

# BIOLOGY SYLLABUS

- Diversity in the living world
- Cell and cell division
- Constituents of food (biomolecules)
- Structural organization of Plants and animals
- Plants physiology and reproduction
- Human system
- Health and diseases
- Economic importance of biology
- Ecology, Biodiversity and Environment

# THE MOST IMPORTANT TOPICS

## 1. CELL

- Discovery
- Eukaryotic vs Prokaryotic cell
- Cell organelles and their functions
- Animal and plant cell

## 2. TISSUE

- Animal Tissue
- Plant tissue (mostly from xylem and phloem)

### 3. COMMON DISEASES

- Bacterial
- Fungal
- Viral
- Deficiency Diseases
- Gastric Disorder
- Hormones & their roles

### 4. CLASSIFICATION OF LIVING ORGANISMS

- Monera
- Protista
- Fungi
- Animal Kingdom
- Plant Kingdom

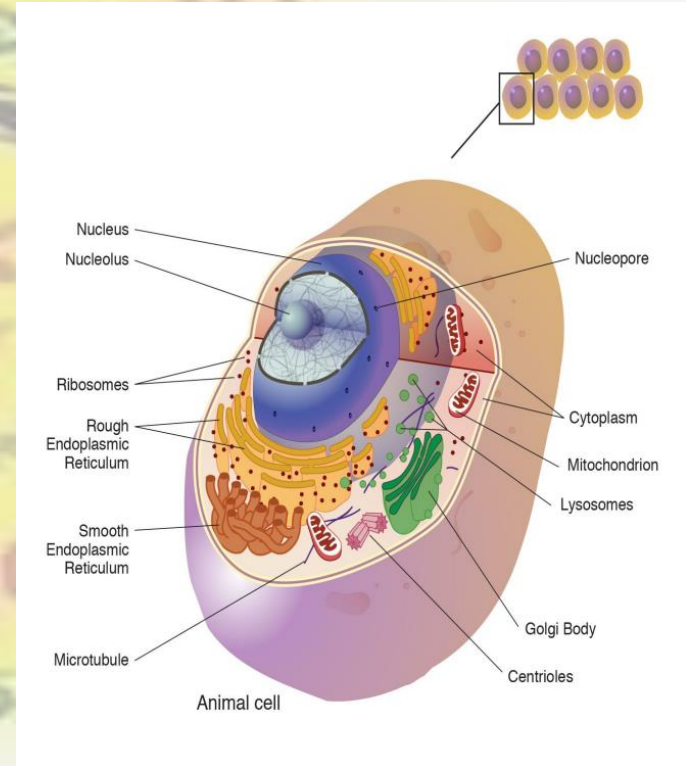
# PLANT PHYSIOLOGY

- Parts of Flower
- Germination of seeds, pollination etc
- General questions on the founders of different terms of Biology
- How to write scientific names
- Founders of different theories

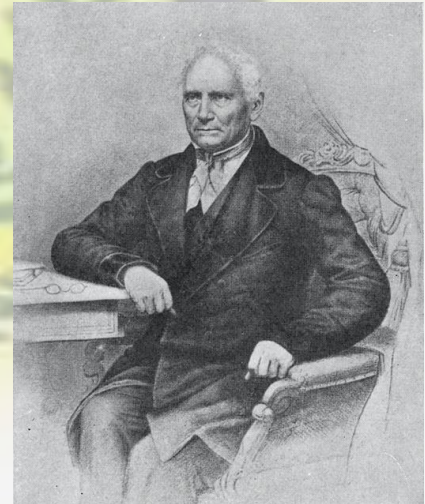


# BASIC UNIT OF LIFE: CELL

- The Human body is composed of trillions of cells
- The basic building block of all living things
- Independent existence
- Performing essential life functions
- Come in different shapes- round, flat, long, star-like, cubed, even shapeless



- First discovered by Robert Hooke 1665
- Robert Brown in 1831, discovered nucleus in a cell
- Leeuwenhoek in 1674, discovered free living cell
- Purkinje in 1839, coined the term protoplasm



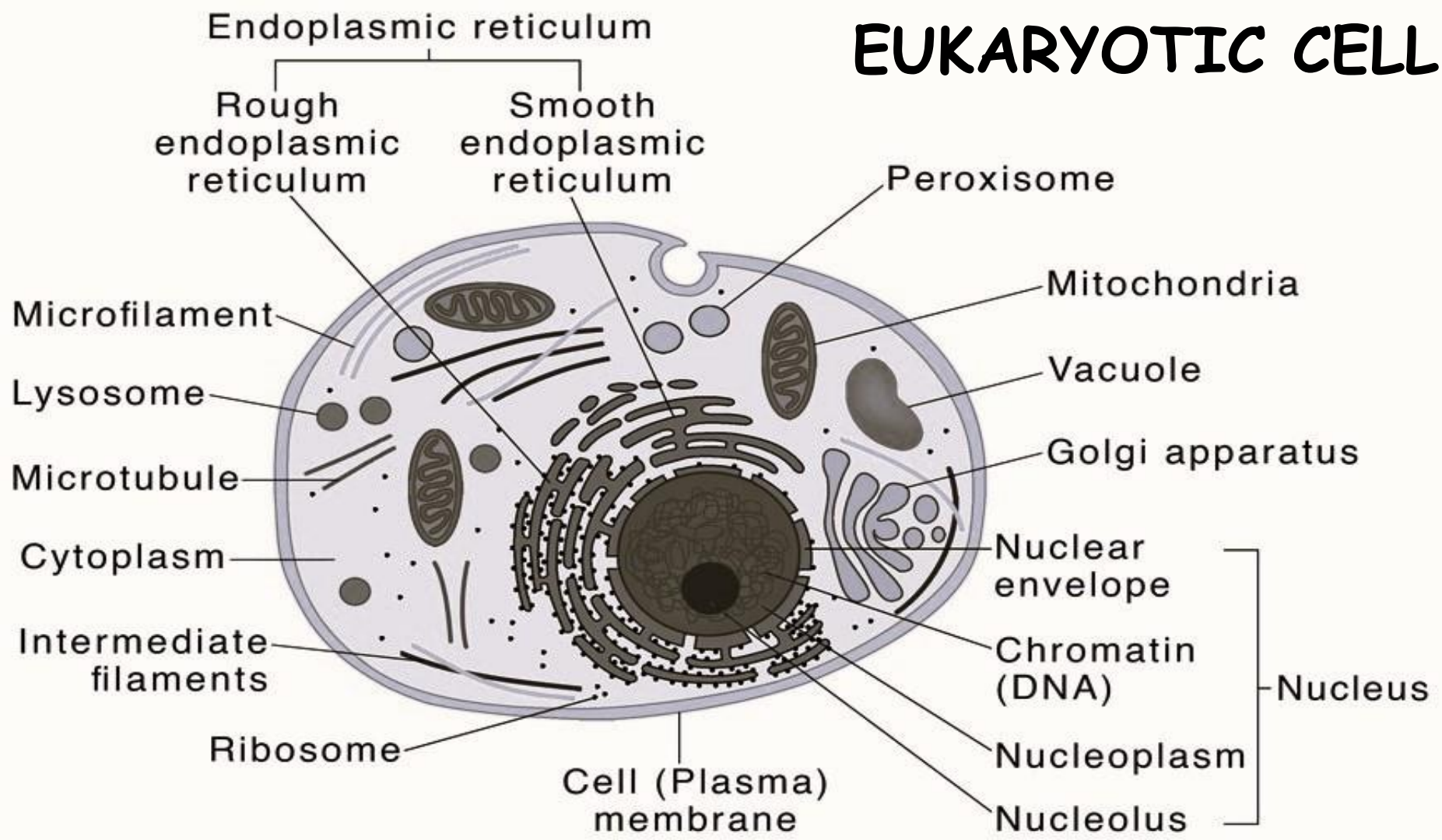
# CELL THEORY

- The three tenants of the cell theory are:
  - ❖ All organisms are composed of one or more cells- Schleiden
  - ❖ The cell is the basic unit of structural and functional unit of organisms- Schwann
  - ❖ Cells arise from pre-existing cells- Virchow





# EUKARYOTIC CELL





# EUKARYOTIC CELL

- Eukaryotic cells are more complex than prokaryotic cells and are found in organisms such as plants, animal, fungi and protists.
- The key characteristics of Eukaryotic cells are as follows -
  - ❖ **Nucleus:**
    - Eukaryotic cells have a distinct nucleus, enclosed by a nuclear envelope (Double membrane)
    - The nucleus contains the cell's genetic material (DNA), which is organized into multiple linear chromosomes.

❖ **Membrane- Bound Organelles:**

- Eukaryotic cells contain various membrane-bound organelles with specialized functions
- These organelles compartmentalize the cell's activities and allow for more efficient processes

❖ **Cell Division:**

- Eukaryotic cell division involves mitosis and meiosis
- Mitosis is responsible for growth, development and tissue repair by producing two identical daughter cells
- Meiosis produces specialized reproductive cells (gametes) with half the chromosome number

❖ **Cell Wall (Plant Cells):**

- Plant cells have a rigid cell wall composed of cellulose that provides structural support and protection
- Cell wall of fungi made of chitin

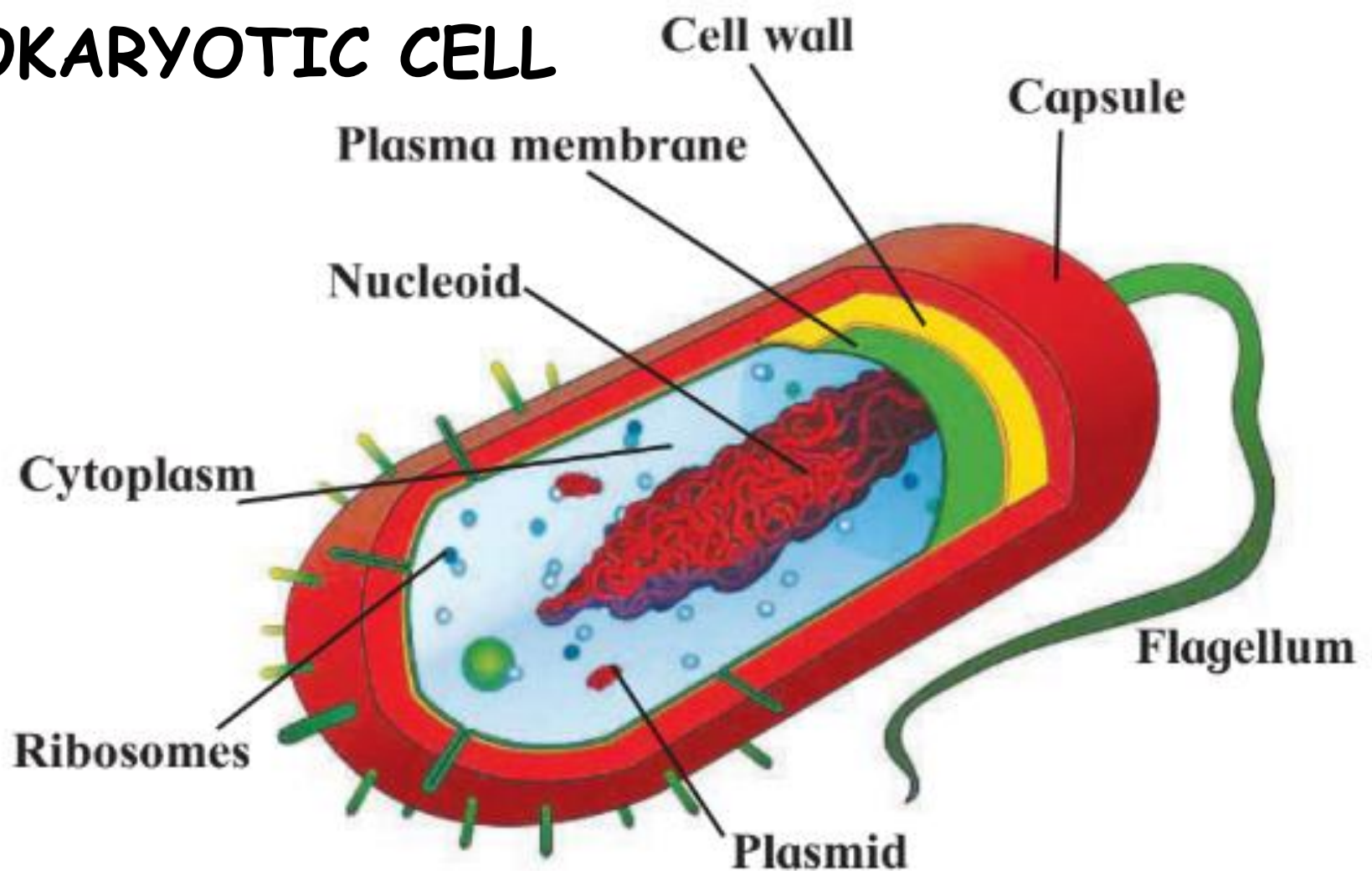
❖ **Lysosomes and Peroxisomes:**

- Eukaryotic cells contain Lysosomes filled with enzymes for waste degradation and recycling
- Peroxisomes are involved in Lipid metabolism and detoxification

❖ **Nuclear Envelope and Pores:**

- The nuclear envelope separates the nucleus from the cytoplasm and contains nuclear pores that control the movement of molecules

# PROKARYOTIC CELL





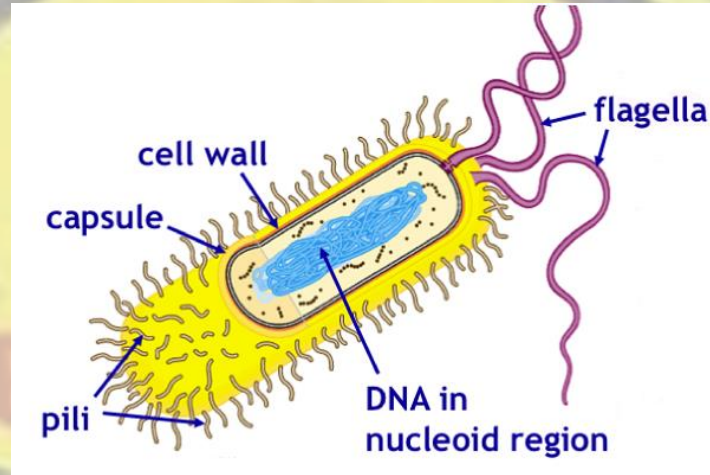
# PROKARYOTIC CELL

- Prokaryotic cells do not have well-defined nucleus
- The plasma membrane, cytoplasm and nucleoid are the only components
- The prokaryotic cells have smaller ribosomes compared to Eukaryotic cells
- Bacteria and blue green algae are examples of Prokaryotic cell
- A prokaryotic cell is a type of cell that lacks a distinct nucleus and other membrane-bound organelles. Prokaryotic cells are simpler in structure.

- Key characteristics of Prokaryotic cells-
  - ❖ **No nucleus:** The most significant feature of Prokaryotic cells is the absence of a membrane-bound nucleus. Instead of having a circular DNA molecule, is located in the nucleoid region within the cytoplasm.
  - ❖ **Cytoplasm:** Contains various cellular components suspended in a semi-fluid matrix. This is where many of the cell's metabolic processes occur
  - ❖ **Lack of Membrane-Bound Organelles:** No membrane-bound organelles like Mitochondria, Endoplasmic Reticulum, Golgi apparatus, or Lysosomes, are found. Instead, they have simpler structures involved in essential cellular functions

- ❖ **Cell wall:** Most prokaryotic cells have a cell wall outside the plasma membrane. The cell wall provides structural support and the protection for the cell. Bacterial cell walls, for example, can be composed of Peptidoglycan
- ❖ **Plasma Membrane:** The Plasma membrane, also known as the cell membrane, surrounds the cytoplasm of the Prokaryotic cell. It regulates the passage of substances in and out of the cell and plays the role in maintaining the cell's internal environment.
- ❖ **Ribosomes:** Prokaryotic cells contain ribosomes, which are responsible for protein synthesis. These ribosomes are small and structurally different from the ribosomes found in eukaryotic cells

- ❖ **Flagella and Pili:** Some prokaryotic cells possess flagella, which are whip-like structures used for movement. Pili, which are shorter and thinner than flagella, help in cell adhesion, conjugation (transfer of genetic material), and other functions.



- ❖ **Small size:** Prokaryotic cells are generally smaller than eukaryotic cells.



# CELL STRUCTURE

- **Cell membrane (Plasma Membrane)**
  - ❖ **Structure:** A double layer of lipids (fats) embedded with proteins
  - ❖ **Function:** Regulates the passage of substances in and out of the cell, maintains cell shape, and facilitates cell communication
- **Cytoplasm**
  - ❖ **Structure:** Gel-like substance that fills the cell, including all organelles
  - ❖ **Function:** Provides a medium for cellular processes and holds organelles in place

- **Nucleus**

- ❖ **Structure:** Surrounded by a double membrane (nuclear envelope) with nuclear pores.
- ❖ **Function:** Contains genetic material (DNA) in the form of chromosomes. Controls cell activities, including gene expression and replication

- **Nucleolus**

- ❖ **Structure:** Inside the nucleus, composed of RNA, proteins & DNA
- ❖ **Function:** Responsible for Ribosome assembly, which is essential for protein synthesis

- **Mitochondria**

- ❖ Structure: Double-membrane organelles with inner folds (cristae)
- ❖ Function: Generates energy through cellular respiration producing ATP (adenosine triphosphate), the cell's energy currency

- **Endoplasmic Reticulum (ER)**

- ❖ Structure: A network of membranous sacs and tubes
- ❖ Function:
  - Rough ER: Studded with ribosomes, involved in protein synthesis and modification
  - Smooth ER: Synthesizes lipids, metabolizes carbohydrates, and detoxifies drugs and poisons.

- **Golgi Apparatus**

- ❖ **Structures:** Stack of flattened membranous sacs (cisternae)
- ❖ **Functions:** Receives, modifies, and packages proteins and lipids from the ER into vesicles for distribution within or outside the cell

- **Lysosomes**

- ❖ **Structure:** Membrane-bound sacs containing hydrolytic enzymes
- ❖ **Function:** Breaks down waste materials, cellular debris, and engulfed pathogens through digestion



- **Chloroplast (Plant Cells Only):**

- ❖ **Structure:** Double membrane organelles containing thylakoids (flattened sacs)
- ❖ **Function:** Carries out photosynthesis, capturing sunlight energy to convert into chemical energy (glucose)

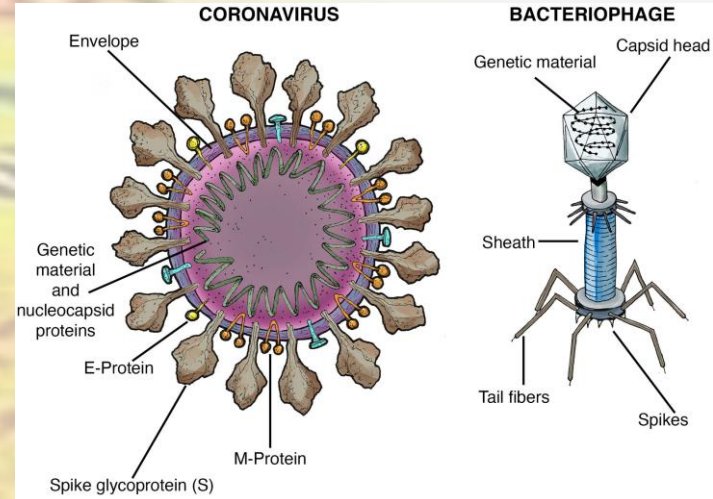
- **Vacuoles:**

- ❖ **Structure:** Membrane-bound sacs containing fluid or stored materials.
- ❖ **Function:** Stores water, ions, nutrients, waste products, and pigments; contributes to cell rigidity in plant cells.

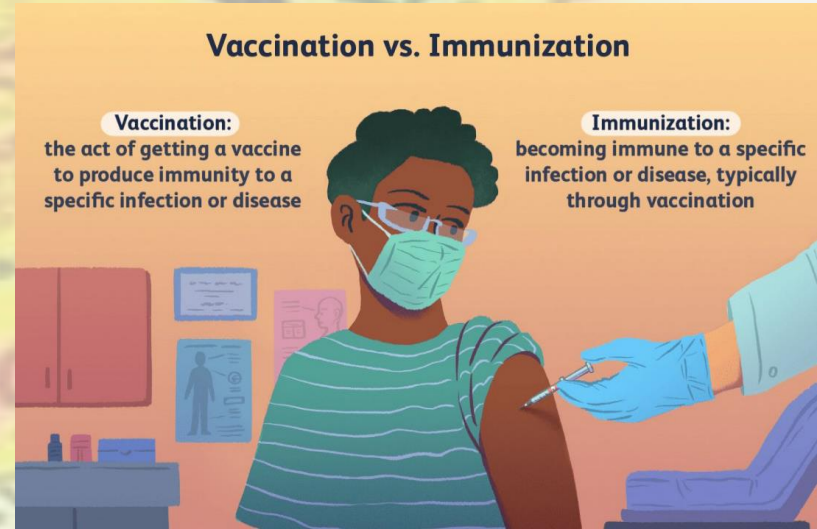
# EXCEPTION OF CELL THEORY

- **Structure:** Viruses have a simple structure consisting of genetic material enclosed in a protein coat called a capsid. Some viruses also have an outer lipid enveloped derived from the host cell membrane
- **Genetic material:** Viruses can contain either DNA (Deoxyribonucleic acid) or RNA (Ribonucleic acid) as their genetic material. This genetic material carries the instructions needed for the virus to replicate
- **Reproductive:** Viruses cannot reproduce on their own. They must infect a host cell and hijack the host's cellular machinery to replicate and produce new viral particles

- **Diseases:** Many viruses are responsible for causing diseases in various organisms, including humans like common cold, influenza, HIV, COVID-19 and many more
- **Evolution and Adaptation:** Viruses have a high mutation rate due to the lack of proofreading mechanisms during replication. This leads to rapid evolution and the emergence of new viral strains and variants



- **Vaccination & Treatment:** Vaccines are developed to stimulate the immune system against specific viruses, preventing infections. Antiviral medications are used to treat some viral infections by targeting viral replications processes
- **Research and Biotechnology:** Viruses have been studied extensively for their role in genetics, evolution, and as tools in biotechnology. Some viruses are used as vectors to deliver genetic material into cells for gene therapy or vaccine development.

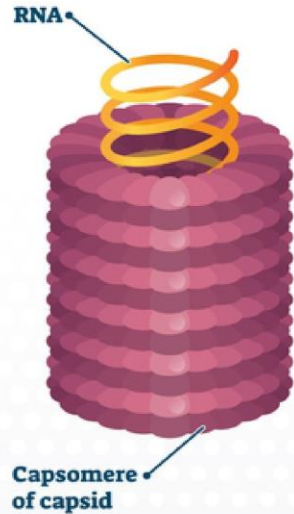




# RNA VIRUS VS DNA VIRUS

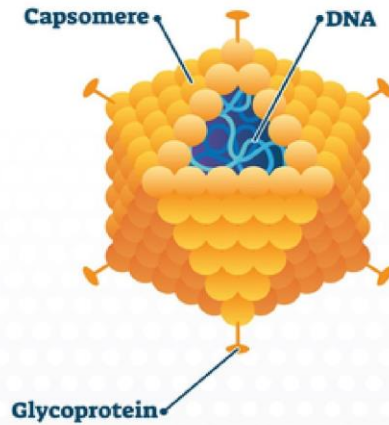
- **Genetic Material**
  - ❖ **RNA Viruses:** These viruses have RNA (Ribonucleic acid) as their genetic material. This RNA can be single-stranded (ssRNA) or double-stranded (dsRNA). Examples- Influenza virus, HIV, and the common cold virus
  - ❖ **DNA Viruses:** These Viruses have DNA (Deoxyribonucleic acid) AS THEIR GENETIC MATERIAL. This DNA can be single-stranded (ssDNA) or double stranded (dsDNA). Examples- Herpesvirus, adenoviruses & papillomaviruses

# TYPES OF VIRUSES



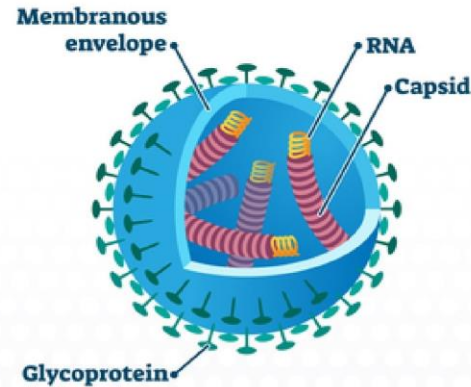
## HELICAL

Tobacco  
Mosaic Virus



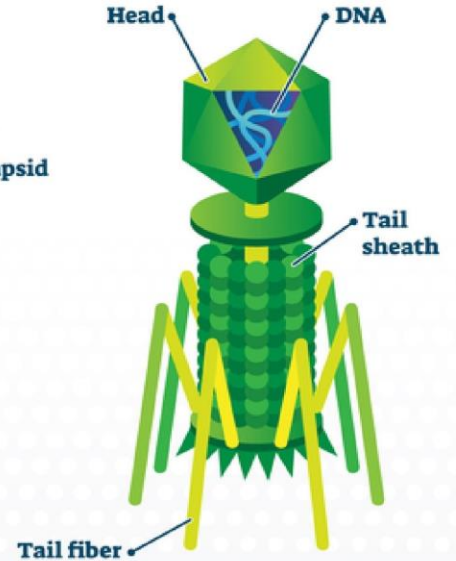
## POLYHEDRAL

Adenovirus



## SPHERICAL

Influenza Virus



## COMPLEX

Bacteriophage

## 1. Mutation Rate

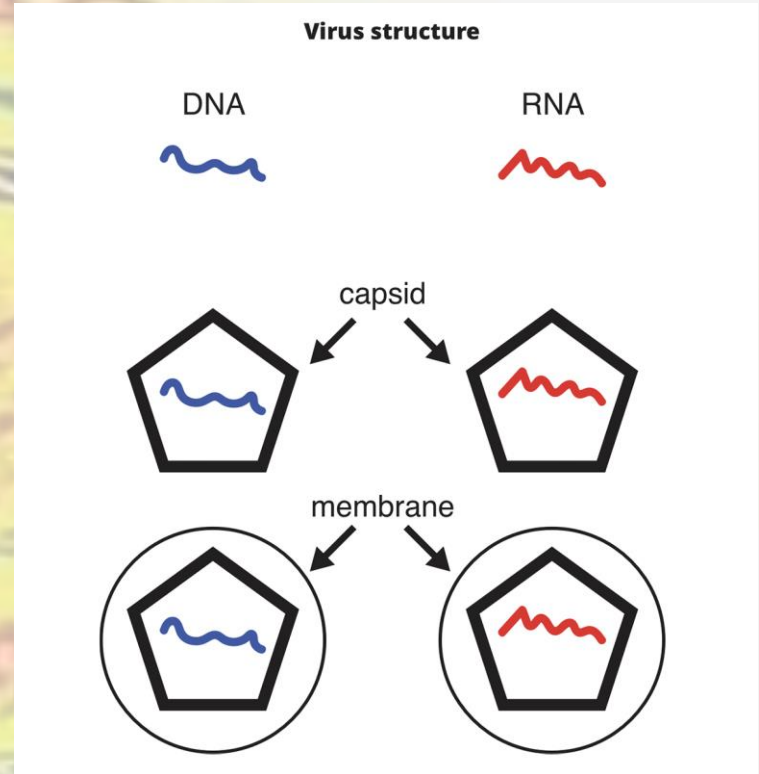
- **RNA Virus:** RNA viruses generally have a higher mutation rate compared to DNA viruses
- **DNA Virus:** DNA viruses tend to have a lower mutation rate

## 2. Replication:

- **RNA Virus-** Replication of RNA viruses occurs primarily in the host cell's cytoplasm.
- **DNA Virus-** Replication of DNA viruses often takes place in the host cell's nucleus.

### 3. Examples of Diseases:

- **RNA Viruses-** Common diseases caused by the RNA viruses include the Common cold, flu, COVID-19, Hepatitis C & Ebola
- **DNA Viruses:** Diseases caused by DNA viruses include Herpes, Chickenpox, Hepatitis B and some types of Cancer (linked to DNA viruses like HPV)





# Some important questions

Q) Blue-green algae do not have

- (a) ribosomes
- (b) cell wall
- (c) cytosol
- (d) Golgi apparatus**

Q) If the ribosomes of a cell are destroyed then

- (a) fats will not stored
- (b) proteins will not be formed**
- (c) carbon assimilation will not occur
- (d) respiration will not take place

Q) Movement of materials to different part of cytoplasm and nucleus is carried out by-(NDA 2021)

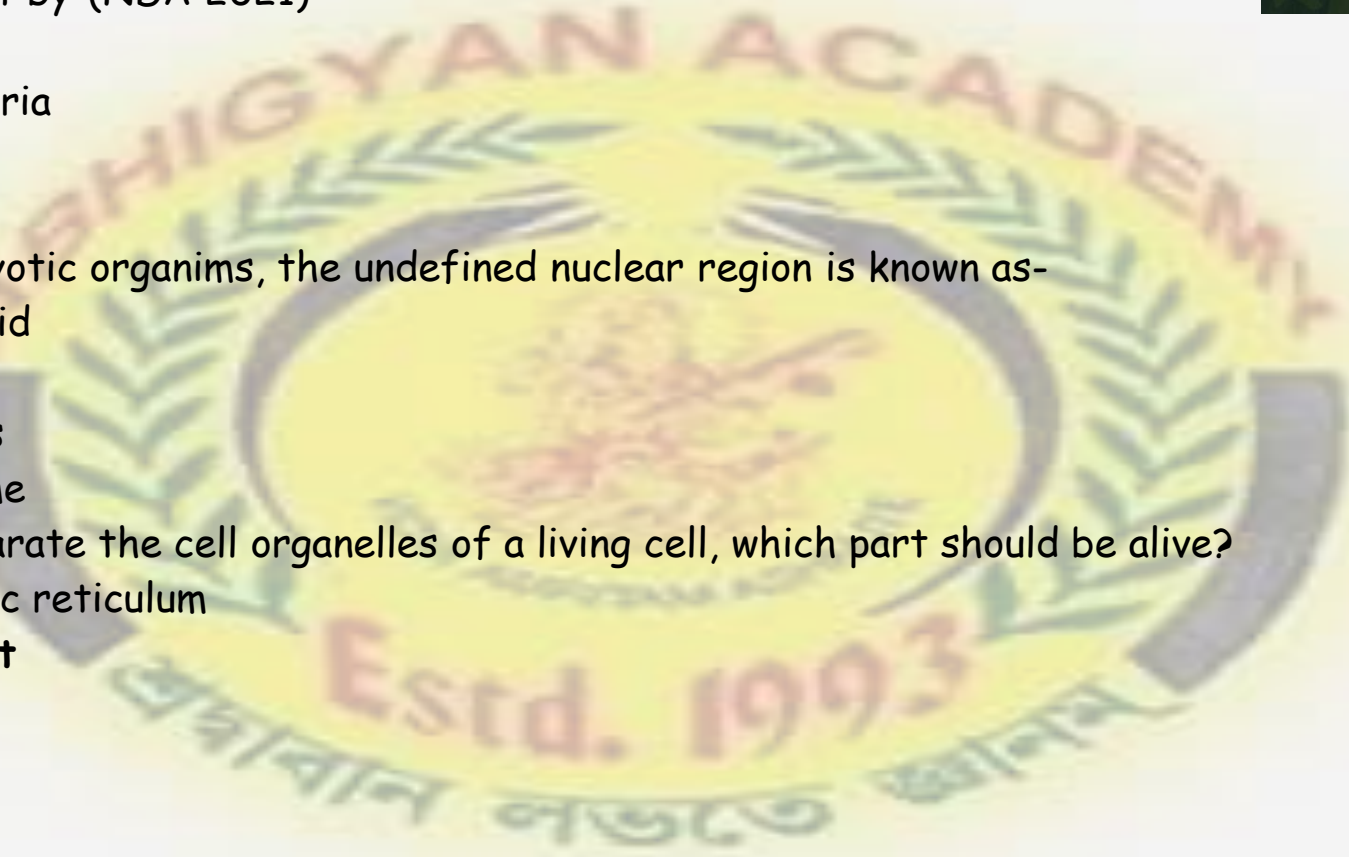
- a) Ribosome
- b) Mitochondria
- c) Lysosome
- d) ER

Q) In prokaryotic organisms, the undefined nuclear region is known as-

- a) Nucleic acid
- b) Nucleoid
- c) Nucleolus
- d) Nucleosome

Q) If we separate the cell organelles of a living cell, which part should be alive?

- (a) Endoplasmic reticulum
- (b) Chloroplast**
- (c) Cell wall
- (d) Ribosomes



Q) Which of the cell organelle expel excess water and waste in unicellular organisms?

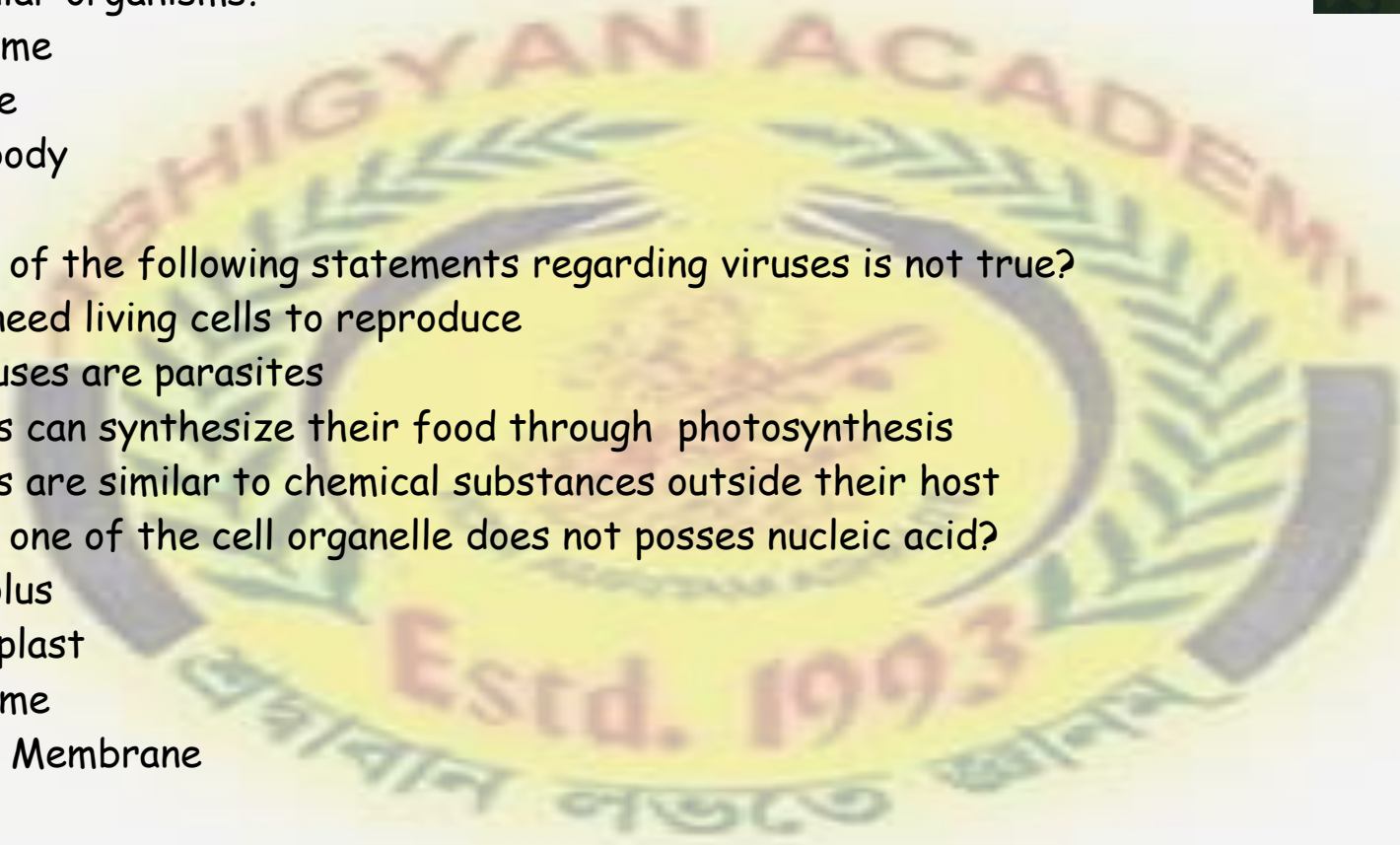
- a) Lysosome
- b) Vacuole
- c) Golgi body
- d) ER

Q) Which of the following statements regarding viruses is not true?

- a) Virus need living cells to reproduce
- b) All viruses are parasites
- c) Viruses can synthesize their food through photosynthesis
- d) Viruses are similar to chemical substances outside their host

Q) Which one of the cell organelle does not possess nucleic acid?

- a) Nucleolus
- b) Chloroplast
- c) Ribosome
- d) Plasma Membrane



Q) Which of the following cell organelle does not possess their own genetic material encoding protein?

- a) Ribosome
- b) Nucleus
- c) Mitochondria
- d) Chloroplast

Q) Name the group of cell organelle contains DNA?

- Ans- mitochondria, nucleus, chloroplast



1. What is the additional function of endoplasmic reticulum?
2. Name the microbe causing acidification and curding of milk?
3. What is the cell wall of fungus composed of?
4. Why cannot we kill viruses?
5. Where is the genetic material of bacteria found in?

1. Which one of the following is not an example of Eukaryotic organism?
  - Yeast
  - Bacteria
  - Plant
  - Human
2. Energy required for maintain of life is obtained by a process called-----
3. Which is the smallest unit that can show response to the environment growth and reproduction?
4. Which cell organelle is absent in animal cell?
5. What is the site of cellular respiration in animal called?