STRUCTURE AND FUNCTIONS OF GOLGI APPARATUS

DEFINITION

The golgi apparatus is a membrane bound organelle found in most cells. It is responsible for packaging proteins into vesicles prior to secretion and therefore plays a key role in the secretory pathway

. The **golgi apparatus** is a membrane bound organelle found in most cells. It is responsible for packaging proteins into vesicles prior to secretion and therefore plays a key role in the secretory pathway.

GOLGI APPARATUS STRUCTURE

In general, the Golgi apparatus is made up of approximately four to eight cisternae, although in some single-celled organisms it may consist of as many as 60 cisternae

. The cisternae are held together by matrix proteins, and the whole of the Golgi apparatus is supported by cytoplasmic microtubules.

The apparatus has three primary compartments, known generally as "cis" (cisternae nearest the endoplasmic reticulum), "medial" (central layers of cisternae), and "trans" (cisternae farthest from the endoplasmic reticulum).

Two networks, the cis Golgi network and the trans Golgi network, which are made up of the outermost cisternae at the cis and trans faces, are responsible for the essential task of sorting proteins and lipids that are received (at the cis face) or released (at the trans face) by the organelle.

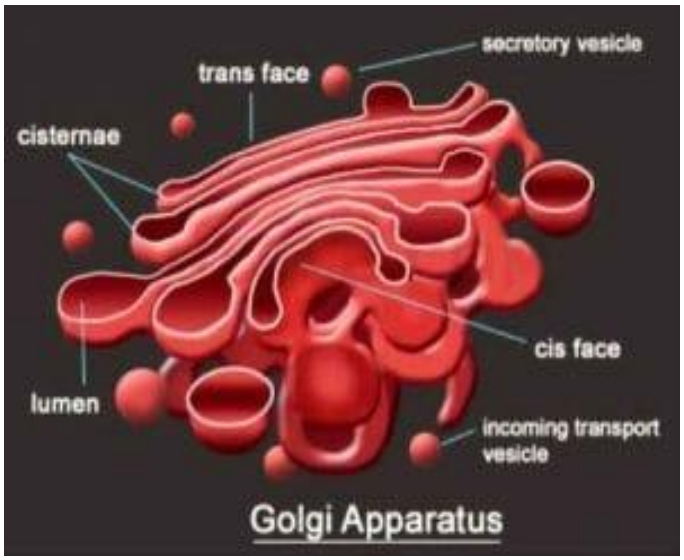
CIS FACE

The image below shows the structure of the Golgi apparatus. The *cis face* of the organelle is closest to the endoplasmic reticulum.

TRANS FACE

The ***Trans face*** is the side furthest from the nucleus, which secretes vesicles to various parts of the cell. Further, **there are a number of lumens and cisternae** through which products flow.

These appear as a series of flattened sacs stack on each other, much like the endoplasmic reticulum.



FUNCTIONS

The golgi apparatus modifies proteins and lipids that it receives from the endoplasmic reticulum. These biochemicals leave the golgi

by exocytosis befor being delivered to different intracellular or extracellular targets.

PROTEIN PROCESSING

Carbohydrate regions of glycoproteins are altered by addition removal or modification of carbohydrates.

LIPID PROCESSING

Adds phosphate groups and glycoproteins to lipids from the endoplasmic reticulum (such as cholesterol) to create the phospholipids that make up the cell membrane. By CNX OpenStax http://cnx.org/contents/GFy_h8cu@10.53:rZudN6XP@2/Introduction [CC BY 4.0] via Wikimedia Common

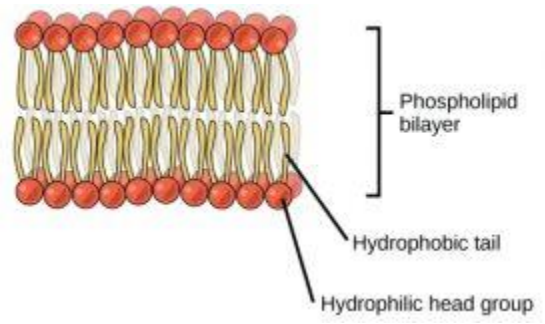


Fig 2.0 – The Phospholipid bilayer is made of components produced in the golgi

SORTING, BUDDING AND EXOCYTOSI

Biochemicals are **chemically labelled** in the golgi to ensure appropriate delivery to the correct destination. Once they bud off the trans-Golgi

LYSOSOMAL PROTEINS

Such as enzymes are packaged into specific vesicles. These proteins are typically tagged with mannose-6-phosphate in the Golgi

SECRETORY PROTEINS

such as hormones are packaged into secretory vesicles ready for exocytosis. This requires ATP as two negatively charged membranes need to fuse to allow their release. The membrane of the vesicle will form part of the cell membrane. This is only possible in Golgi of secretory cells.

CELL SURFACE PROTEINS –

such as phospholipids enter the constitutive secretory pathway present in all cells.

Structure of Eukaryotic cell

DEFINITION

Eukaryotic cells have a nucleus enclosed within the nuclear membrane and form large and complex organisms. Protozoa, fungi, plants, and animals all have eukaryotic cells. They are classified under the kingdom Eukaryota.

They can maintain different environments in a single cell that allows them to carry out various metabolic reactions. This helps them grow many times larger than the prokaryotic cells.

Characteristics of Eukaryotic Cells

The features of eukaryotic cells are as follows:

1. Eukaryotic cells have the nucleus enclosed within the nuclear membrane.
2. The cell has mitochondria.
3. Flagella and cilia are the locomotory organs in a eukaryotic cell.
4. A cell wall is the outermost layer of the eukaryotic cells.
5. The cells divide by a process called mitosis.
6. The eukaryotic cells contain a cytoskeletal structure.
7. The nucleus contains a single, linear DNA, which carries all the genetic information.

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

- 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.

Lysosomes

They are known as “suicidal bags” because they possess hydrolytic enzymes to digest protein, lipids, carbohydrates, and nucleic acids.

These are double-membraned structures and are found only in plant cells. These are of three types:

Chloroplast

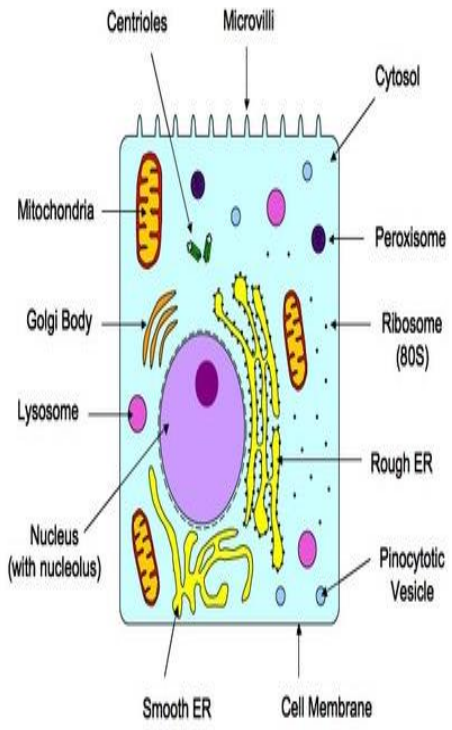
That contains chlorophyll and is involved in photosynthesis.

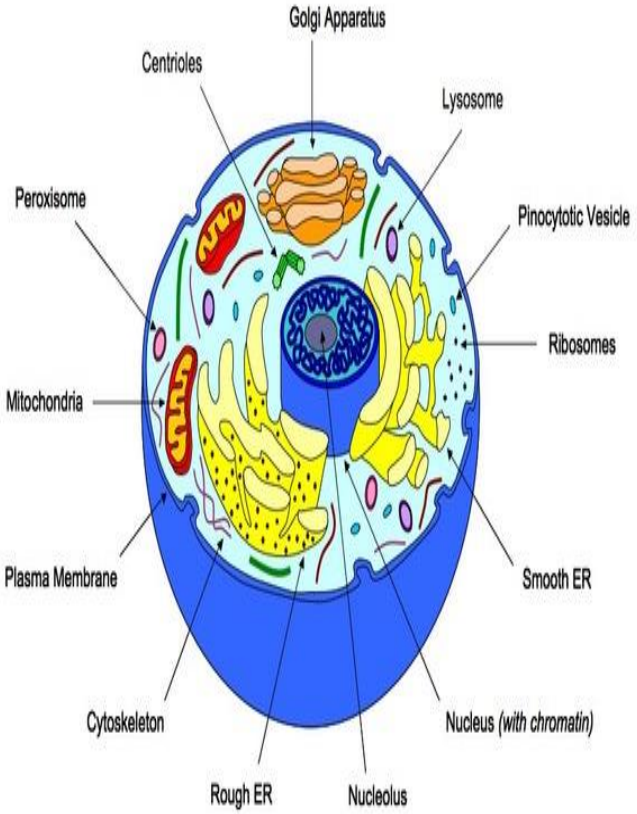
Chromoplast

That contains a pigment called carotene that provides the plants yellow, red, or orange colours.

Leucoplasts

That is colourless and store oil, fats, carbohydrates, or proteins.





Structure of prokaryotes cell

DEFINITION

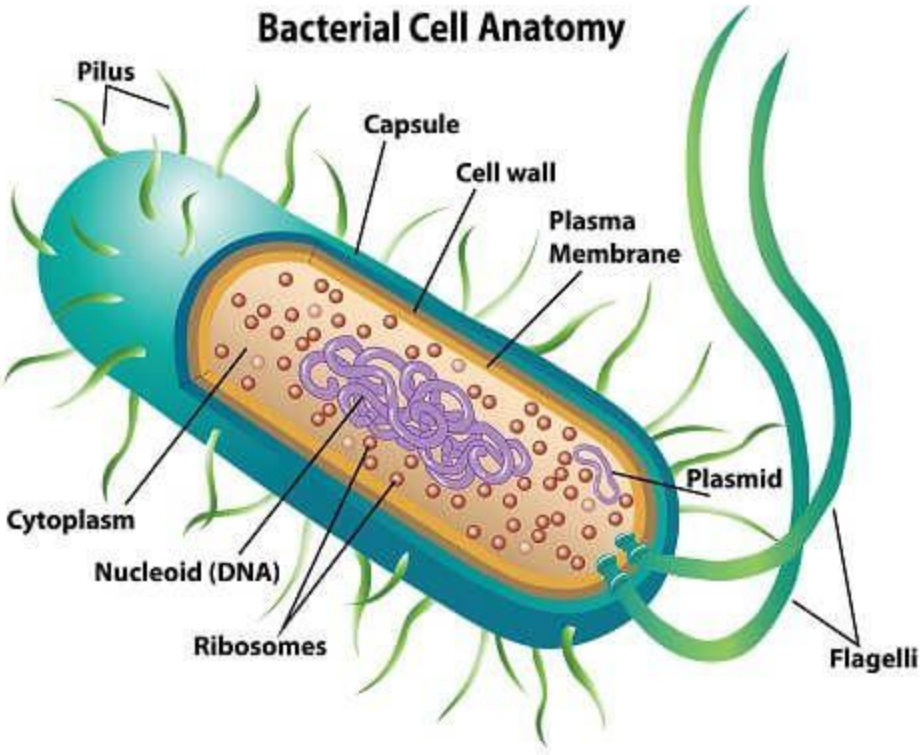
Organisms that have prokaryotic cells are unicellular. They are called “Prokaryotes”. The prokaryotic cell has several elements that allow it to function as a living organism. Second, these cells house both loose DNA and ribosomes. Though ribosomes are organelles, they are not bound by a plasma membrane.

A prokaryotic cell is a type of cell that does not have a true nucleus or membrane-bound organelles. Organisms within the domains Bacteria and Archaea are based on the prokaryotic cell, while all other forms of life are eukaryotic. However, organisms with prokaryotic cells are very abundant and make up much of Earth’s biomass.

EXAMPLES OF PROKARYOTES:

- Escherichia Coli Bacterium (E. coli)
- Streptococcus Bacterium.
- Streptomyces Soil **Bacteria**.
- **Archaea**.

- The following image is a diagram of a prokaryotic cell; in this case, a bacterium.



- The Anatomy of a Bacterial Cell

PROKARYOTIC CELL STRUCTURE

A NUCLEOID REGION

Prokaryotic cells do not have a true nucleus that contains their genetic material as eukaryotic cells do. Instead, prokaryotic cells have a nucleoid region, which is an irregularly-shaped region that contains the cell's DNA and is not surrounded by a nuclear envelope.

CELL WALL

Some other parts of prokaryotic cells are similar to those in eukaryotic cells, such as a cell wall surrounding the cell (which is also found in plant cells, although it has a different composition).

CYTOPLASM

Like eukaryotic cells, prokaryotic cells have cytoplasm, a gel-like substance that makes up the "filling" of the cell, and a cytoskeleton that holds components of the cell in place.

RIBOSOMES

Both prokaryotic cells and eukaryotic cells have ribosomes, which are organelles that produce proteins, and vacuoles, small spaces in cells that store nutrients and help eliminate waste.

FLAGELLA

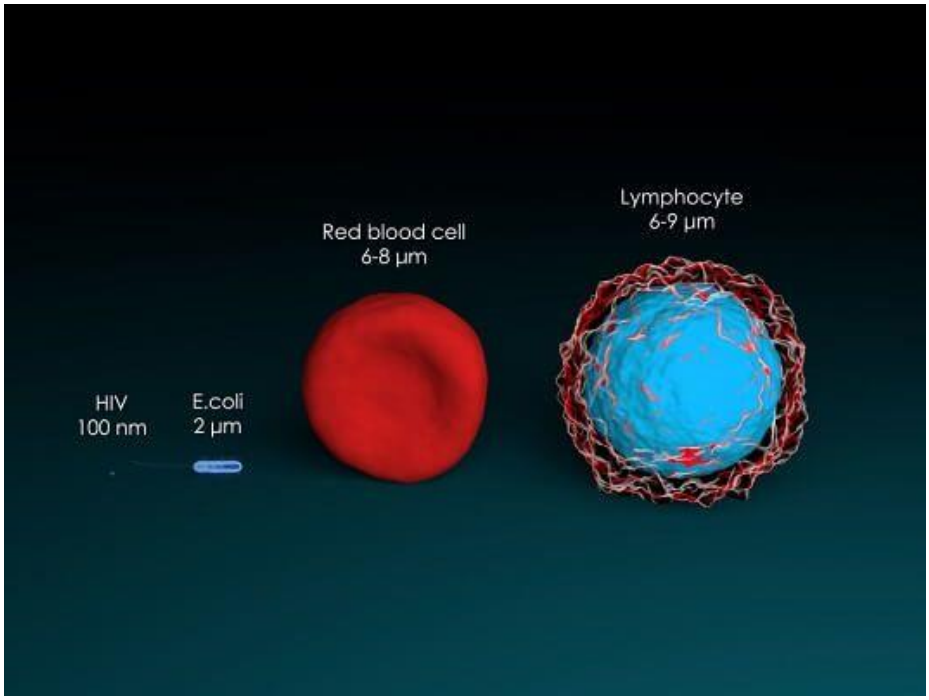
Some prokaryotic cells have flagella, which are tail-like structures that enable the organism to move around.

PILI,

They may also have pili; small hair-like structures that help bacteria adhere to surfaces and can allow DNA to be transferred between two prokaryotic cells in a process known as conjugation.

CAPSULE

Another part that is found in some bacteria is the capsule. The capsule is a sticky layer of carbohydrates that helps the bacterium adhere to surfaces in its surroundings.



- The size of a Prokaryotic cell (E. coli) vs Two Eukaryotic cells and a virus

PROKARYOTIC CELL PARTS

Unlike eukaryotic cells, prokaryotic cells have no distinct organelles bound by membranes. Instead, the many reactions the cell conducts happen within the cytoplasm of the cell. In fact, there are 2 main components that are present within all prokaryotic cells.

THE FIRST IS A CELL MEMBRANE.

This is a layer of phospholipid molecules that separate the inside of the cell from the outside. While not present in all prokaryotes, many secrete a *cell wall* used to protect and house the cell in an extra layer of proteins and structural molecules.

THE SECOND PART FOUND IN ALL PROKARYOTIC CELLS IS DNA.

DNA is the basic blueprint for all life and is found within all cells. In prokaryotes, the DNA often takes the form of a large circular genome. This can be compared to the organized chromosomes which are typically found within eukaryotes. This large circle of DNA directs which proteins the cell creates, and regulates the actions of the cell.

CHARACTERISTICS OF PROKARYOTIC CELLS

All prokaryotic cells have a nucleoid region, DNA and RNA as their genetic material, ribosomes that make proteins, and cytosol that contains a cytoskeleton that organizes cellular materials. However, prokaryotic organisms are a very diverse group of organisms and come in many different shapes and sizes. These changes in structure typically represent changes in function, and these many different organisms occupy very different niches.

Prokaryotic cells are usually between 0.1 to 5 micrometers in length (.00001 to .0005 cm). Eukaryotic cells are generally much larger, between 10 and 100 micrometers. Prokaryotic cells have a higher surface-area-to-volume ratio because they are smaller, which makes them able to obtain a larger amount of nutrients via their plasma membrane.

FUNCTIONS OF PROKERYOTIC CELL

Prokaryotes have a cell membrane or plasma membrane that acts like a protective cover.

They also have a rigid **cell wall** for added support and **protection**. Prokaryotic cells have **ribosomes**, which are molecules that make proteins.

Their genetic material is in the nucleoid, which is the region where DNA lives.