The differences between Eukaryotic cells and prokaryotic cells

1. Eukaryotic cells have a true nucleus, bounded by a double membrane, Prokaryotic cells have no nucleus , most primitive , earlies form of life.
2. Eukaryotic DNA is linear , prokaryotic DNA is circular , it has no end.
3. Eukaryotic DNA is complex with proteins called " histones " and is organized into chromosomes , prokaryotic DNA is simple and " necked" meaning that it has no " histones " associated with it and is not formed into chromosomes .
4. Eukaryotic cell contains a number of chromosomes " multiple" , a prokaryotic cell contains only one (single) circular DNA molecule and assortment of much smaller circlet of DNA called " plasmids " the smaller simpler prokaryotic cell requires for fewer genes to operate than the eukaryotic cell .
5. Eukaryotic cells have many ribosomes , (80_s) layer and more complex than those of prokaryotic cell (70_s) (sedimentation constant) .
6. Eukaryotic ribosomes is composed of five (5) kinds of rRNA and about eighty (80) kinds of proteins , prokaryotic ribosomes are composed of only three (3) kinds of rRNA and about fifty (50) kinds of proteins .
7. Eukaryotic cells either have a plasma membrane or a cell wall in addition to the plasma membrane , prokaryotic cells have a plasma membrane in addition to bacteria cell wall .
8. Eukaryotic cells are largest cells while prokaryotic cells are smaller than eukaryotic cells , have not organelles . eukaryotic cells contain organelles with membrane bounded .

9. Eukaryotic cells reproduce by sexually with use of meiosis while prokaryotic cell don't undergo of meiosis , reproduce sexually by transfer of DNA fragments of DNA through conjugation " plasmids ".
10. Eukaryotic cells have a complex cytoskeletal structure while prokaryotic cells have a primitive or don't have a cytoskeletal at all .

The different between prokaryotic cell and eukaryotic cell

Features	Prokaryotic cell	Eukaryotic cell
1.type of cell	Unicellular	Multicellular and unicellular
2.cell wall	Rigid made of lipids, carbohydrates, and protein.	Flexible made of cellulose .
3.chromosomes	One chromosome, circular molecule of double stranded DNA .	More than one chromosome , multiple linear .
4.nucleus	Nuclear region ,nucleoid .	A true nucleus .
5.histones	Absents.	Presents .
6.plasmids	Presents , one or more (smaller) extra chromosomal elements contain a few genes that help bacteria survive under specific conditions (circular DNA).	Absents .

7.size of ribosomes	70s (small).	80s (large).
8.organelle	Absents.	Presents .
9.sexually reproduction	Don't happen in their cells (without mitosis)	Happen in their cells , cell division by mitosis .
10.growth in antibiotics	Inhabit (sensitive to anti-biotic).	Don't Inhabit no sensitive to anti-biotic.
11.decomposers	Remain unavailable in wastes and dead organisms .	Less than prokaryotic .
12.examples	Bacteria , cyanobacteria	Plants , animals
13.memberane-enclosed organelles including nucleus .	No-membrane enclosed organelles .	Presents .
14.cytoskeleton	No known cytoskeleton .	Present .
15.flagella	Simple flagella .	Complex flagella .
16.streaming in the cytoplasm	No streaming in the cytoplasm .	Not always present .

Characteristics of prokaryotic and eukaryotic cells

Characteristic	Prokaryotic Bacterial cells	Eukaryotic Human cells
1.DNA within a nuclear membrane	No	Yes
2.Mitotic division	No	Yes
3.DNA associated eith histones	No	Yes
4.chromosome number	One	More than one
5.membrane bound organelles , such as mitochondria and lysosomes	No	Yes
6.size of ribosome	70s	80s
7.cell wall containing peptidoglycan	Yes	No
8.cytoskeletal structwe	A primitive or no	A complex or yes
9.organelles	No	Yes

Structure Of Eukaryotic Cell

The eukaryotic cell structure comprises the following:

Plasma Membrane

- The plasma membrane separates the cell from the outside environment.
- It comprises specific embedded proteins, which help in the exchange of substances in and out of the cell.

Cell Wall

- A cell wall is a rigid structure present outside the plant cell. It is, however, absent in animal cells.
- It provides shape to the cell and helps in cell-to-cell interaction.
- It is a protective layer that protects the cell from any injury or pathogen attacks.
- It is composed of cellulose, hemicellulose, pectins, proteins, etc.

Also refer: Cell Wall

Cytoskeleton

The cytoskeleton is present inside the cytoplasm, which consists of microfilaments, microtubules, and fibres to provide perfect shape to the cell, anchor the organelles, and stimulate the cell movement.

Endoplasmic Reticulum

It is a network of small, tubular structures that divides the cell surface into two parts: luminal and extraluminal.

Endoplasmic Reticulum is of two types:

- Rough Endoplasmic Reticulum contains ribosomes.

- Smooth Endoplasmic Reticulum that lacks ribosomes and is therefore smooth.

Nucleus

- The nucleoplasm enclosed within the nucleus contains DNA and proteins.
- The nuclear envelop consists of two layers- the outer membrane and the inner membrane. Both the membranes are permeable to ions, molecules, and RNA material.
- Ribosome production also takes place inside the nucleus.

Golgi Apparatus

- It is made up of flat disc-shaped structures called cisternae.
- It is absent in red blood cells of humans and sieve cells of plants.
- They are arranged parallel and concentrically near the nucleus.
- It is an important site for the formation of glycoproteins and glycolipids.

Also read: Golgi Apparatus

Ribosomes

These are the main site for protein synthesis and are composed of proteins and ribonucleic acids.

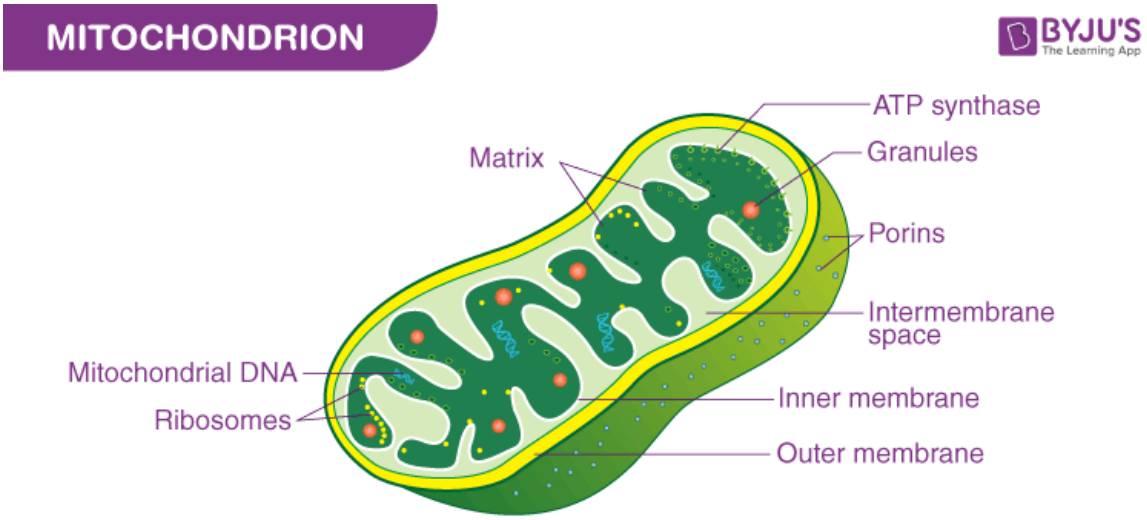
Mitochondria

Definition"Mitochondria are membrane-bound organelles present in the cytoplasm of all eukaryotic cells, that produce adenosine triphosphate (ATP), the main energy molecule used by the cell."

- These are also known as “powerhouse of cells” because they produce energy.
- It consists of an outer membrane and an inner membrane. The inner membrane is divided into folds called cristae.
- They help in the regulation of cell metabolism.

What are Mitochondria?

- Popularly known as the “**Powerhouse of the cell**,” mitochondria (singular: mitochondrion) are a double membrane-bound organelle found in most eukaryotic organisms. They are found inside the cytoplasm and essentially function as the cell’s “digestive system.”
- They play a major role in breaking down nutrients and generating energy-rich molecules for the cell. Many of the biochemical reactions involved in cellular respiration take place within the mitochondria. The term ‘mitochondrion’ is derived from the Greek words “***mitos***” and “***chondrion***” which means “**thread**” and “**granules-like**”, respectively. It was first described by a German pathologist named Richard Altmann in the year 1890.
-
-
- **Mitochondria Diagram**
- The diagram of mitochondria below illustrates several structural features of mitochondria.



-

- ## Structure of Mitochondria
- The mitochondrion is a double-membraned, rod-shaped structure found in both plant and **animal cell.**
- Its size ranges from 0.5 to 1.0 micrometre in diameter.
- The structure comprises an outer membrane, an inner membrane, and a gel-like material called the matrix.
- The outer membrane and the inner membrane are made of proteins and phospholipid layers separated by the intermembrane space.
- The outer membrane covers the surface of the mitochondrion and has a large number of special proteins known as porins.

Functions of Mitochondria

The most important function of mitochondria is to produce energy through the process of **oxidative phosphorylation.** It is also involved in the following process:

1. Regulates the metabolic activity of the cell
2. Promotes the growth of new cells and cell multiplication
3. Helps in detoxifying ammonia in the liver cells
4. Plays an important role in apoptosis or programmed cell death
5. Responsible for building certain parts of the blood and various hormones like testosterone and oestrogen
6. Helps in maintaining an adequate concentration of calcium ions within the compartments of the cell
7. It is also involved in various cellular activities like cellular differentiation, cell signalling, cell senescence, controlling the cell cycle and also in cell growth.

-

Lysosomes

- Definition Lysosomes are an important cell organelle found within eukaryotic animal cells. Due to their peculiar function, they are also known as the "*suicide bags*" of the cell.

The term was coined by Christian de Duve, a Belgian biologist, who discovered it and ultimately got a Nobel Prize in Medicine or Physiology in the year 1974.Let us have a detailed overview of lysosome structure, functions and diseases associated with it.

Lysosome Definition

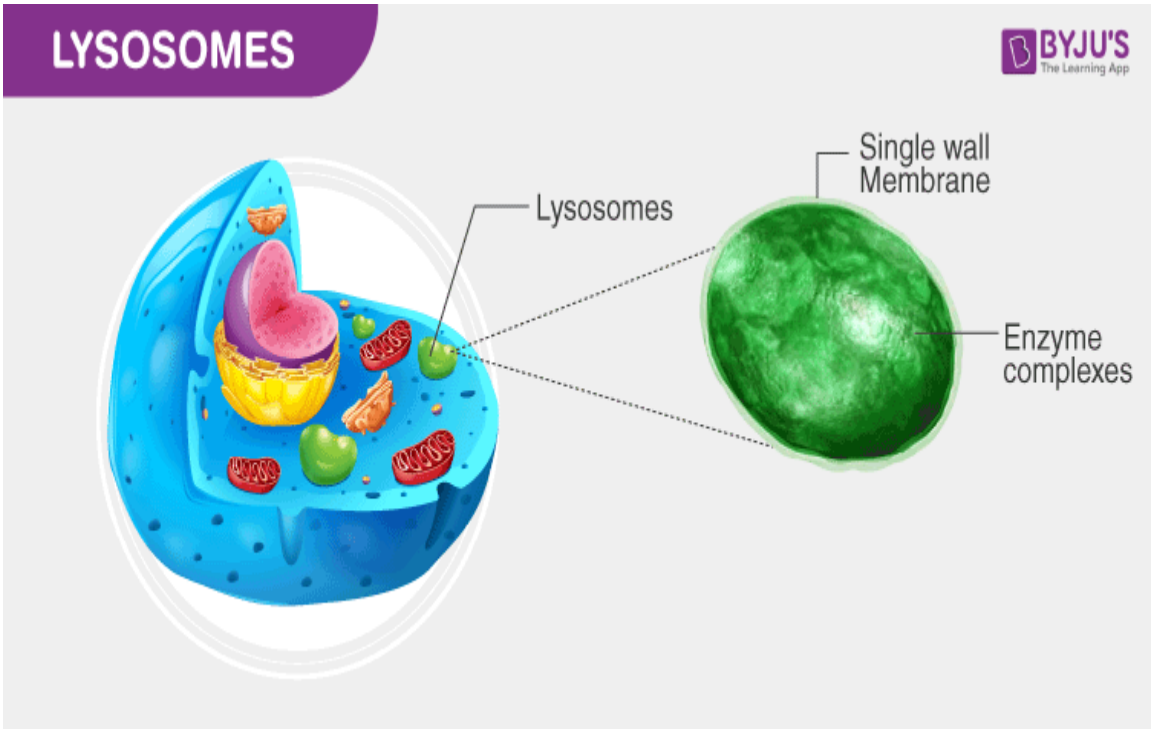
"Lysosomes are sphere-shaped sacs filled with hydrolytic enzymes that have the capability to break down many types of biomolecules."

In other words, lysosomes are membranous organelles whose specific function is to breakdown cellular wastes and debris by engulfing it with hydrolytic enzymes.

Lysosome Structure

Lysosomes are membrane-bound organelles and the area within the membrane is called the lumen, which contains the hydrolytic enzymes and other cellular debris.

The diagram below shows the lysosome structure within a cell.



Lysosome diagram showcasing enzyme complexes within the single-walled membrane

The pH level of the lumen lies between 4.5 and 5.0, which makes it quite acidic. It is almost comparable to the function of acids found in the stomach.

Besides breaking down biological polymers, lysosomes are also involved in various other cell processes such as counting discharged materials, energy metabolism, cell signalling, and restoration of the plasma membrane.

The sizes of lysosomes vary, with the largest ones measuring in more at than 1.2 μm. But they typically range from 0.1 μm to 0.6 μm.

Why are Lysosomes known as Suicidal Bags?

As stated before, lysosomes work as the waste discarding structures of the cell by processing undesirable materials and degrading them, both from the exterior of the cell and waste constituents inside the cell.

But sometimes, the digestive enzymes may end up damaging the lysosomes themselves, and this can cause the cell to die. This is termed as **autolysis**,

where "**auto**" means "*self*" and "**lysis**" means "*the disintegration of the cell by the destruction of its cell membrane*".

Hence, lysosomes are known as "Suicidal Bags" of the cell.

How do the Lysosome function?

The key function of lysosomes is digestion and removal of waste. Cellular debris or foreign particles are pulled in to the cell through the process of endocytosis. The process of endocytosis happens when the cell membrane falls in on itself (invagination), creating a vacuole or a pouch around the external contents and then bringing those contents into the cell.

On the other hand, discarded wastes and other substances originating from within the cell is digested by the process of auto phagocytosis or autophagy. The process of autophagy involves disassembly or degradation of the cellular components through a natural, regulated mechanism.

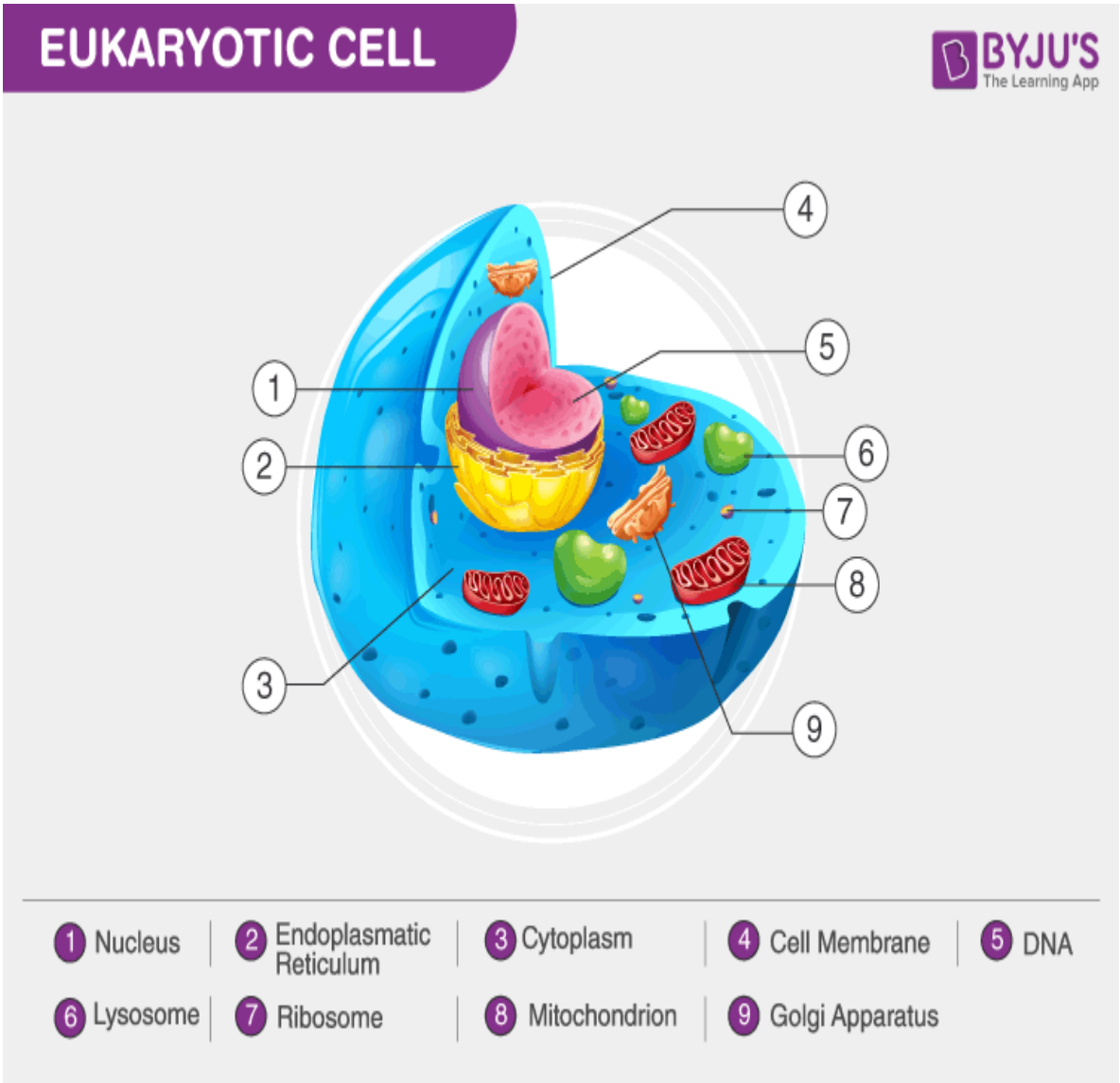
Plastids

These are double-membraned structures and are found only in **plant cell** These are of three types:

- **Chloroplast** that contains chlorophyll and is involved in photosynthesis.
- **Chromoplast** that contains a pigment called carotene that provides the plants yellow, red, or orange colours.
- **Leucoplasts** that are colourless and store oil, fats, carbohydrates, or proteins.

Eukaryotic Cell Diagram

Eukaryotic cell diagram mentioned below depicts different cell organelles present in eukaryotic cells. The nucleus, endoplasmic reticulum, cytoplasm, mitochondria, ribosomes, lysosomes are clearly mentioned in the diagram.



Eukaryotic Cell Diagram illustrated above shows the presence of a true nucleus.

Eukaryotic Cell Cycle

The eukaryotic cells divide during the cell cycle. The cell passes through different stages during the cycle. There are various checkpoints between

n each stage.

Quiescence (G0)

This is known as the resting phase, and the cell does not divide during this stage. The cell cycle starts at this stage. The cells of the liver, kidney, neurons, and stomach all reach this stage and can remain there for longer periods. Many cells do not enter this stage and divide indefinitely throughout their lives.

Interphase

In this stage, the cells grow and take in nutrients to prepare them for the division. It consists of three

checkpoints:

Gap 1 (G1) – Here the cell enlarges. The proteins also increase.

Synthesis (S) – DNA replication takes place in this phase.

Gap 2 (G2) – Ther cells enlarge further to undergo mitotic division.

Mitosis

Mitosis involves the following stages:

- Prophase
- Prometaphase
- Metaphase
- Anaphase
- Telophase

- Cytokinesis

On division, each daughter cell is an exact replica of the original cell.

Examples of Eukaryotic Cells

Eukaryotic cells are exclusively found in plants, animals, fungi, protozoa, and other complex organisms. The examples of eukaryotic cells are mentioned below:

Plant Cells

The cell wall is made up of cellulose, which provides support to the plant. It has a large vacuole which maintains the turgor pressure. The plant cell contains chloroplast, which aids in the process of photosynthesis.

Fungal Cells

The cell wall is made of chitin. Some fungi have holes known as septa which allow the organelles and cytoplasm to pass through them.

Animal Cells

These do not have cell walls. Instead, they have a cell membrane. That is why animals have varied shapes. They have the ability to perform phagocytosis and pinocytosis.

Protozoa

Protozoans are unicellular organisms. Some protozoa have cilia for locomotion. A thin layer called pellicle provides supports to the cell.