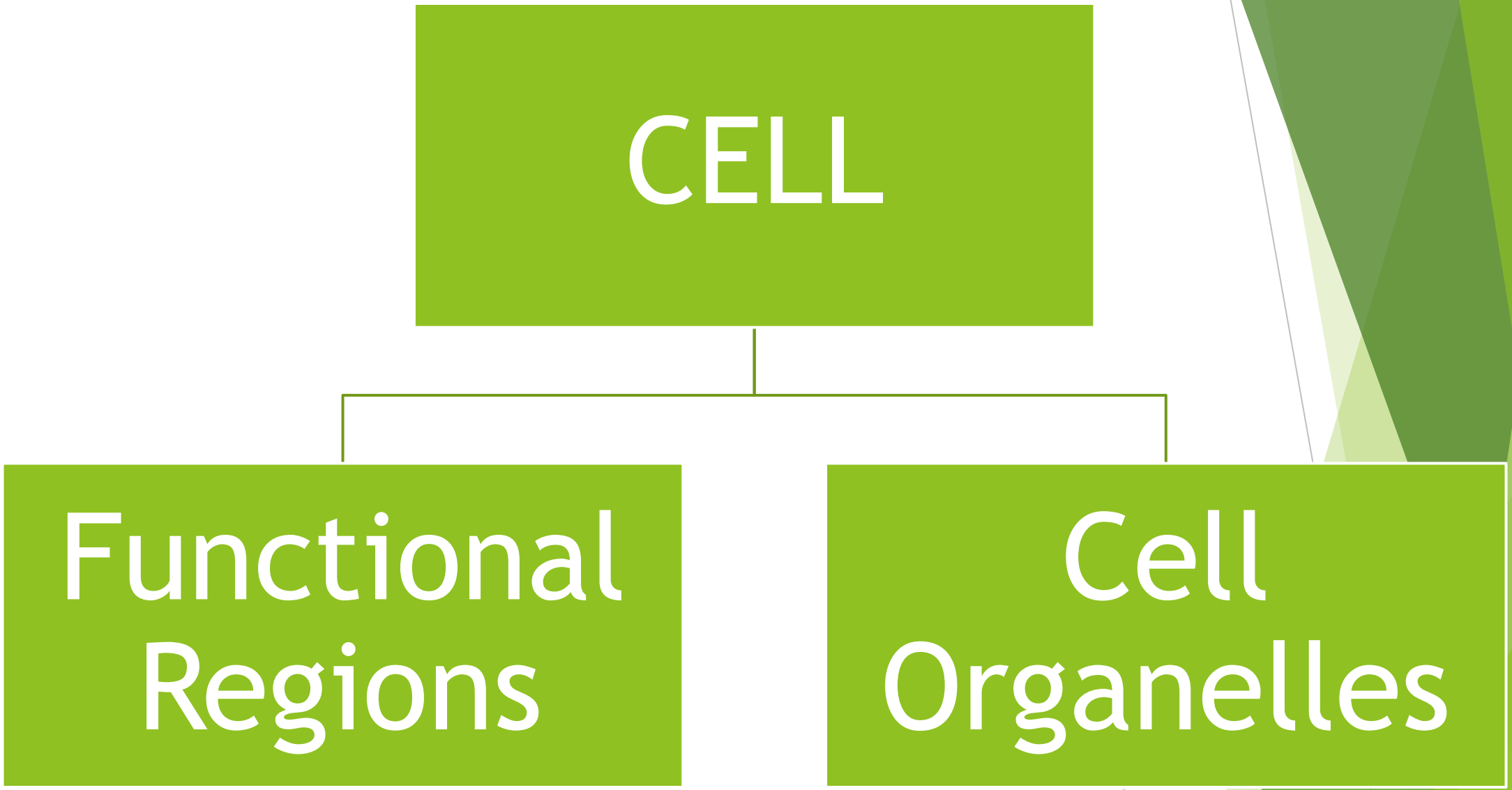
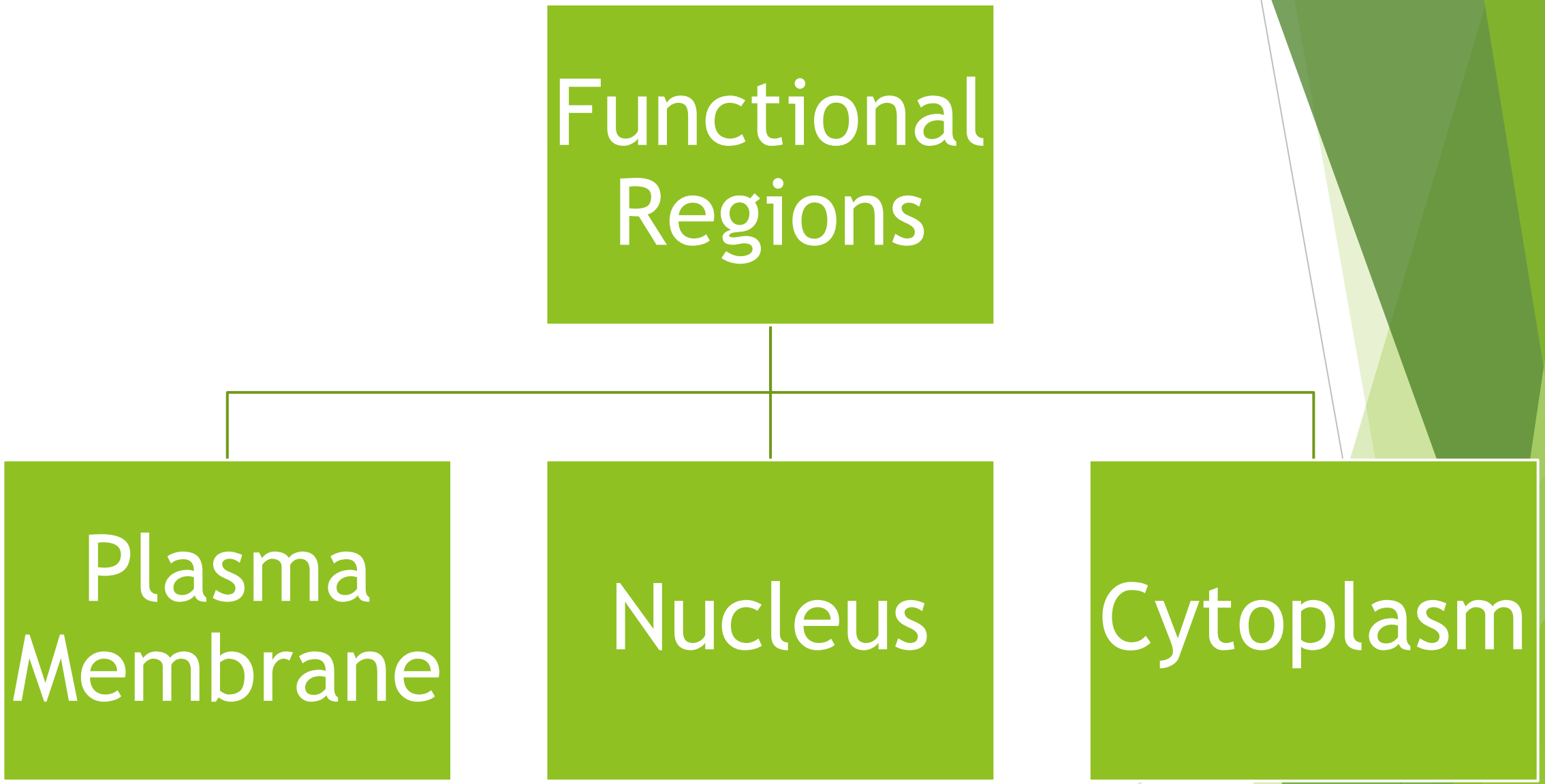
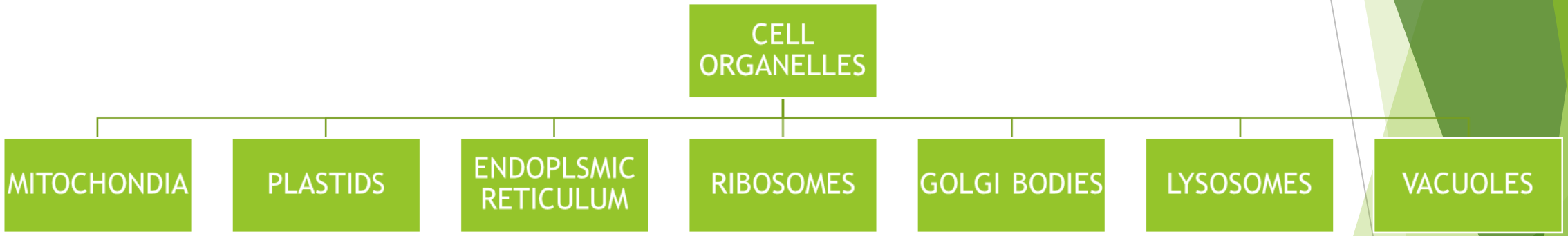
PHYSIOLOGY OF CELL

THE FUNDAMENTAL UNIT OF LIFE


CELL
Functional Regions
Cell Organelles

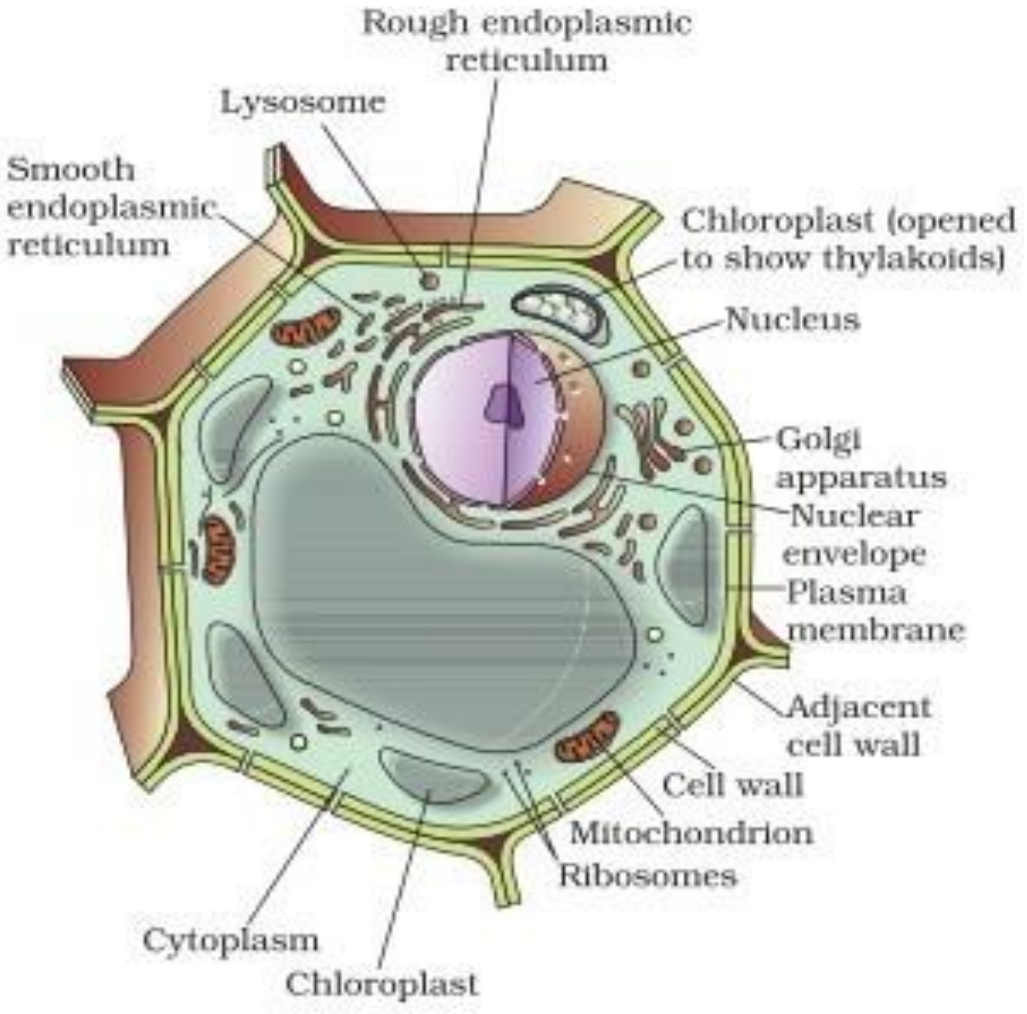

Functional Regions
Plasma Membrane
Nucleus
Cytoplasm


CELL ORGANELLES
MITOCHONDIA
PLASTIDS
ENDOPLSMIC RETICULUM
RIBOSOMES
GOLGI BODIES
LYSOSOMES
VACUOLES

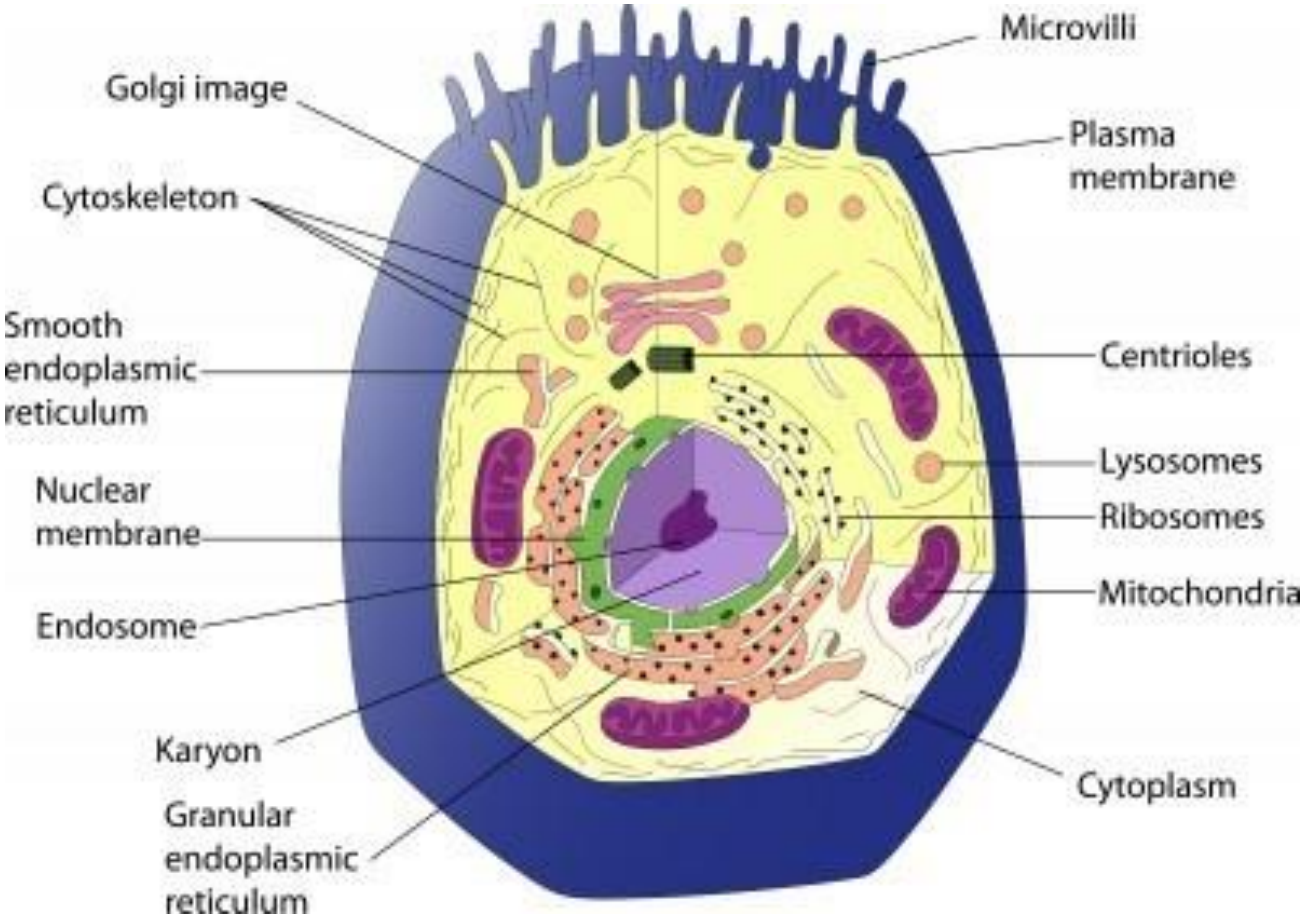
WHAT IS CELL ?

- It is the structural and fundamental unit of life.
- Cell have two parts:-
  1.Functional regions
  2.Cell organelles
- NOTE:- As cell can exist independently but organelles or functional regions like mitochondria, nucleus, etc. cannot exist independently.

PLANT CELL


Rough endoplasmic reticulum
Lysosome
Smooth endoplasmic reticulum
Chloroplast (opened to show thylakoids)
Nucleus
Golgi apparatus
Nuclear envelope
Plasma membrane
Adjacent cell wall
Cell wall
Mitochondrion
Ribosomes
Cytoplasm
Chloroplast

ANIMAL CELL


Microvilli
Golgi image
Plasma membrane
Cytoskeleton
Smooth endoplasmic reticulum
Centrioles
Lysosomes
Nuclear membrane
Ribosomes
Mitochondria
Endosome
Karyon
Cytoplasm
Granular endoplasmic reticulum

FUNCTIONAL REGION OF CELL

FUNCTIONAL REGIONS:- PLASMA MEMBRANE

- Also called as cell membrane.
- It is the outer most covering of each cell, which separates its contents from the surrounding medium.
- It is made up of lipids**(fats)** and proteins**(building blocks of the body)**.
- ***FUNCTIONS:-***

1. Regulates the movement of the molecules in and out of the cell
2. It provides definite shape to the cell

CELL WALL

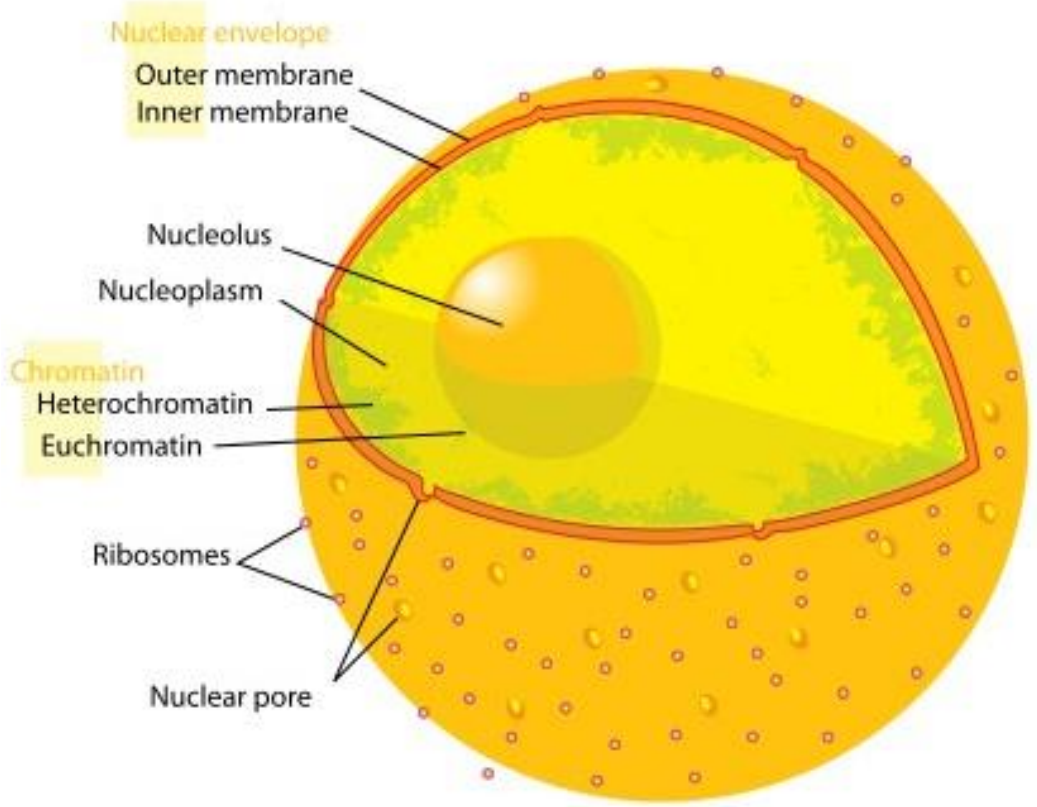
- This is found in plant cell, fungi cell and bacteria cell.
- In addition to the plasma membrane, have another rigid outer covering called the plasma membrane.
- Cell wall mainly composed of cellulose.
- Cellulose is a complex substance and provides structural strength to the cell.

PLASMA MEMBRANE V/s CELL WALL

PLASMA MEMBRANE	CELL WALL
• PRESENT IN EVERY LIVING CELL • SEMI-PERMEABLE • MADE UP OF LIPIDS AND PROTIENS. • MAIN FUNCTION IS TO REGULATE MOVEMENT OF MOLECULES.	• ADDITION LAYER PRESENT ONLY IN plant cell, fungi cell and bacteria cell. • FREELY PERMEABLE • MADE UP OF CELLULOSE(A CARBOHYDRATE) • MAIN FUNCTION IS TO PROVIDE RIGIDITY(STRENGTH)

NUCLEUS

- Prominent, spherical or oval structure controlling all the cell activities.
- Covered by a double layered membrane called ***nuclear membrane***.

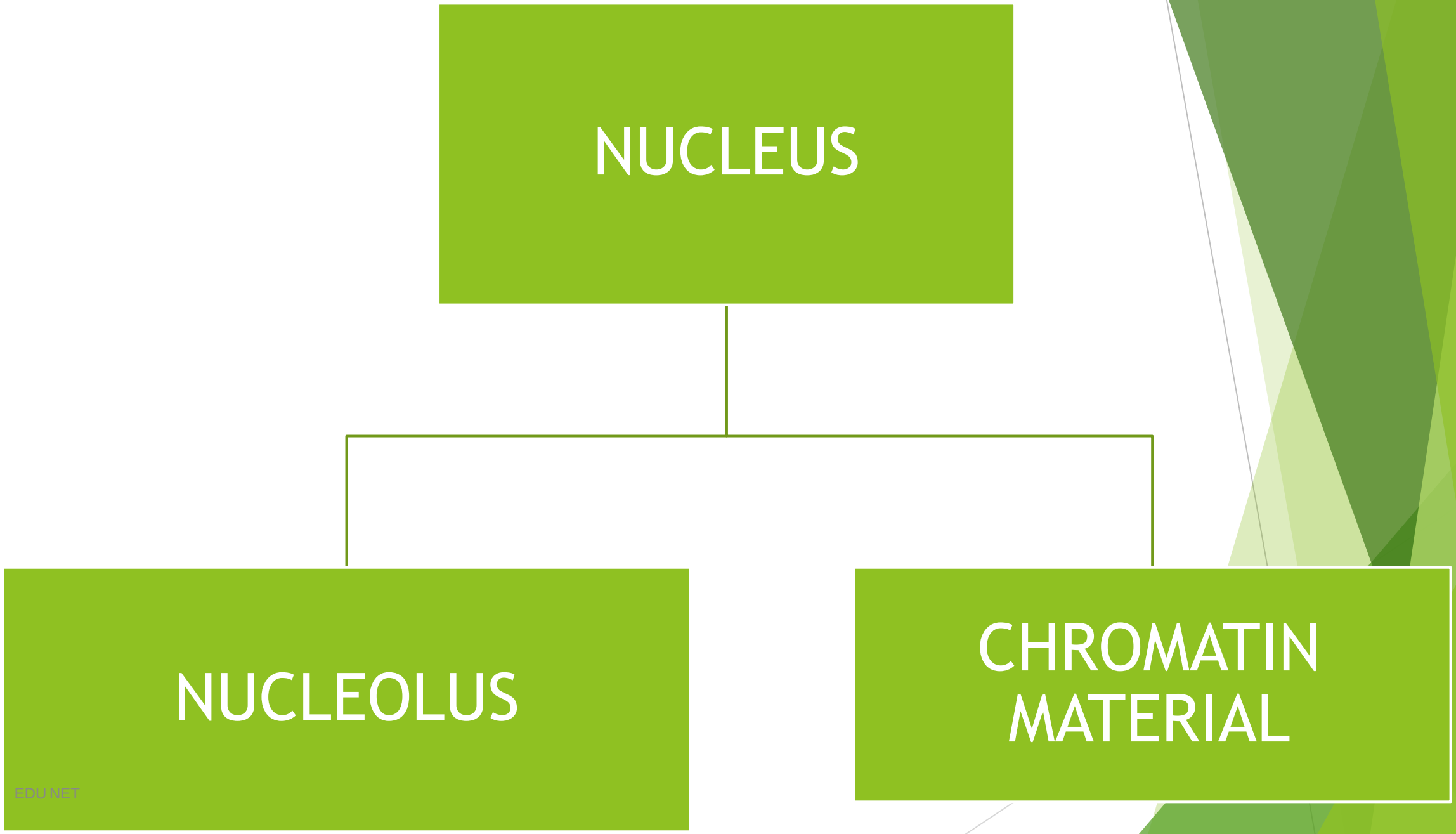


NUCLEAR MEMBRANE

- Nuclear membrane is the membrane containing nuclear pores through which transporting of materials between fluid of nucleus and fluid of cell, takes place.

NUCLEOPLASM

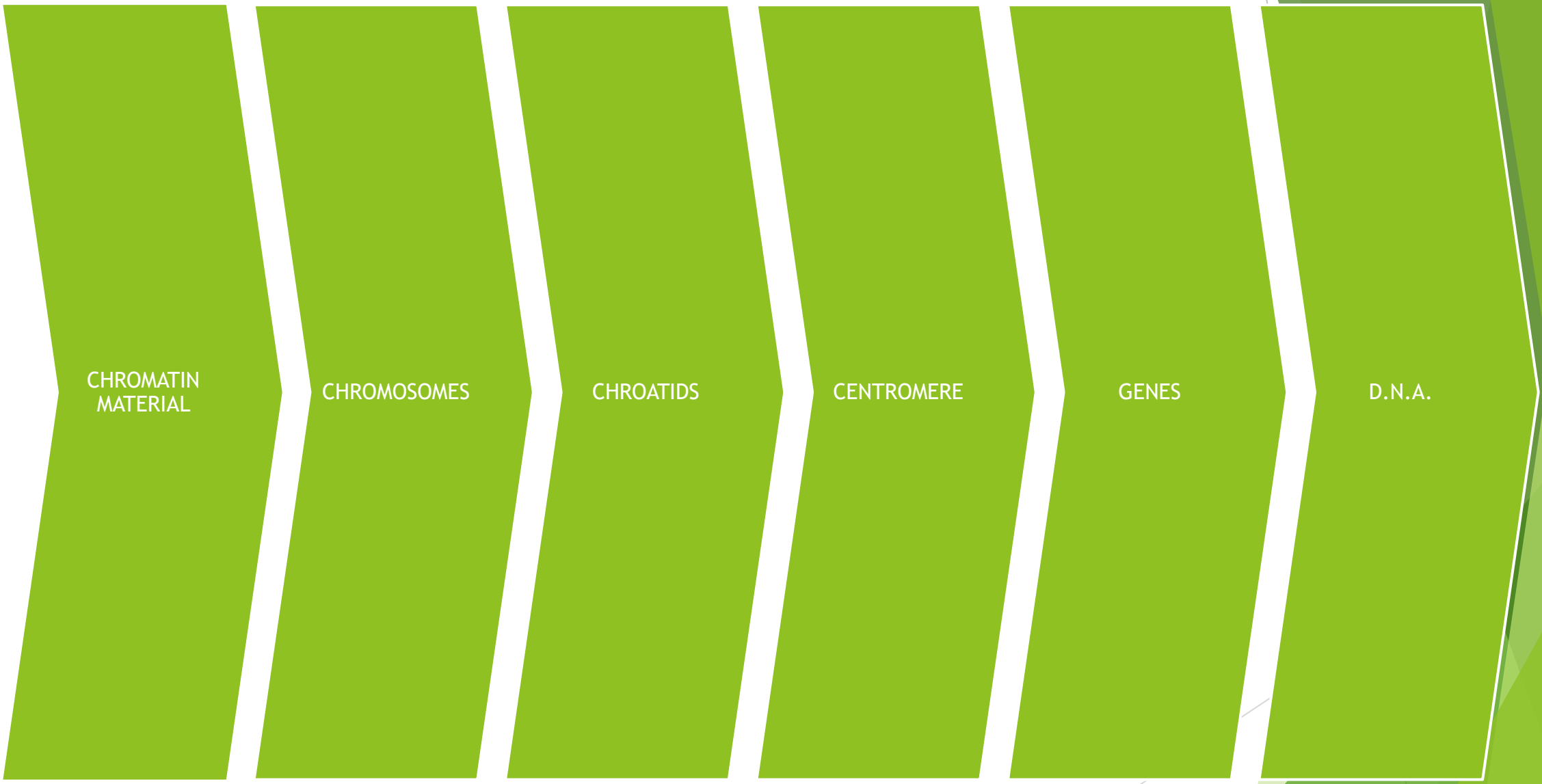
- A colourless dense fluid present inside the nuclear membrane




NUCLEOLUS
R.N.A.
(RIBOSE NUCLEIC ACID)
PROTIENS SYNTHESIS

NUCLEOLUS

- It is a dense spherical structure(contain R.N.A.) occurring inside nucleus of cells that synthesizes proteins.
- R.N.A.**(ribose nucleic acid)** : a kind of nucleic acid which is helpful in synthesis of proteins because it contain RIBOSOMES.


CHROMATIN MATERIAL
CHROMOSOMES
CHROATIDS
CENTROMERE
GENES
D.N.A.

CHROMATIN MATERIAL

- CHROMATIN MATERIAL : An intertwined mass of thread like structures forming chromosomes during cell division.

FUNCTION : Mainly responsible for storing and transmitting the hereditary information from one generation to another.

- CHROMOSOMES : Chromatin condensed into compact rod like bodies at the time of cell division is called as chromosomes.

FUNCTION : Pass hereditary information from one generation to another.

- CHROMATIDS : It is one of the two thread like structures(containing D.N.A.), joined at the centromere, to form a single chromosomes.
- CENTROMERE : It is the point of attachment of two chromatids.
- GENES : Functional unit of chromosomes arranged in single liner order which may be responsible for one or several cell functions
- D.N.A.**(Deoxyribose nucleic acid) :** A kind of nucleic acid acting as a hereditary material and transmitting characters to young ones.

CYTOPLASM

- Fluid present outside the nucleus but inside the plasma membrane.
- A number of small organelles are found inside the cytoplasm and are know as ***cytoplasmic organelles***.

PROTOPLASM

- Nucleoplasm + Cytoplasm
- Colourless, viscous jelly like semi-fluid, which can be distinguish into a nucleoplasm and cytoplasm

CELL ORGANELLES

CELL ORGANELLES

- These are living structures of the cytoplasm and are also called as ***ORGANOIDS.***

MITOCHONDRIA

- Mitochondria are the organelles which contain enzymes for cellular respiration in which energy is realeased.

SHAPE : Rod shaped oraganelles.

FUNCTION : It provides energy in form of ATP(Adenosine Tri Phosphate) which is vital for the activities of living cells. hence it is also called as ***"powerhouse"*** or ***"powerplant"***of cell.

STRUCTURE : Made up of two membranes, the larger membrane is folded inside the smaller membrane forming finger like projection called as ***CRISTAE***.

ENDOPLASMIC RETICULUM

- It is a membranous network enclosing a fluid filled lumengiving internal support to the cytoplasm.
- ***TYPES*** :

1) S.E.R.(Smooth Endoplasmic Reticulum) : This is smooth because this does not contains Ribosomes on its surface.

2) R.E.R.(Rough Endoplasmic Reticulum) : This is rough because it contains Ribosomes on its surface.

- ***FUNCTION*** : Synthesises proteins(by R.E.R.) and Lipids(by S.E.R.) for producing new cellular parts

RIBOSOMES

- Small, bead like bodies found either in free state in cytoplasm or attached to the surface of Endoplasmic Reticulum.

FUNCTION : Associated in the synthesis of protiens.

GOLGI BODIES

- Called as ***DICTYOSOMES*** in plant cells.
- Smooth, flattened, sac like structures placed one over other in parrelel rows.

FUNCTIONS :

1) It packages the synthesised material of Endoplasmic Reticulum and despatches it to various places.
2) Involved in the formation of lysosomes and peroxisomes.

LYSOSOMES

- Sac like cytoplasmic organelles containing hydrolytic enzymes that degrade those cellular components which become useless.
- These serve as intercellular digestive system hence called as ***DIGESTIVE BAGS***.
- They digest the entire damaged or dead cell contain themselves hence also termed as ***SUICIDE BAGS***.

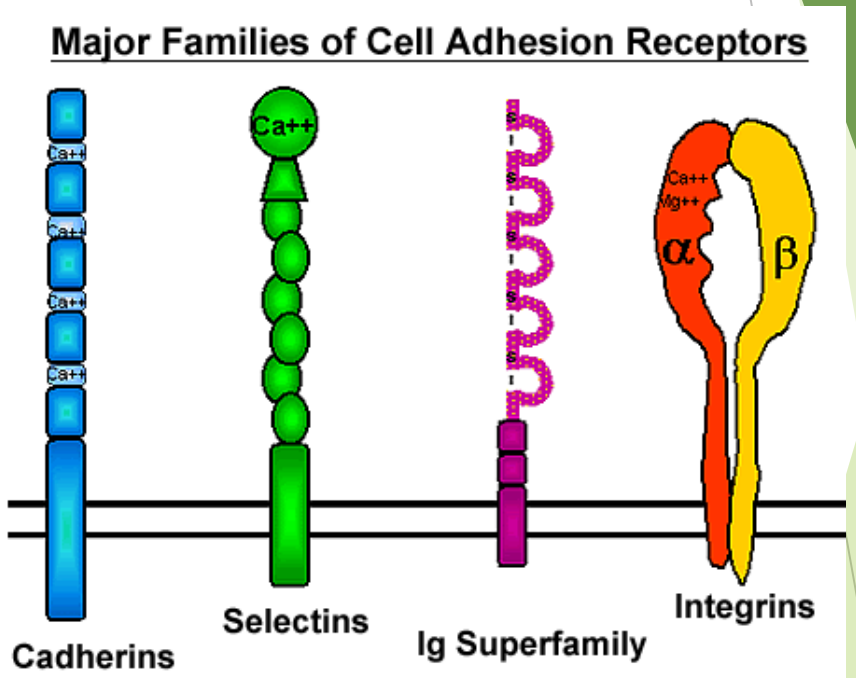
VACUOLES

- ONLY FOUND IN PLANT CELL.
- IN PLANTS SINGLE PROMINENT VACULOE OCCUPIES ABOUT 90% OF THE VOLUME OF THE CELL.
- Membranous bags filled with liquid cell sap with single cell membrane called TONOPLAST.
- ***FUNCTION*** : Provides rigidity and turgidity to plant cell.

Cell adhesion molecules

Ca^{2+}-dependent:

cadherins
selectins
integrins



Ca^{2+}-independent:

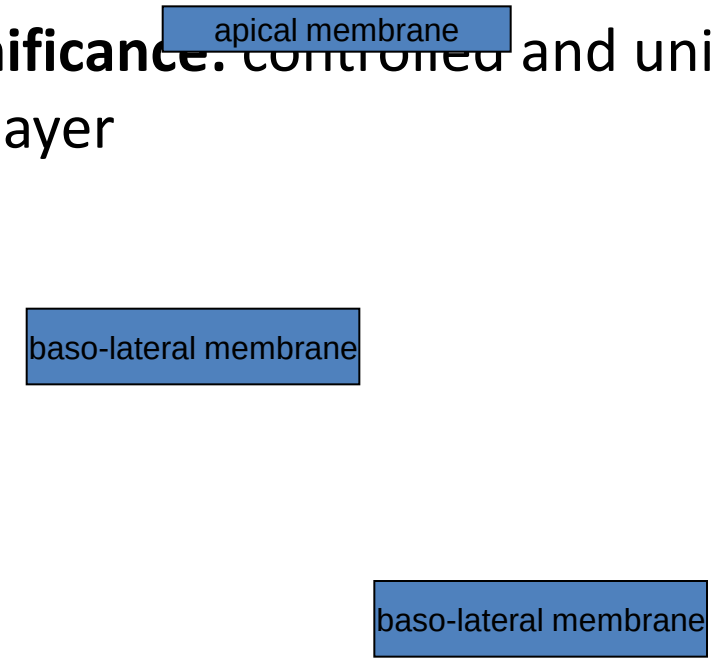
IgG-like- CAMs (immunoglobulin superfamily)
integrins

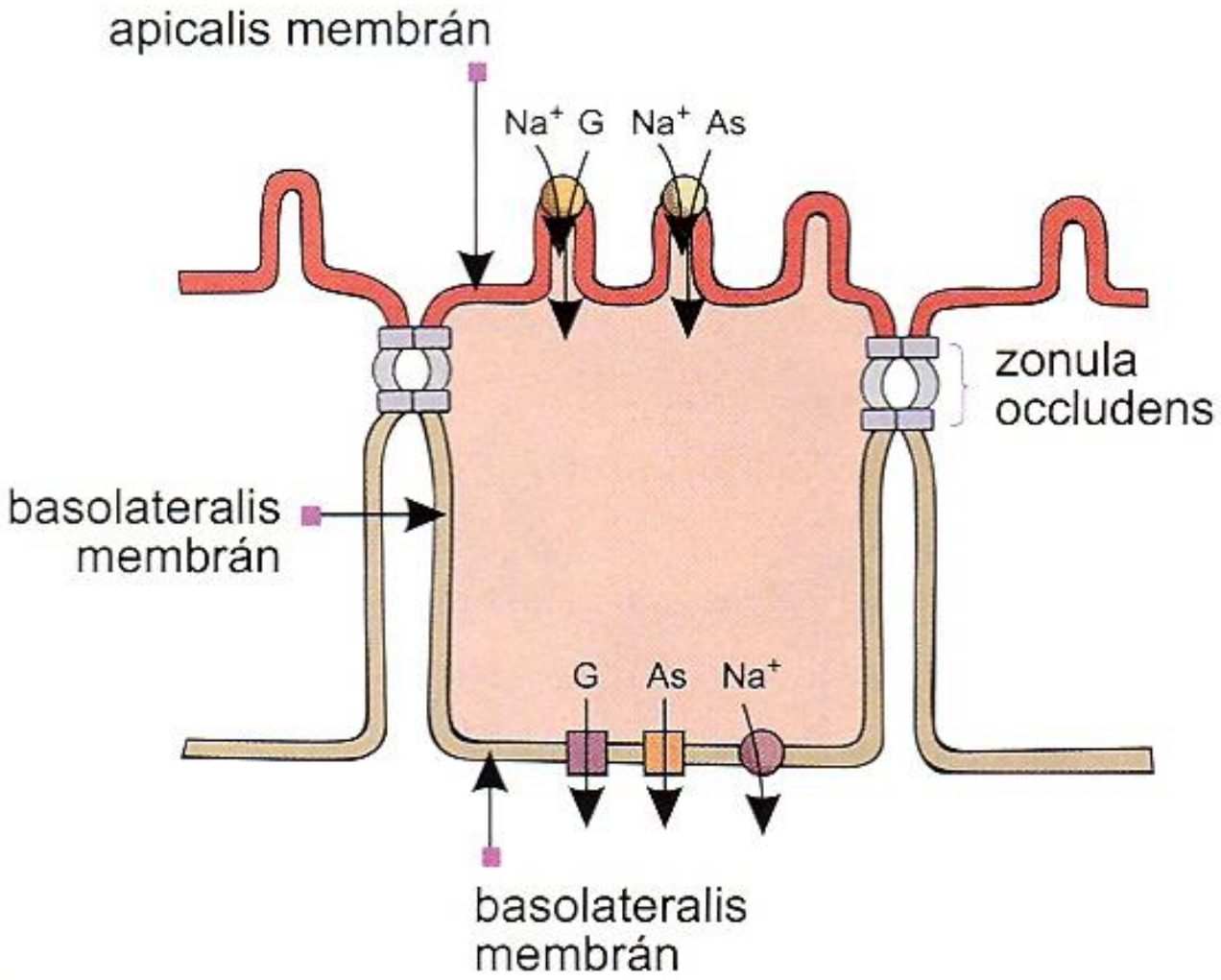
Functions of tight junction

Diffusion barrier in the plasma membrane (blocking lateral diffusion in the membrane), the belt-like tight junction divides the plasma membrane into an apical and baso-lateral domain (with different sets of molecules)

- **Diffusion barrier in the intercellular space:** free diffusion of substances between neighboring cells is blocked.
-

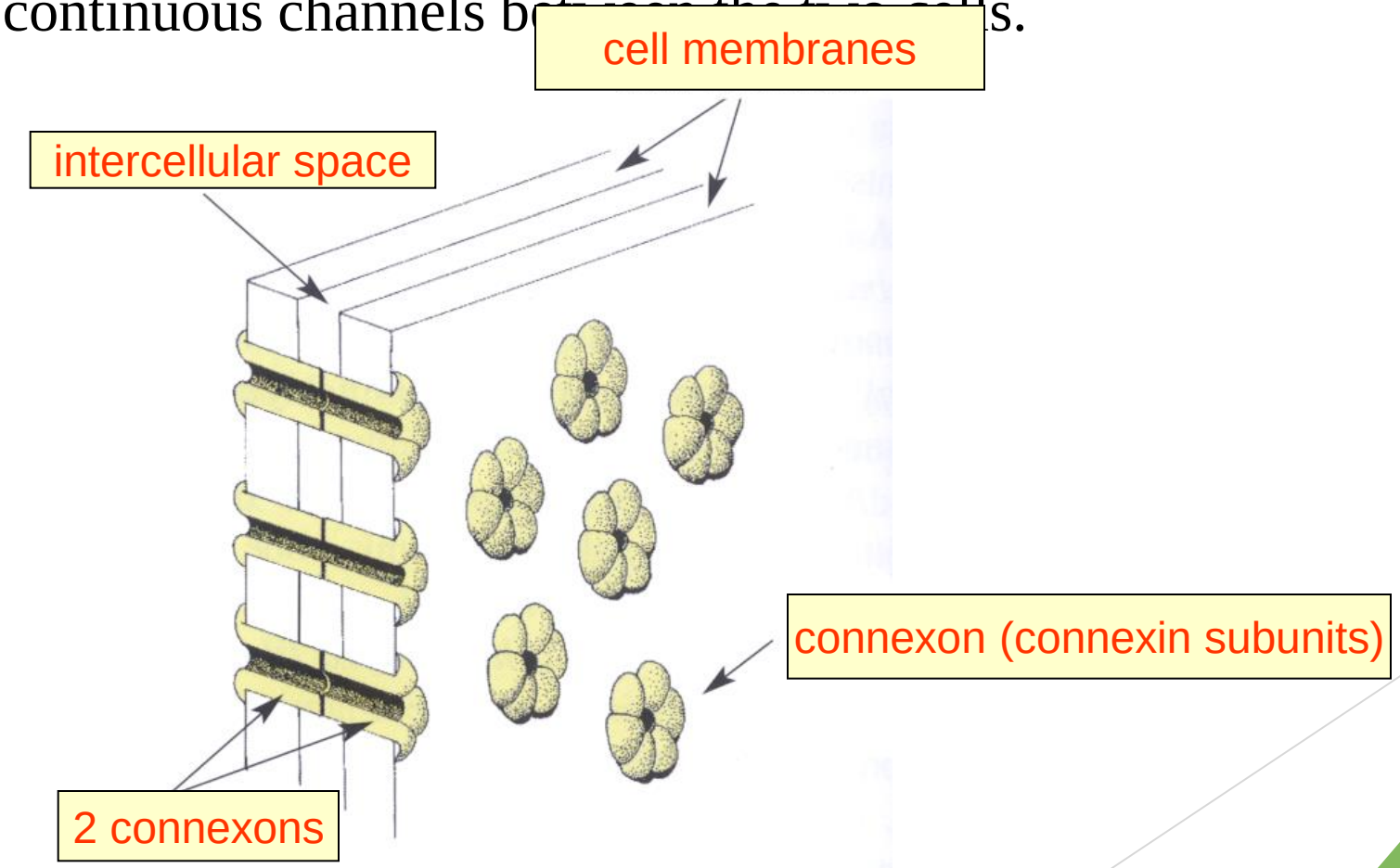
Biological significance: controlled and unidirectional transport across the epithelial layer




apicalis membrán
Na+ G
Na+ As
zonula occludens
basolateralis membrán
G
As
Na+
basolateralis membrán

Nexus (gap junction)

Patch-like contacts between two cells: large number of *channels (connexons)* in the opposite membranes, that are bound to each other in the intercellular space to form continuous channels b[illegible]s.



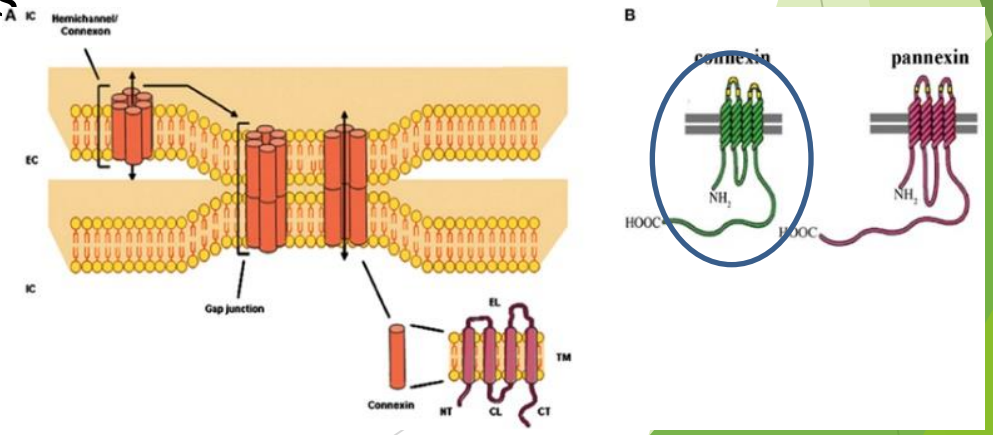
Molecular structure:

connexon: a complex composed of *6 transmembrane proteins* (connexins), that surround a central canal. A similar complex in the opposite membrane is joined to it in the intercellular space. A *continuous canal* is formed which leads from one cell into the other making communication by free diffusion of low molecular weight substances possible.

Connexin: Transmembrane proteins

Cx32 in nerve fibers,

defects lead to problems in nerve conduction.



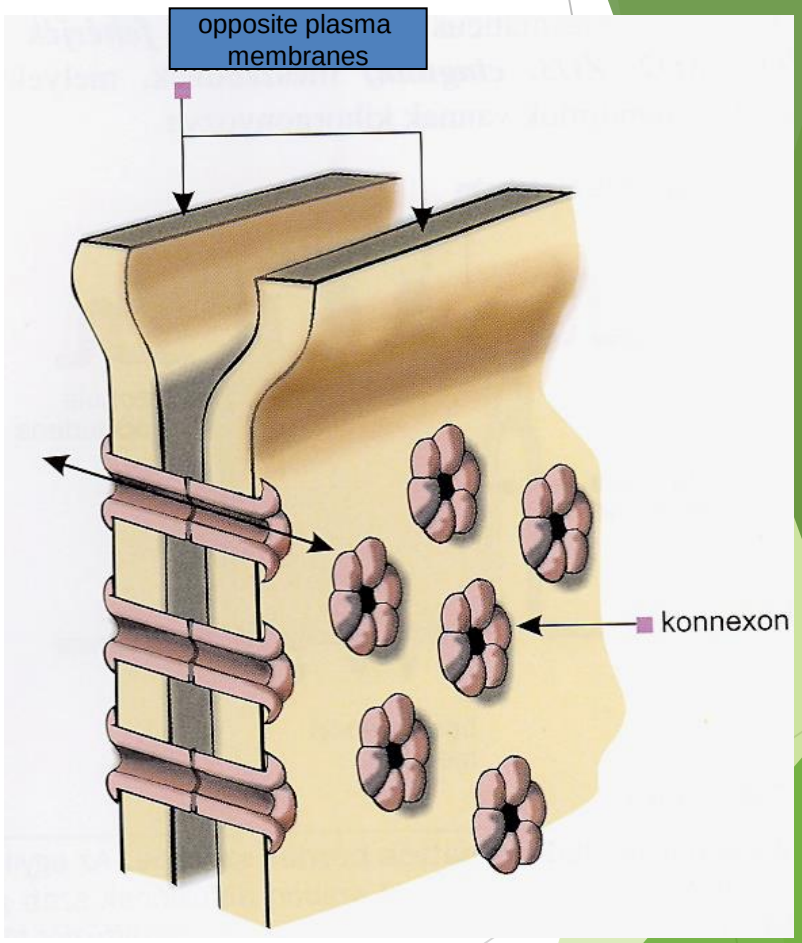
Gap junction: patch-like membrane domain with densely packed connexons

Diversity of connexons, in different cell types. Combinations of different connexins in a connexon.

Examples of connexin isoforms:

Cx50 in the crystalline lens of th eye, defects lead to glaucoma

Cx26 in sensory cells of the inner ear, defects cause auditory malfunction



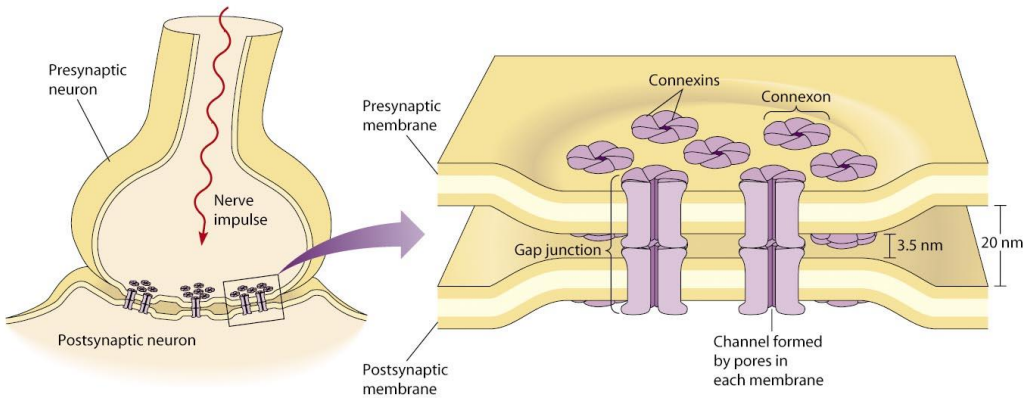
Nexus

Biological significance:

Communication between cells: nutrient transport (cells of the lens, osteocytes, follicular cells surrounding the oocyte in the ovary), synchronized reaction for signals during the development etc.

Electrical connection between cells: electrical synapsis: ions can migrate between cells, stimulus can be transmitted without delay;

In heart muscle: synchronized contraction



(a) An electrical synapse

(b) Gap junctions

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THANK U