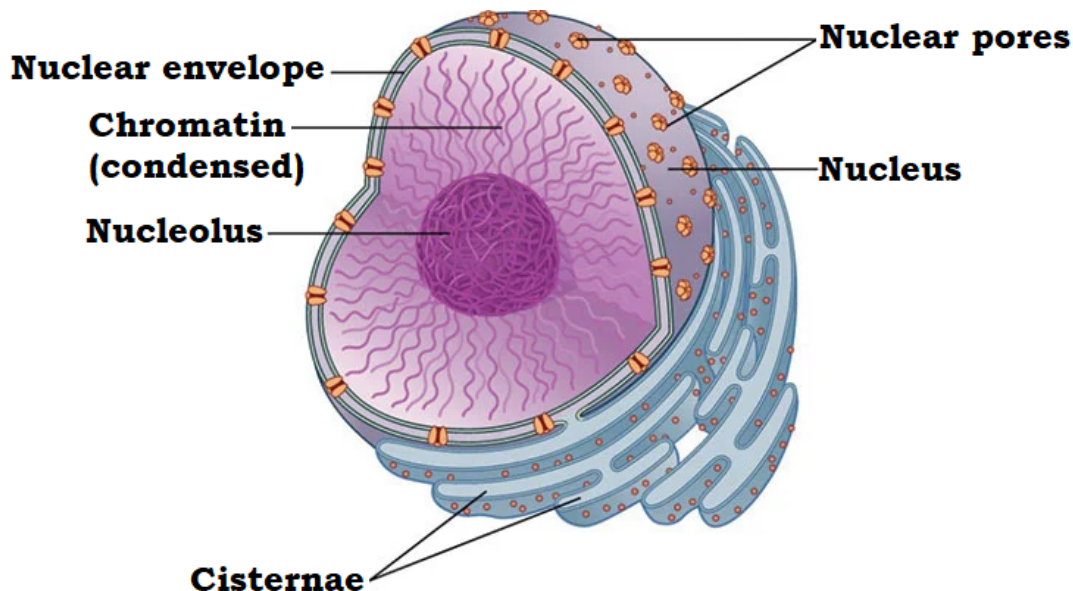
1. **What is the size of a eukaryotic ribosome?**
 - (A) 40s
 - (B) 60s
 - (C) 80s
 - (D) 100s
2. **What is the composition of ribosomes?**
 - (A) Proteins only
 - (B) RNA only
 - (C) Carbohydrates only
 - (D) Proteins and RNA
3. **What is the function of ribosomes in a cell?**
 - (A) Energy production
 - (B) Formation of cell membrane
 - (C) Production of proteins
 - (D) Intracellular digestion
4. **Which scientist described the Golgi complex?**
 - (A) Altamann
 - (B) Benda
 - (C) Golgi
 - (D) De-Duve
5. **What are the three types of structures found in the Golgi complex?**
 - (A) Cisternae, Nuclei, Vesicles
 - (B) Cisternae, Vacuoles, Vesicles
 - (C) Cisternae, Mitochondria, Vesicles
 - (D) Cisternae, Endoplasmic reticulum, Vesicles
6. **What is the main function of mitochondria in a cell?**
 - (A) Intracellular digestion
 - (B) Secretion
 - (C) Oxidation of food material and energy liberation
 - (D) Protection from diseases
7. **Who first described lysosomes?**
 - (A) Altamann
 - (B) Benda
 - (C) Golgi
 - (D) De-Duve
8. **What is the size range of lysosomes?**
 - (A) 150 to 200 microns
 - (B) 40 to 80 microns
 - (C) 0.4 to 0.8 microns
 - (D) 60 to 100 microns
9. **What is the function of vacuoles in a cell?**
 - (A) Energy production
 - (B) Intracellular digestion
 - (C) Storage of cell sap and waste products
 - (D) Formation of cell membrane
10. **What is the covering of a vacuole called?**
 - (A) Nucleus
 - (B) Cytoplasm
 - (C) Tonoplast
 - (D) Endoplasmic reticulum

MARK YOUR ANSWERS WITH PEN ONLY. Time Taken in Minutes

1 (A) (B) (C) (D)	2 (A) (B) (C) (D)	3 (A) (B) (C) (D)	4 (A) (B) (C) (D)	5 (A) (B) (C) (D)
6 (A) (B) (C) (D)	7 (A) (B) (C) (D)	8 (A) (B) (C) (D)	9 (A) (B) (C) (D)	10 (A) (B) (C) (D)

CONCEPT 1.3**Nucleus:**

In a eukaryotic cell, a definite nucleus is present, measuring 5 to 25 microns in size. It consists of the following parts:

**a) Nuclear membrane:**

The nucleus is covered by a double-layered nuclear membrane. The space between the two layers is called the perinuclear space. The nuclear membrane contains small openings (nuclear pores), each surrounded by a small structure called an annulus on the outer side.

Hammerling demonstrated that the nucleus is the seat of heredity through grafting experiments on *Acetabularia*.

b) Nucleoplasm:

Inside the nuclear membrane, nucleoplasm is present. It contains glycoproteins, RNA, and enzymes.

c) Chromatin network:

Within the nucleoplasm, many thin and filamentous chromosomes form a network-like structure called the chromatin network. Genes, which are the units of heredity, are located on the chromosomes.

d) Nucleolus:

One or two round structures called nucleoli are present in the nucleoplasm. They contain proteins and RNA and are responsible for producing ribosomes.

Functions:

1. It is the control centre of the cell.
2. It transmits hereditary information from one generation to the next.
3. It produces nucleic acids.

Types of Cell Nucleus:

Depending on the number, size, and nature of the nucleus, cells may be classified into the following types:

- i) Eukaryon – A cell that contains a single nucleus.
- ii) Dikaryon – A cell that contains two nuclei of the same kind.
- iii) Polykaryon – A cell that contains multiple nuclei of the same type.
- iv) Heterokaryon – A single cell that contains nuclei of two different types, typically produced by the fusion of two distinct cells.
- v) Synkaryon – A hybrid cell formed from a heterokaryon, in which the nuclei have undergone synchronous mitosis and merged.

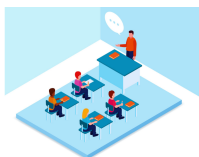
Depending on its nature the nucleus itself may be of the following types:

- i) Amphinucleus – It is a diploid nucleus containing two sets of genomes. It is found in somatic cells.
- ii) Heminucleus – It is a haploid nucleus containing only one set of genome. Heminuclei are found in gametes.
- iii) Pronucleus – The haploid nucleus of an ovum or spermatozoon, present in a fertilized ovum before their fusion, is called a pronucleus.

The nucleus of an ovum before it unites with that of the spermatozoon is called the female pronucleus.

The nucleus of the spermatozoon after it has penetrated the ovum is called the male pronucleus.

- iv) Micronucleus and Macronucleus – In some organisms (e.g., ciliates), the cell contains two unequal nuclei. The smaller one is called the micronucleus, and the larger one is called the macronucleus.



CLASSROOM DISCUSSION QUESTIONS

CDQ
1.3

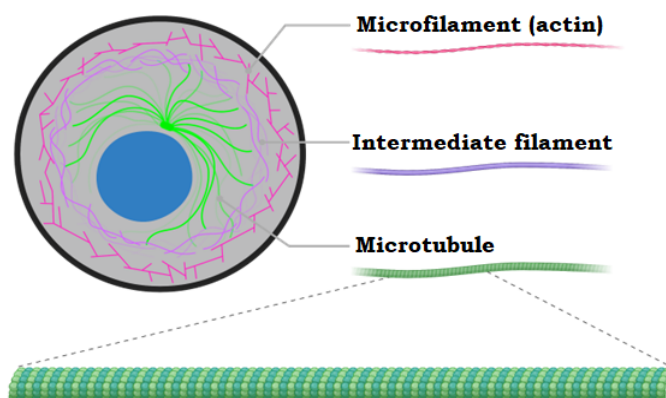
1. **What is the origin of cell nuclei?**
 - (A) Formed afresh during cell division
 - (B) Pre-existing and divided during cell division
 - (C) Synthesized during cell growth
 - (D) Transferred from neighboring cells
2. **What is the size range of a eukaryotic nucleus?**
 - (A) 1 to 10 microns
 - (B) 5 to 25 microns
 - (C) 50 to 100 microns
 - (D) 100 to 200 microns
3. **What is the main component of the nucleoplasm?**
 - (A) Proteins only
 - (B) RNA only
 - (C) Enzymes only
 - (D) Glycoproteins, RNA, and enzymes
4. **What is the function of euchromatin in the nucleus?**
 - (A) Synthesis of ribosomes
 - (B) Synthesis of RNA
 - (C) Control of protein synthesis
 - (D) Storage of hereditary information
5. **What is the function of nucleoli in the nucleus?**
 - (A) Synthesis of DNA
 - (B) Production of enzymes
 - (C) Production of ribosomes
 - (D) Regulation of cell metabolism
6. **Which statement about the nucleus is true?**
 - (A) It has no role in the cell metabolism
 - (B) It does not contain DNA
 - (C) It controls the synthesis of lipids
 - (D) It regulates all the behavior of the cell
7. **Which type of cell contains a single nucleus?**
 - (A) Eukaryon
 - (B) Dikaryon
 - (C) Polykaryon
 - (D) Heterokaryon
8. **What is the type of nucleus found in somatic cells?**
 - (A) Amphinucleus
 - (B) Heminucleus
 - (C) Pronucleus
 - (D) Micronucleus
9. **What is the nucleus of an ovum before it unites with a spermatozoon called?**
 - (A) Female pronucleus
 - (B) Male pronucleus
 - (C) Amphinucleus
 - (D) Heminucleus
10. **In a dikaryon, which nucleus is smaller?**
 - (A) Macronucleus
 - (B) Female pronucleus
 - (C) Male pronucleus
 - (D) Micronucleus

MARK YOUR ANSWERS WITH PEN ONLY. Time Taken in Minutes

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CONCEPT 1.4**Cytoskeleton:**

In eukaryotic cells, a framework of fibrous protein elements is necessary to support the extensive membrane system. These elements collectively form the cytoskeleton of the cell. It maintains and regulates changes in the shape of the cell, which consists of three types.



i) Microtubules: These were first discovered by De Robertis and Franchi in 1953 in the axons of medullated nerve fibres and were named neurotubules.

ii) Microfilament:

These are electron-microscopic, long, narrow, cylindrical, non-contractile protein structures found only in the eukaryotic cytoplasm. They are present in microvilli, muscle fibres (where they are called myofilaments), etc., but are absent in prokaryotes.

iii) Intermediate filaments:

Location: They serve as supportive elements in the cytoplasm of eukaryotic cells but are absent in mammalian RBCs.

Centriole:

This is a pair of short microtubules involved in cell division. Before each division, the centriole replicates itself, and the two centrioles move to opposite ends of the cell, where they initiate the spindle apparatus that organizes and separates the chromosomes.

Chromosome:

In a cell nucleus, the chromatin reticulum dissociates into a definite number of thread-like structures during cell division, called chromosomes.

The major chemical components of chromosomes are nucleic acids and proteins. DNA and RNA are the primary nucleic acids, and the proteins are of two types: histone and non-histone.

The functional fragment of DNA within a chromosome is called a gene.

Chromosomes are self-replicating nucleoprotein filaments composed of hereditary units called genes. They form the intricate chromatin network observed in the interphase nucleus.

Types of chromosome:

Broadly, chromosomes are classified into two types: autosomes and allosomes. Allosomes are also known as sex chromosomes.

i) Autosomes – These are the chromosomes that determine the somatic (body) characteristics of an organism. Humans have 22 pairs of autosomes.

ii) Allosomes – These are the chromosomes other than autosomes, also known as sex chromosomes or heterochromosomes. They primarily determine the sex of an organism.

Sex chromosomes can be either homomorphic or heteromorphic:

In humans: XX in females (homomorphic) and XY in males (heteromorphic).

In birds: ZZ in males (homomorphic) and ZW in females (heteromorphic).

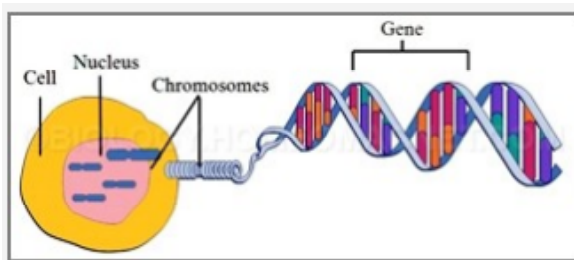
Gene:

A gene is a unit of information that directs the activities of a cell or organism throughout its lifetime. It also transmits information to the next generation when the cell or organism divides or reproduces.

Genes are located on chromosomes, and each chromosome contains several genes. Every gene occupies a fixed position on the chromosome, known as a locus.

A single gene may exist in different forms, called alleles.

Genes on one chromosome can be transferred to another due to processes such as crossing over during meiosis or chromosomal translocations.



Cell Wall:

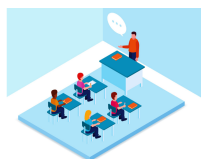
The cell wall is a thick layer located outside the cell membrane that provides strength and rigidity to the cell.

It consists of a network of fibres that offer structural support while remaining freely permeable to solutes (unlike membranes, which are selectively permeable). A wickerwork basket serves as a good analogy for its structure. In plant cells, the cell wall is composed mainly of cellulose, but it can also include hemicellulose, pectin, lignin, and other polysaccharides. It is built in three layers:

1. Primary cell wall
2. Secondary cell wall
3. Middle lamella

There are often channels called plasmodesmata that pass through plant cell walls, allowing communication by linking the cytoplasm of adjacent cells.

In fungi, the cell wall is made of chitin (poly-glucosamine) instead of cellulose.



CLASSROOM DISCUSSION QUESTIONS

CDQ
1.4

1. **What is the function of the cytoskeleton in a cell?**
 - (A) Energy production
 - (B) Storage of genetic material
 - (C) Support, transport, and motility
 - (D) Regulation of cell division
2. **Which motor protein is responsible for chromosome movement in mitosis?**
 - (A) Kinesin (B) Dynein
 - (C) Myosin (D) Tubulin
3. **What is the role of the centriole in cell division?**
 - (A) Synthesis of proteins
 - (B) Formation of cell membrane
 - (C) Organization of the spindle fibers
 - (D) Regulation of metabolic processes
4. **What is a gene?**
 - (A) A unit of information that directs cell activity
 - (B) A type of protein fiber in the cytoskeleton
 - (C) A thick layer outside the cell membrane
 - (D) A convoluted membranous structure in prokaryotic cells
5. **How are genes arranged in a chromosome?**
 - (A) Each gene occupies a fixed position
 - (B) Genes are randomly scattered in the chromosome
 - (C) Multiple genes occupy the same position
 - (D) Genes are not present in chromosomes
6. **What is the main component of plant cell walls?**
 - (A) Cellulose
 - (B) Chitin
 - (C) Lignin
 - (D) Pectin
7. **Which structure is analogous to mitochondria in prokaryotic cells?**
 - (A) Ribosome
 - (B) Golgi complex
 - (C) Mesosome
 - (D) Vacuole
8. **What are allosomes also known as?**
 - (A) Sex chromosomes
 - (B) Autosomes
 - (C) Mitochondria
 - (D) Lysosomes
9. **What is the function of plasmodesmata in plant cell walls?**
 - (A) Energy production
 - (B) DNA replication
 - (C) Regulation of osmotic pressure
 - (D) Cytoplasmic connections between adjacent cells
10. **What is the function of the middle lamella in plant cell walls?**
 - (A) Energy storage
 - (B) Cell division
 - (C) Cell adhesion
 - (D) Protein synthesis

MARK YOUR ANSWERS WITH PEN ONLY. Time Taken in Minutes

1 (A) (B) (C) (D)	2 (A) (B) (C) (D)	3 (A) (B) (C) (D)	4 (A) (B) (C) (D)	5 (A) (B) (C) (D)
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C.D.F.**CONCEPTS, DEFINITIONS AND FORMULAE**

1. Cell is the basic unit of life that can carry out all the processes of life
2. Robert Hooke was the first person to observe cells under a microscope. Schleiden and Schwann proposed the cell theory in 1838.
3. All organisms are made of smaller parts called organs. Organs are made of still smaller parts called cell.
4. Tissue is a group of cells that are alike and work together to perform a specific function. Organ is a relatively independent part of the body. It is a group of tissue that carries out one or more specialised function.
5. Organisms made of more than one cell are called multicellular organisms.
Examples: Plants and Animals
6. Organism made of single cell are called unicellular organisms.
Examples: Amoeba and Paramecium.
7. The single cell of unicellular organisms performs all the basic functions performed by a variety of cells in multicellular organisms.
8. The cell has three main parts: Cell membrane, Cytoplasm, Nucleus
9. Cells without well organised nuclei (lacking nuclear membrane) are called prokaryotic cells. **Example:** Bacterial cell
10. Cells having well organised nuclei with a nuclear membrane are called eukaryotic cells. **Example:** Onion cells and Cheek cells
11. Plasma membrane is a selective permeable membrane. It regulates the movement of molecules in and out of the cells.
12. Plant cells differ from animal cells in having an additional layer over cell membrane called cell wall.
13. Various membrane bound cell organelles present in eukaryotic cell are - Nucleus, Endoplasmic reticulum, Golgi apparatus, mitochondria, plastids, lysosomes etc.
14. Mitochondria form the powerhouse of the cell. They use the oxygen to generate the energy rich compounds.
15. Chloroplasts are chlorophyll containing green plastids. They use water and CO_2 and convert radiant energy of sunlight into chemical energy of carbohydrates.
16. Ribosomes are the sites of protein synthesis.
17. Endoplasmic reticulum is of two types - Smooth ER and Rough ER, SER synthesizes lipids and RER synthesizes proteins.
18. Golgi apparatus is the site for the storage, processing and packaging of various cellular secretions.
19. Lysosomes form garbage disposal system of animal cells.
20. Nucleus contains thread like structures called chromosomes, which carry genes and helps in transmission of characters.

ADVANCED WORKSHEET



Single Correct Answer Type (S.C.A.T)

1. Nucleus was first observed by:

- (A) Robert Hooke
- (B) Robert Brown
- (C) Charles Darwin
- (D) Leeuwenhoek

2. Robert Hooke observed cells in the cork of _____ tree.

- (A) Oak
- (B) Neem
- (C) Mango
- (D) All of these

3. Cell responsible to receive and transfer message in human body parts is:

- (A) Epithelial cell
- (B) Nerve cell
- (C) Fat cell
- (D) Muscle cell

4. The jelly like substance between nucleus and cell membrane:

- (A) Cytoplasm
- (B) Nucleoli
- (C) Cell organelles
- (D) All of these

5. Unicellular organism is:

- (A) Bacteria
- (B) Amoeba
- (C) Chlamydomonas
- (D) All of these

6. Nucleus was first observed in the leaves of:

- (A) Orchid
- (B) Oak
- (C) Wheat
- (D) Rice

7. Outermost layer of the stem gives:

- (A) Protection
- (B) Conduction
- (C) Nutrition
- (D) All of these

8. Pseudopodia are present in:

- (A) Elephant
- (B) Amoeba
- (C) Rat
- (D) Chlamydomonas

9. Living substance of a cell is collectively known as:

- (A) Nucleoplasm
- (B) Cytoplasm
- (C) Protoplasm
- (D) Blood

10. Life processes is:

- (A) Photosynthesis
- (B) Respiration
- (C) Excretion
- (D) All of these

11. The first compound microscope we made in the year 1595 by:

- (A) Robert Brown
- (B) Hooke
- (C) Jhonson
- (D) Johnsen

12. Basic unit of organism:

- (A) Nucleus
- (B) Cytoplasm
- (C) Cell
- (D) Cell wall

13. Microorganisms are discovered by:

- (A) Robert Hooke
- (B) Leeuwenhoek
- (C) Robert Brown
- (D) Swaminathan

14. The boundary of cell is:

- (A) Nucleus
- (B) Cell membrane
- (C) Cytoplasm
- (D) Organelles

15. Plant cells possess outer covering over the cell membrane called:

- (A) Cytoplasm
- (B) Organelles
- (C) Cell wall
- (D) Nucleus

16. Which of the following group is prokaryotes?

- (A) Blue-green algae
- (B) Brown algae
- (C) Protozoa
- (D) Both A & B

17. The size of the cell is related to its:

- (A) Shape
- (B) Function
- (C) Location
- (D) None of these

18. Size of organism depends on:

- (A) Number of cells
- (B) Shape of cells
- (C) Size of cell
- (D) Function of cell

19. Which of the following occurs only in animal cell?

- (A) Ribosomes
- (B) Dictyosomes
- (C) Chromosomes
- (D) Centrosomes

20. Who began the history of cell science:

- (A) Robert Brown
- (B) Robert Hooke
- (C) Van Leeuwenhoek
- (D) Schwann

21. All the living organisms are made up of:

- (A) Cells
- (B) Tissues
- (C) Organs
- (D) Organelles

22. The powerhouse of the cell is:

- (A) Chloroplast
- (B) Ribosomes
- (C) Mitochondria
- (D) Golgi complex

23. Who proposed that cells are formed from pre-existing cells:

- (A) Schwann
- (B) Robert Hooke
- (C) Rudolph Virchow
- (D) Schleiden

24. Who studied animal cells:

- (A) Robert Hooke
- (B) Schwann
- (C) Schleiden
- (D) Rudolph Virchow

25. Who coined or called the cell structure a Nucleus?

- (A) Robert Brown
- (B) Robert Hooke
- (C) Felica Fontana
- (D) Schwann

26. Amoeba moves from one place to another place using:

- (A) Cilia
- (B) Flagella
- (C) Pseudopodia
- (D) No locomotory organs

27. In cell mounting on slide which material stop from drying (dehydration):

- (A) Iodine
- (B) Saffron
- (C) Glycerine
- (D) Fast green

28. Which of the following is the site for energy production?

- (A) Mitochondria
- (B) Nucleoplasm
- (C) Cytoplasm
- (D) Nuclear membrane

29. All organisms consist of smaller part called:

- (A) Organs
- (B) Cell
- (C) Cell wall
- (D) Organelle

30. Which part of the cell contains organelles?

- (A) Protoplasm
- (B) Nucleoplasm
- (C) Chromosomes
- (D) Cytoplasm

31. Which of the following is not a plastid?

- (A) Chloroplast
- (B) Chromoplast
- (C) Leucoplast
- (D) Ribosome

32. The colour of chlorophyll pigment is:

- (A) Yellow
- (B) Green
- (C) Red
- (D) Blue

33. Cell wall of plants is made up of:

- (A) Starch
- (B) Lignin
- (C) Cellulose
- (D) Protein

34. Which of the following is not a unicellular organism?

- (A) WBC
- (B) Paramecium
- (C) Bacteria
- (D) Amoeba

35. Mitosis is a:

- (A) Cell division
- (B) Cell death
- (C) Cell elongation
- (D) Cell wall

36. DNA stands for:

- (A) Deoxy ribose nucleic acid
- (B) Dihydroxy ribonucleic acid
- (C) Dioxide nucleic acid
- (D) Dehydrogenate ribose nucleic acid

37. The largest cell is that of:

- (A) Plant
- (B) Ostrich egg
- (C) Hen egg
- (D) Human cheek

38. Which is the outermost layer of an animal cell?

- (A) Cell wall
- (B) Cytoplasm
- (C) Plasma membrane
- (D) Protoplasm

39. What is known as the powerhouse of the cell?

- (A) Ribosome
- (B) Mitochondria
- (C) Vacuoles
- (D) Nucleolus

40. The Englishman, who discovered cell in 1665 was:

- (A) Robert Cook
- (B) Robert Frost
- (C) Robert Fleming
- (D) Robert Hooke

41. Which is the control centre of the cell?

- (A) Nucleus
- (B) Genes
- (C) Cell wall
- (D) Golgi bodies

42. What is responsible for passing genetic characteristics from parents to off springs?

- (A) Chromosomes
- (B) Genes
- (C) Nucleoplasm
- (D) Nucleolus

43. The Golgi apparatus is found virtually in all the cells which are in nature:

- (A) Prokaryotic
- (B) Eukaryotic
- (C) Protozoan's
- (D) Protista

44. Those tubular membranes which separates the material of endoplasmic reticulum are called:

- (A) Chromatids
- (B) Cisternae
- (C) Tubular membranes
- (D) Tubules

45. The exchange of materials takes place between nucleus and cytoplasm with help of:

- (A) Nuclear pores
- (B) Nuclear membrane
- (C) Nucleus
- (D) Chromatin network

46. Cellulose, pectin, and hemicelluloses together make up to form a:

- (A) Primary wall
- (B) Secondary wall
- (C) Middle wall
- (D) Tertiary wall

47. The protein structures which are long, unbranched and slender tubules are called:

- (A) Microfilaments
- (B) Microtubules
- (C) Intermediate tubules
- (D) Chromatin fibres

48. A group of ribosomes which are attached to mRNA by small ribosome unit is known as:

- (A) Polyribosome
- (B) Polysome
- (C) Monosome
- (D) Chromosome

49. The storage of vital chemicals is:

- (A) Cytoplasm
- (B) Mitochondria
- (C) Golgi complex
- (D) Ribosome

50. The continuous channels that appear to lie between plasma membrane and nuclear membrane is:

- (A) Endoplasmic reticulum
- (B) Golgi complex
- (C) Mitochondria
- (D) Ribosome

51. The place on chromosome where spindle fibres are attached during cell division is called:

- (A) Chromatids
- (B) Centromere
- (C) Centrioles
- (D) Mitochondria

52. Which of the following is/are made up of cellulose?

- (A) Cell membrane
- (B) Plasma membrane
- (C) Cell wall
- (D) All of these

53. Which of the following is the non-living part of the plant cell?

- (A) Nucleus
- (B) Cytoplasm
- (C) Mitochondria
- (D) Cell wall

54. Which of the following organelles is responsible for mechanical support and enzyme transport?

- (A) Mitochondria
- (B) Endoplasmic reticulum
- (C) Chloroplast
- (D) Golgi complex

55. Which of the following structures regulate cell division in animal cells?

- (A) Chromosomes
- (B) Chromatin
- (C) Centrosome
- (D) Spindle fibrils

56. Which of the following saclike structures help in the synthesis and storage of many substances?

- (A) Endoplasmic reticulum
- (B) Nucleus
- (C) Mitochondria
- (D) Golgi bodies

57. Which of the following is the small rod-shaped structure bound by a double membrane which helps in the oxidation of food to release energy?

- (A) Mitochondrion
- (B) Golgi complex
- (C) Nucleus
- (D) Vacuole

58. The function of nucleolus is the synthesis of:

- (A) DNA
- (B) m-RNA
- (C) r-RNA
- (D) t-RNA

59. Chromosomes contain hereditary units called:

- (A) Genes
- (B) Ribosomes
- (C) DNA
- (D) RNA

60. Which one of the following structures is an organelle within an organelle?

- (A) Ribosome
- (B) Peroxisome
- (C) ER
- (D) Mesosome

61. I am a protein packaging and shipping machine! Who am I?

- (A) Vacuole
- (B) Ribosome
- (C) ER
- (D) Golgi apparatus

62. A rigid supporting layer that surrounds the cells of plants and some other organisms like fungi and bacterium is:

- (A) Cell membrane
- (B) Cell wall
- (C) Nucleus
- (D) Cytoplasm

63. A thin flexible barrier that surrounds a cell and controls which substances pass into and out of a cell:

- (A) Cell membrane
- (B) Cell wall
- (C) Cytoplasm
- (D) Ribosome

64. Organelles that convert energy in food molecules to energy the cell can use to carry out its functions

- (A) Ribosome
- (B) Golgi apparatus
- (C) Mitochondria
- (D) Nucleus



Analytical Approach (A.A.T.)

65. Who proposed the "Cell theory" [KCET 2003; HP PMT 2005]

- i) Schleiden**
- ii) Schwann**
- iii) Watson and Crick**
- iv) Mendel and Morgan**

- (A) (i) & (ii)
- (B) (ii) & (iv)
- (C) (i), (ii) & (iii)
- (D) All of the above

66. Which of the following pairs are CORRECT?

i) Chloroplasts: Photosynthesis

ii) Mitochondrions: Respiration

iii) Ribosomes: Intracellular digestion

iv) Centrioles: Reproduction

(A) (i) & (ii)

(B) (ii) & (iii)

(C) (i) & (iii)

(D) (i), (ii) & (iv)

67. The flexibility of plasma membrane can be contributed to the presence of:

(i) Proteins

(ii) Lipids

(iii) Nucleic acids

(iv) Both proteins and lipids

(A) (ii) only

(B) (iii) only

(C) (iv) only

(D) (i) only



Matrix Matching Type (M.M.T.)

SET-I

Column - I

68. Nucleus

69. Prokaryotes

70. Lysosomes

71. Mitochondria

72. Rough E.R

Column-II

(A) Cell's powerhouse

(B) Suicidal bags

(C) Protein synthesis

(D) Cell brain

(E) Bacterium

(F) Lipid synthesis

SET-II

Column-I

73. Cellulose

74. Chromosomes

75. Cell organelles

76. Genes

Column-II

(A) Cytoplasm

(B) Functional segment of DNA

(C) Plant cell wall

(D) Nucleus

Assertion Reason Type (A.R.T.)

(A) Both A and R are true and R is the correct explanation of A.

(B) Both A and R are true but R is not the correct explanation of A.

(C) A is true but R is false.

(D) A is false but R is true.

77. Assertion(A): Every chromosome essentially has a kinetochore on the sides of which centromeres are present.

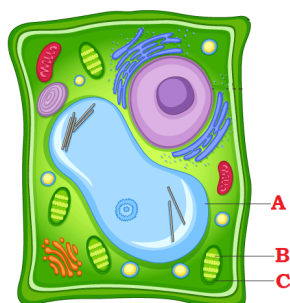
Reason(R): Based on the position of centromere or primary constriction chromosomes can be classified into five types.

78. Assertion(A): Chloroplasts, mitochondria and peroxisomes are not considered as a part of the endomembrane system

Reason(R): Functions of chloroplasts, mitochondria and peroxisomes are not coordinated with ER, Golgi complex, lysosomes and vacuoles.

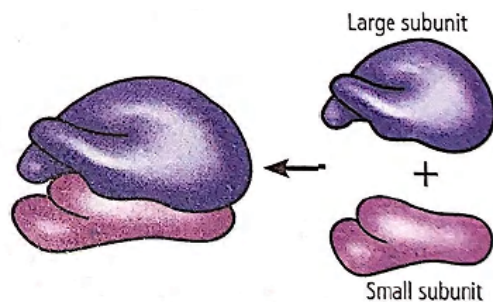
Figure Based (F.B.)

79. Observe the given diagram and choose the option that show correct labelling of diagram.



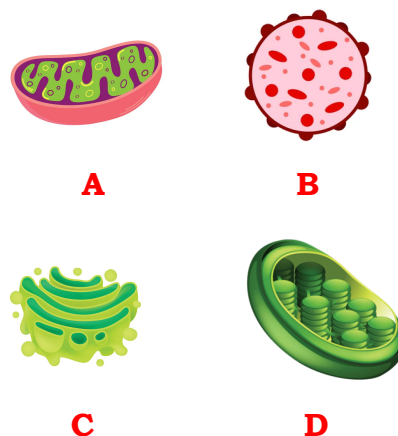
- (A) A-Vacuole, B-Chloroplast, C-Envelope
- (B) A-Chloroplast, B-Vacuole, C-Envelope
- (C) A-Envelope, B-Chloroplast, C-Vacuole
- (D) A-Vacuole, B-Envelope, C-Chloroplast

80. In eukaryotic cells, the given figure is synthesised in:



- (A) nucleus
- (B) Cytoplasm
- (C) Mitochondria
- (D) Golgi complex

81. Observe the given diagram and answer the below questions.



- (i) A - _____
- (ii) B - _____
- (iii) C - _____
- (iv) D - _____