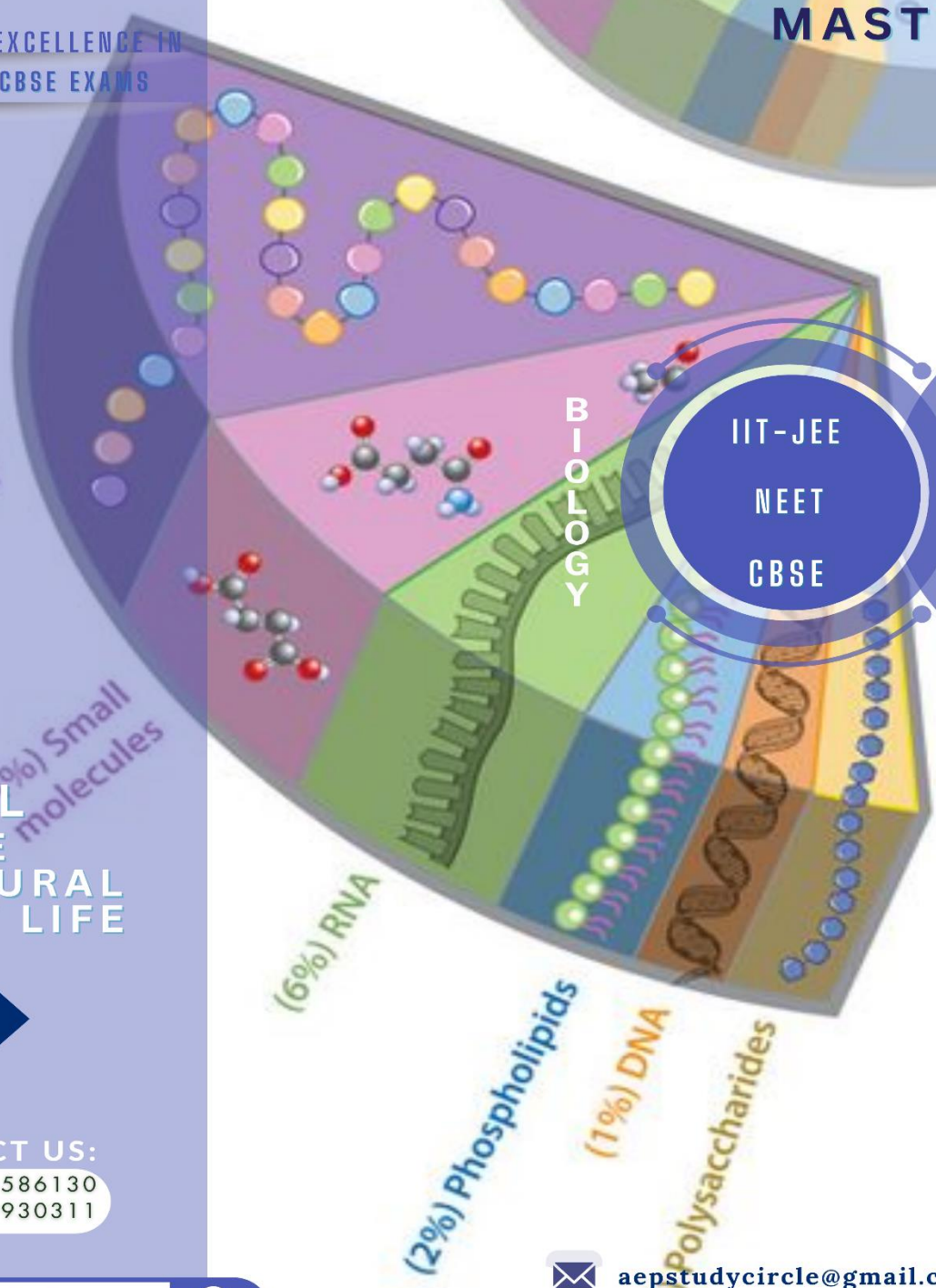




YOUR GATEWAY TO EXCELLENCE IN  
 IIT-JEE, NEET AND CBSE EXAMS

**XI NEET**  
**03 CELL**

**MASTERING NCERT**



**IIT-JEE**  
**NEET**  
**CBSE**



**CELL**  
 THE  
 STRUCTURAL  
 UNIT OF LIFE

**03**

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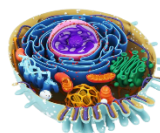
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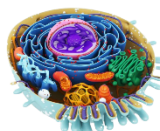


## NEET KEY NOTES

- Cell is the fundamental, structural and functional unit of all living organisms. The term cell was coined by **Robert Hooke** in the year 1665.
- A living cell was first seen and described by **Antonie van Leeuwenhoek**. The nucleus was discovered by **Robert Brown**.
- **Cell theory** was proposed by **Schleiden** and **Schwann** in 1838.
- This theory was modified by **Rudolf Virchow** (1855) to explain the formation of new cells. The cell theory can be summarised as
  - All living organisms are made up of one or more cells.
  - The cell is the basic structural and functional unit of life.
  - All cells arise from pre-existing cells (*Omnis cellula-e-cellula*).
- The cells exhibit high variation in size, lifespan and cellular activities, e.g. mycoplasmas (smallest cell) or PPLOs (Pleuro-Pneumonia Like Organisms) is only 0.3  $\mu\text{m}$  in length and bacterial cells are approximately 3-5  $\mu\text{m}$  in size.
- An ostrich egg, which is known to be the largest isolated single cell measures about 170  $\times$  135 mm. Human Red Blood Cells (RBCs) are about 7  $\mu\text{m}$  in diameter and the nerve cell of human being is the longest cell having a length of 90-100 cm.
- The cells also vary in their shapes and may be polygonal, disc-like, amoeboid, thread-like, cuboid or irregular. The shape of the cell is may varies with the function they performs.
- On the basis of organisation, complexity and variety, all cells can be grouped into two types, i.e. prokaryotic and eukaryotic cells.

### Prokaryotic Cells

- These are represented by bacteria, blue-green algae, mycoplasma, etc.
- All prokaryotic cells are bound by a plasma membrane enclosing a gel or fluid-like cytoplasm. Except mycoplasma, all prokaryotic cells have a cell wall.
- These lack a well-defined nucleus. The genetic material, i.e DNA is naked and circular, not enveloped by a nuclear membrane. Many prokaryotic cells possess extrachromosomal small circular DNA called **plasmids**. It confers unique phenotype to the cell.
- Cell envelope is chemically complex and the manner in which it responds to Gram staining procedure, classified bacteria as **Gram positive** and **Gram negative** bacteria. The cell envelope of former take up the stain, while that of later does not take up the stain.
- Cell envelope consist of three tightly bound layers,
  - **Glycocalyx** Present either as slime layer or as capsule in different bacteria.
  - **Cell wall** Made up of peptidoglycan provides structural support and integrity to the bacterial cell.
  - **Plasma membrane** Selectively permeable in nature.
- **Mesosomes** are the membranous structures which are formed by the extensions of plasma membrane as vesicles, tubules and lamellae. These are involved in cell wall formation, DNA replication, respiration, secretion, increase in surface area, etc.
- **Chromatophores** are pigment containing membranous extensions present in cyanobacteria.



- **Flagella** are thin filamentous extensions, arising from the cell wall of a bacterial cell. A flagellum in a prokaryotic cell is composed of three parts—filament (longest portion), hook and basal body.
- **Pili** are proteinaceous, elongated and tubular structures found on the surface of bacterial cell.
- **Fimbriae** are small, bristle-like fibres like pili, which help the bacteria to attach to the substratum or host tissue. Both pili and fimbriae do not play role in the motility of bacteria.
- Prokaryotes contain **70 S ribosomes** [50 S + 30 S] in the cytoplasm and these are the site of protein synthesis.
- **Polysome** or **Polyribosomes** are formed by the association of several ribosomes to a single mRNA.
- **Inclusion bodies**, e.g. phosphates granules, glycogen granules, gas vacuoles, etc., found in the cytoplasm of prokaryotic cells store reserve food material. These are not bound by any membrane system.
- Studies on human RBCs concluded that the cell membrane is composed of lipid which forms a bilayer with protein molecules embedded in it at different places.
  - **Lipids** Majorly cholesterol and phospholipids are arranged in a bilayer with polar hydrophilic heads facing outwards and non-polar, hydrophobic tails facing inwards the cell.
  - **Proteins** These include, peripheral proteins and integral proteins. The former lies on the surface, while the latter are partially or totally embedded in the membrane.
- **Fluid mosaic model** is the most accepted model of the cell membrane structure. It was proposed by **Singer** and **Nicolson** in 1972. They proposed that the **quasi-fluid** nature of lipids in plasma membrane allow the lateral movement to proteins within the bilayer. It also contributes to cell growth, division, secretion, endocytosis and formation of plasmodesmata.
- The selectively permeable plasma membrane allow the movement of various substances across it through different mechanisms which have been tabulated below

## Eukaryotic Cells

- It includes protists, plants, animals and fungi.
- These possess membrane bound organelles, including an organised nucleus bound by a double-layered nuclear envelope. The nucleus contains genetic material organised into chromosomes.
- All eukaryotic cells are not identical. Plant cells and animal cells differ significantly due to the presence or absence of certain organelles.
- The difference between plant and animal cells can be tabulated as

Structure/Organelles	Plant Cell	Animal Cell
Cell wall	Present	Absent
Plastids	Present	Absent
Centrioles	Absent	Present
Vacuoles	Present as a large central vacuole	Either very small or absent

- An eukaryotic cell is composed of various cell components as cell membrane, cell wall (only in plants), mitochondria, chloroplast, Golgi bodies, ribosomes, centrioles (only in animals), etc.

## Cell Membrane

- Every living cell is covered by a thin, elastic, transparent, semi-permeable and regenerative membrane called **cell membrane** also called **plasma membrane** or **plasmalemma**.
- In 1950s with the advancement of electron microscope the detailed structure of the membrane was studied. Most of the initial studies on cell membrane structure, i.e. especially on the human **Red Blood Cells** (RBCs), which enabled the scientists to deduce the possible structure of plasma membrane.

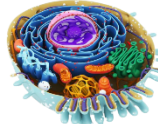
Mode of Transport	Characteristics/Type of Molecules
<b>Passive transport</b>	<ul style="list-style-type: none"> <li>• Does not require energy while transporting molecules along the concentration gradient.</li> </ul>
<ul style="list-style-type: none"> <li>• <b>Simple diffusion</b></li> <li>• <b>Osmosis</b></li> <li>• <b>Carrier proteins</b></li> </ul>	<ul style="list-style-type: none"> <li>• Neutral solutes are transported along the concentration gradient.</li> <li>• Movement of water along the concentration gradient.</li> <li>• Transport of polar molecules is facilitated.</li> </ul>
<b>Active transport</b> (Na <sup>+</sup> /K <sup>+</sup> pump)	<ul style="list-style-type: none"> <li>• Molecules are transported against the concentration gradient by utilising ATP.</li> </ul>

## Cell Wall

- It is the outer covering of plasma membrane in plants and fungi. It is differentiated into
  - **Middle lamella** composed of calcium pectate which keep the different neighbouring cells intact.
  - **Primary wall** capable of growth and thus, found in young plant cells.
  - **Secondary wall** formed on the inner side of the mature cell.
- Occasionally, a tertiary cell wall may also be present.
- Algal cell wall contains galactans, mannans, cellulose and minerals, while plant cell wall contains cellulose, hemicellulose, pectins and proteins. Fungal cell wall consists mainly of chitin.

## Endomembrane System

- It consists of four membranous organelles whose functions are coordinated. These include ER, Golgi complex, lysosomes and vacuoles.



- The structural and functional details of the organelles of the endomembrane system are tabulated below

Organelles	Structure	Functions
<b>Endoplasmic Reticulum (ER)</b>	<ul style="list-style-type: none"> <li>Network of tubular structures.</li> <li><b>Rough ER</b> possess ribosomes on surface, continuous with nuclear membrane.</li> <li><b>Smooth ER</b> does not possess ribosomes.</li> </ul>	<ul style="list-style-type: none"> <li>RER involved in protein synthesis and secretion.</li> <li>SER involved in synthesis of lipids.</li> </ul>
<b>Golgi apparatus</b>	<ul style="list-style-type: none"> <li>Flat, disc-shaped, parallelly stacked <b>cisternae</b>, possess <i>cis</i> (forming) and <i>trans</i> (maturation) faces.</li> </ul>	<ul style="list-style-type: none"> <li>Packaging and secretion.</li> <li>Formation of glycoproteins and glycolipids.</li> </ul>
<b>Lysosomes (Suicidal bags)</b>	<ul style="list-style-type: none"> <li>Single membrane bound vesicular structures containing hydrolytic enzymes.</li> <li>Exhibit polymorphism and occur as primary lysosomes (contain inactive enzymes), secondary lysosomes (digestive vacuoles), residual bodies and autophagic vacuoles.</li> </ul>	<ul style="list-style-type: none"> <li>Digestion of proteins, lipids, nucleic acids and carbohydrates.</li> </ul>
<b>Vacuoles</b>	<ul style="list-style-type: none"> <li>Single membrane (tonoplast) bound sacs in cytoplasm which contain water, sap, excretory products, etc.</li> <li>Food vacuole is formed by fusion of phagosome and lysosome.</li> </ul>	<ul style="list-style-type: none"> <li>Osmoregulation and excretion by contractile vacuole in <i>Amoeba</i>.</li> <li>Food vacuole engulf food particles, as in protists.</li> </ul>

### Mitochondria

- These are enveloped by two unit membranes filled with dense, homogenous matrix. The inner membrane folds into the **matrix** to form **cristae** (bear  $F_1$ -particles or oxysomes).
- Mitochondria are cylindrical bodies with an average diameter of  $0.2-1\ \mu$  and are ordinarily  $3-10\ \mu$  in length.
- These are the site of aerobic respiration and produce energy in the form of ATP. These possess single circular DNA, 70 S ribosomes and RNA. Mitochondria divide by fission.

### Plastids

- These are found in all plant cells and in euglenoids. Based on the type of pigments present, plastids are of three types
  - Chloroplasts** which contain chlorophyll and carotenoid pigments.
  - Chromoplasts** which contain fat soluble carotenoid pigments like carotene and xanthophyll.

- Leucoplasts** are the colourless plastids which store nutrients. These include
  - Amyloplasts** store carbohydrates (starch).
  - Elaioplasts** store oil and fats.
  - Aleuroplasts** store proteins.

- Chloroplasts** are found abundantly in the mesophyll cells of the leaves of most photosynthesising plants.
- These are double membrane bound organelles containing small double-stranded circular DNA and 70 S ribosomes.
- The sectional view of chloroplast shows that the inner membrane encloses stroma which contain flat membranous sacs called **thylakoids**.
- The latter are arranged in piles to form **grana** and these are connected by **stroma lamellae**. These two unit membranes are separated by **periplastidial** or **intermembrane space**.

### Ribosomes

- These are the granular structures first observed under the electron microscope as dense particle by **George Palade** (1953).
- These are composed of Ribonucleic Acid (RNA) and proteins and are not surrounded by any membrane.
- Eukaryotic ribosomes are 80 S, while prokaryotic ribosomes are 70 S. Here, 'S' stands for sedimentation coefficient.
- Both 70 S and 80 S ribosomes are composed of two subunits.

### Cytoskeleton

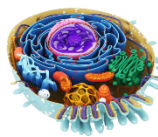
- Network of interconnected proteinaceous microtubules, microfilaments and intermediate filaments present in the cytoplasm is collectively referred to as the cytoskeleton.
- It maintains the shape of the cell, provides mechanical support, etc.

### Cilia and Flagella

- These are hair-like outgrowths of cell membrane which provide motility to the cells.
- Their core called **axoneme** is composed of microtubules exhibiting 9 + 2 arrangement. The nine peripheral tubules are doublets and are joined by nine radial spokes. The two central microtubules are bound by a central sheath.
- Both cilia and flagella emerges from the basal body which is a centriole-like structure.

### Centrosome and Centrioles

- Centrosome** contains two perpendicularly arranged cylindrical structures called **centrioles**.
- Centrioles are made up of nine peripheral fibrils of tubulin protein and a central proteinaceous core called **hub**.



- The peripheral tubules are triplets and each peripheral tubule is connected to hub through radial **spokes** made up of protein.
- Centriole form basal body of cilia and flagella.
- It also forms spindle fibres during cell division in animal cells.

## Nucleus

- It is a structure bound by a nuclear envelope of double unit membrane. It consists of
  - **Chromatin** Flemming described it as nucleoprotein fibres formed when the nucleus of the cell is not dividing, i.e. during interphase.
  - Chromatin consists of DNA, basic proteins called **histones**, non-histone proteins and RNA.
  - **Nuclear envelope** surrounds the nucleus and bears numerous small nuclear pores that allow movement of RNA and protein between nucleus and cytoplasm. The space between its two parallel membrane is called **perinuclear space**.
  - **Nucleolus** is found in the nuclear matrix or **nucleoplasm**. It is not bound by a membrane and acts as the site for active rRNA synthesis. It was discovered by **Fontana** in 1774.

- Chromatin material condenses to form **chromosomes** in the nucleus during cell division.
- Each chromosome possesses two chromatids which remain attached to the centromere or primary constriction. The latter possesses a disc-shaped structure called **kinetochore** on its surface.
- Based on the position of centromere, chromosomes are **metacentric** (middle centromere), **sub-metacentric** (centromere slightly away from middle), **acrocentric** (centromere near the end) and **telocentric** (terminal centromere).
- Few chromosomes possess secondary constrictions called **satellite** at constant locations.

## Microbodies

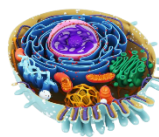
- Many membrane bound minute vesicles called microbodies containing various enzymes are present in both plant and animal cells.
- A few examples are **peroxisomes** in both plant cell and animal cell and **glyoxysomes** in plant cell only.

# Mastering NCERT

## MULTIPLE CHOICE QUESTIONS

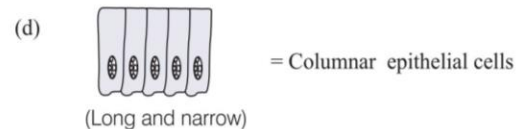
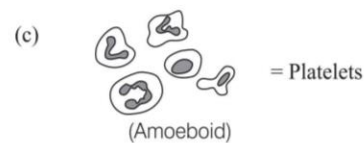
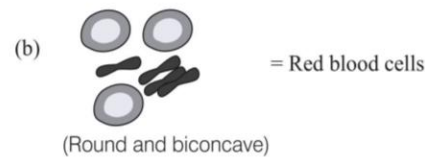
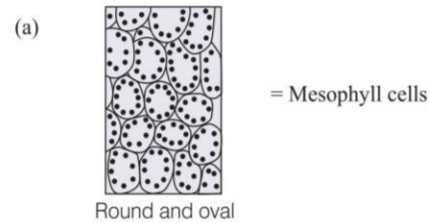
## TOPIC 1 ~ Cell Theory

- Name the scientist, who saw a live cell first time.
  - Robert Brown
  - Antonie van Leeuwenhoek
  - Robert White
  - Schleiden
- The most likely method, used to determine the ultrastructure of a cell organelle is
  - autoradiography
  - microdissection
  - electron microscopy
  - phase contrast microscopy
- Cell theory was formulated by
  - Schleiden and Schwann
  - Rudolf Virchow
  - Robert Brown
  - Robert Hooke
- Schwann proposed cell theory according to which
  - each cell of the body possesses the same genetic information
  - all life activities of the organisms are present in miniature form in each and every cell of its body
  - bodies of animals and plants are made up of cells
  - a new cell always develops by the division of pre-existing cells
- Schleiden and Schwann's cell theory could not explain
  - cell formed from pre-existing cell
  - how new cells were formed
  - body of animals are composed of cells
  - None of the above



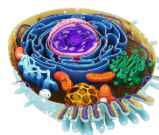
- 6** 'Omnis cellula-e-cellula, (all cells arise from pre-existing cells). Who gave this concept and modified the cell theory?
- Schleiden and Schwann
  - Virchow
  - Robert Brown
  - Leeuwenhoek
- 7** The genetic material is naked in
- prokaryotic cells
  - eukaryotic cells
  - multicellular cell
  - Both (a) and (b)
- 8** Both eukaryotic and prokaryotic cells contain
- mitochondria
  - ribosome
  - chloroplast
  - Endoplasmic Reticulum (ER)
- 9** The largest isolated single cell is
- egg of ostrich
  - egg of peacock
  - egg of duck
  - None of the above

- 10** Which of the following represents the incorrect pair?



## TOPIC 2 ~ Prokaryotic Cell

- 11** Which of the following represents prokaryotic cells?
- PPLO
  - Mycoplasma
  - Bacteria
  - All of these
- 12** The genetic material of prokaryotic cell
- possess small circular DNA called plasmids
  - is not enveloped by nuclear membrane
  - composed of a single circular DNA molecule
  - All of the above
- 13** Plasmids of bacterial cell possess all the following characteristics except
- these are extrachromosomal DNA
  - these are used in genetic engineering
  - these help in the replication of nucleoid
  - these are small, circular and confer unique phenotypic characters to some bacteria
- 14** Which of the following nucleic acids is present in an organism having 70S ribosomes only? **NEET 2019**
- Single-stranded DNA with protein coat
  - Double-stranded circular naked DNA
  - Double-stranded DNA enclosed in nuclear membrane
  - Double-stranded circular DNA with histone proteins
- 15** A specialised differentiated form of cell membrane of prokaryotes is
- ribosome
  - mesosome
  - microvilli
  - vacuoles
- 16** Which of the following components provides sticky character to the bacterial cell? **NEET 2017**
- Cell wall
  - Nuclear membrane
  - Plasma membrane
  - Glycocalyx
- 17** Glycocalyx differs in composition and thickness among different bacteria. It could be a loose sheath called the ..... or it may be thick and tough, called the .....
- capsule; slime layer
  - slime layer; capsule
  - mesosome, slime layer
  - capsule, mesosome
- 18** The cell envelope of bacteria is composed of
- outermost cell wall followed by glycocalyx and plasma membrane
  - plasma membrane and cell wall
  - outermost glycocalyx followed by cell wall and plasma membrane
  - plasma membrane
- 19** Which one of the following does not differ in *E. coli* and *Chlamydomonas*? **NEET 2013**
- Ribosomes
  - Chromosomal organisation
  - Cell wall
  - Cell membrane



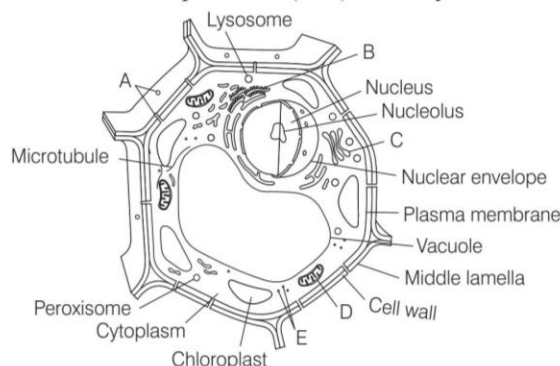
- 20** What is true about mesosomes?  
 (a) Help in cell wall formation  
 (b) Help in cellular respiration  
 (c) Help in DNA replication  
 (d) All of the above
- 21** The longest portion in a bacterial flagellum is  
 (a) hook (b) basal body (c) filament (d) pili
- 22** Choose the incorrect pair.  
 (a) Gram-positive bacteria–Take up the Gram stain  
 (b) Cell wall–Prevents bacterium from collapsing  
 (c) Capsule–Thick and tough glycocalyx  
 (d) Pili–Locomotory structure in bacteria
- 23** If you remove the fimbriae from the bacterial cell, which of the following would you expect to happen?

- (a) The bacteria could no longer swim  
 (b) The bacteria would not adhere to the host tissue  
 (c) Transportation of molecules across the membrane would stop  
 (d) The shape of bacteria would change

- 24** Many ribosomes may associate with a single mRNA to form multiple copies of a polypeptide simultaneously. Such string of ribosomes are termed as **NEET 2018**  
 (a) plastidome (b) polyhedral bodies  
 (c) polysome (d) nucleosome
- 25** Which one of the following is not an inclusion body found in prokaryotes? **CBSE-AIPMT 2015**  
 (a) Cyanophyccean granule (b) Glycogen granule  
 (c) Polysome (d) Phosphate granule

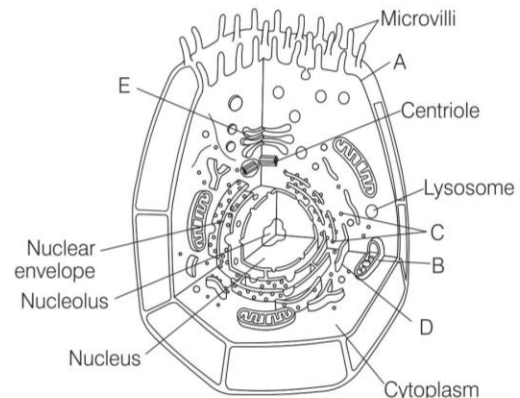
## TOPIC 3 ~ Eukaryotic Cell

- 26** Eukaryotes make the entire body of  
 (a) protists (b) fungi (c) plants (d) All of these
- 27** Which one of the following differentiates plant cells from animal cells?  
 (a) Large vacuole, plastid and cell wall  
 (b) Cell wall, plastid and centriole  
 (c) Cell wall, plastid and mitochondria  
 (d) Cell membrane, plastid and cell wall
- 28** Select the mismatch. **NEET 2016**  
 (a) Gas vacuoles — Green bacteria cells  
 (b) Large central vacuoles — Animal cells  
 (c) Protists — Eukaryotes  
 (d) Methanogens — Prokaryotes
- 29** The following diagram shows some of the missing structures in a plant cell (A-E). Identify the structures.



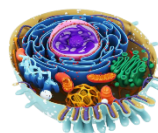
- (a) A–Plasmodesmata, B–Rough endoplasmic reticulum, C–Golgi apparatus, D–Mitochondrion, E–Ribosomes  
 (b) A–Desmosome, B–Rough endoplasmic reticulum, C–Golgi apparatus, D–Mitochondrion, E–Ribosomes  
 (c) A–Plasmodesmata, B–Smooth endoplasmic reticulum, C–Golgi apparatus, D–Mitochondrion, E–Ribosomes  
 (d) A–Tight junction, B–Rough endoplasmic reticulum, C–Golgi apparatus, D–Mitochondrion, E–Ribosomes

- 30** The following diagram shows some of the missing structures in an animal cell (A-E). Identify the structures.



- (a) A–Plasma membrane, B–Rough endoplasmic reticulum, C–Ribosomes, D–Mitochondrion, E–Golgi apparatus  
 (b) A–Plasma membrane, B–Mitochondrion, C–Ribosomes, D–Rough endoplasmic reticulum, E–Golgi apparatus.  
 (c) A–Plasma membrane, B–Mitochondria, C–Ribosomes, D–Smooth endoplasmic reticulum, E–Golgi apparatus  
 (d) A–Plasma membrane, B–Mitochondria, C–Golgi apparatus, D–Smooth endoplasmic reticulum, E–Ribosomes

- 31** Choose the incorrect pair.  
 (a) Best material to study cell membrane structure — RBC of human  
 (b) Arrangement of lipids in cell membrane — Bilayer  
 (c) Abundant lipid in cell membrane — Phospholipid  
 (d) Cell membrane composition — Carbohydrates + Lipids



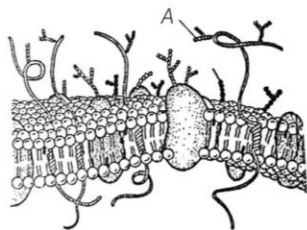
- 32** Lipids are arranged within the membrane with
- polar heads towards innerside and the hydrophobic tails towards outerside
  - Both heads and tails towards outerside
  - heads towards outerside and tails towards inside
  - Both heads and tails towards innerside

- 33** Why tails of lipids in the membrane are towards inner part?
- The tail is non-polar hydrocarbon and so, protected with an aqueous environment
  - The tail is polar hydrocarbon and so, is protected from aqueous environment
  - The non-polar or hydrophobic hydrocarbon tails of lipid, being on innerside ensure their protection from aqueous environment
  - The tail is hydrophilic so, it tends to be located in the aqueous innerside of membrane

- 34** The lipid component of cell membrane consists of
- lipolipids
  - phospholipids
  - hydrophobic lipids
  - None of these

- 35** What is the role of sterol in cell membrane?  
**JIPMER 2018**
- Stability
  - Communication with other cells
  - Secretion
  - Transport

- 36** Identify the component labelled as *A* in the given diagram of cell membrane?



- External protein
  - Integral protein
  - Sugar
  - Lipid
- 37** According to Singer and Nicolson concept, cell membrane is
- solid
  - quasifluid
  - fluid
  - solidified sheath
- 38** The fluid mosaic model explains
- Only structural aspects of cell membrane
  - Only functional aspects of cell membrane
  - Both structural and functional aspects of cell membrane
  - Only fluidity of membrane
- 39** Fluid nature of membrane is able to explain
- cell growth, cell division
  - formation of intercellular junctions
  - secretion and permeation of various substances across the membrane
  - All of the above

- 40** Cell membrane is selectively permeable. This means that it
- allows all materials to pass through
  - allows only water to pass through
  - allows only certain materials to pass through
  - allows only ions to pass through

- 41** The main difference between active and passive transport across cell membrane is **NEET 2019**
- passive transport is non-selective whereas active transport is selective
  - passive transport requires a concentration gradient across a biological membrane whereas active transport requires energy to move solutes
  - passive transport is confined to anionic carrier proteins whereas active transport is confined to cationic channel proteins
  - active transport occurs more rapidly than passive transport

- 42**  $\text{Na}^+ / \text{K}^+$  pump represents
- active transport
  - passive transport
  - osmosis
  - simple diffusion

- 43** One of the major components of cell wall of most fungi is **NEET 2016**
- peptidoglycan
  - cellulose
  - hemicellulose
  - chitin

- 44** The cell wall of plant cells
- provides protection
  - helps in cell to cell interaction
  - provides a barrier to undesirable macromolecules
  - All of the above

- 45** Choose the odd one out with respect to the composition of plant cell wall.
- Cellulose
  - Galactans
  - Pectins and proteins
  - Hemicellulose

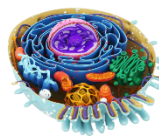
- 46** The innermost portion of a mature plant cell wall possesses
- primary cell wall
  - plasma membrane
  - secondary cell wall
  - plasmodesmata

- 47** The cell wall and middle lamellae are transversed by
- plasmodesmata
  - primary wall
  - cytoplasm
  - cortex

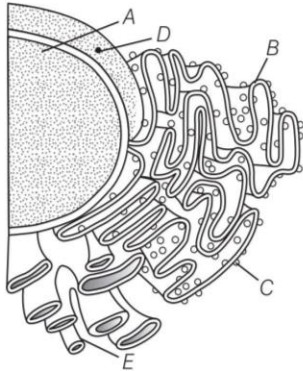
- 48** Why endoplasmic reticulum, Golgi body, lysosome and vacuoles are components of endomembranous system?
- Their structures are distinct
  - Their functions are distinct
  - Their functions are coordinated
  - All of the above

- 49** The main organelle involved in modification and routing of newly synthesised proteins to their destination is
- mitochondria
  - endoplasmic reticulum
  - lysosome
  - chloroplast





50 What does 'B' represent in the figure?



- (a) Ribosome (b) Rough ER  
 (c) Smooth ER (d) Nuclear pore

51 Which one of the following events does not occur in rough endoplasmic reticulum? **NEET 2018**

- (a) Cleavage of signal peptide  
 (b) Protein glycosylation  
 (c) Protein folding  
 (d) Phospholipid synthesis

52 Nuclear envelope is a derivative of **CBSE-AIPMT 2015**

- (a) membrane of Golgi complex  
 (b) microtubules  
 (c) rough endoplasmic reticulum  
 (d) smooth endoplasmic reticulum

53 Select the correct matching in the following pairs.

**CBSE-AIPMT 2015**

- (a) Smooth ER — Synthesis of lipids  
 (b) Rough ER — Synthesis of glycogen  
 (c) Rough ER — Oxidation of fatty acids  
 (d) Smooth ER — Oxidation of phospholipids

54 Smooth endoplasmic reticulum acts as a major site for the synthesis of

- (a) lipids and steroids (b) proteins  
 (c) ribosomes (d) DNA

55 The scientist, who first observed densely stained reticular structures near the nucleus is

- (a) Robert Hooke (b) Robert Brown  
 (c) Strasburger (d) Camillo Golgi

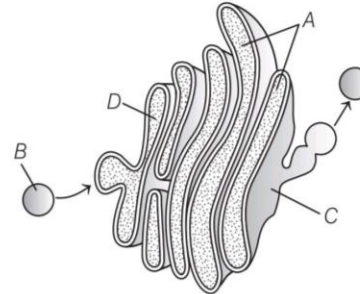
56 Cisternae of Golgi apparatus has diameter of

- (a) 0.1-0.01  $\mu\text{m}$  (b) 0.5-1.0  $\mu\text{m}$   
 (c) 5-1  $\mu\text{m}$  (d) None of these

57 Choose the incorrect pair.

- (a) Golgi bodies – Densely stained reticular structure near the nucleus  
 (b) Cisternae – Circular, fixed in number  
 (c) Forming face – Convex *cis*  
 (d) Maturing face – Concave *trans*

58 Which one of the following is the correct labelling of given structure of Golgi apparatus?



- (a) A–Cisternae, B–Vesicle, C–*cis* face, D–*trans* face  
 (b) A–Cisternae, B–Vesicle, C–*trans* face, D–*cis* face  
 (c) A–Tubules, B–Vesicle, C–*trans* face, D–*cis* face  
 (d) A–Vesicle, B–Cisternae, C–*cis* face, D–*trans* face

59 The Golgi complex participates in **NEET 2018**

- (a) respiration in bacteria  
 (b) formation of secretory vesicles  
 (c) fatty acid breakdown  
 (d) activation of amino acid

60 Which of the following cell organelles is present in the highest number in secretory cells?

**NEET (Odisha) 2019**

- (a) Mitochondria  
 (b) Golgi complex  
 (c) Endoplasmic reticulum  
 (d) Lysosomes

61 Important site for the formation of glycoprotein and glycolipid is

- (a) lysosomes (b) Golgi apparatus  
 (c) vacuoles (d) plastids

62 Which is the correct sequence of modification and transport of secretory vesicles? **JIPMER 2019**

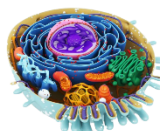
- (a) RER → Cell membrane → Golgi body → Secretory vesicles  
 (b) RER → Secretory vesicles → Cell membrane  
 (c) RER → Cell membrane → Secretory vesicles → Golgi body  
 (d) SER → Golgi body → Cell membrane → Secretory vesicles

63 Which one of the following cell organelles is enclosed by a single membrane? **NEET 2016**

- (a) Chloroplasts (b) Lysosomes  
 (c) Nuclei (d) Mitochondria

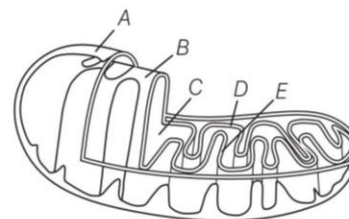
64 Which of the following is correct regarding the origin of lysosome?

- (a) Endoplasmic reticulum → Golgi bodies → Lysosomes  
 (b) Golgi bodies → Endoplasmic reticulum → Lysosomes  
 (c) Nucleus → Golgi bodies → Lysosomes  
 (d) Mitochondria → Endoplasmic reticulum → Golgi bodies → Lysosomes

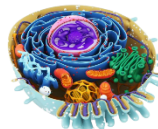


- 65** Which of the following pairs of organelles does not contain DNA?  
**NEET 2019**  
 (a) Chloroplast and vacuoles  
 (b) Lysosomes and vacuoles  
 (c) Nuclear envelope and mitochondria  
 (d) Mitochondria and lysosomes
- 66** In a eukaryotic cell, vacuoles  
 (a) contains water, sap and excretory product  
 (b) is bound by a single membrane called tonoplast  
 (c) maintains turgor pressure  
 (d) All of the above
- 67** The osmotic expansion of a cell kept in water is chiefly regulated by  
**CBSE-AIPMT 2014**  
 (a) mitochondria  
 (b) vacuoles  
 (c) plastids  
 (d) ribosomes
- 68** Why the concentration of a number of ions and other materials is higher in vacuoles than those in cytoplasm?  
 (a) Tonoplast has a number of active transport system that pumps ions into vacuole from cytoplasm  
 (b) Through osmosis, a large amount of ions goes continuously to vacuole from cytoplasm  
 (c) Cytoplasmic ions enter the vacuole through osmotic flow of water  
 (d) Vacuole is always engaged in the hydrolysis of salts into their ions
- 69** Both the membranes of a mitochondrion are  
 (a) structurally different, but functionally similar  
 (b) structurally as well as functionally different  
 (c) structurally similar, but functionally different  
 (d) structurally as well as functionally similar
- 70** All the listed characteristics are true about mitochondria, except  
 (a) unless specifically stained it is not easily visible under the microscope  
 (b) physiological activity of cells determines its number per cell  
 (c) it divide by fission  
 (d) their outer membrane forms number of infoldings called cristae
- 71** The cristae in mitochondria is important because  
 (a) increases surface area  
 (b) decreases surface area  
 (c) have fluid in it  
 (d) None of the above
- 72** Cytochromes are found in  
**CBSE-AIPMT 2015**  
 (a) outer wall of mitochondria  
 (b) cristae of mitochondria  
 (c) lysosomes  
 (d) matrix of mitochondria

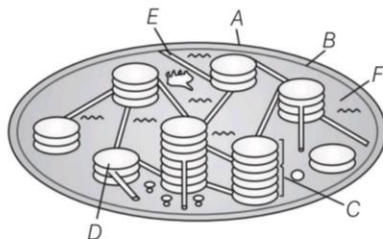
- 73** Go through the sectional view of a mitochondrion showing the different parts and identify the structures A to E.



- (a) A–Outer membrane, B–Inner membrane, C–Matrix, D–Inter membrane space, E–Crista  
 (b) A–Outer membrane, B–Inner membrane, C–Inter membrane space, D–Matrix, E–Crista  
 (c) A–Outer membrane, B–Inner membrane, C–Matrix, D–Crista, E–Inter membrane space  
 (d) A–Outer membrane, B–Inner membrane, C–Crista, D–Matrix, E–Inter membrane space
- 74** Choose the incorrect pair.  
 (a) Chloroplast — Traps light energy  
 (b) Chromoplast — Imparts colours to the plant  
 (c) Leucoplast — Stores nutrients  
 (d) None of the above
- 75** Chromoplasts have fat soluble pigments called  
 (a) chlorophyll (b) carotenoid  
 (c) chloroplast (d) Both (a) and (b)
- 76** The colourless plastids are  
 (a) chloroplasts (b) chromoplasts  
 (c) leucoplasts (d) lymphoplasts
- 77** The leucoplasts, that store oils and fats  
 (a) amyloplasts (b) elaioplasts  
 (c) aleuroplasts (d) glyceroplasts
- 78** Chloroplasts found in plant cells  
 (a) are single membranous structures  
 (b) contain *ds* circular DNA  
 (c) contain 80 S ribosomes  
 (d) are colourless plastids
- 79** Flattened membranous sacs present in the stroma of chloroplast are  
 (a) thylakoids (b) grana  
 (c) mesophyll (d) stroma lamella
- 80** The stroma of chloroplast contains enzymes required for synthesis of  
 (a) carbohydrates (b) proteins  
 (c) fats (d) Both (a) and (b)
- 81** Choose the incorrect pair.  
 (a) Stromal lamellae— Interconnects the grana  
 (b) Thylakoid—Singular unit of grana  
 (c) Stroma of chloroplast — Contains small *ds* circular DNA  
 (d) Ribosomes of chloroplast — 80S



**82** Identify *A* to *F* in the sectional view of a chloroplast showing the different parts.



- (a) A–Inner membrane, B–Granum, C–Outer membrane, D–Stroma lamella, E–Stroma, F–Thylakoid  
 (b) A–Outer membrane, B–Inner membrane, C–Granum, D–Thylakoid, E–Stroma lamella, F–Stroma  
 (c) A–Thylakoid, B–Outer membrane, C–Stroma, D–Stroma lamella, E–Granum, F–Inner membrane  
 (d) A–Outer membrane, B–Stroma, C–Inner membrane, D–Granum, E–Thylakoid, F–Stroma lamella

**83** Who discovered ribosomes as dense particles under the electron microscope?

- (a) George Palade (b) Kolliker  
 (c) Boveri (d) Strasburger

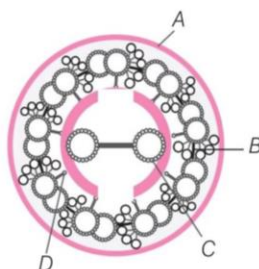
**84** The sedimentation coefficient of ribosome is a measure of

- (a) density (b) number  
 (c) structure (d) None of these

**85** The solid linear cytoskeletal elements having a diameter of 6 nm and made up of a single type of monomer are known as **CBSE-AIPMT 2014**

- (a) microtubules  
 (b) microfilaments  
 (c) intermediate filaments  
 (d) lamins

**86** Identify *A* to *D* in the diagrammatic representation of internal structure of cilia.



- (a) A–Interdoublet bridge, B–Central microtubule, C–Plasma membrane, D–Radial spoke  
 (b) A–Plasma membrane, B–Central microtubule, C–Interdoublet bridge, D–Radial spoke  
 (c) A–Plasma membrane, B–Interdoublet bridge, C–Central microtubule, D–Radial spoke  
 (d) A–Plasma membrane, B–Interdoublet bridge, C–Radial spoke, D–Central microtubule

**87** The sectional view of cilia/flagella shows

	Peripheral microtubules (Doublet)	Central microtubules (Singlet)	Radial spoke	Central sheath
(a)	9 + 0	2	8	1
(b)	9 + 0	9 + 0	9	1
(c)	9	2	9	1
(d)	3	6	9	1

**88** Choose the incorrect pair.

- (a) Cilium or Flagellum – 9 + 2 morphology  
 (b) Axonema – Core of cilium or flagellum  
 (c) Basal body – Centriole-like structure  
 (d) Radial spokes – Connect two central microtubules

**89** What is common between a eukaryotic and prokaryotic flagella? **JIPMER 2018**

- (a) Same structure  
 (b) Both are used for locomotion  
 (c) Composed of same proteins  
 (d) Both are extension of cell membrane

**90** The cross section view of a centriole shows

	Peripheral microtubules (Triplet)	Central microtubules (Singlet)	Hub	Spokes	Inter triplet bridge
(a)	9	2	1	9	9
(b)	9	2	9	9	9
(c)	9	2	1	2	2
(d)	9	0	1	9	9

**91** The central part of the proximal region of the centriole is

- (a) spokes (b) hub  
 (c) centrosome (d) axonema

**92** Which one of the following options represent the sequence of formation of spindle fibres correctly?

- (a) Basal body → Cilium/flagellum → Centriole  
 (b) Cilium/flagellum → Basal body → Centriole  
 (c) Centriole → Basal body → Cilium/flagellum  
 (d) Basal body → Centriole → Flagellum/cilium

**93** The nucleus in a eukaryotic cell

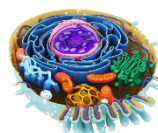
- (a) was first described by Robert Brown  
 (b) was called chromatin by Flemming  
 (c) contain nucleoli in nucleoplasm  
 (d) All of the above

**94** Material of the nucleus is stained by

- (a) acidic dye (b) basic dye  
 (c) neutral dye (d) iodine

**95** For the study of structure of nucleus, the best cell is

- (a) cell in the interphase  
 (b) cell in the late prophase  
 (c) cell in the divisional phase  
 (d) cell in the meiotic phase



- 96** The nuclear pores in the nuclear membrane allows the passage of  
 (a) proteins, enzymes into the nucleus  
 (b) ribosomal components out of the nucleus  
 (c) mRNA out of the nucleus  
 (d) All of the above

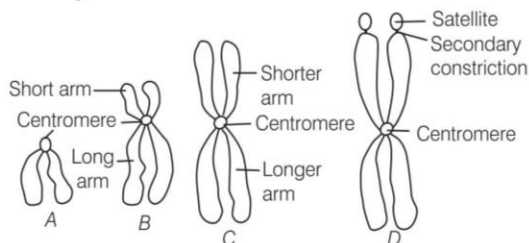
- 97** The cells that lack nucleus are  
 (a) erythrocytes of many mammals  
 (b) tube cells of vascular plants  
 (c) lymphocytes of mammals  
 (d) Both (a) and (b)

- 98** Non-membranous nucleoplasmic structures in nucleus are the site for active synthesis of **NEET (Odisha) 2019**  
 (a) protein synthesis (b) mRNA  
 (c) rRNA (d) tRNA

- 99** Choose the incorrect pair.  
 (a) Histones — Basic proteins  
 (b) Centromere — Primary constriction  
 (c) Kinetochore — Disc-shaped structure  
 (d) None of the above

- 100** The chromosomes are divided into how many types on the basis of position of centromere?  
 (a) 2 (b) 4 (c) 8 (d) 16

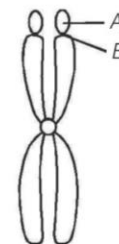
- 101** In the given diagram of types of chromosomes, identify A-D.



- (a) A—Telocentric chromosome, B—Acrocentric chromosome, C—Submetacentric chromosome, D—Metacentric chromosome  
 (b) A—Acrocentric chromosome, B—Telocentric chromosome, C—Metacentric chromosome, D—Submetacentric chromosome  
 (c) A—Submetacentric chromosome, B—Metacentric chromosome, C—Telocentric chromosome, D—Acrocentric chromosome  
 (d) A—Metacentric chromosome, B—Submetacentric chromosome, C—Acrocentric chromosome, D—Telocentric chromosome

- 102** The shorter and longer arms of a submetacentric chromosome are referred to as **NEET 2019**  
 (a) p-arm and q-arm, respectively  
 (b) q-arm and p-arm, respectively  
 (c) m-arm and n-arm, respectively  
 (d) s-arm and l-arm, respectively

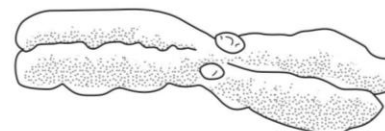
- 103** The below diagram represents chromosome. Identify the structures A, B and type of chromosome C.



Type of chromosome-C

- (a) A—Satellite, B—Primary constriction, C—Acrocentric  
 (b) A—Satellite, B—Secondary constriction, C—Metacentric  
 (c) A—Satellite, B—Centromere, C—Telocentric  
 (d) A—Satellite, B—Centromere, C—Submetacentric

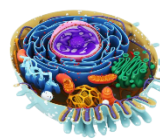
- 104** The below diagram shows a chromosome.



Which of the following table refers correctly to the chromosome?

	Number of Centromere	Number of Kinetochore	Number of Arms
(a)	2	1	4
(b)	1	2	4
(c)	2	2	4
(d)	1	2	2

- 105** Which one is only found in plant? **JIPMER 2019**  
 (a) Ribosome  
 (b) Mitochondria  
 (c) Glyoxysomes  
 (d) Lysosome



# NEET

## SPECIAL TYPES QUESTIONS

### I. Assertion and Reason

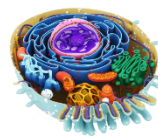
■ **Direction** (Q. No. 106-115) In each of the following questions, a statement of Assertion (A) is given followed by corresponding statement of Reason (R). Of the statements, mark the correct answer as

- (a) If both A and R are true and R is the correct explanation of A
  - (b) If both A and R are true, but R is not the correct explanation of A
  - (c) If A is true, but R is false
  - (d) If A is false, but R is true
- 106 Assertion** (A) Smaller cells are usually metabolically active cells.  
**Reason** (R) Smaller cells have higher nucleocytoplasmic ratio and higher surface volume ratio.
- 107 Assertion** (A) Every cell behaves as a compartment.  
**Reason** (R) Cells are partially covered over by a membrane.
- 108 Assertion** (A) Chloroplast is a cell organelle.  
**Reason** (R) An organelle is a distinct part of cell which has a particular structure and function.
- 109 Assertion** (A) Cell is an open system.  
**Reason** (R) Cell receives a number of materials including energy containing nutrients from outside and also release metabolic wastes into its surroundings.
- 110 Assertion** (A) The cisternae in Golgi complex have *cis* face and *trans* face.  
**Reason** (R) The *cis* face is also called forming face and *trans* face is also called maturing face.
- 111 Assertion** (A) In prokaryotes, mitochondria are absent.  
**Reason** (R) In prokaryotes, mesosomes are present which help in respiration.
- 112 Assertion** (A) Mitochondria and chloroplast are semiautonomous organelles.  
**Reason** (R) These are formed by the division of pre-existing organelles as well as they contain DNA, but lack protein synthesising machinery.
- 113 Assertion** (A) Peroxisomes are involved in photorespiration of the plant cells and help in lipid metabolism in animal cells.  
**Reason** (R) These are the cell garbage disposal system.

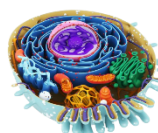
- 114 Assertion** (A) Mitochondria and chloroplast have their own genome.  
**Reason** (R) ER and Golgi body are the cell organelles which have their own DNA.
- 115 Assertion** (A) The chromoplasts contain fat soluble carotenoid pigments.  
**Reason** (R) These pigments provide colour to plant parts other than green.

### II. Statement Based Questions

- 116** Which of the following statements is incorrect?  
 (a) Unicellular organisms are capable of independent existence  
 (b) Any structure less than a complete structure of a cell does not ensure independent living  
 (c) Matthias Schleiden, a German zoologist discovered the nucleus  
 (d) Leeuwenhoek first saw and described a live cell
- 117** Choose the incorrect statement.  
 (a) Mycoplasma is the smallest cell (0.3  $\mu\text{m}$  in length)  
 (b) Bacteria are 3-5  $\mu\text{m}$  in length  
 (c) The largest cell is the egg of an ostrich  
 (d) Nerve cells are some of the smallest cells
- 118** Select the incorrect statement. **NEET 2016**  
 (a) Bacterial cell wall is made up of peptidoglycan  
 (b) Pili and fimbriae are mainly involved in motility of bacterial cells  
 (c) Cyanobacteria lack flagellated cells  
 (d) Mycoplasma is a wall less microorganism
- 119** Select the incorrect statement about prokaryotic ribosomes.  
 (a) 50S and 30S subunits unite to form 70S ribosomes  
 (b) Polysome consists of many ribosomes attached to *tRNA*  
 (c) Ribosome is the site of protein synthesis  
 (d) Polysomes indicate the synthesis of identical polypeptides in multiple copies
- 120** Which of the following statements is incorrect for prokaryotic inclusion bodies?  
 (a) These are storage granules in the cytoplasm  
 (b) They are membrane bound structures  
 (c) Phosphate granules, cyanophycean granules and glycogen granules are the examples of cell inclusions  
 (d) Gas vacuole is found in BGA and purple and green photosynthetic bacteria



- 121** Which of the following statements is incorrect about the plasma membrane?  
 (a) The ratio of proteins and lipid varies considerably in different cell types  
 (b) 52% protein and 40% lipids are in the membrane of human RBCs  
 (c) Integral proteins are found on the intracellular surface of cell membrane  
 (d) Head of lipid is hydrophilic
- 122** Choose the incorrect statement regarding cell membrane.  
 (a) Generally smaller molecules pass easily without energy requirement by passive transport  
 (b) Water soluble substances pass through it less rapidly than lipid soluble substances  
 (c) Neutral solutes move across it by simple diffusion  
 (d) None of the above
- 123** Which one is incorrect about osmosis?  
 (a) It is a specific form of diffusion  
 (b) It refers to the movement of water along its concentration gradient  
 (c) It is a passive movement of water  
 (d) It occurs through a carrier protein and needs ATP
- 124** Which of the following is the correct statement for middle lamella of eukaryotic cell?  
 (a) It is formed as a cell plate during cytokinesis  
 (b) It mainly consists of Ca-pectate  
 (c) It holds different neighbouring cells together  
 (d) All of the above
- 125** Which of the following statements is incorrect about lysosomes? **NEET 2019**  
 (a) The hydrolytic enzymes of lysosomes are active under acidic pH  
 (b) Lysosomes are membrane bound structures  
 (c) Lysosomes are formed by the process of packaging in the endoplasmic reticulum  
 (d) Lysosomes have numerous hydrolytic enzymes
- 126** Which of the following statements is correct?  
 (a) In *Amoeba*, contractile vacuole is important for excretion and osmoregulation  
 (b) In many cells as in protists, food vacuoles are formed by engulfing the food particles  
 (c) Vacuole is always small sized in all cells of plant  
 (d) Both (a) and (b)
- 127** Which of the following statements regarding mitochondria is incorrect? **NEET 2019**  
 (a) Enzymes of electron transport are embedded in outer membrane  
 (b) Inner membrane is convoluted with infoldings  
 (c) Mitochondrial matrix contains single circular DNA molecules and ribosomes  
 (d) Outer membrane is permeable to monomers of carbohydrates, fats and proteins
- 128** Which is incorrect with reference to chloroplast? **JIPMER 2018**  
 (a) Presence in algae and plants  
 (b) Releases O<sub>2</sub>  
 (c) Occurs only in cells with aerobic respiration  
 (d) All of the above
- 129** Identify the incorrect statement about plastids.  
 (a) Found in all plant cells and euglenoids  
 (b) These are large in size  
 (c) Bear some specific pigments  
 (d) None of the above
- 130** Choose the incorrect statement for ribosomes.  
 (a) Granular, not surrounded by any membrane  
 (b) Eukaryotic ribosomes are 80S and prokaryotic ribosomes are 70S  
 (c) 'S' stands for sedimentation coefficient  
 (d) None of the above
- 131** Which of the following statements is incorrect?  
 (a) Both the centrioles in a centrosome lie perpendicular to each other  
 (b) Centrioles form the basal body of spindle fibres only  
 (c) Each centriole has an organisation like that of a cartwheel  
 (d) Centrosome usually contains two cylindrical centrioles
- 132** Choose the incorrect statement.  
 (a) Centrosome is cytoplasmic structure of animal cells  
 (b) Centrioles form spindle poles  
 (c) Centriole is membrane less, but surrounded by amorphous pericentriolar bodies  
 (d) Centrosome occurs in all eukaryotic cells
- 133** Which of the following statements is not correct?  
 (a) Human cheek cells have an outer membrane as the delimiting structure  
 (b) Genetic material is contained in the nucleus of the eukaryotes cells  
 (c) The cytoplasm is the main arena of cellular activities in both plant and animal cells  
 (d) Centriole is non-membranous and commonly found in plant cells
- 134** Which of the following is incorrect about the microbodies?  
 (a) These are present in bacteria  
 (b) Minute membranous vesicles  
 (c) These are present in plants and animals  
 (d) These have various enzymes
- 135** Which of the following is true for nucleolus? **NEET 2018**  
 (a) It takes part in spindle formation  
 (b) It is a membrane-bound structure  
 (c) Larger nucleoli are present in dividing cells  
 (d) It is the site for active ribosomal RNA synthesis



**136** Which one is correct about the Nuclear Membranes (NMs)?

- (a) Both the NMs never fuse
- (b) Both the NMs are always parallel to each other and never fuse
- (c) Both NMs are parallel to each other and fuse to form nuclear pores at a number of places
- (d) Inner NM is attached with ribosomes

**137** Which of the following statements is not correct?

- (a) A single human cell has 2 m long thread of DNA
- (b) Part of chromosomes after second constriction is called telomere
- (c) Centromere forms first site of constriction
- (d) Chromatin consists of DNA, RNA, histones and non-histones

**138** Select the right option, which relates to Schwann regarding the following statements.

- I. He reported that cells have a thin outer layer, which is today known as plasma membrane.
- II. Cell wall is a unique character of the plant cell only.
- III. Body of plants and animals are composed of cells and product of cells.

Choose the correct option from below.

- (a) All are incorrect
- (b) Only III is correct
- (c) All are correct
- (d) II and III are correct

**139** Choose the correct statements from the codes given below.

- I. Schleiden studies were based on different kinds of plant cells and tissues.
- II. An incomplete cell structure does not ensure independent living.
- III. Cells of plant tissues are often connected with one another through cytoplasmic bridges called plasmodesmata.
- IV. Human cheek cells do not possess a cell wall.

**Codes**

- (a) II and III
- (b) I and II
- (c) I, III and IV
- (d) I, II, III and IV

**140** Mesosomes are the infoldings of cell membrane, which

- I. help in cell wall formation, DNA replication and respiration.
- II. increase the surface area of plasma membrane.
- III. are present in both prokaryotic and eukaryotic cells.

Which of the following option is most appropriate?

- (a) II and III are correct
- (b) I and II are correct
- (c) I and III are correct
- (d) I, II and III are correct

**141** Ribosomes are

- I. Non-membrane bound.
  - II. Absent in plastids and mitochondria.
  - III. Present in the cytoplasm and RER.
  - IV. Take part in protein synthesis.
- Which of the following option is most appropriate?

- (a) Only II is correct
- (b) I and II are correct
- (c) I, II, III and IV are correct
- (d) I, III and IV are correct

**142** Mitochondria and chloroplasts are

- I. Semiautonomous organelles.
- II. Formed by division of pre-existing organelles and they contain DNA, but lack protein synthesising machinery.

Which one of the following options is correct?

- (a) II is true, but I is false
- (b) I is true, but II is false
- (c) Both I and II are false
- (d) Both I and II are correct

**NEET 2016**

**143** Consider following features.

- I. Double membrane bound organelle.
- II. Contain 70S ribosomes and RNA.
- III. Possess small circular DNA.

Select the correct option of organelle groups which possess all the above characteristics.

- (a) Nucleus, centrosome, mitochondria
- (b) Nucleus, mitochondria and chloroplast
- (c) Mitochondria and chloroplast
- (d) Chloroplast and vacuole

**NEET 2019**

**144** Consider the following statements and choose the option containing the correct statements.

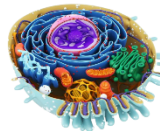
- I. The endomembrane system includes plasma membrane, ER, Golgi complex, lysosomes and vacuoles.
- II. ER helps in the transport of substances, synthesis of proteins, lipoproteins and glycogen.
- III. Ribosomes are involved in protein synthesis.
- IV. Mitochondria helps in oxidative phosphorylation and generation of ATP.

- (a) I, II, III and IV
- (b) Only I
- (c) Only II
- (d) Only III

**145** Which of the following statements are true about endoplasmic reticulum?

- I. Smooth Endoplasmic Reticulum (SER) makes lipids.
- II. It is also called the control centre of the cell.
- III. It processes carbohydrates.
- IV. It modifies chemicals that are toxic to the cell.

- (a) I, II and III
- (b) I, III and IV
- (c) I and IV
- (d) All of these

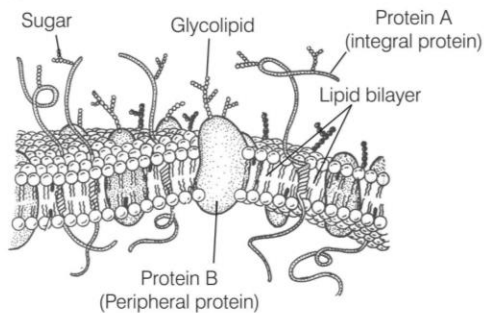


**146** Which of the following statements depict the function of cell wall?

- I. Provides shape to the cell.
- II. Protects the cell from mechanical damage and infection.
- III. Helps in cell to cell interaction.
- IV. Provides barrier to undesirable macromolecules.
- V. Imbibes water.

- (a) Only V (b) Only IV  
(c) II, IV and V (d) All of these

**147** A student made a pictorial representation of a eukaryotic cell membrane and labelled the components as follows.



The student has made errors while labelling the components of membrane. Which of the following statements hold true regarding the error?

- I. Protein A should be labelled as *trans*-membrane protein only and not as integral protein.
- II. The polarity of the protein A should be reversed because the cytosolic phase always shows reducing environment.
- III. Glycolipid should be labelled as glycoprotein.
- IV. Protein B should be labelled as integral membrane protein and not as peripheral glycoprotein.

- (a) I and II (b) III and IV (c) II and III (d) I and IV

**148** Consider the given statements.

- I. The surface area available for cellular functions in a prokaryotic cell is less than that in an eukaryotic cell.
- II. The total genome size of a prokaryotic cell is always less than that of a eukaryotic cell.
- III. Unlike eukaryotes, no respiratory structures are found in prokaryotes. Hence, they respire at a much lesser rate than eukaryotes.
- IV. Eukaryotic cells show various membrane bound organelles such as chloroplasts and nucleus, while ribosomes are the only membrane bound organelles found in prokaryotes.

Which of these statements is/are true?

- (a) I and II (b) Only IV  
(c) Only III (d) I, II and IV

- 149** I. Cilium/flagellum contains an outer ring of nine doublet microtubules surrounding two singlet microtubules.  
II. Cilia are smaller, which work like oars, causing the movement of either the cells or surrounding fluid.  
III. Flagella are comparatively longer and responsible for cell movement.  
IV. Cilium and flagellum are covered with plasma membrane.

Which of the above statements are correct?

- (a) I and II (b) I, II, III and IV  
(c) I and IV (d) II and III

**150** Consider the following statements.

- I. Inclusion bodies in prokaryotic cells are bound by a single membrane.
- II. Gas vacuoles are inclusion bodies in purple and green photosynthetic bacteria.

Select the correct option

- (a) I is true, II is false (b) Both I and II are false  
(c) I is false, II is true (d) Both I and II are true

**151** Consider the following statements

- I. Mesosomes and chromatophores are membranous structures in the prokaryotic cells.
- II. Chromatophores are pigment containing structures in cyanobacteria.

Select the correct option.

- (a) I is true, II is false (b) Both I and II are false  
(c) I is false, II is true (d) Both I and II are true

**152** Consider the following statements.

- I. In the plasma membrane of human erythrocytes, lipids are present in negligible amount.
- II. The fluidity of plasma membrane ensures mobility of lipid molecules across the bilayer.

Select the correct option.

- (a) I is true, II is false (b) Both I and II are false  
(c) I is false, II is true (d) Both I and II are true

### III. Matching Type Questions

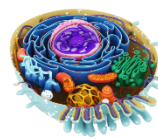
**153** Match the following columns.

Column I (Scientists)	Column II (Discoveries/Proposed theories)
A. Leeuwenhoek	1. First saw and described a living cell
B. Robert Brown	2. Presence of cell wall is unique to plant cells
C. Schleiden	3. Discovered the nucleus
D. Schwann	4. All plants are composed of different kind of cells

**Codes**

- |       |   |   |   |       |   |   |   |
|-------|---|---|---|-------|---|---|---|
| A     | B | C | D | A     | B | C | D |
| (a) 1 | 3 | 4 | 2 | (b) 1 | 3 | 2 | 4 |
| (c) 3 | 1 | 4 | 2 | (d) 1 | 4 | 2 | 3 |





**154** Match the following columns.

Column I (Cells)	Column II (Features)
A. RBCs	1. Branched and long
B. WBCs	2. Long and narrow
C. Columnar epithelial cell	3. Amoeboid
D. Nerve cell	4. Round and biconcave

**Codes**

A	B	C	D	A	B	C	D
(a) 2	3	4	1	(b) 3	2	1	4
(c) 4	3	2	1	(d) 4	2	3	1

**155** Match the following columns. **CBSE-AIPMT 2014**

Column I	Column II
A. Centriole	1. Infoldings in mitochondria
B. Chlorophyll	2. Thylakoids
C. Cristae	3. Nucleic acids
D. Ribozymes	4. Basal body of cilia or flagella

**Codes**

A	B	C	D	A	B	C	D
(a) 4	2	1	3	(b) 1	2	4	3
(c) 1	3	2	4	(d) 4	3	1	2

**156** Match the following columns.

Column I (Cell organelles)	Column II (Functions)
A. Sphaerosomes	1. Glycolate metabolism
B. Peroxisomes	2. Transport of macromolecules
C. Plasmodesmata	3. RNA synthesis
D. Nucleolus	4. Lipid storage

**Codes**

A	B	C	D
(a) 2	3	4	1
(b) 3	4	1	2
(c) 1	2	3	4
(d) 4	1	2	3

**157** Match the following columns.

Column I (Cell organelles)	Column II (Functions)
A. Endoplasmic reticulum	1. Take part in cellular respiration
B. Free-ribosome	2. Take part in osmoregulation and excretion
C. Mitochondrion	3. Synthesis of lipids
D. Contractile vacuole	4. Synthesise non-secretory proteins

**Codes**

A	B	C	D	A	B	C	D
(a) 3	4	1	2	(b) 1	2	4	3
(c) 3	2	1	4	(d) 3	2	4	1

**158** Match the following columns.

Column I (Cell organelles)	Column II (Functions)
A. Lysosomes	1. Hydrolytic activity
B. Ribosomes	2. Formation of spindle
C. Smooth endoplasmic reticulum	3. Protein synthesis
D. Centriole	4. Steroid synthesis

**Codes**

A	B	C	D
(a) 2	1	3	4
(b) 1	3	4	2
(c) 1	4	3	2
(d) 4	3	1	2

**159** Match the following columns.

Column I (Cell organelles)	Column II (Functions)
A. RER	1. Intracellular and extracellular digestion
B. SER	2. Lipid synthesis
C. Golgi complex	3. Protein synthesis and secretion
D. Lysosomes	4. Moves materials out of the cells

**Codes**

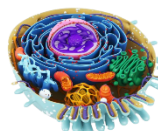
A	B	C	D	A	B	C	D
(a) 3	2	4	1	(b) 2	3	4	1
(c) 1	3	2	4	(d) 4	2	3	1

**160** Match the following columns. **NEET (Odisha) 2019**

Column I (Cell organelles)	Column II (Functions)
A. Golgi apparatus	1. Synthesis of protein
B. Lysosomes	2. Trap waste and excretory products
C. Vacuoles	3. Formation of glycoproteins and glycolipids
D. Ribosomes	4. Digesting biomolecules

**Codes**

A	B	C	D
(a) 3	4	2	1
(b) 4	3	1	2
(c) 3	2	4	1
(d) 1	2	4	3



# NCERT & NCERT Exemplar

## MULTIPLE CHOICE QUESTIONS

### NCERT

- 161** Which of the following is not correct?  
 (a) Robert Brown discovered the cell  
 (b) Schleiden and Schwann formulated the cell theory  
 (c) Virchow explained that cells are formed from pre-existing cells  
 (d) An unicellular organism carries out its life activities within a single cell
- 162** New cells generate from  
 (a) bacterial fermentation  
 (b) regeneration of old cells  
 (c) pre-existing cells  
 (d) abiotic materials
- 163** Which of the following is correct?  
 (a) Cells of all living organisms have a nucleus  
 (b) Both animal and plant cells have well-defined cell wall  
 (c) In prokaryotes, there are no membrane bound organelles  
 (d) Cells are formed *de novo* from abiotic materials
- 164** Match the following columns.

Column I	Column II
A. Cristae	1. Flat membranous sacs in stroma
B. Cisternae	2. Infolding in mitochondria
C. Thylakoid	3. Disc-shaped sacs in Golgi apparatus

### Codes

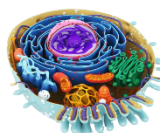
A	B	C	A	B	C
(a) 1	2	3	(b) 2	3	1
(c) 3	1	2	(d) 3	2	1

- 165** Identify the functions performed by mesosome in prokaryotic cell.  
 (a) Helps in cell wall formation  
 (b) Increases the surface area of plasma membrane  
 (c) Helps in DNA replication  
 (d) All of the above
- 166** Name two cell organelles that are double membrane bound.  
 (a) Mitochondria and ribosomes  
 (b) Mitochondria and chloroplasts  
 (c) Chloroplasts and ribosomes  
 (d) Lysosomes and mitochondria
- 167** What are gas vacuoles?  
 (a) Pseudovacuaules  
 (b) Characteristic feature of certain cells  
 (c) Take part in buoyancy regulation  
 (d) All of the above

- 168** What is the function of polysome ?  
 (a) Active protein synthesis  
 (b) Formation of multiple copies of same polypeptide  
 (c) Both (a) and (b)  
 (d) None of the above

### NCERT Exemplar

- 169** Which one of these is not an eukaryote?  
 (a) *Euglena*  
 (b) *Anabaena*  
 (c) *Spirogyra*  
 (d) *Agaricus*
- 170** Which of the following features is common to prokaryotes and many eukaryotes?  
 (a) Chromatin material present  
 (b) Cell wall present  
 (c) Nuclear membrane present  
 (d) Membrane bound subcellular organelles present
- 171** Which of the following is not true for an eukaryotic cell?  
 (a) Cell wall is made up of peptidoglycans  
 (b) It has 80S type of ribosome present in the cytoplasm  
 (c) Mitochondria contain circular DNA  
 (d) Membrane bound organelles are present
- 172** Different cells have different sizes. Arrange the following cells in an ascending order of their size. Choose the correct option among the followings.  
 I. Mycoplasma  
 II. Ostrich eggs  
 III. Human RBC  
 IV. Bacteria  
 (a) I, IV, III, II  
 (b) I, II, III, IV  
 (c) II, I, III, IV  
 (d) III, II, I, IV
- 173** Which one of the following statements is not true for plasma membrane?  
 (a) It is present in both plant and animal cells  
 (b) Lipid is present as a bilayer in it  
 (c) Proteins are present integrated as well as loosely associated with the lipid bilayer  
 (d) Carbohydrate is never found in it
- 174** Who proposed the fluid mosaic model of plasma membrane?  
 (a) Camillo Golgi  
 (b) Schleiden and Schwann  
 (c) Singer and Nicolson  
 (d) Robert Brown



- 175** Which of the following statements is true for a secretory cell?  
 (a) Golgi apparatus is absent  
 (b) Rough Endoplasmic Reticulum (RER) is easily observed in the cell  
 (c) Only Smooth Endoplasmic Reticulum (SER) is present  
 (d) Secretory granules are formed in nucleus
- 176** What is a tonoplast?  
 (a) Outer membrane of mitochondria  
 (b) Inner membrane of chloroplast  
 (c) Membrane boundary of the vacuole of plant cells  
 (d) Cell membrane of a plant cell
- 177** The stain used to visualise mitochondria is  
 (a) fast green (b) safranin  
 (c) acetocarmine (d) janus green
- 178** Plastid differs from mitochondria on the basis of one of the following features. Mark the right answer.  
 (a) The presence of two layers of membrane  
 (b) The presence of ribosomes  
 (c) The presence of thylakoids  
 (d) The presence of DNA
- 179** Select one, which is not true for ribosomes.  
 (a) Made up of two subunits  
 (b) Form polysome  
 (c) May attach to mRNA  
 (d) Have no role in protein synthesis
- 180** Which of the following is not a function of cytoskeleton in a cell ?  
 (a) Intracellular transport  
 (b) Maintenance of cell shape and structure  
 (c) Support of the organelle  
 (d) Cell motility
- 181** A common characteristic feature of plant sieve tube cells and most of mammalian erythrocytes is  
 (a) the absence of mitochondria  
 (b) the presence of cell wall  
 (c) the presence of haemoglobin  
 (d) the absence of nucleus
- 182** Which of the following stains is not used for staining chromosomes?  
 (a) Basic fuchsin (b) Safranin  
 (c) Methylene blue (d) Carmine

## Answers

### › Mastering NCERT with MCQs

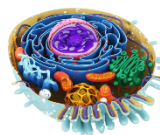
- |         |         |         |         |         |        |        |        |        |         |
|---------|---------|---------|---------|---------|--------|--------|--------|--------|---------|
| 1 (b)   | 2 (c)   | 3 (a)   | 4 (c)   | 5 (b)   | 6 (b)  | 7 (a)  | 8 (b)  | 9 (a)  | 10 (c)  |
| 11 (d)  | 12 (d)  | 13 (c)  | 14 (b)  | 15 (b)  | 16 (d) | 17 (b) | 18 (c) | 19 (d) | 20 (d)  |
| 21 (c)  | 22 (d)  | 23 (b)  | 24 (c)  | 25 (c)  | 26 (d) | 27 (a) | 28 (b) | 29 (a) | 30 (c)  |
| 31 (d)  | 32 (c)  | 33 (c)  | 34 (b)  | 35 (a)  | 36 (c) | 37 (b) | 38 (c) | 39 (d) | 40 (c)  |
| 41 (b)  | 42 (a)  | 43 (d)  | 44 (d)  | 45 (b)  | 46 (c) | 47 (a) | 48 (c) | 49 (b) | 50 (b)  |
| 51 (d)  | 52 (c)  | 53 (a)  | 54 (a)  | 55 (d)  | 56 (b) | 57 (b) | 58 (b) | 59 (b) | 60 (b)  |
| 61 (b)  | 62 (c)  | 63 (b)  | 64 (a)  | 65 (b)  | 66 (d) | 67 (b) | 68 (a) | 69 (b) | 70 (d)  |
| 71 (a)  | 72 (b)  | 73 (a)  | 74 (d)  | 75 (b)  | 76 (c) | 77 (b) | 78 (b) | 79 (a) | 80 (d)  |
| 81 (d)  | 82 (b)  | 83 (a)  | 84 (a)  | 85 (b)  | 86 (c) | 87 (c) | 88 (d) | 89 (b) | 90 (d)  |
| 91 (b)  | 92 (c)  | 93 (d)  | 94 (b)  | 95 (a)  | 96 (d) | 97 (d) | 98 (c) | 99 (d) | 100 (b) |
| 101 (a) | 102 (a) | 103 (b) | 104 (b) | 105 (c) |        |        |        |        |         |

### › NEET Special Types Questions

- |         |         |         |         |         |         |         |         |         |         |
|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| 106 (a) | 107 (c) | 108 (a) | 109 (a) | 110 (b) | 111 (b) | 112 (c) | 113 (c) | 114 (c) | 115 (b) |
| 116 (c) | 117 (d) | 118 (b) | 119 (b) | 120 (b) | 121 (c) | 122 (d) | 123 (d) | 124 (d) | 125 (c) |
| 126 (d) | 127 (a) | 128 (c) | 129 (d) | 130 (d) | 131 (b) | 132 (d) | 133 (d) | 134 (a) | 135 (d) |
| 136 (c) | 137 (b) | 138 (c) | 139 (d) | 140 (b) | 141 (d) | 142 (b) | 143 (c) | 144 (a) | 145 (b) |
| 146 (d) | 147 (b) | 148 (a) | 149 (b) | 150 (c) | 151 (d) | 152 (b) | 153 (a) | 154 (c) | 155 (a) |
| 156 (d) | 157 (a) | 158 (b) | 159 (a) | 160 (a) |         |         |         |         |         |

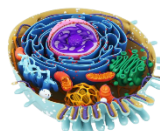
### › NCERT & NCERT Exemplar Questions

- |         |         |         |         |         |         |         |         |         |         |
|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| 161 (a) | 162 (c) | 163 (c) | 164 (b) | 165 (d) | 166 (b) | 167 (d) | 168 (c) | 169 (b) | 170 (b) |
| 171 (a) | 172 (a) | 173 (d) | 174 (c) | 175 (b) | 176 (c) | 177 (d) | 178 (c) | 179 (d) | 180 (a) |
| 181 (d) | 182 (b) |         |         |         |         |         |         |         |         |

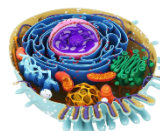


## Answers & Explanations

- 2 (c)** Electron microscope is the best device that is used to determine the ultrastructure of a cell organelle. It can magnify objects up to 250000-400000 times. Its resolving power is 1000 times more than the light microscope.
- 3 (a)** Cell theory was formulated by Schleiden and Schwann in the year 1839 based on their studies on plants and animal cells and their products.
- 4 (c)** Schwann proposed cell theory according to which bodies of animals and plants are made up of cells and their products. He studied different types of animal cells and plant cells and hypothesised about the postulate of cell theory.
- 6 (b)** Rudolf Virchow modified the cell theory and gave the theory '*Omnis cellula-e-cellula*' which means that new cells are formed by the division of the pre-existing cell. This is called theory of cell lineage or common ancestry.
- 7 (a)** The genetic material is naked in prokaryotic cells, i.e. it is not bound by any membrane. However, the genetic material in eukaryotes is well enclosed within the nucleus.
- 10 (c)** Out of the given pairs, option (c) is incorrectly matched. It can be corrected as  
 Amoeboid-shaped, nucleus containing cells are WBCs not platelets.  
 Rest of the options contain correctly matched pairs.
- 11 (d)** The prokaryotic cells are represented by bacteria, blue-green algae, mycoplasma and PPLO. All these cells contain naked DNA and lack well-defined nucleus.
- 13 (c)** Plasmids of bacterial cells do not help in the replication of nucleoid. In prokaryotes, these are additional small circular DNA entities. Plasmids carry additional specific factors like nitrogen-fixation, resistance, fertility, etc. DNA present as genetic material is naked and also called genophore, nuclear body or nucleoid.
- 14 (b)** Double-stranded circular naked DNA is present in an organism having 70 S ribosomes only. These are present in prokaryotic organisms. All prokaryotic cells have a double-stranded (double helix), circular DNA molecule as their genetic material, which is not bound by a nuclear membrane.
- 15 (b)** A specialised differentiated form of cell membrane called mesosome is the characteristic feature of prokaryotes. These are the infoldings of cell membrane into the cell.
- 16 (d)** Glycocalyx gives sticky characteristic to the bacterial cell. It is the outermost mucilage layer of the cell envelope.
- 18 (c)** The cell envelope of bacteria consists of a tightly bound three-layered structure *viz.*, outermost glycocalyx, followed by cell wall and plasma membrane. All these layers act as a single protective unit.
- 19 (d)** Cell membrane does not differ in *E. coli* and *Chlamydomonas*. It is structurally similar in eukaryotes and prokaryotes.
- 21 (c)** Filament is the longest portion in a bacterial flagellum. It constitutes of three parts, i.e. filament, hook and basal body. Bacteria show a wide range in the number and arrangement of flagella.
- 22 (d)** The pair in option (d) is incorrect. It can be corrected as  
 Pili are not involved in locomotion. Actually, pili are longer, fewer in number and thicker tubular outgrowths, which develop in response to  $F^+$  or fertility factor in Gram-negative bacteria. These help in sexual reproduction in bacteria.  
 Rest of the options contain correctly matched pairs.
- 23 (b)** Fimbriae are hair-like structures present in large number in bacteria. These help in attaching bacteria to substratum or host tissues. Thus, the bacteria would not adhere to the host tissue, if the fimbriae are removed from the bacterial cell.
- 24 (c)** Polysome is a string of ribosomes associated with a single mRNA. It helps to produce a number of copies of the same polypeptide.  
 Nucleosome is the unit of eukaryotic DNA that consists of a DNA segment wrapped around a core of eight histone proteins.  
 Plastidome refers to all the plastids of a cell which work as a functional unit.  
 Polyhedral bodies or carboxysomes are present in several groups of autotrophic bacteria that assimilate inorganic carbon *via* Calvin cycle, e.g. cyanobacteria.
- 26 (d)** Except Monera, the cells of the members all the other kingdoms have eukaryotic organisation, e.g. protists, fungi and plants. A eukaryotic cell is the one, which has an organised nucleus and several membrane bound cell organelles.
- 27 (a)** Plant and animal cells are different as plant cells possess cell wall, plastids and a large vacuole, which are absent in animal cells. On the other hand, animal cells have centrioles, which are absent in almost all plant cells.
- 28 (b)** The pair in option (b) is mismatched. The correct explanation for the mismatched pair is as follows  
 Animal cells do not have large central vacuole. Instead, these have 2-3 small vacuoles. The presence of such large central vacuole is the characteristic feature of plant cells.  
 Rest of the pairs are correctly matched.
- 31 (d)** Pair in option (d) is incorrectly matched. Its correct explanation is as follows  
 Cell membrane consists of carbohydrates, lipids and proteins. The ratio of lipids and proteins varies in different cell types.  
 Rest of the pairs are correctly matched.



- 32 (c)** The lipids are arranged within the membrane in such a way that the polar head is faced towards the outside and the hydrophobic tails is faced towards the inner part. Such arrangement ensures that non-polar tails of saturated hydrocarbons remain protected from the aqueous environment.
- 34 (b)** The major lipids components of the cell membrane are phospholipids and they are arranged in a bilayer. In addition to phospholipids, the cell membrane also contains cholesterol.
- 35 (a)** The role of sterol in a cell membrane is to provide stability. Sterols are steroids with 8-10 carbon long aliphatic side chain at carbon 17 and at least one alcoholic hydroxyl.  
 Cholesterol ( $C_{27}H_{45}OH$ ) is a common sterol found in many animal cell membranes.
- 37 (b)** According to the fluid mosaic model proposed by Singer and Nicolson, cell membrane has quasifluid nature. It enables lateral movement of proteins within the overall bilayer. This ability of proteins to move within the lipid bilayer membrane is measured as its fluidity.
- 41 (b)** The main difference between active and passive transport across the cell membrane is that passive transport requires a concentration gradient across the biological membrane to facilitate movements of molecules.  
 Whereas during active transport, the movement of molecules occurs from the region of high concentration to low concentration, i.e. the molecules move against the concentration gradient by using ATP (energy).
- 42 (a)**  $Na^+ / K^+$  pump represents active transport. This is because sodium and potassium ions are transported across the membrane against their concentration gradient, i.e. from lower to the higher concentration with the help of ATPase complex, which utilises ATP.
- 43 (d)** One of the major components of the fungal cell wall is chitin. It is the second most abundant carbohydrate and is a homopolymer of N-Acetyl Glucosamine (NAG) joined with  $\beta$  1-4 linkages. NAG is a modification of glucose molecule.
- 44 (d)** The cell wall in a plant cell performs various functions. It gives shape to the cell and protects the cell from mechanical damage and infections. It also helps in cell to cell interaction and provides barrier to undesirable macromolecules.
- 45 (b)** Galactans is the odd one out with respect to the composition of plant cell wall. Galactans are present in the algal cell wall. The algal cell wall is made up of cellulose, galactans, mannans and minerals like calcium carbonate. On the other hand plant cell wall consists of cellulose, hemicellulose, pectins and proteins.
- 46 (c)** The innermost portion of a mature plant cell wall possesses secondary cell wall. The cell wall of a young plant cell is the primary cell wall which is capable of growth. It gradually diminishes as the cell matures and the secondary cell wall is formed on the inner (towards membrane) side of the cell.
- 47 (a)** Plasmodesmata are the microscopic channels which transverse the cell wall and middle lamellae and connect the cytoplasm of two neighbouring cells.
- 49 (b)** Endoplasmic reticulum is involved in the modification and routing of newly synthesised proteins to their destinations. Rough endoplasmic reticulum possesses ribosomes on its surface and serves as the site of protein synthesis and modification.
- 51 (d)** Phospholipid synthesis does not occur in Rough Endoplasmic Reticulum (RER). It occurs inside Smooth Endoplasmic Reticulum (SER). A signal peptide is a short peptide present at the N-terminus of the newly synthesised proteins. It targets them to the Endoplasmic Reticulum and is then cleaved off. RER synthesises proteins. It bears enzymes for modifying polypeptides synthesised by attached ribosomes, e.g. glycosylation.
- 52 (c)** Nuclear envelope arise from the rough endoplasmic reticulum during the late prophase stage. Thus, nuclear envelope is a derivative of rough endoplasmic reticulum.
- 57 (b)** The pair in option (b) is incorrect. Its correct explanation is as follows  
 Golgi bodies consist of many fat, disc-shaped sacs or cisternae of varied number. These are stacked parallel to each other. The Golgi cisternae are concentrically arranged near the nucleus.  
 Rest of the pairs are correctly matched.
- 59 (b)** Golgi complex participates in the formation of secretory vesicles. It is a cytoplasmic structure found in eukaryotic cells. It is made up of four parts, i.e. cisternae, tubules, vesicles and vacuoles.  
 In bacteria, respiration occurs with the help of mesosomes. The breakdown of fatty acid occurs in peroxisomes and mitochondria. Activation of amino acid is an important step of protein synthesis and it occurs in the cytoplasm. In this process, amino acids get attached to tRNA molecules.
- 60 (b)** Golgi complex (Golgi apparatus) is present in the highest number in secretory cells. It is the sites of modification, packaging and secretions of secretory proteins and glycoproteins outside the cell.
- 61 (b)** Golgi apparatus is involved in the glycosylation of proteins and lipids, so as to form glycoproteins and glycolipids. It is also involved in protein trafficking. It packages materials and delivers them to various cell targets.
- 62 (c)** The correct sequence of modification and transport of secretory vesicles is as follows  
 RER  $\rightarrow$  Cell membrane  $\rightarrow$  Secretory vesicles  $\rightarrow$  Golgi body  
 Protein destined for secretion are synthesised on ribosomes bound to the RER. The proteins move through the endomembrane system and are dispatched from the *trans* face of the Golgi apparatus in transport vesicles. The latter move through the cytoplasm and then fuse with the plasma membrane thus, releasing the protein to the outside of the cell.
- 63 (b)** Lysosomes are enclosed by a single membrane. These store hydrolysing enzymes to digest proteins,

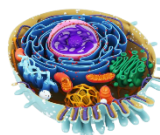


lipids, etc. Mitochondria, chloroplast and nuclei are all double membrane bound organelles.

- 64 (a)** The correct sequence of origin of lysosome is represented by option (a) and can be described as follows  
 Lysosomes are believed to be formed by the joint activity of endoplasmic reticulum and Golgi complex. The precursors of hydrolytic enzymes are mostly synthesised at the rough endoplasmic reticulum.  
 The latter transfers them to the forming face of Golgi complex. In Golgi complex, the precursors are changed to enzymes. The enzymes are then packed in larger vesicles, which are further modified into lysosomes.
- 65 (b)** Lysosomes and vacuoles do not contain DNA. Lysosomes are single membrane bound small vesicles which contain hydrolytic enzymes.  
 Vacuoles are large membranous sacs found in the cytoplasm. These contain substances that are not essentially useful for the cell like water, sap, excretory products and other materials.
- 67 (b)** The osmotic expansion of a cell kept in water is chiefly regulated by vacuoles. The vacuoles usually possess high solute concentration. During osmosis, the water moves from the region of high concentration of solvent to that of lower concentration. Thus, the water enters into the vacuole and the cell expands.
- 68 (a)** In plants, the tonoplast facilitates the active transport of a number of ions and other materials against concentration gradients into the vacuole. Hence, the ions and other materials are present in a concentration which is significantly higher in the vacuole than in the cytoplasm.
- 69 (b)** The two membranes of mitochondria are structurally and functionally different. These have their own specific enzymes associated with mitochondrial function. Structurally the inner membrane possesses several infoldings cristae which are absent in the outer membrane.
- 75 (b)** Chromoplasts have fat soluble pigments called carotenoids. They protect the chlorophyll molecule from oxidation in the presence of light.
- 77 (b)** The leucoplasts which store oils and fats are elaioplasts. Amyloplasts store carbohydrates and aleuroplasts store proteins.
- 78 (b)** Chloroplasts found in plant cells contain double-stranded circular DNA due to which they are known as semiautonomous organelles. These are double membrane bounded, green-colour plastids which contain 70S ribosomes.
- 79 (a)** Chloroplast contains flat membranous sacs called thylakoids in the stroma. These get stacked over one another to form grana and different grana are connected to one another through stroma lamellae.
- 81 (d)** Pair in option (d) is incorrect. The correct form is as follows  
 Ribosomes of chloroplast are 70S type and they are smaller than the cytoplasmic ribosomes, 80S.  
 Rest of the pairs are correct.
- 83 (a)** George Palade (1953) was the first to discover ribosomes. He observed ribosomes under the electron

microscope as dense granular structures consisting of RNA and proteins.

- 88 (d)** The pair in option (d) is incorrect. Its correct explanation is as follows  
 In cilium, the central tubules are connected by bridges and they are connected to peripheral doublets by radial spokes. Thus, there are nine radial spokes. The peripheral doublets are also interconnected by linkers.
- 89 (b)** The common feature between eukaryotic and prokaryotic flagella is that both are used in locomotion. Eukaryotic flagellum has two parts, i.e. basal body and shaft, while prokaryotic flagellum consists of three parts, i.e. basal body, hook and filament. Prokaryotic and eukaryotic flagella are made up of flagellin and tubulin proteins, respectively.
- 92 (c)** Option (c) gives the correct sequence of the formation of spindle fibres.  
 The centrioles form the basal body of cilia or flagella and spindle fibres that give rise to spindle apparatus during cell division in animal cells.
- 95 (a)** During interphase, the nucleus contains loose and indistinct network of nucleoprotein fibres called chromatin. Thus, it is the best phase to study the structure of nucleus.
- 97 (d)** Erythrocytes of many mammals and tube cells of vascular plants lack nucleus, so as to carry out specialised functions. Absence of nucleus in human RBCs help them to transport maximum amount of O<sub>2</sub> and CO<sub>2</sub> across body tissues. Absence of nucleus in tube cells of vascular plants allow maximum movement of food (mostly sugar). Lymphocytes of mammals are nucleated cells.
- 98 (c)** Non-membranous nucleoplasmic structures in the nucleus of the cell are the site for active synthesis of rRNA. These structures are called nucleoli. Larger and more numerous nucleoli are present in the cell actively carrying out the protein synthesis.
- 100 (b)** Based on the position of centromere or primary constriction in a chromosome, they are of 4 types namely, metacentric (centrally placed centromere), submetacentric (centromere lies a little away from centre), acrocentric (centromere near one end) and telocentric (terminal centromere).
- 102 (a)** The shorter and longer arms of a submetacentric chromosome are designated as p-arm and q-arm, respectively. Here, 'p' signifies petite or short. In a submetacentric chromosome, centromere is located near the centre due to which the two arms have an unequal length.
- 105 (c)** Out of the given options, glyoxysomes are exclusively found in plant cells. These were discovered by Brewers (1919) in the endosperm of germinating seeds. These are involved in fat metabolism through glyoxylate cycle.
- 106 (a)** Both Assertion and Reason are true and Reason is the correct explanation of Assertion.



Metabolically active cells are usually smaller as such cells have a higher nucleocytoplasmic ratio and higher surface volume ratio.

- 107 (c)** Assertion is true, but Reason is false and its correct explanation is as follows

Every cell behaves as a compartment because it is completely enclosed by a membrane known as plasma membrane or plasmalemma.

- 108 (a)** Both Assertion and Reason are true and Reason is the correct explanation of Assertion.

A cell organelle is a distinct part of a cell which also has a particular structure and function.

Since, chloroplast possesses a specific membrane bound structure and plays an important role in photosynthesis, it is said to be a cell organelle.

- 109 (a)** Both Assertion and Reason are true and Reason is the correct explanation of Assertion.

An open system is the one, which is separated from its surroundings by a boundary that allows the transfer of materials and energy across it. Cell is an open system because it receives a number of materials including energy containing nutrients from outside. It liberates energy as heat and excretes metabolic wastes from inside.

- 110 (b)** Both Assertion and Reason are true, but Reason is not the correct explanation of Assertion.

Golgi complex consists of a stack of cisternae, which are curved to give definite polarity to the Golgi apparatus.

The convex side (forming/*cis* face) receives vesicles from endoplasmic reticulum. The concave side (maturing/*trans* face) buds off vesicles as secretion.

- 111 (b)** Both Assertion and Reason are true, but Reason is not true correct explanation of Assertion .

Mitochondria are absent in prokaryotes. Mesosomes are characteristic, circular to villiform shaped specialisation of cell membrane of bacteria that develop as ingrowths from the plasma membrane.

It contains respiratory enzymes and is, therefore, often called chondroid. It is believed to be equal to mitochondrion of eukaryotes. However, respiratory enzymes are also present over the plasma membrane in prokaryotic cell.

- 112 (c)** Assertion is true, but Reason is false and its correct explanation is as follows

Mitochondria and chloroplasts are semiautonomous cell organelles, which contain their own DNA and protein synthesising machinery. These arise from pre-existing organelles and their functions are partially controlled by nucleus of the cells and partially by themselves (semiautonomous).

- 113 (c)** Assertion is true, but Reason is false and its correct explanation is as follows

Peroxisomes are found in photosynthetic cells and perform photorespiration. They also take part in lipid metabolism. Lysosomes are the cell garbage disposal system.

- 114 (c)** Assertion is true, but Reason is false and its correct explanation is as follows

Chloroplasts and mitochondria are endosymbionts in eukaryotic cells, having their own DNA. ER and Golgi bodies do not contain their own DNA.

- 115 (b)** Both Assertion and Reason are true, but Reason is not the correct explanation of Assertion.

Chromoplasts are yellow or reddish in colour because of the presence of fat soluble carotenoid pigments. In some plants chlorophylls is absent and hence, the carotenoid pigments provide a colour to plant parts other than green, e.g. orange colour of carrot roots, etc.

- 116 (c)** The statement in option (c) is incorrect and can be corrected as

Nucleus was first described by Robert Brown.

Rest of the statements are correct.

- 117 (d)** The statement in option (d) is incorrect. The correct information is as follows

Longest cells of human body are the nerve cells, which may reach up to 90 cm length.

Rest of the statements are correct.

- 118 (b)** The statement in option (b) is incorrect. The correct information is as follows

Fimbriae and pili are fine hair-like appendages used by bacteria for attachment rather than motility. These are formed of a protein called pilin.

Rest of the statements are correct.

- 119 (b)** The statement in option (b) is incorrect about prokaryotic ribosomes. It can be corrected as

In prokaryotes, polysome consists of many ribosomes attached to mRNA and not to tRNA. Prokaryotic ribosomes are associated with the plasma membrane of the cell.

These are of about 15 nm by 20 nm in size and are made up of two subunits—50S and 30S, which when present together form 70S prokaryotic ribosomes.

Rest of the statements are correct.

- 120 (b)** The statement in option (b) is incorrect for prokaryotic inclusion bodies. The corrected form is as follows

Prokaryotic inclusion bodies are not bound by any membrane system and lie free in the cytoplasm. Reserve material in prokaryotic cells are stored in the cytoplasm in the form of inclusion bodies.

Rest of the statements are correct for prokaryotic inclusion bodies.

- 121 (c)** The statement in option (c) is incorrect about the plasma membrane. It can be corrected as

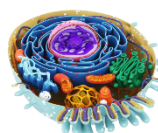
Integral proteins are found partially or totally buried in the cell membrane. Peripheral proteins lie on the surface of membrane.

Rest of the statements are correct.

- 123 (d)** The statement in option (d) is incorrect about osmosis. It can be corrected as

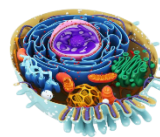
Osmosis is the movement of water across cell membrane and it does not require ATP. It is a type of passive transport which occurs from the region of higher concentration to that of lower concentration. ATP is required in case of active transport.

Rest of the statements are correct.



- 125** (c) The statement in option (c) is incorrect about lysosomes. It can be corrected as  
 Lysosomes are actually formed by budding off from the *trans*-face of Golgi bodies. These membrane bound structures contain hydrolytic enzymes whose precursors are synthesised by rough endoplasmic reticulum.  
 Rest of the statements are correct.
- 126** (d) Option (d) is correct because statements in both options (a) and (b) are correct. The incorrect statement in option (c) can be corrected as follows  
 Plants contain a single large vacuole, which can occupy up to 90 per cent of the volume of the cell.
- 127** (a) The statement in option (a) regarding mitochondria is incorrect. The correct form of the incorrect statement is as follows  
 Enzymes of electron transport are embedded in the inner membrane of mitochondria.  
 Rest of the statements are correct.
- 128** (c) The statement in option (c) is incorrect about chloroplasts. The correct information is as follows  
 These are not associated with any type of respiration, i.e. aerobic and anaerobic. Chloroplasts are involved in photosynthesis due to the presence of chlorophyll in them.  
 Rest of the statements are correct.
- 131** (b) The statement in option (b) is incorrect and its corrected form is as follows  
 The centrioles form the basal body of cilia or flagella and spindle fibres that give rise to spindle apparatus during cell division in animal cells.  
 Rest of the statements are correct.
- 132** (d) The statement in option (d) is incorrect. It can be corrected as  
 Centrosomes do not occur in all eukaryotic cells. Plants cells being eukaryotic cells lack centrosomes. But these are present in animal cells.  
 Rest of the statements are correct.
- 133** (d) The statement in option (d) is not correct. Its corrected form is as follows  
 Non-membranous organelle called centriole is found in animal cells and not in plant cells. It helps in cell division.  
 Rest of the statements are correct.
- 134** (a) The statement in option (a) is incorrect about microbodies. Its corrected form is as follows  
 Many membrane bound minute vesicles called microbodies which contain various enzymes, are present in both plant and animal cells, but not in bacteria.  
 Rest of the statements are correct.
- 135** (d) The statement in option (d) is true for nucleolus as it is the site for active ribosomal RNA synthesis.  
 Other statements are incorrect and can be corrected as
- Microtubules take part in spindle formation.
  - Mitochondria, plastids, vacuoles, etc., are membrane bound structures.
  - Larger and numerous nucleoli are present in cells which actively carry out protein synthesis.
- 136** (c) The statement in option (c) is correct about the Nuclear Membranes (NMs). Rest of the statements are incorrect and can be corrected as
- Electron microscopy has revealed that the nuclear envelope, consists of two parallel membranes with a space between (10-50 nm) called the perinuclear space.
  - At a number of places, the nuclear envelope is interrupted by minute pores, which are formed by the fusion of its two membranes. These nuclear pores are the passages through which movement of RNA and protein molecules takes place in both directions between the nucleus and the cytoplasm.
- 137** (b) The statement in option (b) is not correct. Its corrected form is as follows  
 Part of chromosomes after second constriction is called satellite. It cannot be stained and is found at a constant location.  
 Rest of the statements are correct.
- 140** (b) Statements I and II are correct, but III is incorrect about mesosomes. Its corrected form is as follows  
 Mesosomes are present in prokaryotes and not in eukaryotes. Mesosomes help in cell respiration and the same function is carried out by mitochondria in eukaryotic cells.
- 141** (d) Statements I, III and IV are correct and II is incorrect and can be corrected as  
 Ribosomes are present in mitochondria and chloroplast (plastids). Both of these organelles contain 70S ribosomes.
- 142** (b) Statement I is true, but II is false. Its corrected form is as follows  
 Both mitochondria and chloroplast are semiautonomous organelles as they contain their own circular DNA and protein synthesising machinery including 70S ribosomes and RNA.
- 145** (b) Statements I, III and IV are correct, while II is incorrect. Its corrected form is as follows  
 Endoplasmic reticulum is not the control centre of the cell. Nucleus controls all the activities occurring within the cell and is hence called as the control centre of a cell.
- 147** (b) Statements III and IV hold true regarding the error made by student, while labelling different components of plasma membrane. The correct information regarding the statements is as follows
- Glycolipids are found directly attached to lipid bilayer whereas carbohydrate moiety attached to the membrane proteins is glycoprotein.
  - Protein B is embedded in the plasma membrane and therefore, it should be labelled as integral protein. Peripheral proteins are present on the surface of lipid bilayer.
- 148** (a) Statements I and II are correct, while III and IV are incorrect and can be corrected as
- Prokaryotes contain mesosomes which perform similar function like eukaryotic mitochondria, i.e. respiration.





- Prokaryotes do not contain any membrane bound organelles and ribosomes are non-membranous organelles found in both prokaryotic and eukaryotic cells.
- 150 (c)** Statement I is false and II is true. The incorrect statement can be corrected as  
 Inclusion bodies in prokaryotic cells are not bound by any membrane. No membrane bound organelle is found in prokaryotic cells.
- 152 (b)** Both I and II are false and can be corrected as
- The plasma membrane of human erythrocyte contains approximately 52% protein and 40% lipids along with few carbohydrates about 48%.
  - The fluidity of plasma membrane ensures that the proteins can easily move within the lipid bilayer and not lipid molecules.
- 161 (a)** Option (a) is incorrect and can be corrected as Robert Brown discovered the nucleus.  
 Rest of the options are correct.
- 163 (c)** Option (c) is correct. Rest of the options are incorrect and can be corrected as
- Only eukaryotic cells have a nucleus.
  - A well-defined cell wall is present only in plant cells. It is absent in animal cells.
  - Cells arise from pre-existing cells.
- 167 (d)** Gas vacuoles are also known as pseudovacuoles or air vacuoles. These are the characteristic feature of prokaryotes. These store metabolic gases and take part in buoyancy regulation.
- 168 (c)** A polysome consists of a cluster of ribosomes that are held simultaneously by a strand of messenger RNA (mRNA) in rosette or helical group. These contain a portion of the genetic code that each ribosome is translating and are used in the formation of multiple copies of same polypeptide.
- 169 (b)** Out of the given options, *Anabaena* is not an eukaryote as it is a prokaryote and a cyanobacteria belonging to the group, eubacteria. It possesses prokaryotic characteristic features, i.e. the absence of membrane bound organelles and undefined nucleus.
- 170 (b)** Presence of cell wall is the common feature that is observed in both prokaryotic and in some eukaryotic cells.  
 Cell wall is present in bacteria (prokaryotes) and in plants (eukaryotes) however, cell wall is absent in animal cells.  
 Cell wall acts as protection unit for cell and also provides shape to the cell. Cell wall is made up of cellulose, hemicellulose or pectins in plants.
- 171 (a)** Statement in option (a) is not true for an eukaryotic cell. The incorrect statement can be corrected as  
 A cell wall made up of peptidoglycan is found in bacteria and not in eukaryotes.  
 Eukaryotic plant cell wall is made up of cellulose, hemicellulose, pectin, chitin, etc.  
 Rest of the statements are correct for an eukaryotic cell.
- 172 (a)** Option (a) represents the correct arrangement of cells in an ascending order of their size. Cells in organism vary greatly in their size, shapes and activities.
- I. Mycoplasmas are the smallest cell with size only 0.3  $\mu\text{m}$ .
  - IV. Bacterial cells are of size 30-5  $\mu\text{m}$ .
  - III. In human, red blood cells are of about 7.0  $\mu\text{m}$  in diameter.
  - II. Ostrich eggs are among the largest cells with size (15  $\times$  13 cm).
- 173 (d)** The statement in option (d) is not true for plasma membrane. The correct form of this statement is as follows  
 The biochemical investigation done on cell membrane clearly demonstrates that the cell membrane possesses lipids, protein and carbohydrates as biochemical components.  
 Rest of the statements are correct.
- 175 (b)** Statement in option (b) is true for secretory cell.  
 Rest of the options are incorrect and can be corrected as
- Both Smooth Endoplasmic Reticulum (SER) and Rough Endoplasmic Reticulum (RER) are observed in secretory cells.
  - The secretory cells contain large amount of Golgi apparatus.
  - Secretory granules are formed outside the nucleus.
- 176 (c)** In plant cell, the vacuole is bound by a single membrane called tonoplast. It facilitates the transport of ions and other material against the concentration gradient into the vacuole.
- 177 (d)** Janus green is the stain used to visualise mitochondria. It acts as an indicator and changes colour according to the amount of oxygen present. It oxidises to blue colour in the presence of oxygen and in the absence of  $\text{O}_2$ , it changes its colour to pink.
- 178 (c)** The presence of thylakoids, the structural elements of chloroplast, differentiates them (plastids) from mitochondria.  
 Thylakoids are flattened sacs stacked one above the other to form grana. They perform specific functions in photosynthesis.
- 179 (d)** The statement in option (d) is not true.  
 Ribosomes are called as protein factory and they play a vital role in protein synthesis.  
 Rest of the statements are true.
- 180 (a)** Cytoskeleton is not associated with intracellular transport. The microtubules and microfilaments are the components of cytoskeleton and are responsible for cellular and intercellular movements.  
 Rest of the options are functions of cytoskeleton in a cell.
- 182 (b)** Safranin is used as a counterstain in Gram staining and endospore staining. It can also be used for the detection of cartilage and mast cell granule. However, it is not used to stain chromosomes.