ULTRASTRUCTURE OF EUKARYOTIC CELL

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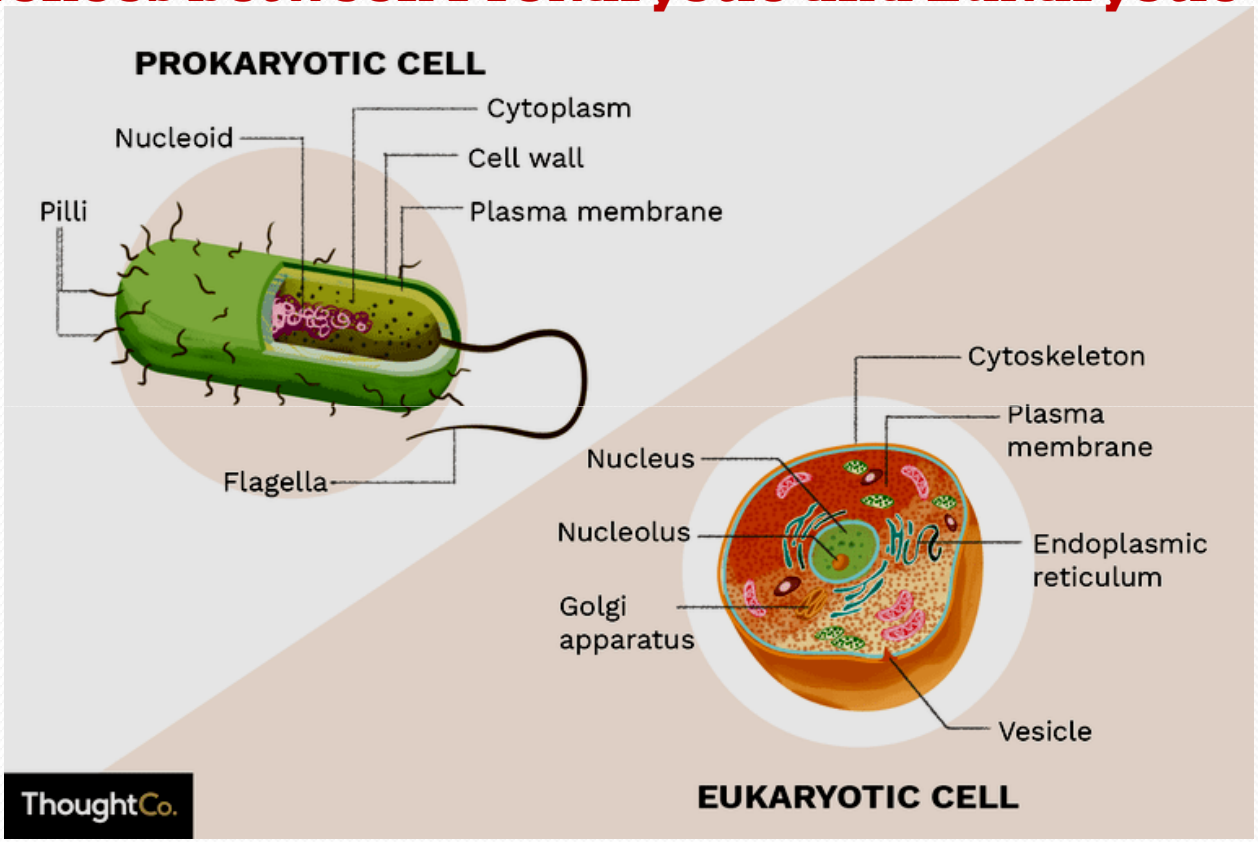
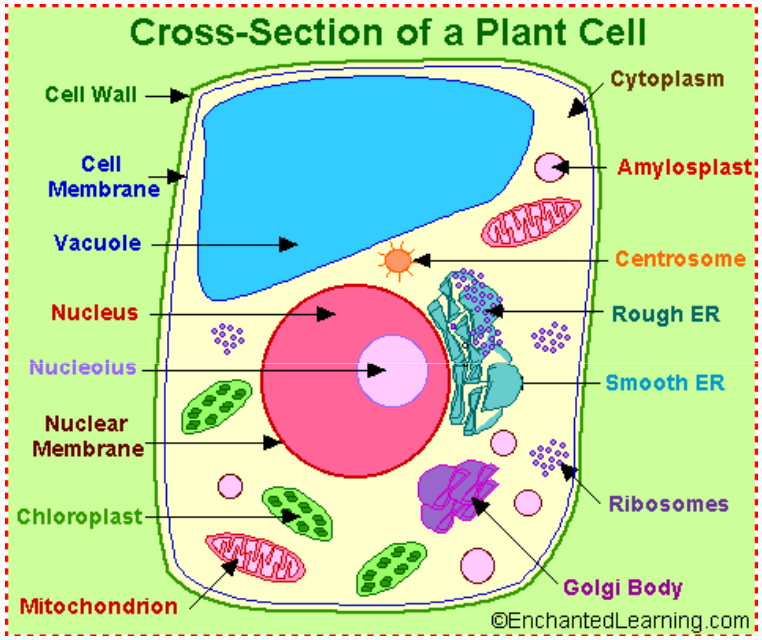
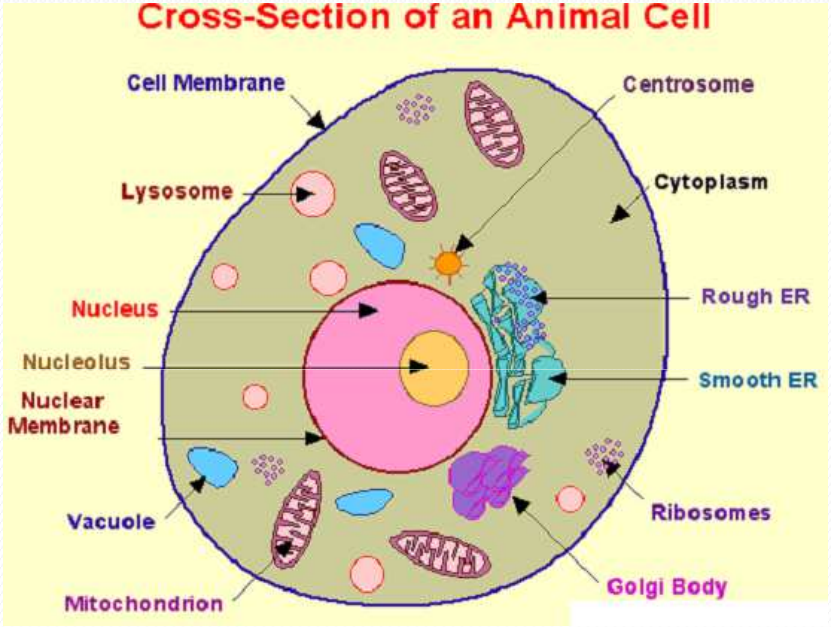
Differences between Prokaryotic and Eukaryotic Cells



Overview of Plant and Animal Cell



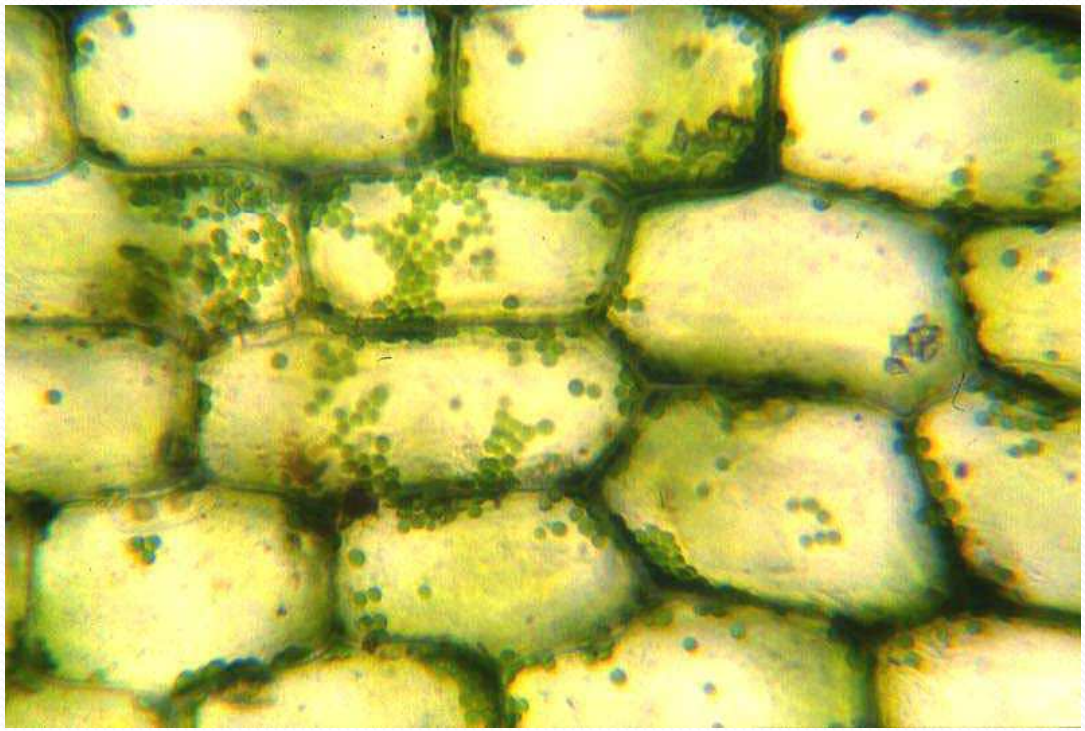


Major differences between Plant and Animal Cells

	Animal Cell	Plant Cell
Cell wall:	Absent	Present
Shape:	Round (irregular shape)	Rectangular (fixed shape)
Vacuole:	One or more small vacuoles (	One
Centrioles:	Present in all animal cells	Only present in lower plant forms.
Chloroplast:	Animal cells don't have chloroplasts	Plant cells have chloroplasts because they make their own food
Cytoplasm:	Present	Present
Endoplasmic Reticulum (Smooth and Rough):	Present	Present
Ribosomes:	Present	Present
Mitochondria:	Present	Present
Golgi Apparatus:	Present	Present
Plasma Membrane:	only cell membrane	cell wall and a cell membrane
Microtubules/ Microfilaments:	Present	Present
Lysosomes:	Lysosomes occur in cytoplasm.	Lysosomes usually not evident.
Nucleus:	Present	Present

Primary Cell Structure

That can be seen using the light microscope



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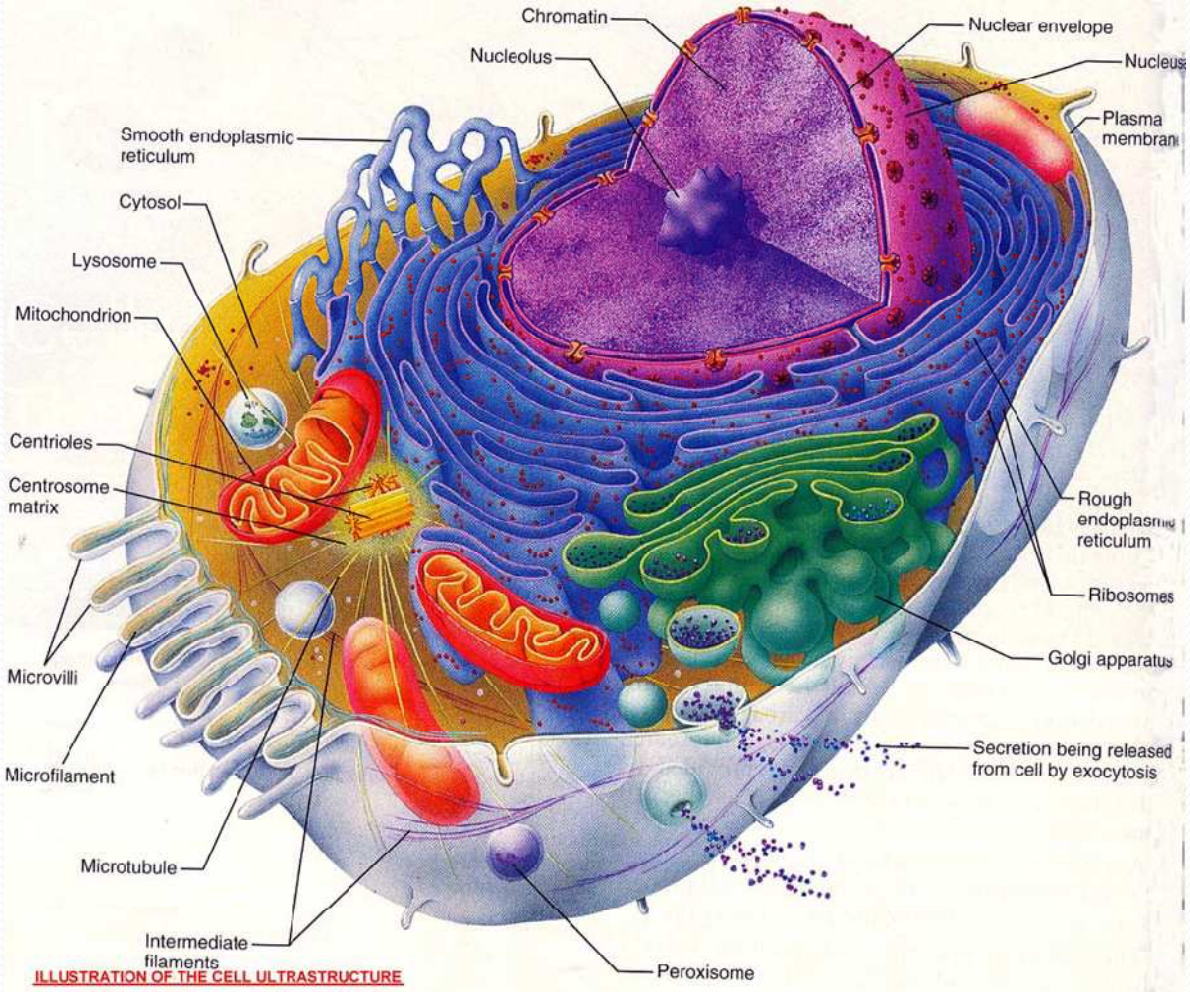
Ultrastructure as observed under the Electron Microscope



EUKARYOTE CELL ULTRASTRUCTURE

ORGANELLE	MAIN FUNCTIONS	DIMENSIONS
Nucleus	Cell division, protein synthesis	10 µm diameter
Mitochondrion	Respiration pathways	1.0 to 12.5 µm
Chloroplast	Photosynthetic pathways	5 to 10 µm dia
Lysosome	Digestion, recycling & isolation	0.5 to 3.0 µm dia
Golgi apparatus	Secretion, reprocessing, lysosome synthesis	Cisternae: 0.5µm thick, l-3µm diameter
Endoplasmic Reticulum (ER)	Support, Golgi apparatus synthesis	26 to 56 nm thick
Ribosome	Protein synthesis	20 nm diameter

Cell Wall

Most plant cell possess,
This distinguishes from animal cell,
Non-living, secreted by living protoplast
Structure:
Three layers i. Middle lamella
ii. Primary Cell Wall
iii. Secondary Cell Wall
Occasionally tertiary wall may be present

FUNCTIONS OF CELL WALL

- Protects the protoplast & Provides mechanical strength
- Give definite shape to the cell
- Helps in absorption, secretion and transportation
- Controls the size of cell
- Controlling Turgur pressure

Turgor Pressure or turgidity is the pressure of the cell contents against the cell wall

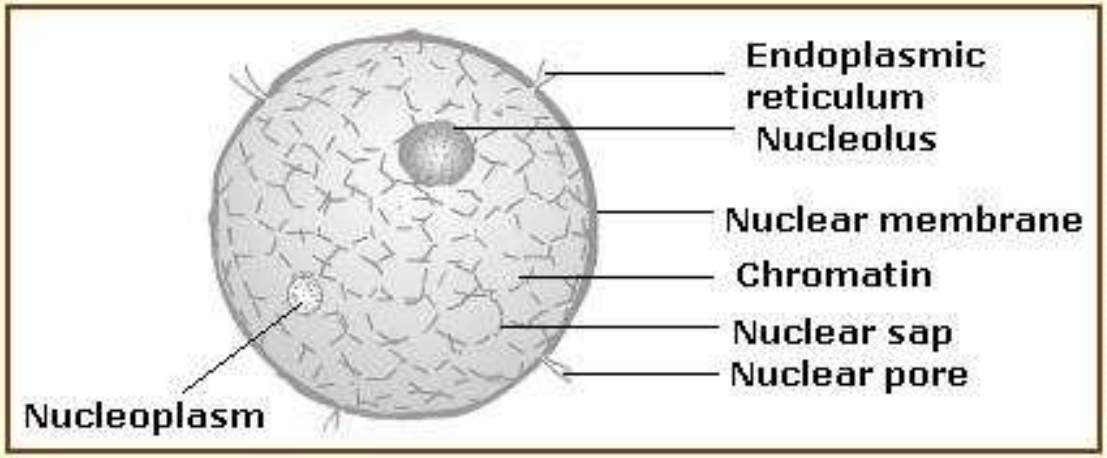
PLASMA MEMBRANE

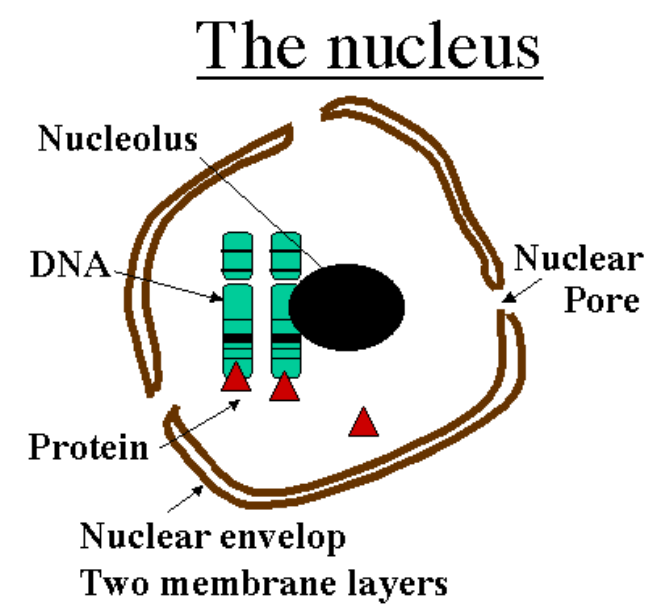
- **Protoplast bounded by thin membrane beneath the cell wall – Plasmalemma/Cell Membrane/ Plasma Membrane.**
- **Measure 7.5 nm thickness.**
- **Chemically made up of Proteins & Phospholipids.**

Functions of Plasma Membrane

- **Communication**
- **Permeability**
- **Osmosis and Osmotic Pressure**
- **Diffusion or Passive Transport.**
- **Endocytosis**

Nucleus



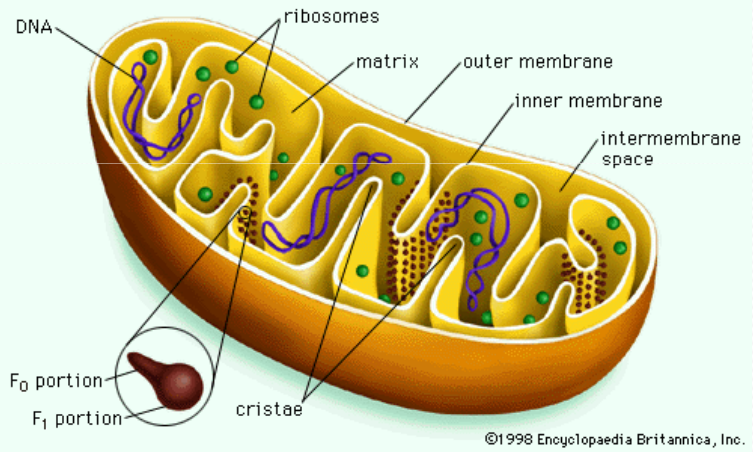


- Discovered by Robert Brown 1831.
- Number
- Shape
- Nuclear Membrane
- Nucleoplasm
- Chromatin
- Nucleolus

Functions of nucleus

- Controls & regulates all functions of the cell. So called as Dynamic Centre of Cell / Cell Brain.
- Plays important role in heredity.
- Nuclear membrane separates genetic material from cytoplasmic enzymes.
- Helps in Transcription, Translation & ribosome formation.

Mitochomdria

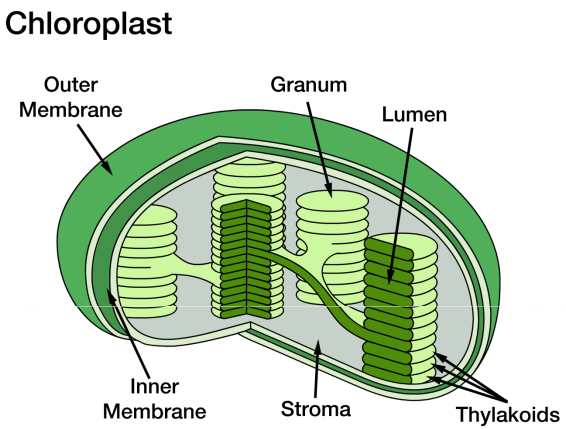


- **Discovered by Kolliker in 1880.**
- **-5 distinct compartments- outer membrane, inter membrane space, inner membrane, cristae & matrix**
- **Inner Membrane Subunits/Elementary particles involved in respiratory chain.**

Functions of Mitochondria

- **Are the POWER HOUSE OF THE CELL / Cell Furnaces/ Bio – Furnaces**
- **Respiration by Glycolysis, Oxidation of Pyruvuc acid, Kreb's Cycle.**
- **Most mitochondria have set of enzymes that controls lipid synthesis, fatty acids etc.,**

Chloroplast

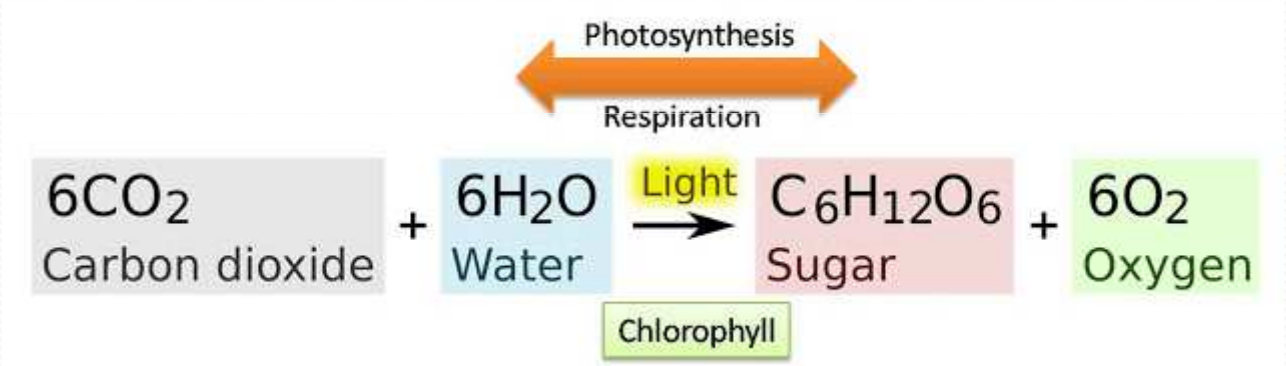


- **Outer and inner membranes form a compartment.**
- **The formed compartment is called the inter membrane space**
- **The space inside the inner membrane holds stroma fluid and grana**
- **In Stroma: Dark reaction**
- **In Grana : Light reaction**

Shape:
Size:
Number:

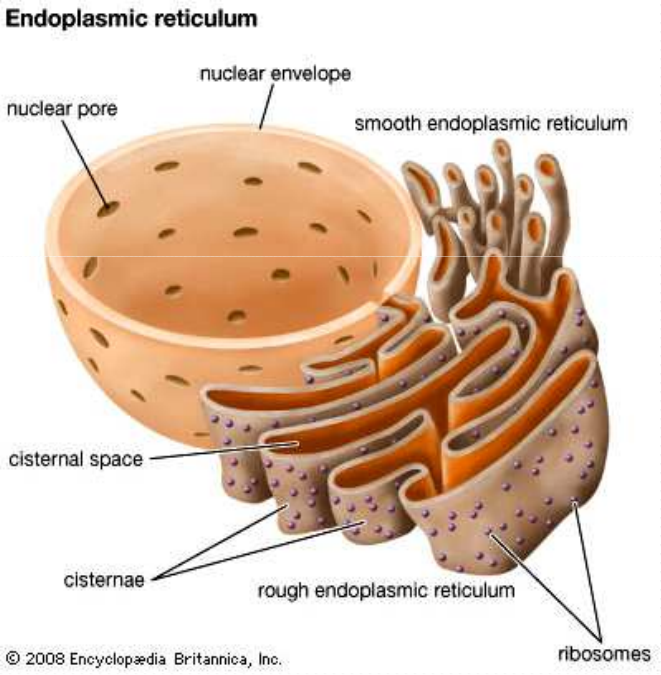
Functions of Chloroplast

- Carry out the PHOTOSYNTHESIS by light reaction and dark reaction



Endoplasmic Reticulum

Coined by Porter, 1953



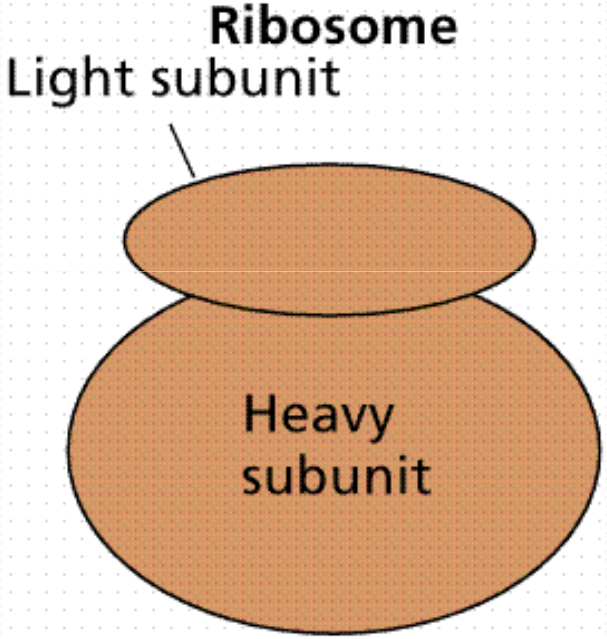
- Continuous with the outer membrane of the nucleus
- Network of sac-like structures
- Held together by the cytoskeleton
- Work with the Golgi Apparatus
- Vesicular, tubular, or flattened sheets
- Expands as the cell becomes more active
- Inside is called lumen

Occures as cisternae/vesicles/ tubules

Functions of Endoplasmic Reticulum

- **Act as secretary, storage, circulatory and nervous system of the cell.**
- **It provides skeletal frame work to the cell**
- **Membrane contains many enzymes that controls various catabolic (breaking) & anabolic (synthesis) reactions.**
- **It forms new nuclear envelop after each cell division.**

Ribosomes

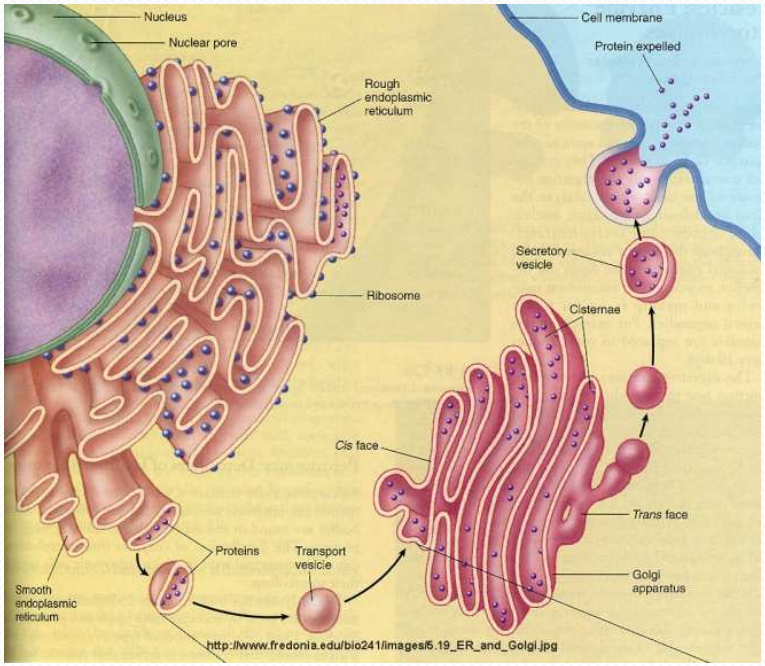


- Formed in the nucleus
- Has two subunits-60S &40S
- Made up of
  - -~65% RNA
  - -~35% protein
- About 20 nm in diameter

Functions of Ribosomes

- **Take part in Protein synthesis**.

Golgi Complex



- **Membrane bound sacs**
- **Number -1 or more**
- **Golgi network fuse with parts of the rough ER to work together**
- **Lumen is the inside**
- **Vesicular-tubular cluster moves back and forth to the ER and the Golgi Apparatus**

Functions of Golgi Complex

- **Processes proteins for excretion**
- **Modifying, sorting, and packaging macromolecues**
  - **-for cell excretion (exocytosis)**
  - **-for use inside the cell**
- **Modifies proteins delivered by the rough ER and other substances/molecule**
- **Creates lysosomes**
- **Allows for modification and sorting by enzymes in the lumen**

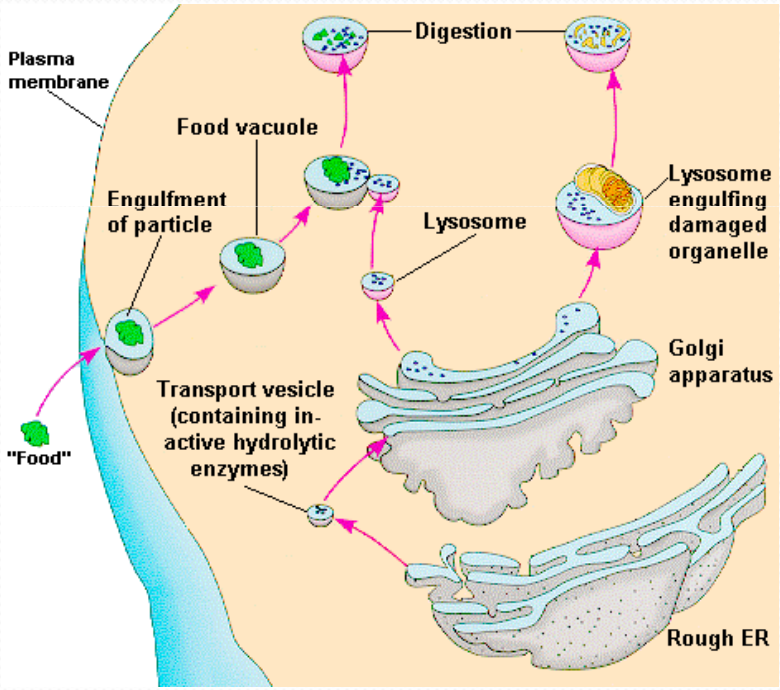
Lysosomes

- **Contain digestive enzymes-Proteases, Nucleases, Phosphatases, Phospholipases**
- **Protects the organelle from destroying the cell**

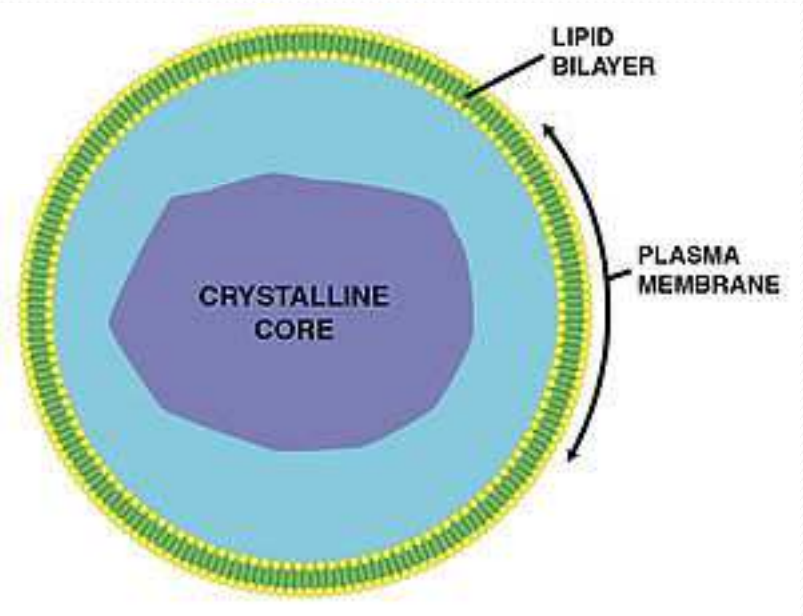
Functions of Lysosomes

- -organelles
- -food particles
- -bacteria
- -macromolecules

Method of garbage disposal in cells



Peroxisomes



Peroxisomes are single-membrane structures found in all eukaryotic cells.

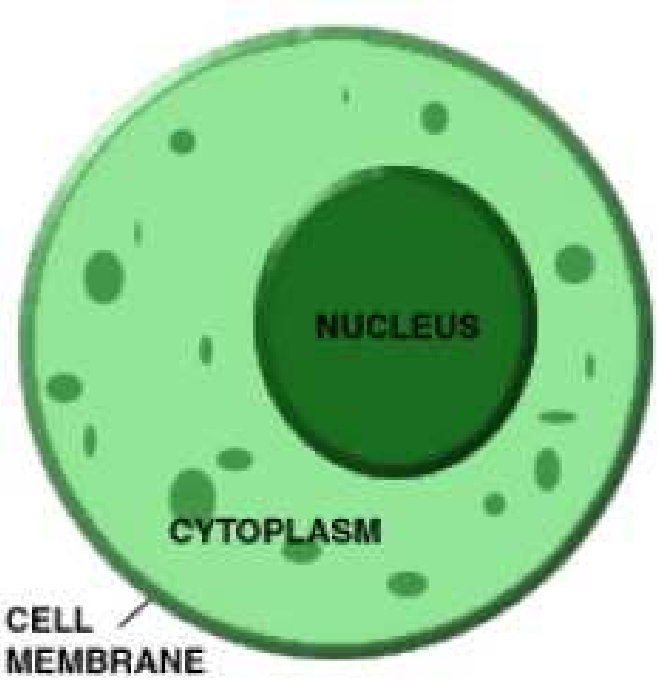
Are small, that use molecular oxygen to oxidize organic molecules.

Enzymes that help produce and degrade hydrogen peroxide.

Functions of Peroxisomes

- **Hydrogen peroxide metabolism**
- **Breakdown of fatty acids by β-Oxidation**
- **Photorespiration & Glyoxylate Cycle**

Cytoplasm



- **Cytoplasm is a homogeneous, generally clear jelly-like material that fills cells.**
- **Consists of cytosol and the cellular organelles, except the nucleus.**
- **The cytoplasm plays an important role in a cell, serving as a "molecular soup" in which the organelles are suspended and held together by a fatty membrane.**

Functions of Cytoplasm

The cytoplasm plays a mechanical role, *i.e.*, to maintain the shape, the consistency of the cell and to provide suspension to the organelles.

Acknowledgements
to

INTERNET

FOR
PICTURES