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FACULTY OF ENGINEERING & TECHNOLOGY
DEPARTMENT OF BIOTECHNOLOGY

Some characteristic of major group of microorganisms

Prokaryotic & Eukaryotic Microorganism and their differences:

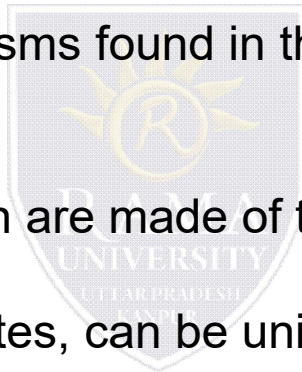
All living things can be divided into three basic domains: Bacteria, Archaea and Eukarya.

The primarily single-celled organisms found in the Bacteria and Archaea domains are known as prokaryotes.

Organisms in the Eukarya domain are made of the more complex eukaryotic cells.

These organisms, called eukaryotes, can be unicellular or multicellular and include animals, plants, fungi and protists.

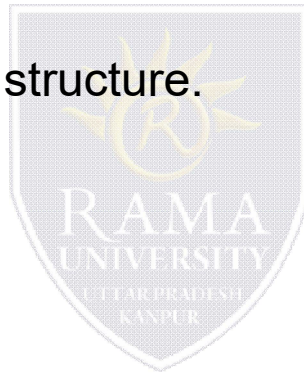
Yeast and fungi are eukaryotes share similar cell structure to all other eukaryotes.



Definition:

Prokaryotes: *Pro* means 'old,' and *karyon* means 'nucleus,' So as the name suggest the history of the evolution of prokaryotic cells is at least **3.5 billion years** old.

They lack well defined organellar structure.



Generalized structure of Prokaryotic cell consists of the following:

Glycocalyx: This layer function as a receptor, the adhesive also provide protection to the cell wall.

Nucleoid: It is the location of the genetic material (DNA), large DNA molecule is condensed into the small packet.

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.

Mesosomes: It is the extension of the cell membrane, unfolded into the cytoplasm their role is during the cellular respiration.

Flagellum: Helps in movement, attached to the basal body of the cell.

Cell Wall: It provides rigidity and support for the cell.

Fimbriae: Helps in attachment to the surface and other bacteria while mating. These are small hair-like structure.

Inclusion/Granules: It helps in storage of carbohydrates, glycogen, phosphate, fats in the form of particles which can be used when needed.

Ribosomes: Tiny particles which help in protein synthesis.

Cell membrane: Thin layer of protein and lipids, surrounds cytoplasm and regulate the flow of materials inside and outside the cells.

Endospore: It helps cell in surviving during harsh conditions.

Eukaryotes:

❖ *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.

❖ In terms of peptidoglycan present in the cell wall, prokaryotes can be divided into Gram-positive and Gram -negative bacteria.

❖ The former contains a large amount of peptidoglycan in their cell wall while the latter have the thin layer. One important point of distinction between gram +ive and gram -ive is also based on presence of teichoic acid in cell wall.

❖ In Gram +ive bacteria **Teichoic acids** are **found** within the cell wall of most Gram-positive bacteria such as species in the genera Staphylococcus, Streptococcus, Bacillus, Clostridium, Corynebacterium, and Listeria, and appear to extend to the surface of the peptidoglycan layer whereas Teichoic acid is absent in Gram -ive bacteria.

The general structure of Eukaryotic cells contains:

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.

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:

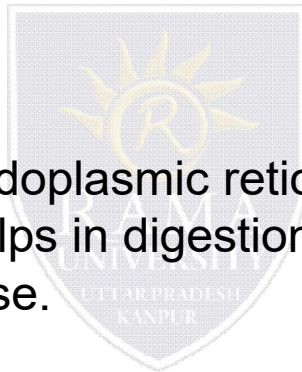
It consists of a stack of many flattened, disc-shaped sacs known as cisternae.

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 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 nanometers (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.