

Cell Organelles and Their Functions

In the previous lesson, we learned that the cell is the basic structural and functional unit of life. All living organisms are made up of cells, and every cell performs various activities necessary for survival.

We also learned that most cells have three main parts:

1. Cell Membrane
2. Cytoplasm
3. Nucleus

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 **CLASS 8
SCIENCE**

In the Previous Lesson...

We learned that the **cell** is the **basic structural and functional unit of life**. All living organisms are made up of cells, and every cell performs various activities necessary for survival.

THE THREE MAIN PARTS OF A CELL

1 Cell Membrane

The **cell membrane** protects the cell and controls the movement of substances entering and leaving the cell.

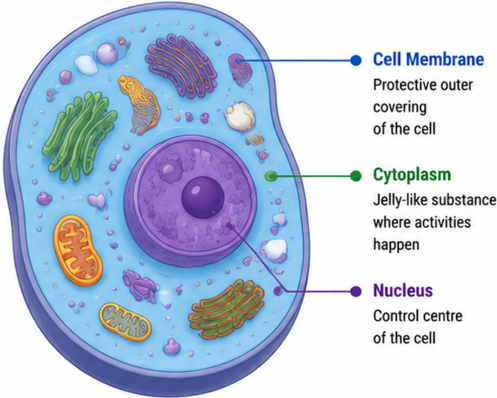
2 Cytoplasm

The **cytoplasm** is the jelly-like substance present inside the cell where many important chemical activities take place.

3 Nucleus

The **nucleus** acts as the control centre of the cell and contains DNA, which carries genetic information.

The Cell at a Glance



More Than Just Three Parts!

A cell is not just made up of these three parts. Inside the cytoplasm, there are several small, **specialized structures** that perform different tasks. These structures are called **cell organelles**.



Mitochondria
(Energy Producer)



Ribosomes
(Protein Factory)



Endoplasmic Reticulum
(Transport System)



Golgi Apparatus
(Packaging Centre)



Lysosomes
(Waste Disposal System)



Vacuoles
(Storage Unit)

and many more...

KEY TAKEAWAY

A cell has three main parts – **cell membrane**, **cytoplasm** and **nucleus**. Inside the cytoplasm, different **organelles** work together to help the cell survive, grow and perform its functions.

**Many parts, Many jobs,
One goal – Life!**



 **Learn Today, Grow Tomorrow!** 

The cell membrane protects the cell and controls the movement of substances entering and leaving the cell.

The cytoplasm is the jelly-like substance present inside the cell where many important chemical activities take place.

The nucleus acts as the control centre of the cell and contains DNA, which carries genetic information.

However, a cell is not just made up of these three parts. Inside the cytoplasm, there are several small specialized structures that perform different tasks. These structures are called **cell organelles**.

Just like a factory has different departments such as production, packaging, storage, transport, and waste management, a cell also has different organelles that perform specific functions to keep the cell working properly.

What are Cell Organelles?

Cell organelles are specialized structures present inside the cytoplasm of a cell. Each organelle performs a specific function that is necessary for the survival and proper functioning of the cell.

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CELL ORGANELLES

— AND THEIR FUNCTIONS —

What are Cell Organelles?

Cell organelles are specialized structures present inside the cytoplasm of a cell. Each organelle performs a specific function that is necessary for the survival and proper functioning of the cell.

Different organelles work together in a coordinated manner to carry out all life processes of the cell.

For example:

- Some organelles produce **energy**.
- Some make **proteins**.
- Some **transport** materials inside the cell.
- Some remove **waste** materials.

Together, all cell organelles help the cell grow, repair itself, and perform its activities.

Cell Membrane
Protects the cell and controls what enters and leaves.

Nucleus
Control centre of the cell. Contains DNA.

Cytoplasm
Jelly-like substance where organelles are present and activities occur.

A typical animal cell showing different organelles

★ ★ IMPORTANT CELL ORGANELLES ★ ★

The major cell organelles that we will study are:

1 Mitochondria Produces energy for the cell. (Powerhouse of the cell)	2 Ribosomes Makes proteins required for growth and repair of the cell.	3 Endoplasmic Reticulum Helps in the transport of materials. RER makes proteins and SER makes fats.	4 Golgi Apparatus Modifies, packages and transports materials inside and outside the cell.	5 Lysosomes Breaks down waste materials and damaged cell parts. (Cleansing system)	6 Vacuoles Stores water, food, minerals and waste materials. (Maintains shape in plants)
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★ LEARN TODAY, GROW TOMORROW! ★

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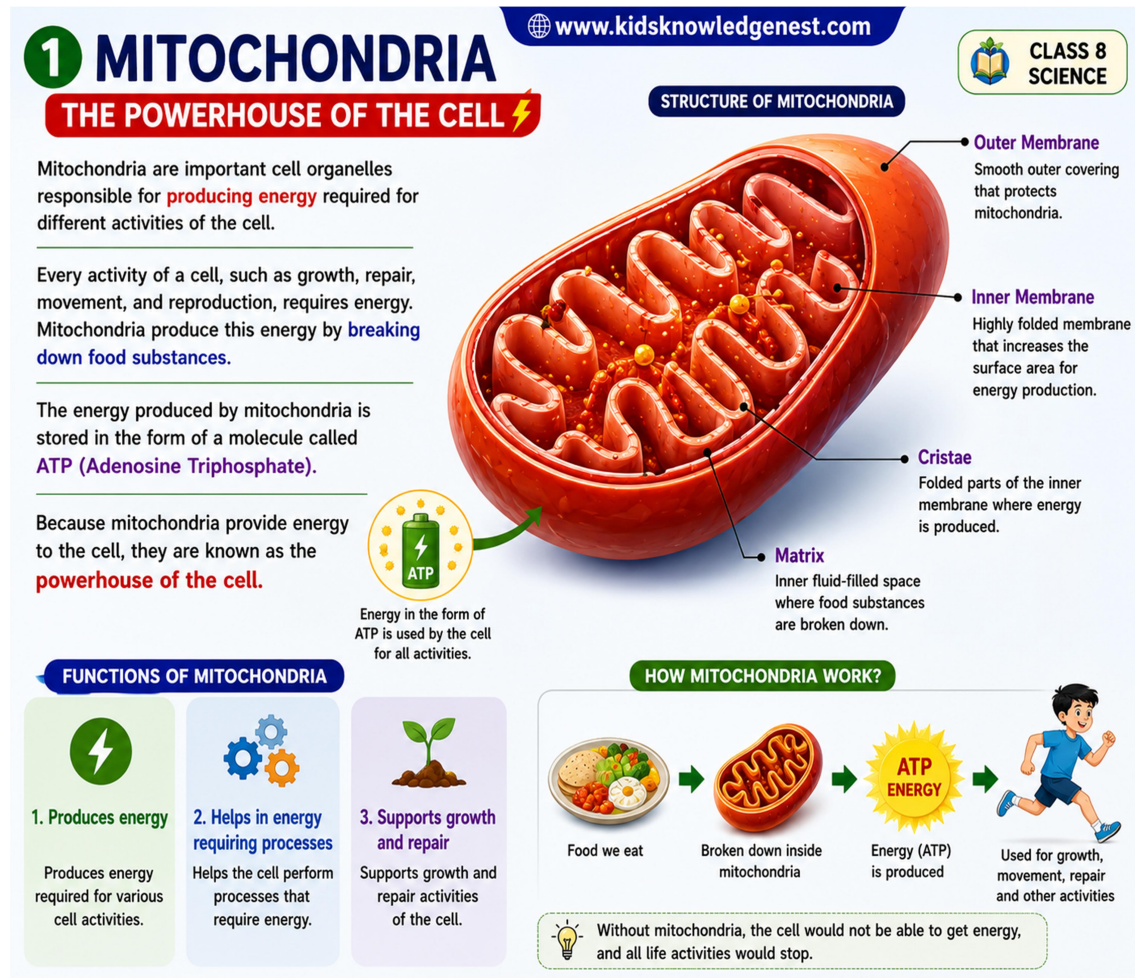
1. **Mitochondria**
2. **Ribosomes**
3. **Endoplasmic Reticulum**
4. **Golgi Apparatus**
5. **Lysosomes**
6. **Vacuoles**

Let us now explore each of these cell organelles one by one to understand their structure and specific functions in detail.

1. Mitochondria – The Powerhouse of the Cell

Mitochondria are important cell organelles responsible for producing energy required for different activities of the cell.

Every activity of a cell, such as growth, repair, movement, and reproduction, requires energy. Mitochondria produce this energy by breaking down food substances.



The energy produced by mitochondria is stored in the form of a molecule called **ATP (Adenosine Triphosphate)**.

Because mitochondria provide energy to the cell, they are known as the **powerhouse of the cell**.

Key features and functions of Mitochondria:

Energy Production (Cellular Respiration): Mitochondria act as the cell's power plant. They take nutrients from the food we eat (like glucose) and break them down in the presence of oxygen to release usable energy.

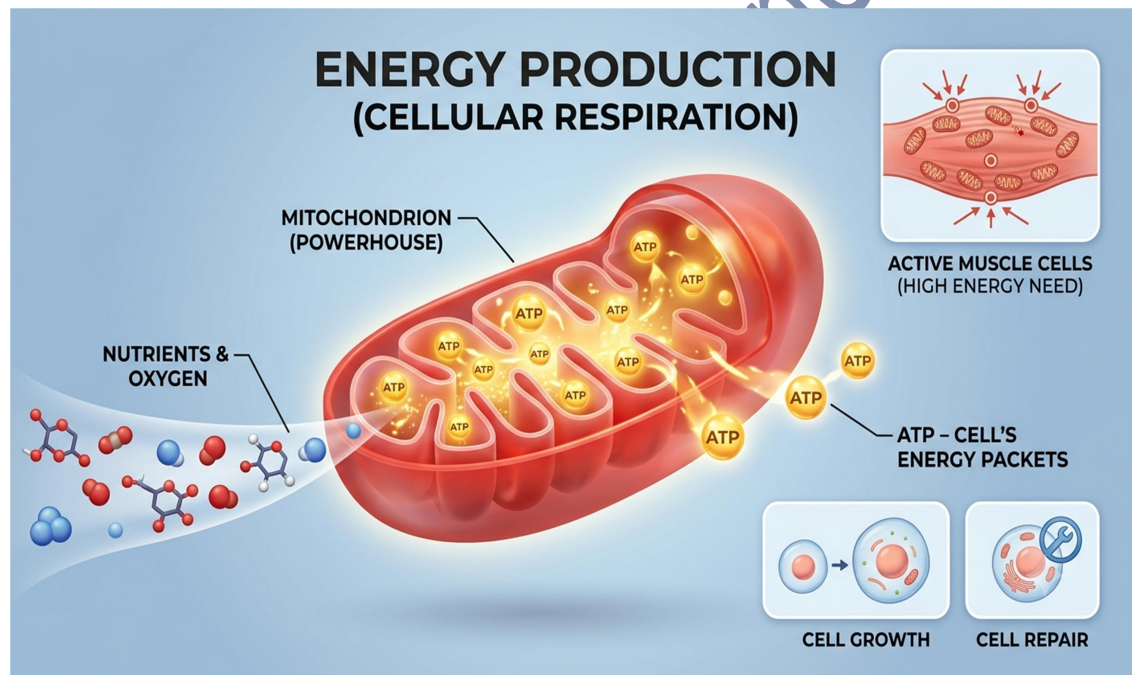
The Energy Currency (ATP): The energy generated by mitochondria is not left floating around; it is stored inside special energy-rich molecules called **ATP (Adenosine Triphosphate)**. Whenever a cell needs energy to perform a task, it uses these ATP molecules—acting as the cell's battery packets.

The "Powerhouse" Nickname: Because mitochondria generate and supply the energy (ATP) required for almost all cellular activities, they are universally known as the **"Powerhouse of the Cell"**.

Number Varies by Need: Different cells have different energy demands. For instance, active muscle cells that constantly move contain hundreds or thousands of mitochondria to meet their heavy energy needs.

The following functions are performed by the mitochondria:

- Produces energy required for various cell activities.
- Helps the cell perform processes that require energy.
- Supports growth and repair activities of the cell.



Mitochondria – The Energy-Producing Organelles of the Cell

We learned that **mitochondria are called the powerhouse of the cell because they produce energy needed for different activities of the cell**. But mitochondria do not create energy directly. They produce energy by breaking down food molecules through a process called **cellular respiration**.

Cellular respiration is a series of chemical reactions in which the mitochondria convert the energy stored in food into a usable form of energy called **ATP (Adenosine Triphosphate)**.

Step 1: Food Provides the Energy Source

The food we eat contains carbohydrates, which are broken down during digestion into a simple sugar called **glucose**.

Glucose is transported through the blood and reaches every cell of the body.

Glucose contains stored chemical energy. However, this energy cannot be used directly by the cell. It must first be converted into a usable form.

This is where mitochondria play an important role.

Step 2: Glucose Breakdown Begins in Cytoplasm

When glucose enters a cell, its first stage of breakdown takes place in the **cytoplasm**.

The large glucose molecule is broken into smaller molecules.

These smaller molecules then enter the mitochondria, where the main process of energy production occurs.

Step 3: Mitochondria Use Oxygen to Release Energy

Inside the mitochondria, these smaller food molecules are further broken down with the help of **oxygen**.

Oxygen enters our body through breathing, reaches the cells through blood, and finally reaches the mitochondria.

The mitochondria use oxygen to completely break down the food molecules.

During this process:

Energy stored in glucose → Released as usable energy (ATP)

The mitochondria capture this released energy and store it in ATP molecules.

Step 4: Formation of ATP – The Energy Packets

The energy produced during cellular respiration is stored in small molecules called **ATP (Adenosine Triphosphate)**.

ATP acts like tiny energy packets or rechargeable batteries of the cell.

Whenever a cell needs energy for activities such as:

- Growth
- Repair of damaged parts
- Movement
- Making new substances

ATP releases the stored energy and provides power to the cell.



Mitochondria

MITOCHONDRIA – THE ENERGY-PRODUCING ORGANELLES OF THE CELL

HOW MITOCHONDRIA PRODUCE ENERGY THROUGH CELLULAR RESPIRATION

Mitochondria are called the **powerhouse of the cell** because they produce energy by breaking down food molecules through a process called **cellular respiration**.

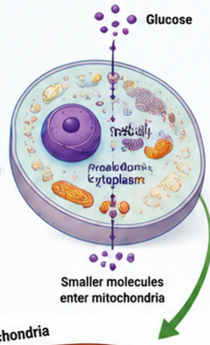
1 FOOD PROVIDES THE ENERGY SOURCE

- The food we eat contains carbohydrates.
- During digestion, carbohydrates are broken down into simple sugar called glucose.
- Glucose is transported through the blood and reaches every cell of the body.
- Glucose contains stored chemical energy which cannot be used directly by the cell.
- Mitochondria convert this energy into a usable form.



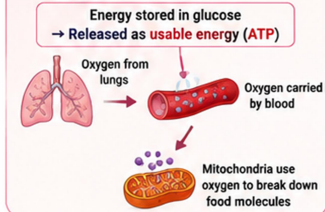
2 GLUCOSE BREAKDOWN BEGINS IN CYTOPLASM

- When glucose enters a cell, its first stage of breakdown occurs in the cytoplasm.
- The large glucose molecule is broken into smaller molecules.
- These smaller molecules then enter the mitochondria for further breakdown.



3 MITOCHONDRIA USE OXYGEN TO RELEASE ENERGY

- Inside the mitochondria, smaller food molecules are broken down with the help of oxygen.
- Oxygen enters our body through breathing, reaches cells through blood, and finally reaches mitochondria.
- Mitochondria use oxygen to completely break down the food molecules.

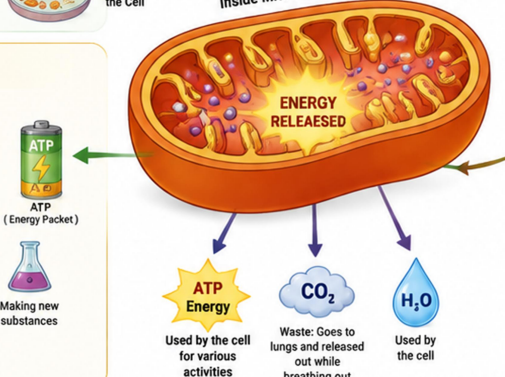


4 FORMATION OF ATP – THE ENERGY PACKETS

- The energy produced during cellular respiration is stored in small molecules called ATP (Adenosine Triphosphate).
- ATP acts like tiny energy packets or rechargeable batteries of the cell.
- Whenever a cell needs energy for:



- ATP releases the stored energy and provides power to the cell.



5 REMOVAL OF WASTE PRODUCTS

During cellular respiration, mitochondria also produce waste products.

- Carbon Dioxide**
Carbon dioxide is released during the breakdown of food molecules. It travels through the blood to the lungs and leaves the body when we breathe out.
- Water**
Water is also formed during cellular respiration and can be used by the cell.

COMPLETE PROCESS OF ENERGY PRODUCTION



KEY TAKEAWAY Mitochondria break down glucose with the help of oxygen in a process called cellular respiration and produce ATP energy, along with carbon dioxide and water. This energy keeps the cell alive and helps it perform all important functions.



That's why we are called the **POWERHOUSE OF THE CELL!**

Step 5: Removal of Waste Products

During cellular respiration, mitochondria also produce waste products.

The main waste products are:

- Carbon dioxide** is released during the breakdown of food molecules. It travels through the blood to the lungs and leaves the body when we breathe out.
- Water** is also formed during cellular respiration and can be used by the cell.

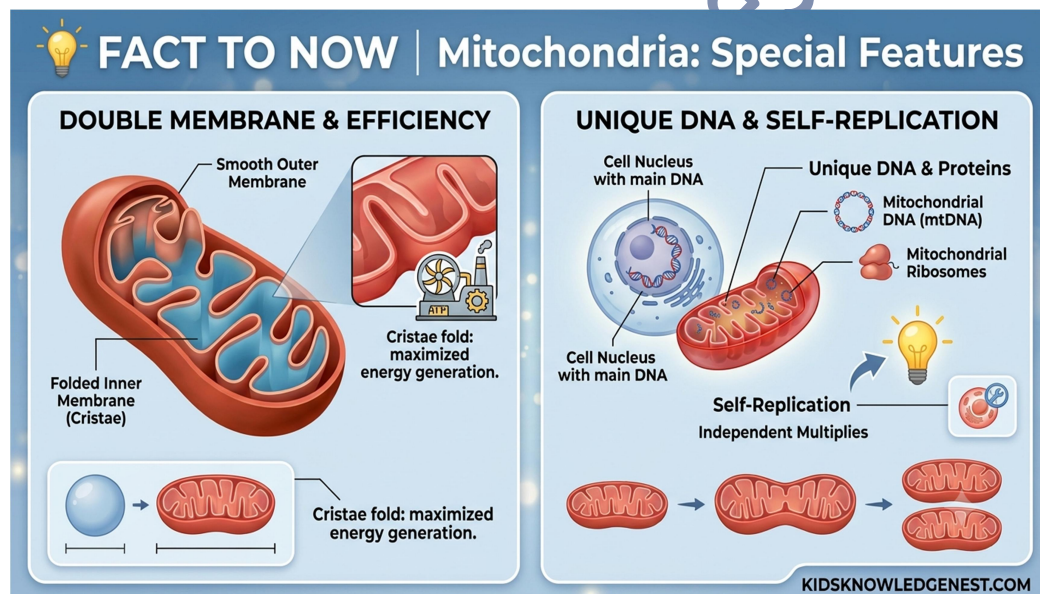
Complete Process of Energy Production

The process can be represented as:

Glucose + Oxygen → Mitochondria → ATP Energy + Carbon Dioxide + Water

Did You Know? (Special Facts for Class 8 Science)

- **Double Membrane:** Unlike many other organelles, a mitochondrion has **two protective membranes**—a smooth outer membrane and a folded inner membrane (called *cristae*) that provides more space to produce ATP efficiently.
- **Unique DNA:** Mitochondria are unique because they have their own genetic material (DNA) and ribosomes, allowing them to make some of their own proteins and divide on their own.



Multiple Choice Questions (MCQs)

Q1. Which part of the cell is responsible for controlling all cell activities and carrying genetic material (DNA)?

- (A) Cytoplasm
- (B) Nucleus
- (C) Cell Membrane
- (D) Vacuole

Q2. Small, specialized structures present inside the cytoplasm that perform specific tasks are called:

- (A) Cell Organelles

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- (B) Tissues
- (C) Organs
- (D) Membranes

Q3. Mitochondria are commonly known as the "Powerhouse of the Cell" because they:

- (A) Store waste products
- (B) Synthesize proteins for the cell
- (C) Generate usable energy (ATP) for cellular activities
- (D) Control entry and exit of materials

Q4. Energy produced during cellular respiration is stored in molecules known as:

- (A) DNA
- (B) ATP (Adenosine Triphosphate)
- (C) Glucose
- (D) RNA

Q5. Where does the initial breakdown of glucose into smaller molecules begin?

- (A) Inside the nucleus
- (B) Inside the mitochondria
- (C) In the cytoplasm
- (D) On the cell membrane

Q6. Which of the following is required by mitochondria to completely break down food molecules during cellular respiration?

- (A) Carbon Dioxide
- (B) Nitrogen
- (C) Oxygen
- (D) Hydrogen

Q7. What is the complete chemical process of energy production inside the mitochondria?

- (A) Glucose + Carbon Dioxide $\rightarrow$ ATP + Oxygen + Water
- (B) Glucose + Oxygen $\rightarrow$ ATP Energy + Carbon Dioxide + Water
- (C) Water + Oxygen $\rightarrow$ Glucose + Carbon Dioxide
- (D) ATP + Oxygen $\rightarrow$ Glucose + Water

Q8. Which waste gas produced during cellular respiration is exhaled out of the body through the lungs?

- (A) Oxygen
- (B) Nitrogen
- (C) Carbon Dioxide
- (D) Hydrogen

Q9. Why do active muscle cells contain a larger number of mitochondria compared to skin cells?

- (A) They need to store more water
- (B) They have higher energy demands due to constant movement
- (C) They need to manufacture more DNA
- (D) They protect the body from foreign invaders

Q10. What unique structural feature of mitochondria helps them increase the surface area available for ATP production?

- (A) A thick single outer layer
- (B) Folded inner membrane called cristae
- (C) Large central storage sac
- (D) Jelly-like inner fluid only

Answer Key & Detailed Explanations

- **1. Correct Answer: (B) Nucleus**
 - *Explanation:* The nucleus acts as the control centre of the cell and houses DNA, which carries genetic instructions for all cellular activities.
- **2. Correct Answer: (A) Cell Organelles**
 - *Explanation:* Specialized structures inside the cytoplasm that perform distinct jobs (like energy production or waste removal) are called cell organelles.
- **3. Correct Answer: (C) Generate usable energy (ATP) for cellular activities**
 - *Explanation:* Mitochondria break down food molecules to release energy needed for cellular growth, repair, and movement, giving them the nickname "powerhouse of the cell."
- **4. Correct Answer: (B) ATP (Adenosine Triphosphate)**
 - *Explanation:* ATP acts as the cell's energy currency or rechargeable battery, storing the energy released during cellular respiration for later use.
- **5. Correct Answer: (C) In the cytoplasm**
 - *Explanation:* The first step of glucose breakdown occurs in the cytoplasm, splitting glucose into smaller fragments before they enter the mitochondria.
- **6. Correct Answer: (C) Oxygen**
 - *Explanation:* Mitochondria require oxygen (brought in through breathing and blood circulation) to break down food fragments completely and release energy.
- **7. Correct Answer: (B) Glucose + Oxygen = ATP Energy + Carbon Dioxide + Water**
 - *Explanation:* Cellular respiration uses glucose and oxygen as inputs to produce usable ATP energy along with carbon dioxide and water as by products.
- **8. Correct Answer: (C) Carbon Dioxide**

- *Explanation:* Carbon dioxide is a by-product of cellular respiration that travels via blood back to the lungs to be exhaled out of the body.
- **9. Correct Answer: (B) They have higher energy demands due to constant movement**
 - *Explanation:* Cells with heavy workloads (like active muscle cells) require significantly more ATP energy, meaning they need hundreds or thousands of mitochondria.
- **10. Correct Answer: (B) Folded inner membrane called cristae**
 - *Explanation:* The inner membrane of a mitochondrion is folded into structures called *cristae*, providing a larger surface area to synthesize ATP efficiently in a compact space.

That's it for now kids, we will learn Ribosomes and other Cell-organelles parts in our next lesson on www.kidsknowledgenest.com. Till then take care.

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