Experiment 6: Study of Mitochondria Using Electron Micrograph

Aim

To study the ultrastructure of mitochondria using an electron micrograph (TEM image).

Principle

Mitochondria are double-membrane-bound organelles found in eukaryotic cells. They are best studied using Transmission Electron Microscopy (TEM), which reveals their internal structure such as cristae and matrix. Mitochondria are known as the "powerhouse of the cell" because they produce ATP through cellular respiration.

Requirements

- **Electron micrograph of mitochondria (TEM image)**

Procedure

1. **Observe the given electron micrograph carefully.**
2. **Identify mitochondrial structures.**
3. **Note shape, size, and internal organization.**
4. **Draw a neat labeled diagram based on observation.**

Observations

1. **Mitochondria are double membrane-bound organelles.**
2. **They are found in all eukaryotic cells.**
3. **The outer membrane is smooth and permeable.**
4. **The inner membrane is highly folded into cristae.**
5. **Cristae increase the surface area for ATP production.**
6. **The space inside is filled with mitochondrial matrix.**
7. **Matrix contains enzymes of Krebs cycle (TCA cycle).**
8. **Mitochondria contain circular DNA (mtDNA).**
9. **They also contain 70S ribosomes for protein synthesis.**
10. **Mitochondria can self-replicate (semi-autonomous organelles).**
11. **They vary in shape: rod-shaped, spherical, or filamentous.**
12. **They are mainly involved in aerobic respiration and energy (ATP) production.**
13. **Number of mitochondria is higher in active cells (muscle cells, liver cells).**
14. **Electron micrographs clearly show outer membrane, inner membrane, and cristae.**

Result

The ultrastructure of mitochondria was studied using an electron micrograph and key structural features were identified.

Conclusion

Mitochondria are semi-autonomous, double-membraned organelles responsible for ATP production, and their structure is clearly visible under electron microscopy.

Experiment 7: Study of Chloroplast Using Electron Micrograph

Aim

To study the ultrastructure of chloroplast using an electron micrograph (TEM image).

Principle

Chloroplasts are double membrane-bound organelles found in plant cells and algae. They contain chlorophyll pigments and are responsible for photosynthesis. Their detailed structure can be observed using Transmission Electron Microscopy (TEM), which reveals internal components like grana, thylakoids, and stroma.

Requirements

- **Electron micrograph of chloroplast (TEM image)**

Procedure

1. **Observe the given electron micrograph carefully.**
2. **Identify different parts of the chloroplast.**
3. **Note the arrangement of membranes and internal structures.**
4. **Draw a neat labeled diagram based on observation.**

Observations

1. **Chloroplasts are double membrane-bound organelles found in plant cells.**
2. **They are green in color due to chlorophyll pigment.**
3. **The outer and inner membranes form the chloroplast envelope.**
4. **Inside is the fluid-filled stroma.**
5. **Stroma contains enzymes for dark reactions (Calvin cycle).**
6. **Chloroplast contains its own circular DNA (cpDNA).**
7. **It also has 70S ribosomes, making it semi-autonomous.**
8. **Internal membrane system forms thylakoids.**
9. **Thylakoids are arranged in stacks called grana.**
10. **Grana are connected by stroma lamellae (intergranal lamellae).**
11. **Light reactions of photosynthesis occur on thylakoid membranes.**
12. **Electron micrographs clearly show grana, stroma, and envelope membranes.**
13. **Chloroplasts may vary in shape: disc-shaped, oval, or lens-shaped.**
14. **They are abundant in leaf mesophyll cells.**

Result

The ultrastructure of chloroplast was studied using an electron micrograph and its key components were identified.

Conclusion

Chloroplasts are semi-autonomous, double membrane-bound organelles responsible for photosynthesis, and their internal structure (grana and thylakoids) is clearly visible under electron microscopy.

Experiment 8 Study of Nucleus Using Electron Micrograph

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

Principle

The nucleus is a double membrane-bound organelle found in eukaryotic cells. It controls all cellular activities and contains genetic material (DNA). Its detailed structure can be studied using Transmission Electron Microscopy (TEM), which shows components like nuclear envelope, nucleolus, chromatin, and nuclear pores.

Requirements

- **Electron micrograph of nucleus (TEM image)**

Procedure

1. **Observe the given electron micrograph carefully.**
2. **Identify different nuclear components.**
3. **Note the structure and organization.**
4. **Draw a neat labeled diagram based on observation.**

Observations

1. **The nucleus is a double membrane-bound organelle.**
2. **It is present only in eukaryotic cells.**
3. **The outer membrane is continuous with the endoplasmic reticulum.**
4. **The nucleus contains genetic material (DNA) in the form of chromatin.**
5. **Chromatin appears as electron-dense and light regions in TEM.**
6. **During cell division, chromatin condenses into chromosomes.**
7. **The nucleus contains a dense body called the nucleolus.**
8. **Nucleolus is the site of ribosomal RNA (rRNA) synthesis.**
9. **The nucleus is surrounded by a nuclear envelope (double membrane).**
10. **The nuclear envelope has nuclear pores for exchange of materials.**
11. **The nucleoplasm is a gel-like matrix inside the nucleus.**
12. **Nuclear pores regulate movement of RNA and proteins between nucleus and cytoplasm.**
13. **Electron micrographs clearly show nuclear envelope, pores, chromatin, and nucleolus.**
14. **The nucleus acts as the control center of the cell.**

Result

The ultrastructure of the nucleus was studied using an electron micrograph and its main components were identified.

Conclusion

The nucleus is a double membrane-bound control organelle of eukaryotic cells, containing chromatin and nucleolus, and its structure is clearly visible under electron microscopy.

Experiment 9: Study of Cell Cycle Using Chart

Aim

To study the different stages of the cell cycle using a chart/model.

Principle

The cell cycle is a continuous process of cell growth and division. It is divided into:

- **Interphase (G_1, S, G_2 phases)**
- **M phase (mitosis and cytokinesis)**

A chart helps in visualizing the sequence of events clearly and understanding the progression of the cycle.

Requirements

- **Cell cycle chart/model**
- **Pointer or pencil**
- **Observation sheet**

Procedure

1. **Observe the given cell cycle chart carefully.**
2. **Identify different phases in sequence.**
3. **Note key events in each phase.**
4. **Draw a labeled diagram of the cell cycle in the record.**

Observations

1. **The cell cycle consists of interphase and mitotic phase.**
2. **Interphase includes G_1, S, and G_2 phases.**
3. **In G_1 phase, cell growth and protein synthesis occur.**
4. **In S phase, DNA replication takes place.**
5. **In G_2 phase, cell prepares for division.**
6. **M phase includes mitosis and cytokinesis.**
7. **Mitosis has four stages: prophase, metaphase, anaphase, telophase.**
8. **Chromosomes are equally distributed to daughter cells.**
9. **Cytokinesis divides the cytoplasm into two cells.**
10. **The chart shows that the cell cycle is a continuous and regulated process.**

Result

The cell cycle was studied successfully using a chart and all major stages were identified.

Conclusion

The cell cycle is a well-organized process of cell growth and division, clearly represented through chart-based study.