CLASS 11 BIOLOGY NCERT SOLUTIONS

NCERT Solutions for Class 11 Biology Chapter 8: Cell – The Unit of Life – Free PDF Download

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Contents

Chapter 8, “Cell – The Unit of Life”, introduces the cell as the fundamental structural and functional unit of all living organisms, tracing the development of cell theory and contrasting the simple organisation of **prokaryotic cells** with the compartmentalised, organelle-rich structure of **eukaryotic cells**. It covers the plasma membrane and its fluid mosaic model, the cell wall, the endomembrane system (endoplasmic reticulum, Golgi apparatus, lysosomes, vacuoles), mitochondria, plastids, ribosomes, the cytoskeleton, cilia and flagella, the centrosome, and the nucleus. These Class 11 Biology Chapter 8 solutions are also useful as quick revision notes before exams.

Exercises

Q1. 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) A unicellular organism carries out its life activities within a single cell.

Answer: Statement **(a)** is not correct. It was **Robert Hooke**, not Robert Brown, who first discovered and named the cell in 1665 while examining a thin slice of cork under a self-designed microscope. Robert Brown is credited with the discovery of the **nucleus** in 1831, not the cell itself. Statements (b), (c) and (d) are all correct: Schleiden and Schwann jointly proposed the cell theory, Virchow modified it by explaining that cells arise from pre-existing cells (*Omnis cellula-e cellula*), and a unicellular organism indeed performs all life activities — nutrition, respiration, excretion, reproduction — within the boundary of one single cell.

Q2. New cells generate from

(a) bacterial fermentation (b) regeneration of old cells (c) pre-existing cells (d) abiotic materials

Answer: The correct option is **(c) pre-existing cells**. This principle was established by Rudolf Virchow in 1855, who showed that cells divide to form new cells, and that new cells cannot arise spontaneously from non-living (abiotic) matter or through any process other than division of an already-existing cell.

Q3. Match the following

Column I	Column II
(a) Cristae	(ii) Infoldings in mitochondria
(b) Cisternae	(iii) Disc-shaped sacs in Golgi apparatus
(c) Thylakoids	(i) Flat membranous sacs in stroma

Answer: Cristae are the finger-like infoldings of the inner mitochondrial membrane that project into the matrix and increase the surface area available for the enzymes of aerobic respiration. **Cisternae** are the flat, disc-shaped membranous sacs, stacked parallel to one another, that make up the Golgi apparatus. **Thylakoids** are flattened membranous sacs present in the stroma of the chloroplast; they are stacked to form grana and contain the chlorophyll pigments involved in the light reactions of photosynthesis.

Q4. Which of the following is correct?

(a) Cells of all living organisms have a nucleus.
(b) Both animal and plant cells have a well-defined cell wall.
(c) In prokaryotes, there are no membrane-bound organelles.

(d) Cells are formed de novo from abiotic materials.

Answer: The correct option is **(c) In prokaryotes, there are no membrane-bound organelles**. Prokaryotic cells (bacteria, blue-green algae, mycoplasma) lack a nuclear membrane as well as membrane-bound organelles such as mitochondria, plastids, ER, Golgi apparatus and lysosomes; the only organelles they possess are ribosomes, which are not membrane-bound. Option (a) is wrong because prokaryotes and mature mammalian RBCs lack a nucleus; (b) is wrong because animal cells do not have a cell wall; (d) is wrong because Virchow established that cells arise only from pre-existing cells, not spontaneously from non-living material.

Q5. What is a mesosome in a prokaryotic cell? Mention the functions that it performs.

A **mesosome** is a specialised, differentiated form of the plasma membrane found in prokaryotic cells. It is formed by the extension (infolding) of the plasma membrane into the cell in the form of vesicles, tubules and lamellae. Mesosomes perform several important functions: they help in **cell wall formation**, aid in **DNA replication** and its distribution to the two daughter cells during cell division, assist in **respiration** and secretion processes, and increase the effective **surface area of the plasma membrane** along with its enzymatic content.

Q6. How do neutral solutes move across the plasma membrane? Can the polar molecules also move across it in the same way? If not, then how are these transported across the membrane?

Neutral solutes move across the plasma membrane by **simple diffusion**, travelling along the concentration gradient, i.e., from a region of higher concentration to a region of lower concentration, without any expenditure of energy. Water moves in a similar passive manner by **osmosis**, from higher to lower water concentration. However, **polar molecules cannot cross the membrane in the same way** because the interior of the phospholipid bilayer is hydrophobic and repels charged or polar substances. Such molecules require the help of specific **carrier proteins** embedded in the membrane. Some polar/ionic substances move down their concentration gradient with the help of carrier proteins without using energy (facilitated transport), while others are moved **against** their concentration gradient — from lower to higher concentration — which is an energy-dependent process called **active transport**, using ATP; the Na^+/K^+ pump is a classic example.

Q7. Name two cell-organelles that are double membrane bound. What are the characteristics of these two organelles? State their functions and draw labelled diagrams of both.

The two double membrane-bound organelles are the **mitochondrion** and the **chloroplast** (a type of plastid).

Mitochondrion: It is typically sausage-shaped or cylindrical, about 0.2–1.0 µm in diameter and 1.0–4.1 µm in length, bound by two membranes — a smooth outer membrane and a folded inner membrane. The infoldings of the inner membrane are called **cristae**, which project into the matrix and increase the surface area for respiratory enzymes. The space enclosed by the inner membrane is filled with a dense homogeneous substance called the **matrix**, which contains a single circular DNA molecule, a few RNA molecules, ribosomes (70S) and the enzymes needed for cellular respiration. Mitochondria are the sites of aerobic respiration and produce ATP, the energy currency of the cell — hence they are called the "powerhouses" of the cell. They multiply by fission.
Labelled diagram parts: outer membrane, inner membrane, cristae, matrix, inter-membrane space.

Chloroplast: Found in green plant cells, it is generally lens-shaped or oval, 5–10 µm long and 2–4 µm wide, and bound by two membranes, the inner of which is less permeable. The space enclosed by the inner membrane is called the **stroma**, which contains flattened membranous sacs called **thylakoids**, stacked like piles of coins to form **grana**, interconnected by tubular **stroma lamellae**. The thylakoid membranes contain chlorophyll and carry out the light reactions of photosynthesis, while the stroma contains enzymes for carbon fixation, along with its own circular DNA and 70S ribosomes. Chloroplasts are the site of photosynthesis, converting light energy into chemical energy stored in carbohydrates.
Labelled diagram parts: outer membrane, inner membrane, stroma, granum, thylakoid, stroma lamella.

Q8. What are the characteristics of prokaryotic cells?

Prokaryotic cells, represented by bacteria, blue-green algae (cyanobacteria), mycoplasma and PPLO, show the following characteristics:

They are generally very small (typically 1–10 µm) and multiply much faster than eukaryotic cells.

They lack a true, membrane-bound nucleus; the genetic material (a single circular DNA/chromosome) lies freely in the cytoplasm as a region called the **nucleoid**. Many also contain small circular extra-chromosomal DNA called **plasmids**, which can confer traits such as antibiotic resistance.

They lack membrane-bound organelles such as mitochondria, plastids, ER, Golgi apparatus, lysosomes and vacuoles. The only organelles present are **ribosomes** (70S), which are not membrane-bound.

A cell wall is present in almost all prokaryotes (except mycoplasma), surrounding the plasma membrane; along with the glycocalyx it forms the cell envelope.

Specialised infoldings of the plasma membrane called **mesosomes** and, in some cyanobacteria, **chromatophores**, are present.

Reserve food material is stored as free, non-membrane-bound **inclusion bodies** (e.g., glycogen granules, phosphate granules) or as gas vacuoles.

Motile forms bear simple, filamentous **flagella** made of the protein flagellin; surface structures such as pili and fimbriae may also be present, though not involved in motility.

Q9. Multicellular organisms have division of labour. Explain.

In multicellular organisms, cells are not identical repeating units performing all functions independently; instead, different groups of cells become structurally and functionally specialised to carry out particular tasks. Such specialised cells organise into **tissues**, tissues combine to form **organs**, and organs work together as **organ systems**. For example, in humans, muscle cells specialise in contraction for movement, nerve cells specialise in conducting impulses, and red blood cells specialise in carrying oxygen. This **division of labour** allows each type of cell to perform its function with greater efficiency than a single generalised cell could, and it allows the organism as a whole to carry out complex physiological processes such as digestion, circulation, respiration and reproduction in a coordinated manner.

Q10. Cell is the basic unit of life. Discuss in brief.

The cell is regarded as the **basic structural and functional unit of life** because it is the smallest unit capable of independent existence and of performing all the essential activities of life — nutrition, respiration, excretion, growth, reproduction and response to stimuli. Unicellular organisms demonstrate this most clearly, since a single cell alone is sufficient to sustain life. All organisms, whether unicellular or multicellular, are built up of one or more cells, and no structure simpler than a complete cell can carry out independent living. Every cell arises from a pre-existing cell by division, ensuring continuity of life from one generation of cells to the next. This is the essence of the cell theory: (i) all living organisms are composed of cells and products of cells, and (ii) all cells arise from pre-existing cells.

Q11. What are nuclear pores? State their function.

Nuclear pores are minute openings formed at numerous points where the outer and inner membranes of the nuclear envelope fuse together, interrupting the double-membraned envelope that separates the nucleus from the cytoplasm. Their function is to serve as passages that allow the bidirectional movement of **RNA and protein molecules** between the nucleus and the cytoplasm, thereby permitting communication and exchange of material between the nucleoplasm and the surrounding cytoplasm.

Q12. Both lysosomes and vacuoles are endomembrane structures, yet they differ in terms of their functions. Comment.

Lysosomes are small, membrane-bound vesicular structures formed by the packaging activity of the Golgi apparatus. They are rich in hydrolytic enzymes (hydrolases such as lipases, proteases and carbohydrases) that remain optimally active at acidic pH. Lysosomes digest carbohydrates, proteins, lipids and nucleic acids, both materials taken up from outside the cell and worn-out cell organelles, and are therefore often called the “suicide bags” of the cell because they can bring about the digestion of the cell’s own contents.

Vacuoles, by contrast, are membrane-bound (the surrounding membrane is called the **tonoplast**) sac-like spaces in the cytoplasm that store water, cell sap, excretory products, and other materials not immediately useful to the cell. In plant cells, vacuoles may occupy up to 90 percent of cell volume and help maintain turgor pressure; the tonoplast actively transports ions and solutes into the vacuole against a concentration gradient. In *Amoeba*, a contractile vacuole performs osmoregulation and excretion, and in many protists, food vacuoles are formed to digest engulfed food particles. Thus, although both are parts of the endomembrane system, lysosomes function mainly in intracellular digestion while vacuoles primarily function in storage, osmoregulation and maintenance of cell turgidity.

Q13. Describe the structure of the following with the help of labelled diagrams: (i) Nucleus (ii) Centrosome

(i) Nucleus: First described by Robert Brown in 1831, the nucleus is usually spherical and is bound by a double-membraned **nuclear envelope**, the two membranes being separated by a fluid-filled **perinuclear space** (10–50 nm). The outer membrane is often continuous with the endoplasmic reticulum and bears ribosomes on its surface. The envelope is interrupted at several points by **nuclear pores**, which allow exchange of RNA and proteins between nucleus and cytoplasm. Inside, the nucleus contains the **nucleoplasm**, in which lie the loosely organised **chromatin** fibres (made of DNA and histone proteins) and one or more spherical **nucleoli**, which are the sites of ribosomal RNA synthesis.
Diagram parts to label: nuclear envelope (outer and inner membrane), perinuclear space, nuclear pore, nucleoplasm, chromatin, nucleolus.

(ii) Centrosome: The centrosome is a non-membrane-bound organelle, found near the nucleus in animal cells, consisting of two cylindrical structures called **centrioles** lying perpendicular to one another,

surrounded by amorphous pericentriolar material. Each centriole has a “cartwheel” organisation made of nine evenly spaced peripheral fibrils of the protein tubulin, with each peripheral fibril actually being a triplet; the adjacent triplets are interlinked, and the central proteinaceous hub is connected to the peripheral triplets by radial spokes. Centrioles form the basal bodies of cilia and flagella, and give rise to the spindle fibres of the spindle apparatus during cell division.
Diagram parts to label: two centrioles at right angles, pericentriolar material, peripheral triplet tubulin fibrils, hub, radial spokes.

Q14. What is a centromere? How does the position of the centromere form the basis of classification of chromosomes? Support your answer with a diagram showing the position of centromere on different types of chromosomes.

A **centromere** is the primary constriction on a chromosome, visible only during cell division, at either side of which disc-shaped structures called **kinetochores** are present. It holds the two sister chromatids of a chromosome together and serves as the point of attachment for spindle fibres during nuclear division.

Based on the **position of the centromere**, chromosomes are classified into four types:

Metacentric — the centromere lies in the middle, producing two equal arms.

Sub-metacentric — the centromere is slightly away from the middle, giving one shorter and one longer arm.

Acrocentric — the centromere lies close to one end, giving one extremely short arm and one very long arm.

Telocentric — the centromere is located right at the terminal end of the chromosome, so there is effectively only one arm.

Diagram description: four rod-shaped chromosomes shown side by side, each with a labelled centromere placed at the middle, slightly off-middle, near one end, and at the very end respectively, illustrating the metacentric, sub-metacentric, acrocentric and telocentric forms.

Class 11 Biology Chapter 8 – Notes and Extra Questions

This chapter’s NCERT exercise consists of exactly **14 questions** — four objective-type questions (Q1–Q4, including a “not correct/correct” identification format and a match-the-column question) followed by ten descriptive questions (Q5–Q14) that range from short definitional answers (mesosome, nuclear pores, centromere) to longer explanatory answers requiring labelled diagrams (double membrane-bound organelles, nucleus, centrosome, and chromosome classification by centromere position). Based on cross-verification against the official NCERT textbook and multiple current solution sources, this exercise set has remained unchanged through the 2023 syllabus rationalisation — it is identical in numbering, wording and structure to the exercise carried in earlier editions of this chapter. While answering, students should be precise about numerical/terminological details examiners frequently test: 70S ribosomes in prokaryotes, mitochondria and chloroplasts versus 80S ribosomes in the eukaryotic cytoplasm; the distinction between cristae (mitochondria), thylakoids (chloroplast) and cisternae (Golgi apparatus); and the exact difference between passive diffusion, facilitated transport and energy-dependent active transport across the plasma membrane. Diagram-based questions (Q7, Q13, Q14) carry significant marks in board exams, so

practising labelled sketches of the mitochondrion, chloroplast, nucleus, centrosome and the four chromosome types is strongly recommended.

What is the difference between 70S and 80S ribosomes?

Ribosomes are classified by their sedimentation coefficient, measured in Svedberg units (S). Prokaryotic cells, along with mitochondria and chloroplasts inside eukaryotic cells, contain smaller **70S ribosomes**, made of a 50S large subunit and a 30S small subunit. The cytoplasm of eukaryotic cells contains larger **80S ribosomes**, made of a 60S large subunit and a 40S small subunit. Both types are composed of ribosomal RNA and protein and are not bound by any membrane.

Why are mitochondria called the “powerhouse of the cell”?

Mitochondria are called the powerhouse of the cell because they are the principal site of aerobic respiration, where oxygen is used to break down food molecules and generate **ATP** (adenosine triphosphate), the energy currency that powers almost all cellular activities. The infolded inner membrane (cristae) provides a large surface area for the respiratory enzymes that carry out this ATP-generating process.

What is the fluid mosaic model of the cell membrane?

Proposed by Singer and Nicolson in 1972, the **fluid mosaic model** describes the plasma membrane as a bilayer of phospholipid molecules (with polar heads facing outward and hydrophobic tails facing inward), studded with proteins that can be either embedded within the bilayer (integral proteins) or attached to its surface (peripheral proteins). Because the lipid bilayer is quasi-fluid, these proteins can move laterally within the membrane, a property called membrane fluidity, which is essential for processes like cell growth, secretion, endocytosis and cell division.

How many questions are there in the NCERT Class 11 Biology Chapter 8 exercise, and are they still relevant after the 2023 syllabus rationalisation?

The current NCERT Class 11 Biology textbook (2023 rationalised edition, applicable for the 2026–27 session) carries exactly **14 exercise questions** at the end of Chapter 8 — the same set of questions, in the same order and wording, that appeared in pre-rationalisation editions of this chapter. Unlike several other chapters that were significantly trimmed during rationalisation, the Cell: The Unit of Life exercise has not been shortened, so students preparing from this chapter’s official exercise are working with a stable, unchanged question set.