

Quadrant II – Notes

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Notes

The cell is the basic unit of life, responsible for all biological activities of the living being whether its Based on the structure and functions, cells are broadly classified as Prokaryotic cell and Eukaryotic cell *Pro* means 'old,' and *karyon* means 'nucleus. **Prokaryotes** are simple, small cells. These cells do not have a **well-defined nucleus** but DNA molecule is located in the cell, termed as **nucleoid**. **They** are the most primitive kind of cells and lack few features as compared to the eukaryotic cell. But features like growth, response, and most importantly giving birth to the young ones are the commonly shared by all living organisms.

Eukaryotic cells are complex, large structured which can be single celled or multicellular and have a **well-defined nucleus**, where genetic material is stored. **Eukaryotic cells** have evolved from prokaryotic cells only but contain different types of organelles like Endoplasmic reticulum, Golgi body, Mitochondria etc, which are specific in their functions.

BASIS FOR COMPARISON	PROKARYOTIC CELLS	EUKARYOTIC CELLS
Size	1-10um	10-100um
Kind of Cell	Single-cell	Multicellular
Cell Wall	Cell wall present, comprise of peptidoglycan or mucopeptide (polysaccharide).	Usually cell wall absent, if present (plant cells and fungus), comprises of cellulose (polysaccharide)
Presence of Nucleus	Well-defined nucleus is absent, rather 'nucleoid' is present which is an open region containing DNA.	A well-defined nucleus is present enclosed within nuclear membrane.
Shape of DNA	Circular, double-stranded DNA.	Linear, double-stranded DNA.

BASIS FOR COMPARISON	PROKARYOTIC CELLS	EUKARYOTIC CELLS
Mitochondria	Absent	Present
Ribosome	70S	80S
Golgi Apparatus	Absent	Present
Endoplasmic Reticulum	Absent	Present
Mode of Reproduction	Asexual	Most commonly sexual
Cell Division	Binary Fission	Mitosis
Lysosomes and Peroxisomes	Absent	Present
Chloroplast	(Absent) scattered in the cytoplasm.	Present in plants, algae.
Transcription and Translation	Occurs together.	Transcription occurs in nucleus and translation in cytosol.
Organelles	Organelles are not membrane bound, if present any.	Organelles are membrane bound and are specific in function.
Number of Chromosomes	Only one (not true called as a plasmid).	More than one.
Examples	Archaea, Bacteria.	Plants and Animals.

Generalized structure of Prokaryotic cell consists of the following:

1. **Glycocalyx:** This layer function as a receptor, the adhesive also provide protection to the cell wall.
2. **Nucleoid:** It is the location of the genetic material (DNA), large DNA molecule is condensed into the small packet.
3. **Pilus:** Hair like hollow attachment present on the surface of bacteria, and is used to transfers of DNA to other cells during cell-cell adhesion.
4. **Mesosomes:** It is the extension of the cell membrane, unfolded into the cytoplasm their role is during the cellular respiration.
5. **Flagellum:** Helps in movement, attached to the basal body of the cell.
6. **Cell Wall:** It provides rigidity and support for the cell.
7. **Fimbriae:** Helps in attachment to the surface and other bacteria while mating. These are small hair-like structure.
8. **Inclusion/Granules:** It helps in storage of carbohydrates, glycogen, phosphate, fats in the form of particles which can be used when needed.
9. **Ribosomes:** Tiny particles which help in protein synthesis.

10. **Cell membrane:** Thin layer of protein and lipids, surrounds cytoplasm and regulate the flow of materials inside and outside the cells.
11. **Endospore:** It helps cell in surviving during harsh conditions.

Eukaryotic Cells

Eu means 'new,' and *karyon* means 'nucleus,' so these are the advanced type of cells found in plant, animals, and fungi. Eukaryotic cells have a well-defined nucleus and different organelles to perform different functions within the cell, though working is complex to understand.

This kind of cells are found in algae, fungi, protozoa, plants, and animals and can be single-celled, colonial or multicellular. Among them, fungi and protists (algae and protozoa) are the major kingdoms.

The general structure of Eukaryotic cells contain

- **Nucleus:** Eukaryotic cells have a well-defined nucleus where DNA (genetic material) is stored, it helps in the production of protein synthesis and ribosomes also. The chromosome is present inside the nucleus, which is surrounded by the **nuclear envelope**. It is a bi-lipid layer and controls the passage of ions and molecules.
- **Cytoplasm:** It is the location where other organelles are located, and other metabolic activities of the cell also take place here. It consists of –
 - **Mitochondria:** It is called 'the powerhouse of the cell,' and is responsible for making ATP. Mitochondria has its own DNA and ribosomes.
 - **Chloroplast:** These are found in algae and plants, it is one of the most important organelles in the plant which helps in converting energy sunlight into chemical energy through photosynthesis. They resemble mitochondria.
 - **Golgi Apparatus:** It consists of a stack of many flattened, disc-shaped sacs known as cisternae. The exact nature of Golgi varies, but it helps in the packaging of materials and in secreting them.
 - Lysosomes and Vacuoles – The most important function of Endoplasmic reticulum and Golgi apparatus is the synthesis of Lysosomes, which helps in digestion of intracellular molecules with the help of the enzyme called hydrolase.
 - Vacuoles are the membrane-bound cavities containing fluid as well as solid materials, and they engulf materials through endocytosis.
 - **Endoplasmic Reticulum:** It transport lipids, proteins, and other materials through the cell. They are of two types of smooth endoplasmic reticulum and rough endoplasmic reticulum.
- **Appendages:** Cilia and Flagella are locomotory attachments, helps in the movement of a cell towards positive stimuli. Cilia are shorter than flagella and numerous.
- **Surface structure:** Glycocalyx is a kind of polysaccharide, and it is the outermost layer of the cell which helps in cell adherence, protection and in receiving signals from other cells.
- **Cell Wall:** Cell Wall provides shapes, rigidity, and support to the cell. Compositions of the cell wall may vary of different organisms but which can be of either cellulose, pectin, chitin or peptidoglycan.
- **Cytoplasmic Membrane/Plasma Membrane:** It is a thin semipermeable, surrounding the cytoplasm, it acts as the barrier of the cell which regulates entry and exit of the substances inside and outside the cell. This layer is made up of two layers of phospholipids embedded with proteins. In Plant cell, this layer is present below the cell wall whereas in the Animal cell it is the outermost layer.
- **Ribosomes:** Though small in size but are present in numbers, they help in protein synthesis. Eukaryotes have 80S ribosomes which are further divided into two subunits which are 40S and 60S (S stands for Sedverg unit).
- **Cytoskeleton:** It is supporting framework of the cells, which is of two types Microtubules and Microfilaments. Microtubules have a diameter of about 24 nanometres (nm), made up of a protein called tubulin, while Microfilaments has a diameter of 6nm, made of the protein called actin. Microtubules are the largest filament and Microfilament the smallest one.

Prokaryote or eukaryote, both of these cells vary in their role, like prokaryotes are the old type of cells hence they lack a proper nucleus and other organelles too, which are very well present in eukaryotes, as these are the evolved and advanced cells.