



Here is the complete, exhaustive Cell The Building Block of Life [NCERT](#) Exercise Class 9 Exploration

Part 1: Chapter Introduction & "Think It Over"

Q: Where does a cell come from?

A: New cells are formed only from pre-existing cells. This happens through a process called cell division.

Q: How have technological interventions facilitated the creation of new knowledge in understanding the world beyond the naked eye?

A: The human eye has a limit of resolution of about 0.1 mm . Technological inventions like the light microscope and electron microscope allow scientists to magnify objects up to the nanometre scale, revealing the existence of tiny cells and their internal structures .

Q: How is the cell structural and functional unit of life?

A: Structurally, all living organisms are made up of cells. Functionally, a cell is like a tiny living factory where different organelles carry out various life processes (like producing energy or removing waste) independently .

Q: How does a cell multiply?

A: A cell multiplies through a process called cell division, specifically through mitosis or meiosis .

Q: What are the different components of a cell?

A: Most cells have three basic parts: a selectively permeable plasma membrane, a jelly-like cytoplasm, and a prominent nucleus . Inside the cytoplasm, there are also various organelles like mitochondria, endoplasmic reticulum, and vacuoles.

Q: How do cells in our body communicate with each other?

A: All living cells communicate with their surroundings and their neighbouring cells through the cell membrane.

Q: Do cells live forever, or do they die?

A: Cells do not live forever. They grow, carry out their functions, and eventually die when they are no longer needed (a process called Programmed Cell Death) or get damaged, after which they are replaced by new cells .

Part 2: In-Text Questions (Sections 2.1 & 2.2)

Q: What do we call the ability of the human eye to see two very close objects as separate and distinct?

A: This is called the limit of resolution of the human eye, which is 0.1 mm.

Q: how have cell biologists studied the structure and function of cells that are much smaller than the limit of resolution of the human eye?

A: Scientists use light microscopes and powerful electron microscopes to magnify images and reveal fine details of cell structures .

Q: Under the microscope, you will see a magnified image of an object. Can you estimate its actual size?

A: Yes, by placing a transparent ruler with millimetre markings on the microscope stage to measure the diameter of the field of view, and then counting the number of cells that fit across that diameter .

Q: If the estimated size of an onion peel cell is 200 μm , how much does a light microscope magnify this cell?

A: If both the eyepiece and the objective lens have a magnifying power of 10X, the total magnification is 100X. This means the cell will appear 100 times larger.

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Q: How does the structure of the cell membrane in the cells of alveoli control the movement of substances across it?

A: The cell membrane is selectively permeable, which means it allows specific substances (like oxygen and carbon dioxide) to pass through it while blocking others .

Part 3: Embedded Activities & "What Ifs"

Activity 2.2: Let us experiment

Q: What do you observe? You may observe that-

A: The potato piece in Beaker A (plain water) swells, and the potato piece in Beaker B (20 per cent salt solution) shrinks.

Q: What if mung bean seeds are kept in a concentrated solution after soaking in water for 12 hours? Q: What will happen to them?

A: The soaked mung beans will shrink. The concentrated solution outside is hypertonic, so the seeds will lose water to the surrounding solution through osmosis .

Q: What do you infer? What do you expect in terms of changes in their weight?

A: The weight of the potato piece in Beaker A has increased as it absorbed water, while the weight of the potato piece in Beaker B has decreased because it lost water.

Q: What if... a cell is kept in salt or sugar solutions of different concentrations?

A: If kept in an isotonic solution, the cell stays the same. In a hypotonic solution (dilute), the cell swells. In a hypertonic solution (concentrated), the cell shrinks .

Activity 2.3: Let us investigate

Q: What do you think is the necessity of the cell wall in these cells?

A: Since plants cannot move to seek shelter, they need a rigid cell wall to withstand environmental stresses like wind and rain, and to keep the plant upright .

Q: What do you observe? *(After observing onion and cheek cells)*

A: Onion peel cells are box-shaped and regularly arranged, whereas cheek cells are irregularly arranged.

Q: Why do you think this difference exists?

A: Plant cells (onion) have a rigid cell wall outside the membrane that maintains a fixed shape . Animal cells (cheek) lack a cell wall, allowing them to change shape easily.

Q: Observe them under a microscope after half an hour. What do you observe? *(After adding 20 per cent sugar solution)*

A: In the plant cells, the outer boundary remains the same but the inner content shrinks and pulls away from the cell wall. The cheek cells, lacking a cell wall, shrink considerably entirely.

Part 4: "Pause and Ponder" (1-3)

1. What argument would you give for the necessity of a cell wall in plants usually fixed in one place versus in animals usually moving from one place to the other?

A: Plants cannot move away from harsh weather, so they require a rigid cell wall to withstand environmental stresses and remain upright. Animals move freely; lacking a cell wall provides the cellular flexibility necessary for the movement of animal tissues.

2. What consequences would you predict for a plant cell if its cell wall were to become as flexible as a cell membrane?

A: The plant cell would lose its ability to remain firm and maintain its shape against internal water pressure. Without a rigid structure, the entire plant would likely wilt and collapse.

3. Why is it important to cut the two potato pieces in roughly equal size and measure their initial weight before placing them in different liquids?

A: Measuring the initial weight establishes a baseline. It allows you to accurately calculate the difference between the initial and final weights, providing clear, mathematical proof of how much water was gained or lost due to osmosis.

Part 5: Cell Interior & More Activities

Q: Which of the cells given in Fig. 2.10 fall under the categories of prokaryotic and eukaryotic cells?

A: The bacterial cell (a) is a prokaryotic cell because it lacks a well-defined nucleus. The plant cell (b) and animal cell (c) are eukaryotic cells because they have a well-defined nucleus and membrane-bound organelles.

Q: Do you know any other cells without nucleus?

A: Yes. Blood platelets in humans also lack a nucleus. In plants, mature sieve tube elements (which transport food) lose their nucleus to allow nutrients to flow freely.

Q: How does the cell prevent these wastes from accumulating inside it?

A: Cells use Lysosomes. Lysosomes are filled with enzymes that break down unwanted wastes and damaged organelles, keeping the cell clean.

Q: But where do plants synthesise their food and obtain energy for cellular activities?

A: Plants synthesise food using special organelles called plastids (specifically chloroplasts) in the presence of sunlight.

Q: Are there any other plastids in plant cells that contain any pigments other than the green pigments?

A: Yes, there are plastids called chromoplasts that contain yellow, orange, or red pigments.

Q: How do flowers, fruits, and vegetables acquire varied colours?

A: They acquire varied bright colours from the pigments stored inside their chromoplasts.

Q: But where are water, minerals, and waste materials stored in the cell?

A: They are stored in the vacuole. In plant cells, there is usually one large central vacuole filled with a watery fluid called cell sap.

Q: Why do plants look wilted when they do not get enough water?

A: When a plant does not get enough water, the large central vacuole loses water. This causes the cells to become less firm, resulting in the plant wilting.

Part 6: "Pause and Ponder" (4-7)

4. Do white flowers contain any pigment? Give reasons.

A: No, white flowers generally do not contain a pigment. Instead, their cells contain colourless plastids called *leucoplasts*, which are used to store starch, oils or proteins. The white color is an optical effect caused by the reflection of light.

5. Draw a well-labelled schematic diagram of a plant or an animal cell using these clues (i) Nucleus appears as a dark and round body inside the cell. (ii) ER spreads like a network of extended nuclear envelope. (iii) Mitochondria and chloroplasts are rod shaped.

A: (You can copy Fig. 2.10b or 2.10c exactly as instructed by these clues).

6. Instead of many small ones, why does a cell not have a single giant mitochondrion? How does this relate to the concept of surface area?

A: Having many small mitochondria, combined with their inner folded membranes (cristae), dramatically increases the total surface area inside the cell. A larger surface area allows for many more chemical reactions to happen at once, making energy (ATP) production much faster and more efficient .

7. If the skin cells start dividing by meiosis instead of mitosis, what do you think will happen to a cut on the skin?

A: Mitosis produces genetically identical cells with the exact same number of chromosomes to repair tissue . If skin divided by meiosis, the new cells would only have half the normal chromosomes . The cut would not heal properly because the new cells would be genetically incomplete.

Part 7: Cell Division & Society (Activity 2.5)

Q: When you get a small cut on your skin, it heals after a few days. When hair fall out, new hair grow back. How does this happen?

A: It happens because cells in our body can grow and divide (through mitosis) to replace the old, dead, or damaged cells .

Q: Do you observe the roots growing? A: Yes, the roots of the onion bulb will grow downward into the water over 5-6 days.

Q: What do you observe? Do you observe the cells of the onion root tip? Are they similar in structure?

A: We observe the cells of the root tip, but they are not all similar in structure .

Q: Do you find any structural differences in these cells? If yes, why is it so?

A: Yes, there are structural differences because the cells at the growing tip are continuously dividing. The structural differences correspond to the different stages of cell division .

Q: Can you identify which stage comes first during cell division?

A: The first visible stage is when the tangled chromatin material gets organised into visible, rod-shaped chromosomes .

Q: What happens if meiosis and mitosis do not happen properly?

A: Errors in mitosis can lead to uncontrolled cell division and tumour formation. Errors in meiosis can result in genetic disorders, developmental problems, or reduced fertility .

Q: Do cells grow and reproduce forever?

A: No, they do not reproduce forever. Every cell has a definite life span. They grow, carry out their functions, and eventually die when no longer needed .

Q: How do cells monitor their growth to maintain a balance?

A: In many animal cells, growth is monitored by *contact inhibition*, where cell division stops when cells touch neighbouring cells . They also maintain balance through Programmed Cell Death (PCD) .

Q: How do cancer cells grow and spread?

A: Cancer cells lose the control mechanism of contact inhibition and start growing and dividing uncontrollably, forming tumours that can invade nearby tissues and spread to other parts of the body.

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Part 8: "Revise, Reflect, Refine" (Exercises)

1. Differentiate between the following pairs of terms based on the clues given in parentheses:

(i) Cell membrane and cell wall (permeability): Cell membrane is *selectively permeable* (allows only specific substances). Cell wall is *permeable* (allows water and dissolved minerals freely).

(ii) RER and SER (structure): RER looks rough because it has ribosomes attached to its surface. SER looks smooth because it lacks ribosomes.

(iii) Chloroplasts and chromoplasts (pigments): Chloroplasts contain green chlorophyll. Chromoplasts contain other coloured pigments (yellow, orange, or red).

2. Two similar animal cells are placed in two different solutions: • Cell X is placed in pure water. • Cell Y is placed in a concentrated salt solution. Cells are observed after some time. Cell X swells, and Cell Y shrinks. Which statement provides the correct explanation for the above observations? (i) Salt molecules moved into Cell Y, causing it to shrink. (ii) Water moved into Cell X and more water moved out of Cell Y than the salt solution entered in it. (iii) Water moved into Cell X and moved out of Cell Y through the cell membrane. (iv) Solute movement caused osmosis in both cells.

A: (iii) Water moved into Cell X and moved out of Cell Y through the cell membrane.

3. Look at the diagram of a cell in Fig. 2.20. Identify the parts labelled from (a) to (g) and correctly match them with their functions given below:

(i) Controlling all the activities of a cell.

(ii) Site of cellular respiration.

(iii) Storage organelle that also provides rigidity to the cell.

(iv) Separates the cell contents from surroundings.

(v) Provides structural rigidity to the cell.

(vi) Packs and stores materials received from ER.

(vii) Helps in manufacturing food.

A: * (b) Nucleus --> (i) Controlling all the activities of a cell.

- (a) Mitochondria --> (ii) Site of cellular respiration.
- (g) Vacuole --> (iii) Storage organelle that also provides rigidity to the cell.
- (f) Cell membrane --> (iv) Separates the cell contents from surroundings.
- (e) Cell wall --> (v) Provides structural rigidity to the cell.
- (c) Golgi apparatus --> (vi) Packs and stores materials received from ER.
- (d) Chloroplast --> (vii) Helps in manufacturing food.

4. Which of the following option(s) of the pairs of cell organelles are correctly placed under the given categories?

A: (i) Present in the plant cells: Leucoplast | Absent in the animal cells: Cell wall.

5. Two students, Renu and Rohit, were having a discussion on the plastids. Renu emphasised that all parts of the plants, even roots, contain plastids. However, Rohit did not agree with the statement and told her that plastids are absent in plant roots since the roots are underground and do not need to perform photosynthesis. Who is correct? Justify your answer.

A: Renu is correct. While roots do not need to perform photosynthesis, they still contain colourless plastids called *leucoplasts*.

Leucoplasts are specifically used to store food materials like starch, oils or proteins.

6. Mitochondria and chloroplasts are two important organelles in a plant cell. Discuss how these two organelles are structurally and functionally similar to each other, and different from each other.

A: Similarities: Structurally, both are double-membrane-bound organelles. They both have their own DNA and ribosomes, allowing them to make some of their own proteins. **Differences:** Functionally, mitochondria break down glucose to release energy (cellular respiration). Chloroplasts absorb light to synthesise food (photosynthesis).

7. Which of the following pairs of cell organelles contains DNA? (i) *Chloroplasts, Ribosomes* (ii) *Mitochondria, Nucleus* (iii) *Golgi bodies, Ribosomes* (iv) *Nucleus, Lysosomes*

A: (ii) Mitochondria, Nucleus.

8. A researcher carried out an experiment in which she took two carrots of similar size. She placed one carrot in plain water and the other carrot in concentrated salt solution (Fig. 2.21). After 24 hours she recorded her observations.

(i) What hypothesis does she want to test through this experiment?

(ii) What would you suggest for the improvement of this experiment?

(iii) Why does the carrot in plain water stay stiff and crunchy, but the carrot in concentrated salt solution become rubbery and limp?

A: (i) She is testing the hypothesis that the direction of water movement (osmosis) across a cell membrane depends on the solute concentration of the surrounding medium.

(ii) She should measure and record the initial and final weights of the carrots to obtain exact quantitative data.

(iii) The plain water is hypotonic, so water enters the cells, creating internal pressure that keeps the carrot stiff. The salt solution is hypertonic, so the cells lose water. The cell membrane pulls away from the cell wall, making the tissue limp and rubbery.

9. Indicate the presence or absence of following structures in bacterial and animal cells:

A: * Chromosome --> Bacterial cell: Present (as nucleoid); Animal cell: Present

- Nucleus --> Bacterial cell: Absent; Animal cell: Present
- Mitochondria --> Bacterial cell: Absent; Animal cell: Present
- Golgi complex --> Bacterial cell: Absent; Animal cell: Present
- Chromoplasts --> Bacterial cell: Absent; Animal cell: Absent (specific to plants)

10. Carry out the following experiment: Take four peeled potato halves and scoop each one out to make potato cups. One of these potato cups should be made from a boiled potato. Place each of the potato cups in a beaker containing water (Fig. 2.22). Now, set up the experiment as follows:

(a) Keep Cup A empty.

(b) Add one teaspoon sugar in Cup B.

(c) Add one teaspoon salt in Cup C.

(d) Add one teaspoon sugar in the boiled potato in Cup D. Observe the four potato cups at least two hours and answer the following questions:

(i) Explain why water gathers in the hollowed portion of Cup B and Cup C.

(ii) Why is Cup A necessary for this experiment?

(iii) Explain why water does not gather in the hollowed portions of Cups A and D.

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A: (i) The sugar and salt create a concentrated (hypertonic) environment inside Cups B and C. Through osmosis, water moves from the dilute beaker, through the potato cells, and into the hollows .

(ii) Cup A acts as a control to prove that water will not spontaneously gather inside the potato without a solute to cause osmosis.

(iii) Cup A has no solute to create a concentration difference. Cup D is boiled, which kills the cells and destroys the selectively permeable cell membrane, halting osmosis entirely.

11. Identify the pair that incorrectly matches the cell organelle with its function.

(i) *Ribosome - Protein synthesis*

(ii) *SER-Lipid and cellulose synthesis*

(iii) *Lysosome - Digestion of foreign agents*

A: (ii) SER-Lipid and cellulose synthesis. (Explanation: SER synthesises lipids, but cellulose is synthesised to form the plant cell wall, not by the SER).

12. What outcome do you expect, if all the mitochondria are removed from a eukaryotic cell?

A: The cell would lose its ability to break down glucose and release energy (ATP) through cellular respiration . Without this energy, the cell would cease all activities and eventually die.

13. Which phenomenon inhibits the formation of tumors in the human body? Can plants also develop tumors? Explain.

A: Contact inhibition is the phenomenon that stops animal cells from dividing uncontrollably when they come in contact with neighbouring cells . Due to their rigid cell walls, plant cells do not show contact inhibition and follow a different pattern of growth. *(Note: Plants can develop abnormal growths called galls, but they do not develop systemic spreading tumours like humans do).*

14. The cell membrane of a cell is made up of proteins and lipids. Which cell organelles help in the synthesis of cell membrane? Write the path of these compounds from their site of synthesis to the cell membrane and show this through a labelled diagram.

A: The Rough Endoplasmic Reticulum (RER) synthesises proteins, and the Smooth Endoplasmic Reticulum (SER) synthesises lipids . Path: RER/SER --> Vesicles --> Golgi Apparatus (packaged and modified) --> Secretory Vesicles --> Cell Membrane. *(Refer to Fig. 2.13 for the diagram).*

15. What would happen if gametes are formed by mitotic divisions?

A: Mitosis produces cells with the exact same number of chromosomes . If gametes (sperm and egg) were formed by mitosis, the resulting embryo would have double the normal number of chromosomes when they fuse. This would cause severe genetic abnormalities, making survival impossible .

16. A farmer, Deepa, was very happy with the harvest of amla (Indian Gooseberry) and lemons on her farm... Based on the above passage answer the following questions:

(i) Which scientific concept has the farmer applied in the preservation of the farm produce?

(ii) How does the addition of high concentrations of salt and sugar create an environment that prevents the growth of spoilage-causing bacteria and fungi?

(iii) Suggest a healthy recipe of this kind for food preservation.

(iv) What are the scientific values addressed in this case?

A: (i) Osmosis .

(ii) High salt or sugar creates a severe hypertonic environment . Spoilage-causing bacteria or fungi that land on the food lose their internal water rapidly via osmosis, causing them to shrink and die .

(iii) Making sun-dried vegetables with a moderate salt rub, or preserving fruits using natural jaggery instead of highly refined sugar.

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(iv) Scientific values include keen observation, applying biological concepts (osmosis) to real-world problems, preventing food waste, and sustainable economic management .

Part 9: The Journey Beyond & The Quest Continues...

Q: How did teamwork contribute to the success of the activity?

A: (Student reflection) Teamwork allows for the division of labor, sharing of creative ideas for building models (like using eco-friendly materials), and collaborative problem-solving.

Q: Did this activity change your perspective or understanding of the cell division topic in any way? If so, explain how?

A: (Student reflection) Building a physical model or simulation transforms cell division from an abstract, static textbook diagram into a dynamic, 3D biological process, making the steps (like chromosome separation) much easier to visualize.

Q: What is the future of the development of synthetic cells using non-living chemicals?

A: Based on synthetic biology experiments (like synthesizing DNA), the future could involve creating custom "cell factories" designed to safely produce medicines, vaccines, or sustainable food sources .

Q: If a synthetic cell is developed, what may be the related ethical issues?

A: Ethical issues include the debate over humans "playing God" by creating life, the potential biosafety risks if a synthetic cell escapes and disrupts the natural environment, and questions regarding the ownership or patenting of living synthetic organisms.

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