Experiment 3: Study of Prokaryotic Cell Structure

Aim To study and describe the structural features of a prokaryotic cell (bacterial cell).

Principle

Prokaryotic cells are simple, primitive cells that lack a true nucleus and membrane-bound organelles. Their structure can be studied using diagrams under a compound microscope.

Requirements

- Prepared Microsoft slide of bacterial cell
- Pencil and observation sheet

Observations / Comments on Prokaryotic Cell

1. Prokaryotic cells are simple and primitive cells.
2. They belong to Kingdom Monera.
3. They lack a true nucleus.
4. DNA is present in a nucleoid region.
5. Nuclear membrane is absent.
6. Membrane-bound organelles are absent.
7. Ribosomes are of 70S type.
8. Cell wall is mainly made of peptidoglycan.
9. Cell membrane controls transport of substances.
10. They reproduce by binary fission.
11. They are usually microscopic (1–10 μm).
12. They are the oldest and most primitive form of life.

Result

The structure of a prokaryotic cell was studied and key features were observed.

Conclusion

Prokaryotic cells are simple organisms without a true nucleus and organelles.

Experiment 4 : Study of Animal Cell Structure

Aim To study the ultrastructure of an animal cell using an electron micrograph (TEM image).

Principle

Electron microscopy uses a beam of electrons to produce highly magnified and high-resolution images of cells. An electron micrograph reveals the fine internal structure (ultrastructure) of an animal cell that cannot be seen under a light microscope.

- TEM (Transmission Electron Microscope): shows internal organelles
- Resolution is high enough to observe membrane-bound organelles clearly

Requirements

- Electron micrograph of animal cell (TEM image)
- Observation sheet
- Pencil for labeling diagram

Procedure

1. Observe the given electron micrograph of the animal cell.
2. Identify different cell organelles.
3. Compare structures based on shape, position, and appearance.
4. Draw a labeled diagram based on observation.

Observations

1. Animal cells are eukaryotic cells with a well-defined nucleus.
2. The nucleus is surrounded by a double nuclear membrane with pores.
3. Nucleolus is visible inside the nucleus.
4. Chromatin appears as dense and light regions.
5. Plasma membrane forms the outer boundary of the cell.
6. Animal cells lack a cell wall.
7. Mitochondria are clearly visible with double membrane and cristae.
8. Endoplasmic reticulum (rough and smooth) is seen as membrane networks.
9. Ribosomes (80S) appear as small dense granules.
10. Golgi apparatus appears as stacked membrane cisternae.
11. Lysosomes are seen as small vesicular bodies.
12. Centrioles may be observed near the nucleus (important in cell division).
13. Cytoplasm appears dense and granular in TEM images.
14. Vacuoles, if present, are small and few in number.
15. The cell shows compartmentalization of functions due to organelles.

Result

The ultrastructure of an animal cell was studied using an electron micrograph and various organelles were identified clearly.

Conclusion

Electron micrographs provide detailed information about the internal organization of animal cells, confirming their eukaryotic nature and complex structure.

Experiment 5: Study of Plant Cell Using Electron Micrograph

Aim To study the ultrastructure of a plant cell using an electron micrograph (TEM image).

Principle

Electron microscopy provides high-resolution images of cellular structures using a beam of electrons. A plant cell electron micrograph reveals detailed ultrastructure of organelles, including membrane systems, nucleus, chloroplasts, and cell wall.

- TEM (Transmission Electron Microscope) is mainly used
- It helps in studying internal organization at nanometer resolution

Requirements

- Electron micrograph of plant cell (TEM image)
- Observation sheet
- Pencil for labeling diagram

Procedure

1. Observe the given electron micrograph carefully.
2. Identify visible cell structures.
3. Note the shape, position, and characteristics of organelles.
4. Draw a neat labeled diagram based on the image.

Observations

1. Plant cells are eukaryotic cells with a well-defined nucleus.
2. The nucleus is surrounded by a double nuclear membrane with pores.
3. A distinct nucleolus is present inside the nucleus.
4. Chromatin material appears as dense and light regions.
5. A rigid cell wall made of cellulose is clearly visible outside the plasma membrane.
6. The plasma membrane lies just inside the cell wall.
7. Large central vacuole is often visible, bounded by the tonoplast.
8. Chloroplasts are present with double membrane and thylakoid/grana structures.
9. Mitochondria are present with cristae for energy production.
10. Endoplasmic reticulum (RER and SER) appears as membrane networks.
11. Golgi apparatus (dictyosomes) appears as stacked flattened sacs.
12. Ribosomes (80S) appear as small dense particles.
13. Cytoplasm shows compartmental organization due to organelles.
14. Plasmodesmata may be visible as channels in the cell wall.
15. Plant cells show high structural complexity and compartmentalization.

Result

The ultrastructure of a plant cell was studied using an electron micrograph and various organelles were identified clearly.

Conclusion

Electron micrographs reveal that plant cells are eukaryotic and highly organized, characterized by the presence of a cell wall, chloroplasts, and large central vacuole, which distinguish them from animal cells.