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المحاضرة /1

What is the cell

Is the structural and functional unit of all living organisms and sometimes

called the building block of life.

History of the Cell: Discovering the Cell:

The discovery of the cell would not have been possible if not for advancements to the microscope. Interested in learning more about the microscopic world, scientist Robert Hooke improved the design of the existing compound microscope in 1665. His microscope used three lenses and a stage light, which illuminated and enlarged the specimens. These advancements allowed Hooke to see something wondrous when he placed a piece of cork under the microscope. Hooke detailed his observations of this tiny and previously unseen world in his book, *Micrographia*. To him, the cork looked as if it was made of tiny pores, which he came to call "cells" because they reminded him of the cells in a monastery.

In observing the cork's cells, Hooke noted in *Micrographia* that, "I could exceedingly plainly perceive it to be all perforated and porous, much like a Honey-comb, but that the pores of it were not regular… these pores, or cells,…were indeed the first microscopical pores I ever saw, and perhaps, that were ever seen, for I had not met with any Writer or Person, that had made any mention of them before this…"

Not long after Hooke's discovery, Dutch scientist Antonie van Leeuwenhoek detected other hidden, minuscule organisms—bacteria and protozoa. It was unsurprising that van Leeuwenhoek would make such a discovery. He was a master microscope maker and perfected the design of the simple microscope (which only had a single lens), enabling it to magnify an object by around two hundred to three hundred times its original size. What van Leeuwenhoek saw with these microscopes was bacteria and protozoa, but he called these tiny creatures "animalcules."

Van Leeuwenhoek became fascinated. He went on to be the first to observe and describe spermatozoa in 1677. He even took a look at the plaque between his teeth under the microscope. In a letter to the Royal Society, he wrote, "I then most always saw, with great wonder, that in the said matter there were many very little living animalcules, very prettily a-moving."

In the nineteenth century, biologists began taking a closer look at both animal and plant tissues, perfecting cell theory. Scientists could readily tell that plants were completely made up of cells due to their cell wall. However, this was not so obvious for animal cells, which lack a cell wall. Many scientists believed that animals were made of "globules."

German scientists Theodore Schwann and Mattias Schleiden studied cells of animals and plants respectively. These scientists identified key differences between the two cell types and put forth the idea that cells were the fundamental units of both plants and animals.

However, Schwann and Schleiden misunderstood how cells grow. Schleiden believed that cells were "seeded" by the nucleus and grew from there. Similarly, Schwann claimed that animal cells "crystalized" from the material between other cells. Eventually, other scientists began to uncover the truth. Another piece of the cell theory puzzle was identified by Rudolf Virchow in 1855, who stated that all cells are generated by existing cells.

At the turn of the century, attention began to shift toward cytogenetics, which aimed to link the study of cells to the study of genetics. In the 1880s, Walter Sutton and Theodor Boveri were responsible for identifying the chromosome as the hub for heredity—forever linking genetics and cytology. Later discoveries further confirmed and solidified the role of the cell in heredity, such as James Watson and Francis Crick's studies on the structure of DNA.

The discovery of the cell continued to impact science one hundred years later, with the discovery of stem cells, the undifferentiated cells that have yet to develop into more specialized cells. Scientists began deriving embryonic stem cells from mice in the 1980s, and in 1998, James Thomson isolated human embryonic stem cells and developed cell lines. His work was then published in an article in the journal *Science*. It was later discovered that adult tissues, usually skin, could be reprogrammed into stem cells and then form other cell

types. These cells are known as induced pluripotent stem cells. Stem cells are now used to treat many conditions such as Alzheimer's and heart disease.

The discovery of the cell has had a far greater impact on science than Hooke could have ever dreamed in 1665. In addition to giving us a fundamental understanding of the building blocks of all living organisms, the discovery of the cell has led to advances in medical technology and treatment. Today, scientists are working on personalized medicine, which would allow us to grow stem cells from our very own cells and then use them to understand disease processes. All of this and more grew from a single observation of the cell in a cork.

Types of the cells:

1- **Prokaryotic cell**

2- **Eukaryotic cell**

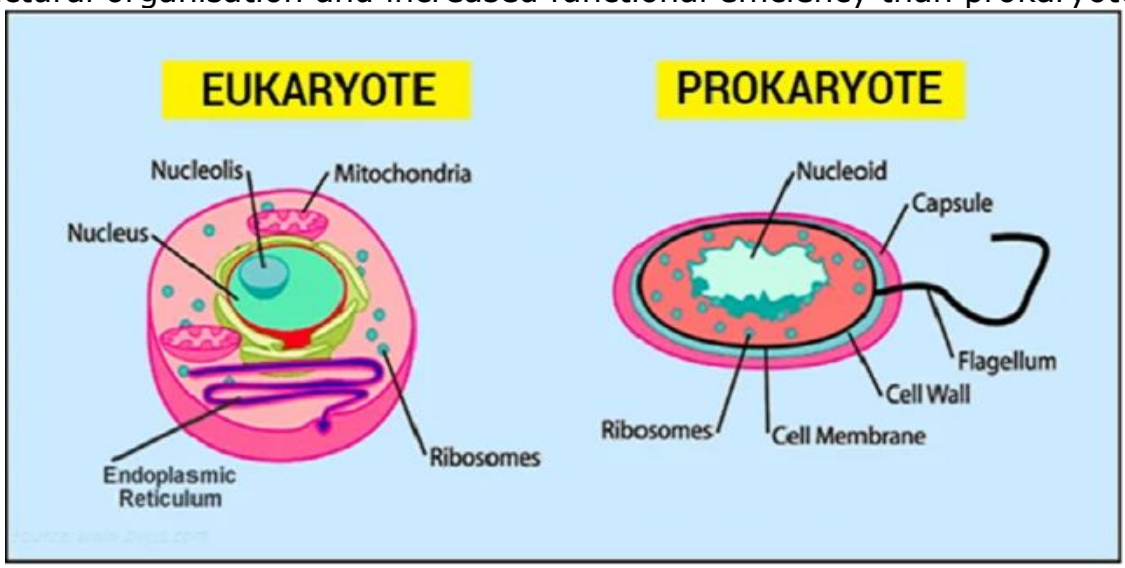
What are Prokaryotes?

According to the morphological point of view, prokaryotic cells are the most **primitive cells**. They do not have a definite nucleus which includes bacteria and cyanobacteria (blue-green algae). The chromatin bodies remain scattered inside the cytoplasm. In prokaryotes, asexual division occurs basically binary fission. Prokaryotes are smaller than eukaryotes. Do you know that the nucleus which does not have a nuclear membrane is known as nucleoid?

What are Eukaryotes?

It is believed that eukaryotes have been evolved from the prokaryotes. They have been characterised by their membrane nucleus. They contain organelles like **mitochondria** bounded by membranes and are located in the cytoplasm. That is they contain a **definite nucleus**. The chromatin bodies are enclosed by a nuclear membrane. Both asexual and sexual division

occurs in eukaryotes. They are larger than prokaryotes and show better structural organisation and increased functional efficiency than prokaryotes.



the difference between Prokaryotic and Eukaryotic Cells

Prokaryotic Cell	Eukaryotic cell
Size is 0.1- 5.0 um	Size is 5-100 um
Nucleus is absent	Nucleus is present
Membrane-bound nucleus absent.	Membrane-bound Nucleus is present.
One chromosome is present, but not true chromosome plastids	More than one number of chromosomes is present.
Unicellular	Multicellular
Lysosomes and Peroxisomes absent	Lysosomes and Peroxisomes present
Microtubules absent	Microtubules present
Endoplasmic reticulum absent	Endoplasmic reticulum present
Mitochondria absent	Mitochondria present

Cytoskeleton absent	Cytoskeleton present
Ribosomes smaller	Ribosomes larger
Vesicles present	Vesicles present
Golgi apparatus absent	Golgi apparatus present
Chloroplasts absent; chlorophyll scattered in the cytoplasm	Chloroplasts present in plants
Submicroscopic in size Flagella is present and made up of only one fiber	Microscopic in size, membrane-bound
Cell wall chemically complexed	Cell wall is present in plants and fungi and chemically simpler
Vacuoles absent	Vacuoles present
Permeability of Nuclear membrane is not present	Permeability of Nuclear membrane is selective
Sexual reproduction is absent	Sexual reproduction is present
Endocytosis and exocytosis are absent.	Endocytosis and exocytosis occurred
It may have pili and fimbriae.	Pili and fimbriae are absent
Transcription occurs in the cytoplasm	Transcription occurs inside the nucleus.
Examples: Bacteria and Archaea	Examples: Protists, Fungi, Plants, and Animals

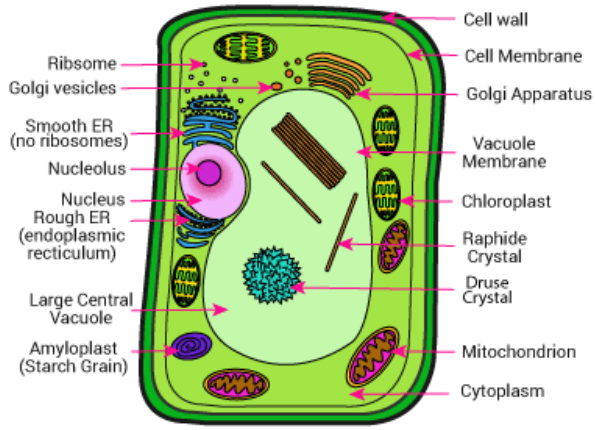
the difference between animal and plant cell

Plant Cell	**Animal Cell**
Cell Shape	

Square or rectangular in shape	Irregular or round in shape
Cell Wall	
Present	Absent
Plasma/Cell Membrane	
Present	Present
Endoplasmic Reticulum	
Present	Present
Nucleus	
Present and lies on one side of the cell	Present and lies in the centre of the cell
Lysosomes	
Present but are very rare	Present
Centrosomes	
Absent	Present
Golgi Apparatus	
Present	Present

Cytoplasm	
Present	Present
Ribosomes	
Present	Present
Plastids	
Present	Absent
Vacuoles	
Few large or a single, centrally positioned vacuole	Usually small and numerous
Cilia	
Absent	Present in most of the animal cells
Mitochondria	
Present but fewer in number	Present and are numerous

Plant Cell



Animal Cell

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