

# Biology

CLASS XI

## BIOLOGY    UNIT-1    Part-I    WORKBOOK-I

### Introduction to living world:

Concept and definition of Biology:

The term Biology is formed by combining two Greek words → bios, meaning "life" and logia, meaning "study of".

Thus Biology is the natural science concerned with the study of life and living organisms. Following are the various <sup>sub</sup>disciplines of Biology:

- (1) Anatomy: Branch of Biology concerned with the study of structure of organisms and their parts.
- (2) Biochemistry: Study of chemical reactions required for life to exist & function.
- (3) Botany: Study of plants.
- (4) Zoology: Study of animals, including classification, physiology, development & behaviour.
- (5) Virology: Study of viruses & virus-like agents.
- (6) Pathology: Study of diseases, including their cause, processes & development.
- (7) Physiology: Study of functioning of living organisms.
- (8) Microbiology: Study of microorganisms.
- (9) Proteomics: Study of proteins, particularly their structure & function.
- (10) Biotechnology: Exploitation of biological processes for industrial & other purposes, especially the genetic manipulation of microorganisms for the production of antibiotics, hormones etc.

- Characteristic features of living organisms:
- 1. Definite form & size: Every living organism has definite form & size with little variance.
  - 2. cell as basic unit of life: All living organisms are made up of basic structural & functional unit of life known as cell.
  - 3. Metabolism → refers to some total of all the rxns that takes place inside living organism.  
Metabolism = ~~total~~ anabolism + catabolism
  - 4. Nutrition, The way by which organism procure food to be used for energy and as carbon source is called nutrition.
  - 5. Respiration → stepwise oxidation of food to release energy. However, some organism respire anaerobically.
  - 6. Growth & development → irreversible increase in the size and weight of an organism is called Growth.
  - 7. Exchange of materials: All living organisms inhale Oxygen and take nutrition, whereas they exhale  $\text{CO}_2$  and waste material out of body.
  - 8. Excretion → The process of removal of waste material from body is called excretion.
  - 9. Movement → Most organisms are able to move from one place to another.
  - 10. Reproduction → All organisms reproduce ~~to produce~~ either sexually or asexually or by vegetative means to form offsprings.
  - 11. Adaptation: → Physiological or behavioural changes in the body of organisms to make it better suited to the environment for its survival.
  - 12. Life span: All living organisms have a definite life span with in a certain range after which they die.

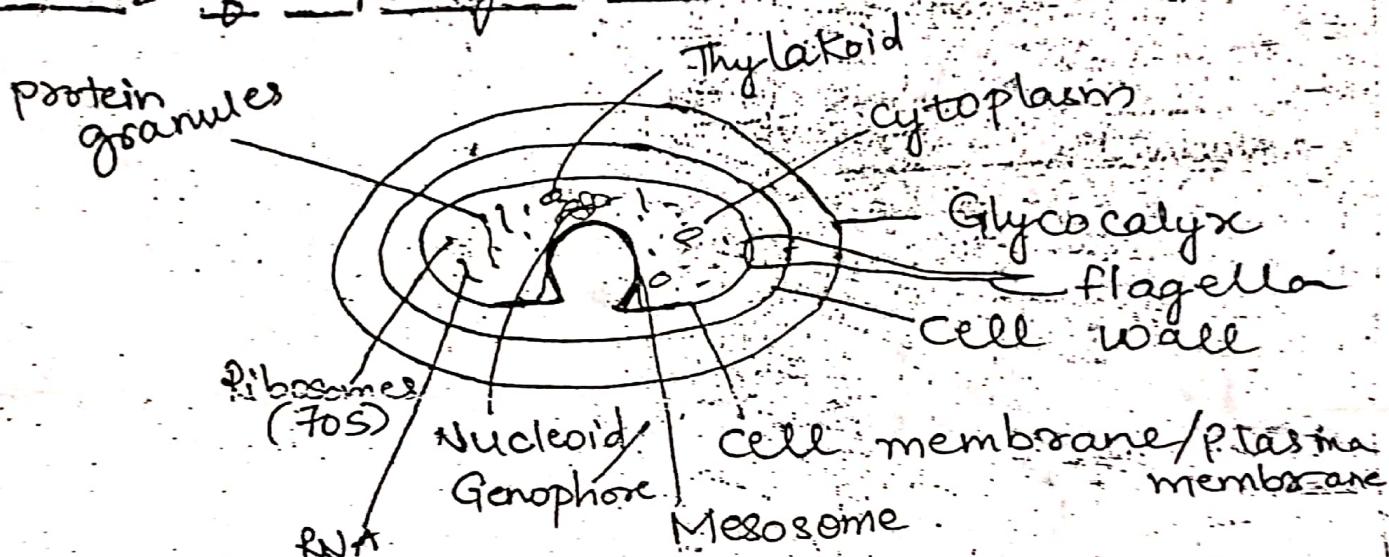
PROKARYOTIC CELL: is that cell which lacks a well-defined nucleus and membrane-bound organelles.

Ex: 1. Bacteria

2. Cyanobacteria

3. PPLO [Pleuro - pneumonia-like Organism]  
Pleuro & pneumonia like organism

Structure of a prokaryotic cell:



1. Cell wall: Cell wall in Bacteria is made up of peptido-glycan which is a polymer of NAG & NAM  
NAG  $\rightarrow$  N-acetylglucosamine ; NAM  $\rightarrow$  N-acetylmuramic acid  
It provides shape and Rigidity to cell.

2. Glycocalyx: It is made up of polysaccharide or proteins or both. function  $\rightarrow$  Helps in the attachment of bacterial cell to various surfaces. In some bacteria, it also contributes to pathogenicity [disease causing ability].

3. Flagella/cilia:

It is present in some bacteria. It is a locomotory structure that helps in the movement of bacteria. It is made up of protein called flagellin.

flagella is single stood in bacteria.

4. Plasma membrane: Plasma membrane is selectively permeable membrane present around cell.

5. Mesosomes: They are invagination or infolding of plasma membrane.

- 1.) It has a role in DNA replication.
- 2.) It has a role in the formation of cell septum for cell division.
3. Also help in scission, scission process and to increase the surface area of plasma membrane.

6. Nucleoid: The naked DNA of prokaryotes which is not enclosed inside the nucleus is called nucleoid / nucleoplasm. In addition to genomic DNA, many bacteria have small circular DNA outside genomic DNA called Plasmids, which confers traits like antibiotic-resistance to bacteria.

7. Ribosomes: They are the protein-factory of cell. In prokaryotes ribosomes lie freely in the cytoplasm and are of 70's type, which has two subunits - 50S & 30S.

8. Thylakoid: They are present in some bacteria & blue-green algae which are autotrophic. They lie in cytoplasm and contain pigments such as bacteriochlorophyll.

9. Protein granules / fat/lipid globules: They lie freely in the cytoplasm.

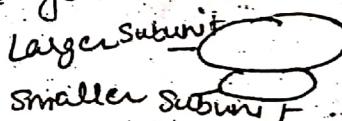
10. Gas vacuoles: They are not true vacuoles & are present in some bacteria to provide buoyancy. For eg - these gas vacuoles are present in purple & green photosynthetic bacteria.

→ They are made up of DNA & protein  
→ Protein factory of the cell  
Ribosomes: nucleoprotein membrane-less organelles which  
are the sites for protein synthesis:  
- consists of two unequal subunits:  
    large subunit is dome-shaped & smaller subunit  
    is ellipsoid & fits like a cap over the large subunit  
Depending upon their place of occurrence, ribosomes are  
of two types:

1. Cytoplasmic ribosomes: These are found in cytoplasm of prokaryotes (70S) and eukaryotes (80S) as well as endoplasmic reticulum (RER of eukaryotes).
2. organellar ribosomes: They are found in microcondidia and chloroplast of eukaryotes.

Depending upon size:

1. 70S ribosomes
  - These are smaller in size
  - They are lighter
  - Found in cytoplasm of prokaryotes
  - ② in chloroplast of eukaryotes
  - 4. Mitochondria
    - RNA: Protein ratio  
60 : 40
    - subunits → 50S & 30S



### 80S ribosomes

- These are larger in size.
- They are heavier.
- Found in
  - ④ Cytoplasm of eukaryotes

→ RNA: Protein ratio  
40 : 60

→ subunits → 60S & 40S

~~Imp~~ 4  
Eukaryotic cell: contains a well-defined nucleus & membrane-bound organelles such as mitochondria.

For eg. Animal cell & Plant cell.

Difference: PLANT CELL

	<u>ANIMAL CELL</u>
1. Cell wall is present & made up of cellulose	- absent
2. Large central vacuole is present	- absent. Small vacuoles may be present.
3. Nucleus is present towards the periphery	- Nucleus is present in the center.
4. Chloroplast is present	- absent
5. Glyoxysomes are present	- absent
6. Lysosomes are generally absent.	- present
7. Dictyosomes are present	- well developed Golgi bodies are present.
8. Starch is the reserve food.	- Glycogen is the reserve food.
9. Regular in shape	- not regular in shape.
10. Centriole is absent	- Centriole is present.

Imp.

Difference between Prokaryotic cell & Eukaryotic cell

PROKARYOTIC CELLS

1. Well-defined nucleus is absent
2. Endoplasmic reticulum is absent in prokaryotic cell
3. Golgi body - absent
4. Lysosomes absent
5. Ribosomes - 70S
6. Flagella is single stranded
7. flagella, if present, is made up of protein flagellin
8. DNA is circular
9. Amount of DNA is lower
10. Histones are absent
11. Transcription & Translation occurs in the cytoplasm.
12. Cytoplasmic streaming (cyclosis) is absent
13. Endocytosis & exocytosis are rare
14. Respiratory enzymes are present on plasma membrane
15. Cell wall is made up of peptidoglycan
16. Eg → Bacteria

EUKARYOTIC cells

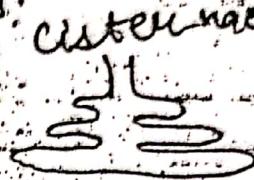
1. present
2. present
3. present
4. present in animal cell.
5. 80S
6. even (9+2) stranded.
7. flagella, if present is made up of protein tubulin.
8. Generally linear.
9. Higher
10. present & have role in packaging of protein.
11. Transcription occurs inside the nucleus & translation occurs in the cytoplasm.
12. cyclosis occurs
13. Endocytosis & exocytosis are common.
14. Respiratory enzymes are present in mitochondria & cytoplasm.
15. Cell wall absent in animal cell.  
in plant cells → made up of cellulose
16. Eg → Animal & Plant cell

Endoplasmic reticulum: is an extensive network of membrane lined channels within the cytoplasm.

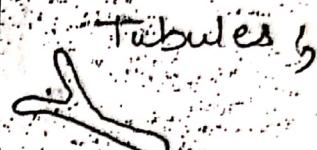
The ER network is continuous with nuclear envelope.

ER can exist in following three forms: cisternae,

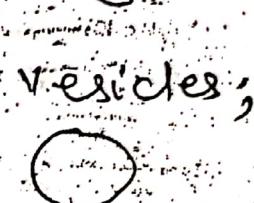
→ CISTERNAE: These are interconnected flattened stacks that mainly form RER.



2. TUBULES: These are branched or unbranched tubelike structures that mainly form SER.



3. VESICLES: These are spherical or oval element of ER that exist along Cisternae & Tubules.



There are two types of ER:

① RER :— The endoplasmic reticulum that ribosomes on its surface & concern with the synthesis of proteins is called RER (rough ER).

② SER :— The ER that don't have ribosomes & mainly concern with synthesis of lipids. Called SER (smooth ER).

Functions:

- ER provides mean for intracellular transport

- It acts as cytoskeleton to cell

- It provides membrane to the nucleus during telophase

- It provides material to the golgi for secretion

- RER is concerned with synthesis of protein.

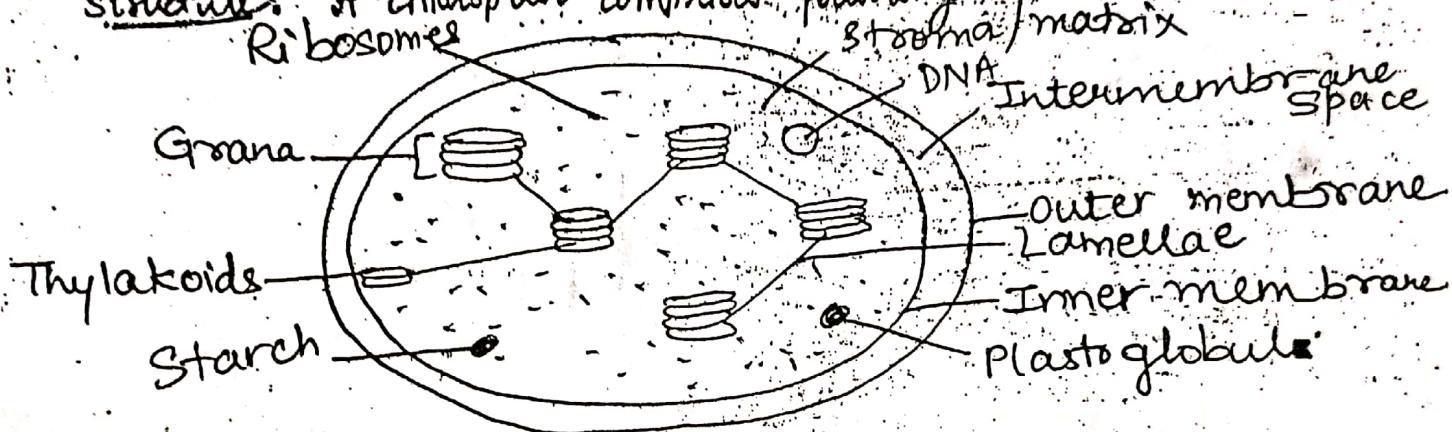
- The ER muscle cell is modified to ~~store~~ calcium which is ~~released~~ at the time of muscle contraction. This modified ER is called ~~reticulum~~ sarcoplasmic reticulum.

- (g) SER helps in detoxification of harmful drugs
- (h) SER helps in glycogen metabolism
- (i) SER provides surface for the synthesis of lipids, steroids & visual pigments

Chloroplasts: are green plastids that take part in photosynthesis. They are double-membrane bound organelles that contain chlorophyll as well as enzymes required for light reaction of photosynthesis.

- found in algae & green plants.

Structure: A chloroplast comprises following main components:



1. Envelope: Chloroplast is enclosed by 2 membrane
  - a.) Outer membrane, which may be continuous with endoplasmic reticulum
  - b.) Inner membrane, which is attached with Thylakoids at various places. The space b/w 2 membrane is called Intermembrane space.
2. Stroma: The ground substance enclosed by inner membrane of chloroplast is called stroma/matrix. It contains Grana, DNA, 70's ribosome, plastoglobuli & some enzymes.

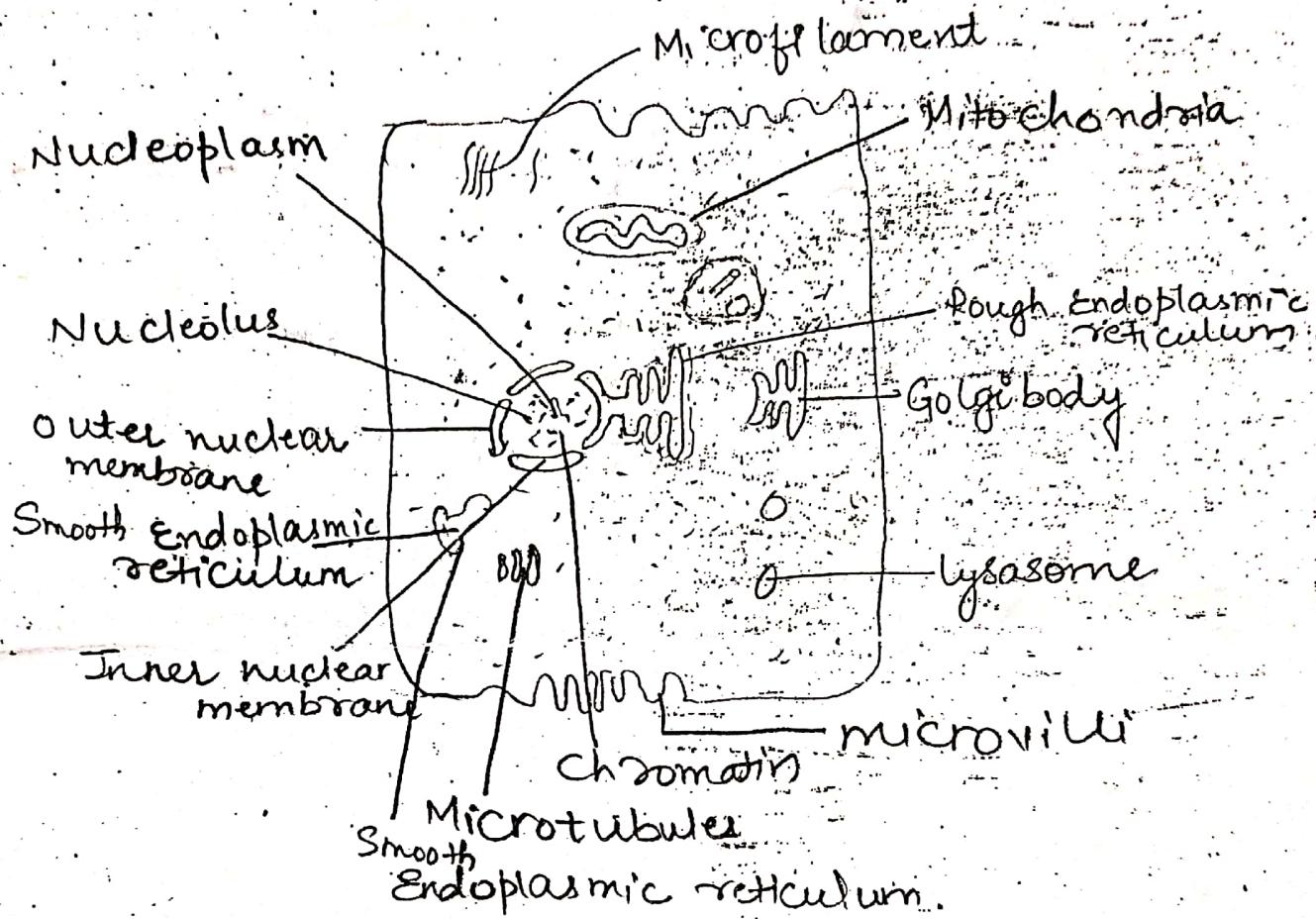
3. Thylakoids: The flattened sac like structures with pigmented membrane consisting of chlorophyll is called Thylakoids. Stack of Thylakoid is called Grana. Each Grana contain 2 to 100 thylakoid.

Functions:

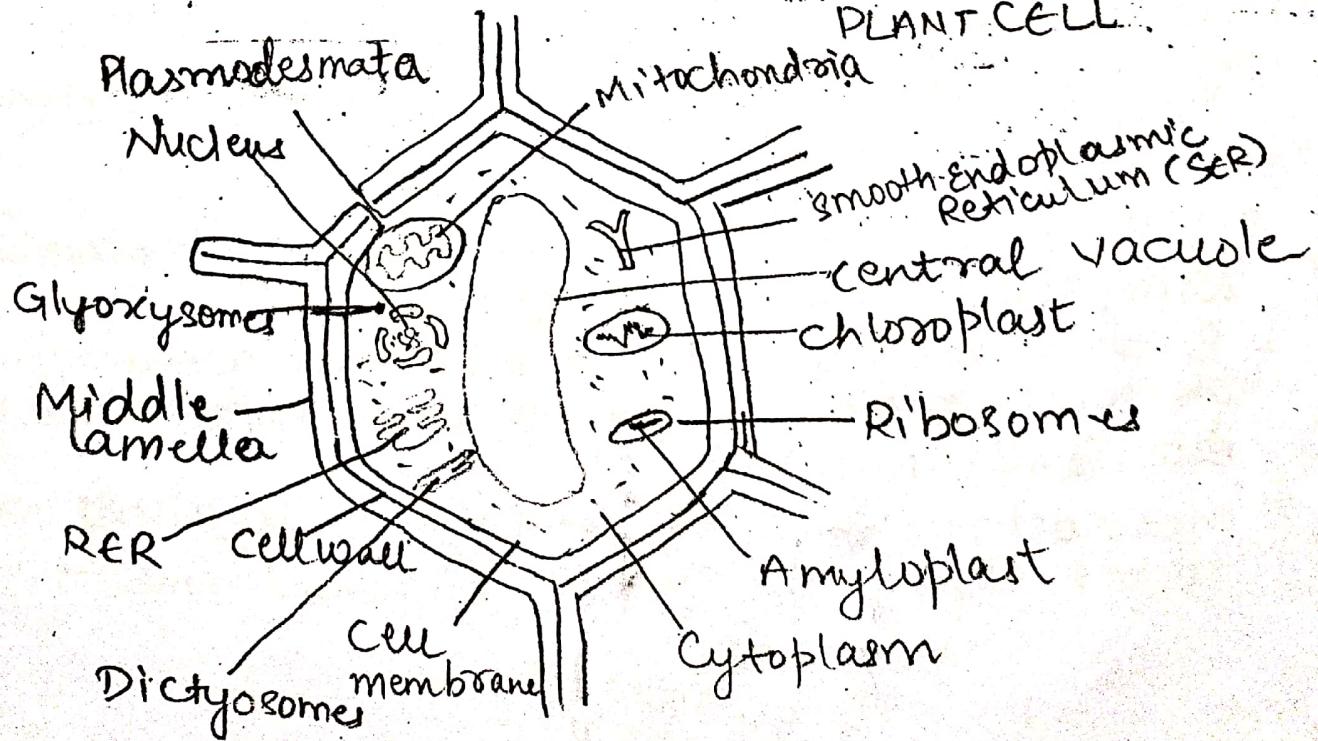
- a) Chloroplast carry out photosynthesis i.e conversion of solar energy into chemical energy of food.
- b) They carry out the synthesis of amino acid
- c) They carry out the synthesis of fatty acids
- d) They maintain  $\text{CO}_2$ -oxygen balance of the atmosphere
- e) They store starch
- f) They store fat in the form of plastoglobule

Difference between animal & plant cell  
(Diagrams)

### ANIMAL CELL



### PLANT CELL



Nucleus: Is double-membrane bound organelle which contains all the generic information for controlling cellular metabolism & transmission to the offsprings.

- usually spherical/oval
- frequently the largest structure in the cell
- characteristic organelle of eukaryotic cell  
with exception of RBCs of mammals & mature stem cells of vascular plants

Structure: The nucleus is composed of following structures:

### 1. Nuclear membrane / Nuclear envelope:

nucleus is surrounded by two membranes Outer nuclear membrane which is continuous with endoplasmic reticulum and may be studded with ribosomes.

② Inner nuclear membrane, The space b/w the 2 membranes is called peri-nuclear space.

### 2. Nucleoplasm → The ~~gelly~~ jelly-like matrix

that is present inside nucleus is called Nucleoplasm. It has contents similar to those present in cytoplasm. In addition, it contains NTPs as well as enzymes for replication and Transcription.

### 3. Chromatin It refers to the DNA which is packaged with help of protein. (2 types).

1. Euchromatin → The DNA which is active i.e, which expresses itself to form proteins is called Euchromatin.

2. Heterochromatin → The DNA which is silent i.e, doesn't express is called Heterochromatin

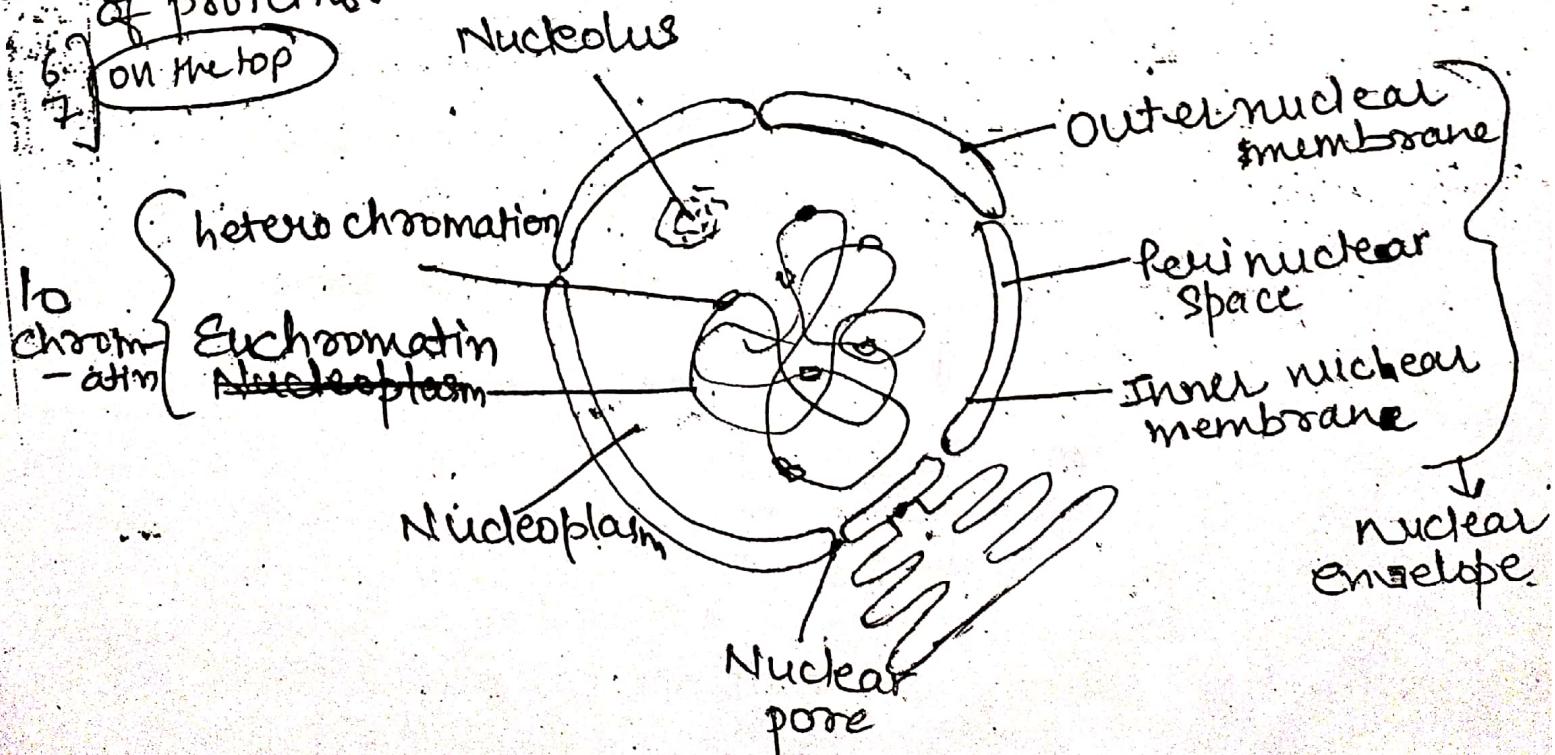
It controls cell division.

It has role in the synthesis of ribosomal RNA

4. Nuclear pores :→ The gaps b/w the membrane that allows the exchange of material b/w nucleus and cytoplasm.

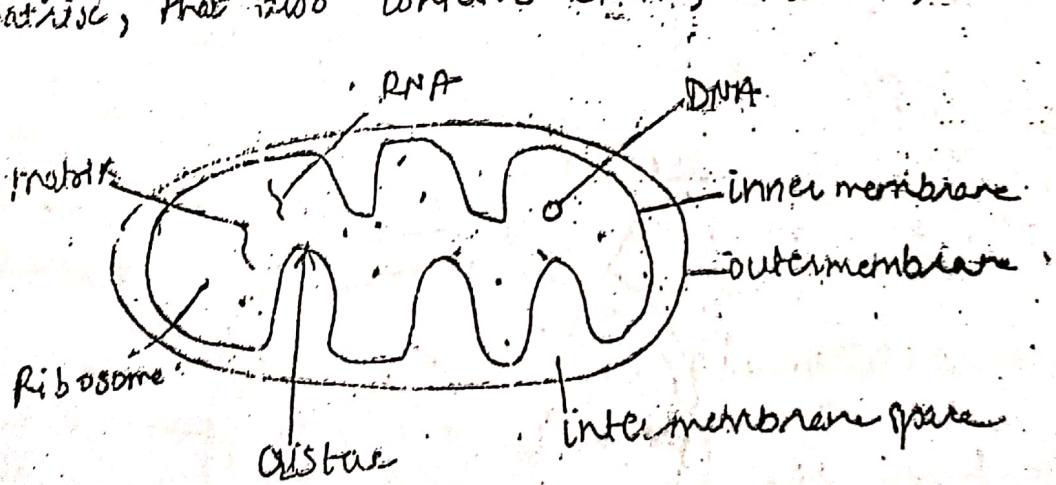
5. Nucleus :→ It is dark staining membrane-less body i.e., concern with the synthesis of ribosomal RNA (rRNA).

- functions:
1. Nucleus store all the hereditary information in the form of DNA.
  2. It passes on hereditary information to the next generation.
  3. It controls ~~processes~~ synthesis of enzymes
  4. It controls cell differentiation by activating certain genes & silencing others.
  5. It maintains the cytoplasm by guiding the synthesis of proteins.



MITOCHONDRIA: are generally sausage/cylindrical shaped organelles of aerobic eukaryotes.

1. Each mitochondrion is a double-membrane bound structure with the outer membrane and inner membrane dividing its lumen into two compartments:
  - the outer compartment is called intermembrane space
  - the inner compartment is called matrix
2. The outer membrane forms the continuous limiting boundary of the organelle while inner membrane forms a number of infoldings called cristae.  
The cristae increase the surface area.
3. Cristae as well as inner membrane possess small particles called elementary particles or oxysones that contain enzyme ATPase & some coupling factor.
4. The membranes bear their own specific enzymes associated with mitochondrial function.
5. Many steps of cellular respiration (citric acid cycle) occurs inside matrix, that also contains DNA, tRNA, ribosomes, RNA etc.



### function :-

- ① oxidise respiratory substrates to  $\text{CO}_2 + \text{H}_2\text{O}$  and generates energy in the form of ATP.
- ② provide intermediate for the synthesis of various chemicals like chlorophyll, steroids etc.
- ③ matrix has enzymes of fatty-acids' synthesis
- ④ synthesis of many amino acid

Mitochondria has its own circular DNA & 70S ribosomes and can synthesize some of its proteins. They get other proteins from cytoplasm formed under directions of nuclear DNA.

- ⑤ Cellular proliferation regulation
- ⑥ Regulation of cellular metabolism
- ⑦ Regulation of membrane potential
- ⑧ Apoptosis — programmed cell death

Q.1 Part-A

Match the following:

1. Prokaryotic cell
2. Mitochondria
3. Nucleus
4. Chloroplast
5. 80S ribosomes
6. Plant cell
7. Animal cell
8. Endoplasmic reticulum
9. Peptidoglycan
10. Eukaryotic cell

- synthesis of proteins &  
lipids
2. centriole
3. Large central vacuole
4. naked DNA
5. bacterial cell wall
6. genetic information  
chromosomes
7. Thylakoids
8. well-defined nucleus
9. Eukaryotes

Q.1 Part-B Fill in the blanks/ Short Ans. Q. questions:

1. In prokaryotic cell \_\_\_\_\_ and \_\_\_\_\_ are absent.
2. 70S ribosomes are present in \_\_\_\_\_ and \_\_\_\_\_.
3. Three examples of double-membrane bound organelles are \_\_\_\_\_.
4. Cell wall is made up of \_\_\_\_\_ in plant cell.
5. The 30S subunits of 80S ribosomes are \_\_\_\_\_ & \_\_\_\_\_.
6. Formation of vacuoles is the function of \_\_\_\_\_.
7. Nucleolus is the site for the synthesis of \_\_\_\_\_.
8. Grana refers to the stacks of \_\_\_\_\_.
9. In animal cell \_\_\_\_\_ are present while \_\_\_\_\_ is absent.
10. Plasmids are small, extrachromosomal, double-stranded DNA found in \_\_\_\_\_.

### Part-C Long-ans Questions

1. What are the main differences between

- (a) prokaryotic & eukaryotic cells
- (b) animal & plant cell

2. What are the similarities & differences between

Mitochondria and Chloroplast?

3. Explain the structure & function of

- (a) Nucleus
- (b) Mitochondria
- (c) Chloroplast
- (d) Endoplasmic Reticulum

4. What are the differences between 70S & 80S ribosomes?

5. What are the basic characteristics of living organisms?

6. What is Biology? ~~Ex what are~~ Mention its various branches

7. Draw well labelled diagram of

- (a) Bacterial cell
- (b) Plant cell
- (c) Animal cell

8. Define the following:

- (a) Plasmid
- (b) Nucleoid
- (c) Flagella
- (d) Thylakoids
- (e) cistae
- (f) chromatin

9. What are plastids? Explain its types.

10. Write short notes on (a) Golgi bodies

- (b) lysosomes