



**CHANDIGARH
UNIVERSITY**

Discover. Learn. Empower.

UNIVERSITY INSTITUTE OF SCIENCES

DIVISION ACEDMIC UNIT 1

Bachelor of Engineering (Computer Science & Engineering)

Biology For Engineers 20SZT-148



CELL ORGANELLE

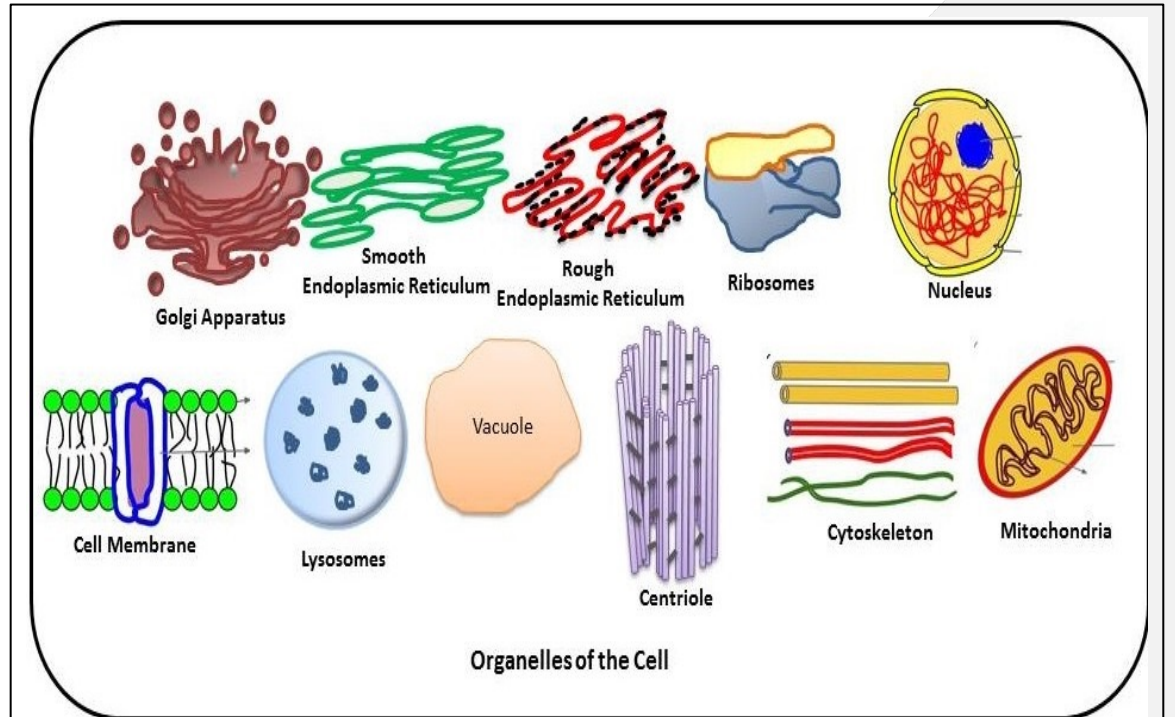
BY Shruti Sharma

DISCOVER . **LEARN** . EMPOWER

CELL ORGANELLE

Course Objective

- This subject is designed to impart fundamental knowledge on basic and emerging fields of biology like bioinformatics.
- It is designed to impart knowledge that how to apply basics of biology in engineering.

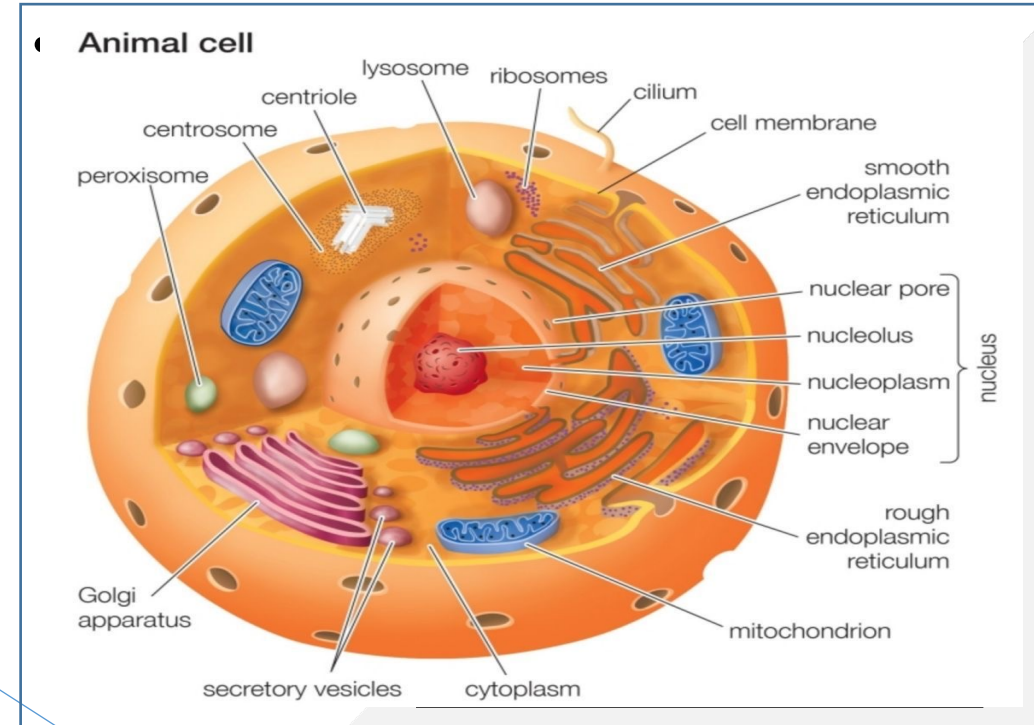


https://3.bp.blogspot.com/-WMDKz54WFG0/UQDBY8b_L-I/AAAAAAAAAKs/EP6G73F9msQ/s1600/Organelles+of+the+cell.jpg

CELL ORGANELLE

Course Outcome

CO Number	Title	Level
CO1	To apply knowledge of cell biology to identify, formulate, and solve problems.	Remember
CO2	To excel in career as researcher in both traditional and emerging fields of science .	Understand
CO3	To apply knowledge of molecular biology, biosensors and immunology to excel in areas such as entrepreneurship, medicine, government, and education	Understand
CO4	To think critically and creatively, especially about the use knowledge about biology of cancer and new areas of biology to address local and global problems	Understand



Will be covered
in this lecture

Fig 1. Animal cell

<https://cdn.britannica.com/03/114903-050-502CFE8D/Cutaway-drawing-cell.jpg>

SYLLABUS

Unit 1 Two Chapters: (15 hours)

- **Chapter No.1**

- **Basic Cell Biology**

Contact Hours

9 Hours

- Introduction: Living Organisms, Cells and Cell theory, Cell Structure and Function, Genetic information, protein synthesis, and protein structure.

- **Chapter No. 2**

- **Cell cycle & Tissue Engineering**

6 hours

- Cell growth, Cell Division, and differentiation. Ageing, apoptosis, stem
- Cell Biology and Tissue engineering

CELL ORGANELLES

An **organelle** (think of it as a **cell's** internal organ) is a membrane bound structure found within a **cell**. Just like **cells** have membranes to hold everything in, these mini-organs are also bound in a double layer of phospholipids to insulate their little compartments within the larger **cells**.

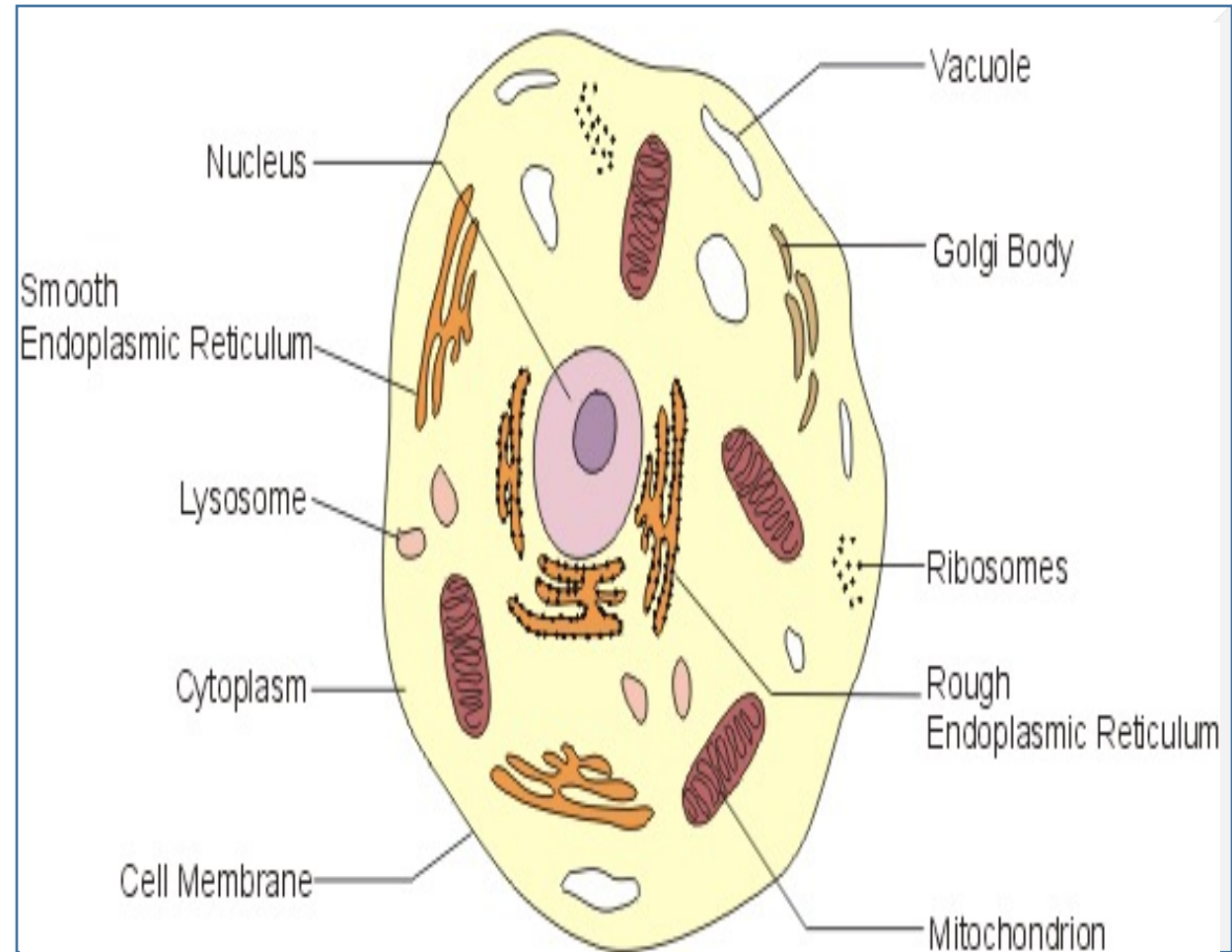


Fig2.Cell Organelle

<https://www.oum.ox.ac.uk/thezone/animals/life/images/cell02.gif>

CELL ORGANELLES

Organelle	Function	Factory part
Nucleus	DNA Storage	Room where the blueprints are kept
Mitochondrion	Energy production	Powerplant
Smooth Endoplasmic Reticulum (SER)	Lipid production; Detoxification	Accessory production - makes decorations for the toy, etc.
Rough Endoplasmic Reticulum (RER)	Protein production; in particular for export out of the cell	Primary production line - makes the toys
Golgi apparatus	Protein modification and export	Shipping department
Peroxisome	Lipid Destruction; contains oxidative enzymes	Security and waste removal
Lysosome	Protein destruction	Recycling and security

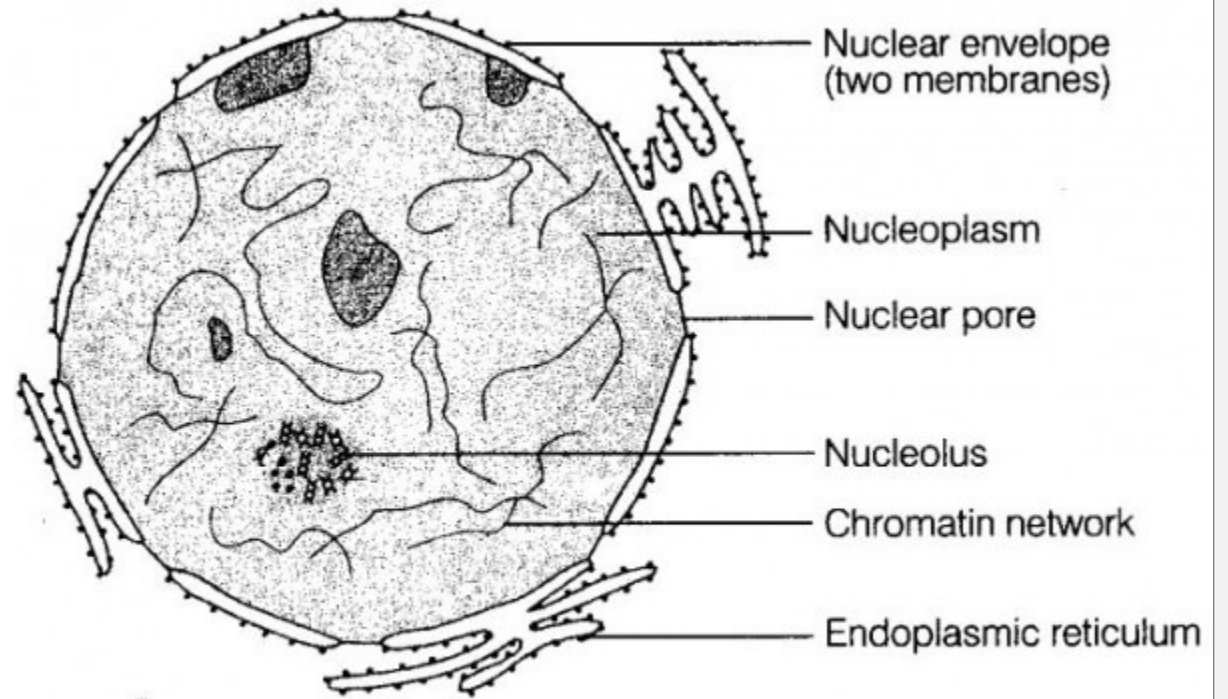
NUCLEUS

- The nucleus is the largest organelle in animal cells.
- In mammalian cells, the average diameter of the nucleus is approximately 6 micrometres (μm)
- The contents of the nucleus are held in the nucleoplasm similar to the cytoplasm in the rest of the cell.
- In most types of granulocyte, a white blood cell, the nucleus is lobated and can be bi-lobed, tri-lobed or multi-lobed.

NUCLEUS

Nucleus consists of these parts:

- Nuclear envelope and pores
- Nuclear lamina
- Chromosomes
- Nucleolus
- Other nuclear bodies



A well labelled diagram of eukaryotic nucleus

Fig 4.Nucleus

https://www.studyrankersonline.com/?qa=blob&qa_blobid=5493838274361406496

FUNCTIONS OF NUCLEUS

- The nucleus provides a site for genetic transcription.
- The main function of the cell nucleus is to control gene expression and mediate the replication of DNA during the cell cycle.
- It contains the majority of the cell's genetic material.
- Genetic material is organized as DNA molecules, along with a variety of proteins, to form chromosomes.

MITOCHONDRIA

- A mitochondrion contains outer and inner membranes composed of phospholipid bilayers and proteins..
- the outer mitochondrial membrane,
- the intermembrane space (the space between the outer and inner membranes),
- the inner mitochondrial membrane,
- the cristae space (formed by infoldings of the inner membrane), and
- the matrix (space within the inner membrane).

MITOCHONDRIA

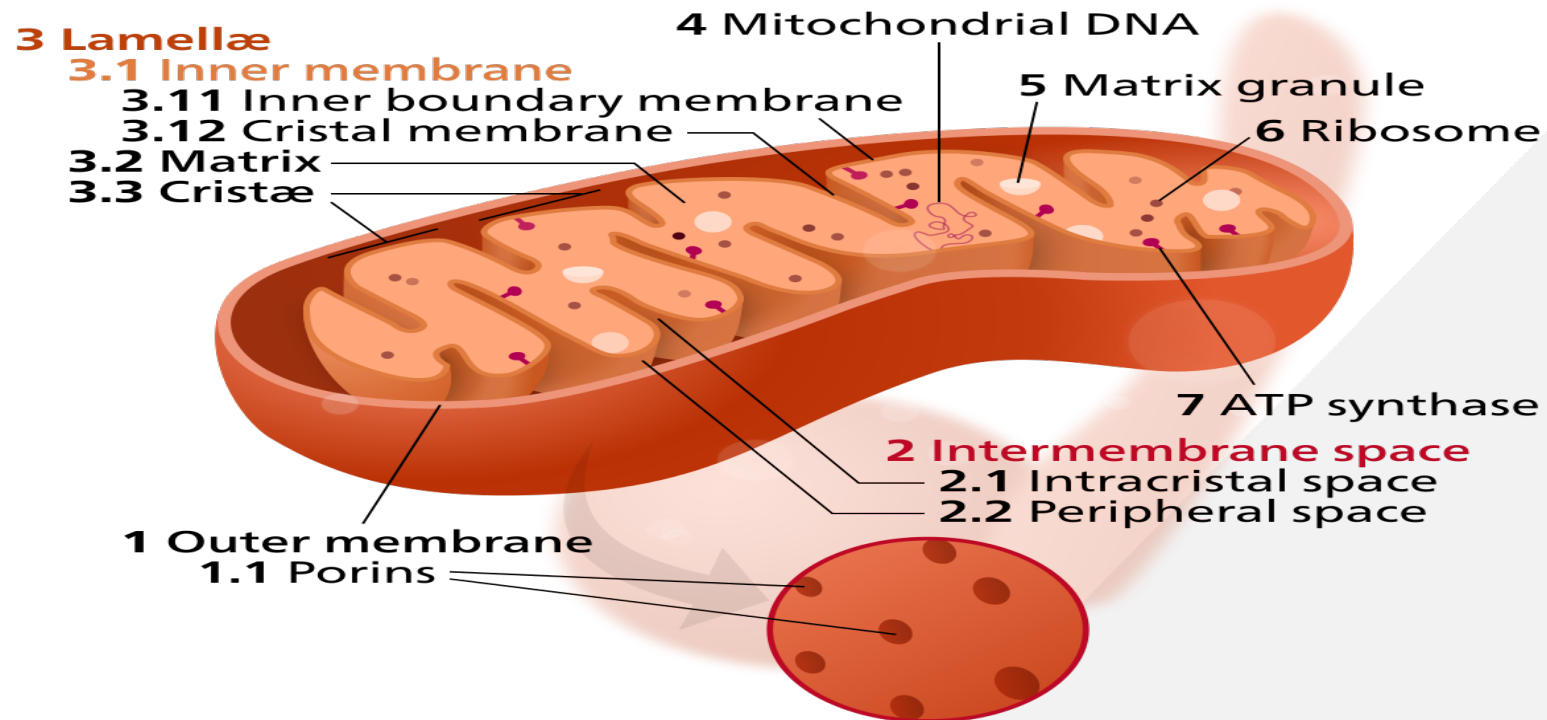


Fig 5 Mitochondria

https://upload.wikimedia.org/wikipedia/commons/thumb/b/b5/Mitochondrion_mini.svg/1200px-Mitochondrion_mini.svg.png

FUNCTIONS OF MITOCHONDRIA

- The most prominent roles of mitochondria are to produce the energy currency of the cell, ATP (i.e., phosphorylation of ADP), through respiration,
- To regulate cellular metabolism.
- The central set of reactions involved in ATP production are collectively known as the citric acid cycle, or the Krebs cycle.

FUNCTIONS OF MITOCHONDRIA

Mitochondria play a central role in many other metabolic tasks, such as:

- Signalling through mitochondrial reactive oxygen species
- Regulation of the membrane potential
- Apoptosis-programmed cell death
- Calcium signalling (including calcium-evoked apoptosis)
- Regulation of cellular metabolism
- Certain heme synthesis reactions
- Steroid synthesis and Hormonal Signalling.

Questions for Polling

Function of Mitochondria

1. To regulate cellular metabolism.
2. Apoptosis-programmed cell death
3. ATP production
4. All of the above

ENDOPLASMIC RETICULUM

- The endoplasmic reticulum is not found in red blood cells, or spermatozoa.
- The two types of ER share many of the same proteins and engage in certain common activities such as the synthesis of certain lipids and cholesterol.
- The outer (cytosolic) face of the rough endoplasmic reticulum is studded with ribosomes that are the sites of protein synthesis.
- The rough endoplasmic reticulum is especially prominent in cells such as hepatocytes.
- The smooth endoplasmic reticulum is especial mammalian liver and gonad cells.

ENDOPLASMIC RETICULUM

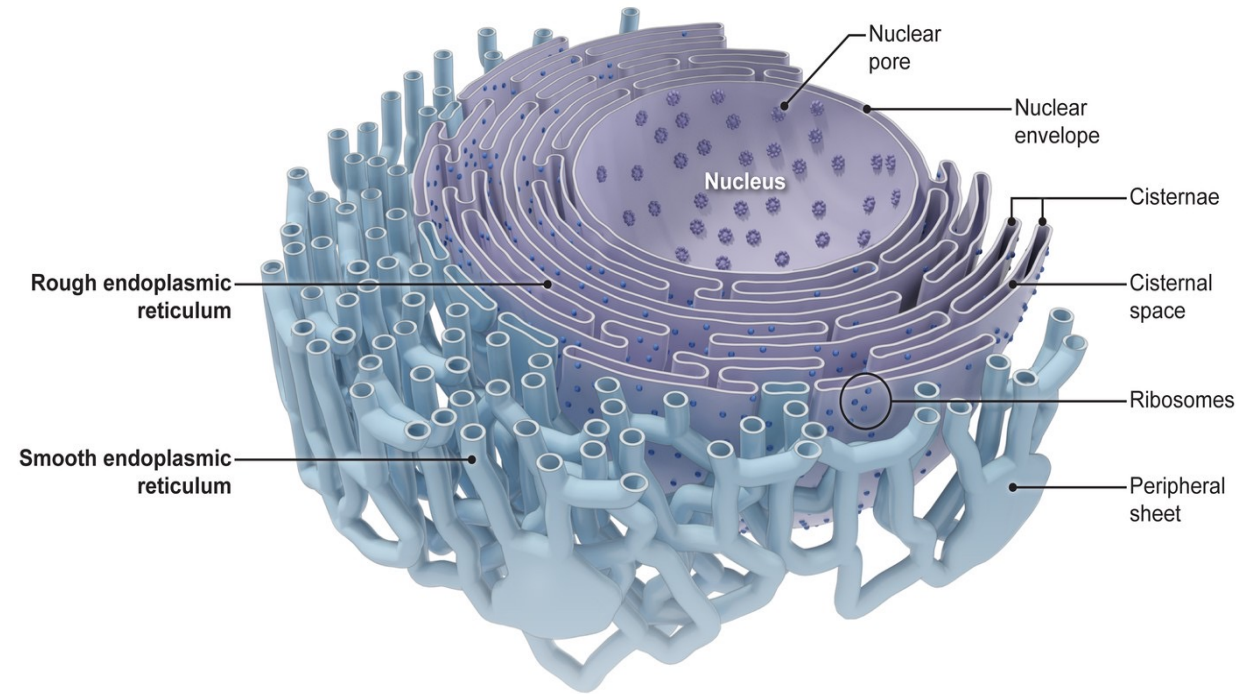


Fig 6 Endoplasmic Reticulum

<https://iiif.elifesciences.org/lax:20468%2Felif-20468-fig1-v1.tif/full/1500,/0/default.jpg>

FUNCTIONS OF ENDOPLASMIC RETICULUM

- Folding of protein molecules in sacs called cisternae.
- Transport of synthesized proteins in vesicles to the Golgi apparatus.
- Only properly folded proteins are transported from the rough ER to the Golgi apparatus .
- Disturbances in redox regulation, calcium regulation, glucose deprivation, and viral infection or the over-expression of proteins can lead to endoplasmic reticulum stress response (ER stress). This stress is emerging as a potential cause of damage in hypoxia/ischemia, insulin resistance, and other disorders.
- The smooth endoplasmic reticulum lacks ribosomes and functions in lipid synthesis but not metabolism, the production of steroid hormones, and detoxification.^[1]

CHLOROPLAST

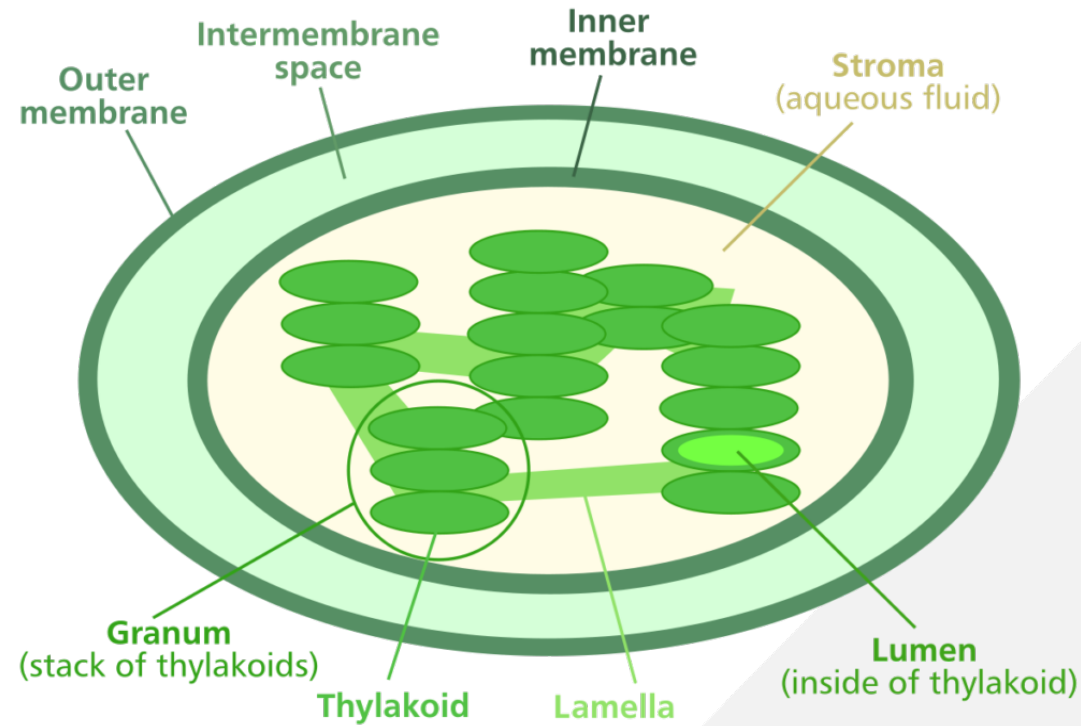


Fig 11.Chloroplast:

https://d1whtlypfis84e.cloudfront.net/guides/wp-content/uploads/2019/10/09071738/1200px-Chloroplast_diagram.svg_1024x724.png

FUNCTIONS

The most important function of the chloroplast is to synthesize food by the process of photosynthesis.

Absorbs light energy and converts it into chemical energy.

Chloroplast has a structure called chlorophyll which functions by trapping the solar energy.

LYSOSOME

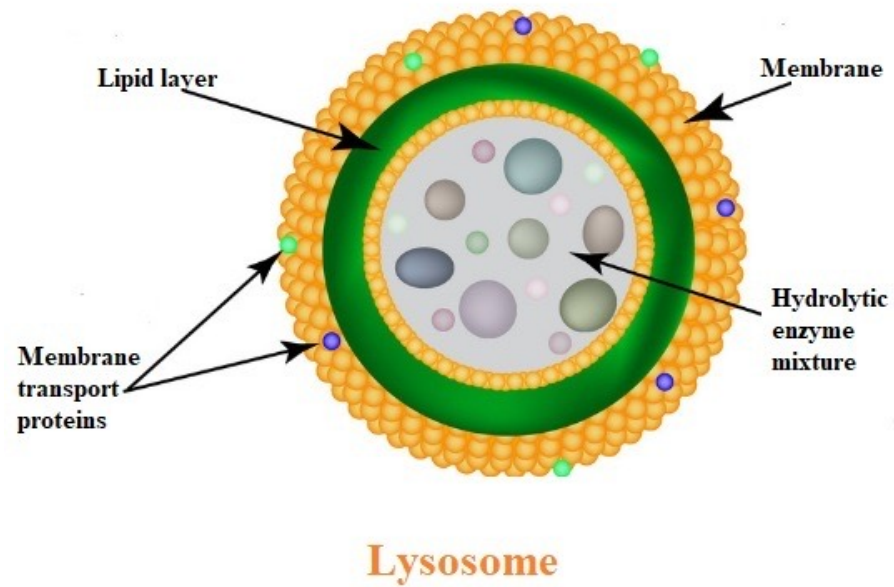


Fig 11.Lysosome

<https://www.thegreatestgarden.com/wp-content/uploads/2019/03/Lysosome-.jpg>

FUNCTIONS

- Intracellular Digestion
- Autolytic Action
- Extracellular Digestion
- Autolysis
- Fertilization

GOLGI APPARATUS

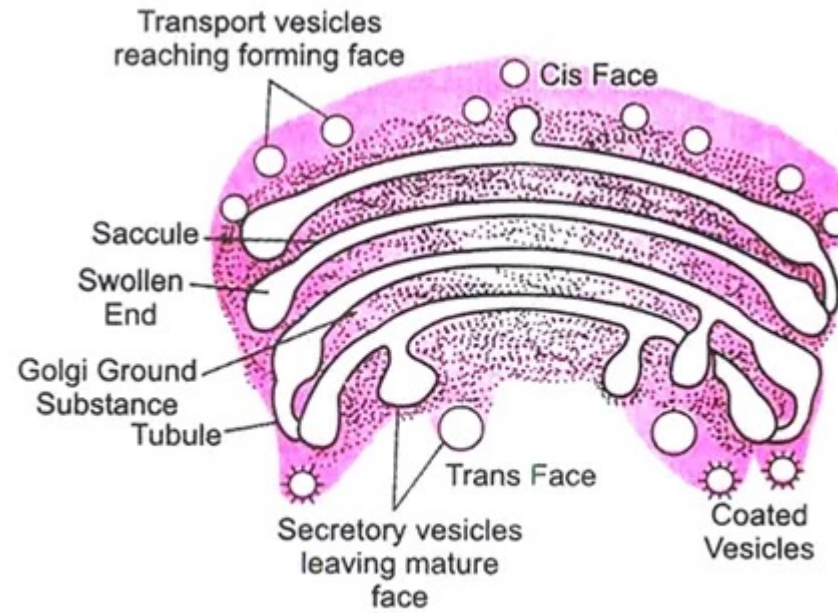


Figure : GOLGI APPARATUS IN SECTION

https://i2.wp.com/c1.staticflickr.com/9/8207/29269128522_b44f37f12b_o.png?resize=428%2C348&ssl=1

FUNCTIONS

- Absorption of compounds:
- Formation of secretory vesicles and secretion:
- Helps in enzyme formation:
- Production of hormones:
- Storage of protein:
- Formation of acrosome:
- Formation of plant cell wall:

CONCLUSION

- The nucleus is the largest organelle in animal cells.
- In mammalian cells, the average diameter of the nucleus is approximately 6 micrometres (μm)
- A mitochondrion contains outer and inner membranes composed of phospholipid bilayers and proteins. Because of this double-membraned organization, there are five distinct parts to a mitochondrion.
- The endoplasmic reticulum (ER) is a type of organelle made up of two subunits
 - rough endoplasmic reticulum (RER)
 - smooth endoplasmic reticulum (SER).

HOME WORK

- What are the functions of Nucleus.
- The site of aerobic respiration in eukaryotic cells is _____
 - a) Peroxisome
 - b) Plastid
 - c) Mitochondria
 - d) Cilia

APPLICATIONS

The study of Cell and its structures will pave way for advance studies in the cell.

It will give thorough knowledge of the Cell to enable students to disseminate knowledge in pursuing excellence in academic areas.

REFERENCES

1. <https://byjus.com/biology/cells/>
2. <https://msu.edu/~potters6/te801/Biology/biounits/cellstructure&function.htm#:~:text=Cells%20have%20many%20structures%20inside,cell's%20activities%20and%20stores%20DNA.>
3. <https://www.khanacademy.org/science/ap-biology/cell-structure-and-function>
4. C.B.Powar.2010. Cell Biology VOL I. Himalaya Publishing House.
5. Robert Weaver. 2012 “*Molecular Biology*,” 5th Edition, MCGraw-Hill.

A large, stylized white graphic composed of multiple parallel lines forming a large, open 'L' shape that frames the text 'THANK YOU' from the left and top.

THANK YOU

Two thin, parallel orange diagonal lines are positioned in the bottom-left corner of the slide.

For queries
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