

CELL



- Cell is the struc. & functional unit of LIFE
- Organisms can be unicellular & multicellular
 - ① can exist independently
 - ② Perform all essential functions
- Robert Hooke: discovered cell (cell wall) & named 'cellula'
- Robert Brown (1831): discovered nucleus
- Leeuwenhoek: discovered LIVING CELL

CELL THEORY

- Schleiden (1838): German botanist: said all plants are made up of diff. cells that makes different tissues
- Schwann (1839): German zoologist: reported cell memb. in animal cells & said plants have BOTH cell memb. & cell wall (outer)
- HYPOTHESIS: All plants and animals are composed of cells & products of cells
- Schleiden + Schwann: cell theory
- Virchow (1855): 'omnis cellula-e-cellula'
∴ modified / gave final shape to cell theory
- CELL THEORY:
 - ① All organisms made of cells & cell products
 - ② New cells arise from pre-existing cells

PLANT VS ANIMAL CELLS

- cell wall ⊕nt
- = ⊕nt
- = ⊕nt
- central vacuole ⊕nt
- = ⊕nt
- Centriole & centrosome ⊕nt

NOTE: Cholesterol is ⊕nt in animal cell memb. but in plants, other Sterols ⊕nt

NOTE: Centrioles ⊕nt only in animal cells; helps in cell division; membraneless

PROK. VS EUK. CELL

- well defined nucleus • ⊕nt
- Membrane bound organelles ⊕nt
- Ribosome = 70S
e.g., Bacteria, PPLO, etc.
- 80S & 70S
 - ↓ RER
 - ↓ Mitochondria & Chloroplast

NOTE: RIBOSOME is universal membraneless organelle

NOTE: RBC (biconcave & round); WBC (amoeboid); Nerve cell (long & branched); Mesophyll cell (round, oval); mycoplasma (0.3um diameter); PPLO (size = 0.1um); bacteria (length = 3-5um); Typical prok. (1-2um size); Typical euk. (size = 10-20 um); virus (0.02-0.2um); ostrich egg (largest cell)

CELL: OVERVIEW

- Nucleus: dense membr. bound str. in euk. cell
 - ↳ contains chromosomes which contains DNA
- Cytoplasm: Main arena of chemical reaction
 - ↳ keep cell in living state
 - Semi-fluid

PROKARYOTIC CELLS

- smaller; divide faster; 4 major shapes: coccus, bacillus, vibrio, spirillum (round) (rod) (comma) (spirocyclic)
- Main DNA/Nucleoid: ds circular DNA
- Plasmid: ds circular DNA; extrachromosomal; replicate independently; provide antibiotic resistance
- Membrane: selectively permeable
- Cell wall: Rigid (⊕nt in mycoplasma)
- Inclusion bodies: membraneless; helps in storage: e.g., phosphate granule, glycogen granule, cyanophycean granule etc.

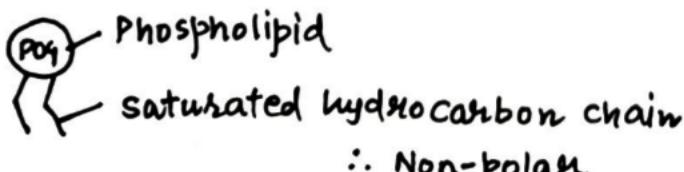
- Gas vacuole is also an inclusion body found in blue green & purple green bacteria
- Mesosome: infolding of cell memb; help in cell wall formation, DNA replication & distribution, cell secretion, respiration
- Chromatophore: memb. infolding containing pigments e.g., in BGA
- Surface structures:

- ① Flagella (flagellin protein): Motility
- ② Fimbriae: Anchorage ↓
3 parts
 - Filament (long)
 - Hook
 - Basal body
- ③ Pili: conjugation

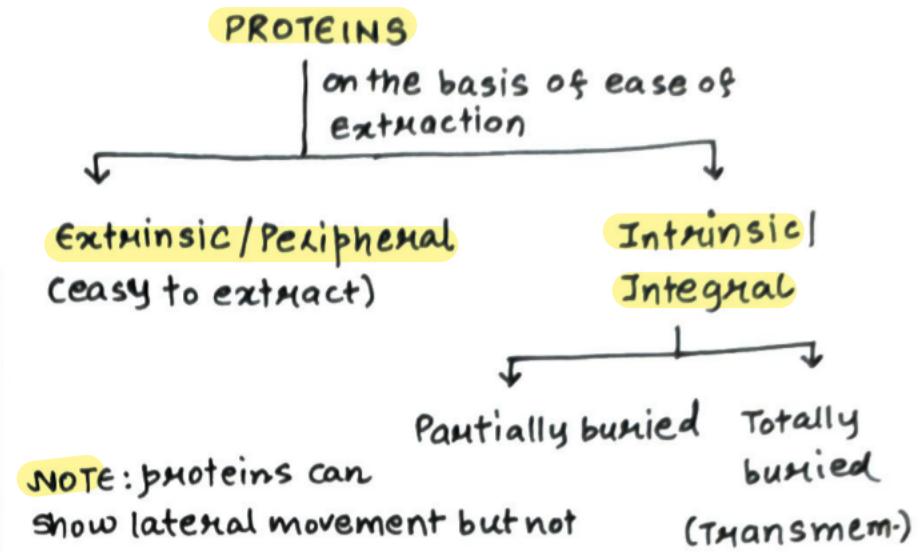
- Cell envelope: found in majority of bacteria; chemically complex; made of 3 layers
 - ↳ ① outermost Glycocalyx - [Tough: capsule
② cell wall
③ cell memb. (inner)]
 - Loose: Slime layer
- Bacteria are Gram +ve & -ve based on cell env.

CELL MEMB.

- Euk. cells contains complex cytoskeletal & locomotory structures
- RBC is the cell used to study membrane
- RBC has 52% protein & 40% lipid in memb.
- carbohydrate (on outer side) also found in membrane
- LIPID: provide fluid nature to memb. ∴ provide lateral & flip-flop movement (name)
∴ Helps in cell growth, division, exo and endocytosis & cell-junction formation
- LIPID has a polar (hydrophilic) head & a non-polar tail


Phospholipid
saturated hydrocarbon chain
∴ Non-polar

NOTE: Lipid is +ve as BILAYER



- Neutral/Non-polar things: DIFFUSION
- Polar solutes: Facilitated DIFFUSION
- ↓ conc. to ↑ conc.: ACTIVE TRANSPORT

CELL WALL

- Non-living RIGID layer
- helps in cell-cell interactions; prevents entry of MACRO molecules
- Fungi: chitin
- Algae: cellulose + Galactans + Mannans + CaCO_3
- Plants: cellulose + Hemicellulose + Pectin + Protein

- 1° cell wall allows growth
- 2° cell wall forms in mature cell inside 1° wall that restricts growth
- Middle lamella (Ca-Pectate) adhere 2 cells
- cytoplasms of 2 plant cells are connected by plasmodesmata

ENDOMEMB. SYSTEM *

- Includes ER, GC, Lysosome, vacuole
 - ER
 - RER (Ribosomes on)
 - SER (Ribosomes off)
 - (has ribosomes)
 - ↓ close to Nucleus
 - Make lipids & steroids
 - Make proteins
- Proteins & Lipids from ER are sent to cis/concave/forming face of GC
 - ↓ then to Median Golgi
 - ↓ then to Trans/concave/Maturing face

- Glycosylation & packaging of proteins & lipids occur in GC
- Lysosome: formed from GC; contains hydrolytic enzymes which are active at acidic pH ($\text{pH} \downarrow$); $\therefore \text{H}^+$ pumped from cytoplasm to lysosome
- Vacuole: it is like storehouse of cell; contain sap, H_2O , excretory waste, anthocyanine etc
- Materials are pumped from cytoplasm (conc. \downarrow) to vacuole (conc. \uparrow)
- Amoeba: Contractile vacuole
- Protist: Food vacuole by engulfing food
- Ribosome: Palade particles / protein factories smallest organelle

$70S \rightarrow 50S + 30S$

$80S \rightarrow 60S + 40S$

Svedberg unit

Measurement of density & size NOT WEIGHT

mRNA + many ribosomes \rightarrow POLYSOMES

MITOCHONDRIA

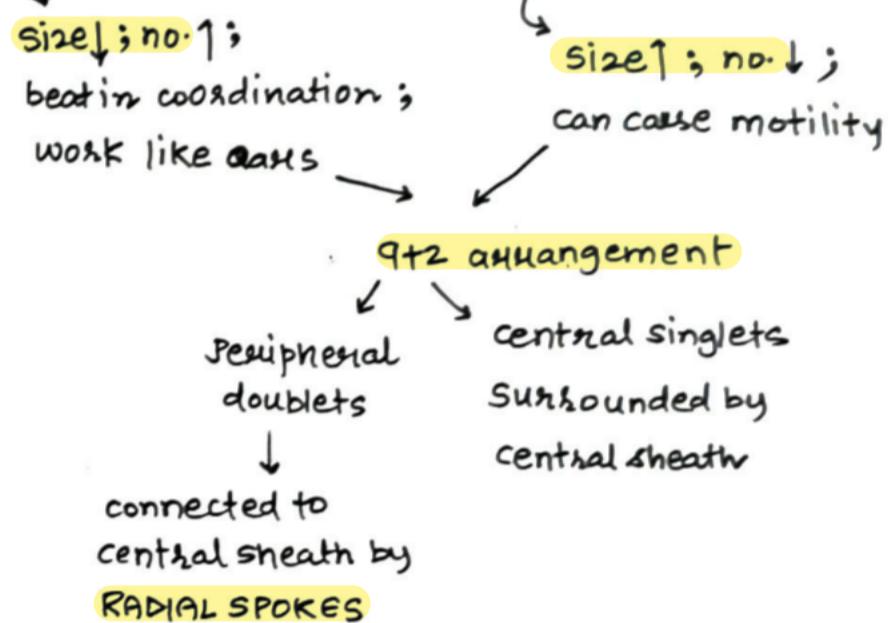
- stained with Janus Green
- Divide by FISSION; semiautonomous (\because have ds circular DNA & 70S ribosome in matrix)
- called powerhouse; outer memb. has PORINS; Inner memb. has infoldings called CISTAE (have $\text{F}_0 - \text{F}_1$)

PLASTIDS

- 3 Types:
 - Chloroplast (green): chlorophyll + carotenoids
 - Chromoplast (yellow, pink, orange): carotene + xanthophylls: Fat Soluble
 - Leucoplast: stores nutrients
 - Amyloplast: Stores starch
 - Alloplast: Stores proteins
 - Elaeoplast: Stores oils & fats

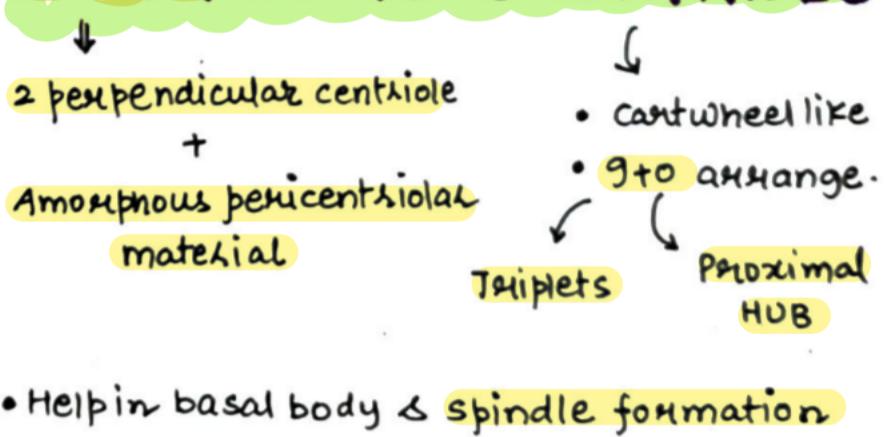
- No. of Chloroplast can vary: 1 in Chlamydomonas; 20-40 in mesophyll cell
- It is larger than mitochondria
- It is also semiautonomous
- Thin flat discs like thylakoid piles up to make grana
- Matrix here is called STROMA
- Stroma lamellae connects 2 grana

CILLIA & FLAGELLA



- They are covered with membrane
- Their core is called axoneme
- Basal body is centriole like

CENTROSOME & CENTRIOLE



- Help in basal body & spindle formation

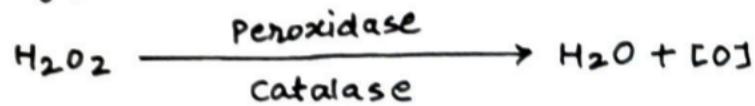
CYTOSKELETAL

- Network of protein filament that provides shape, support to euk. cell
- Microtubule > Int. Filament > Microfilament

MICROBODIES

- Found in both plants & animals ; small ; single membrane ; contain specific enzymes

e.g., PEROXISOME

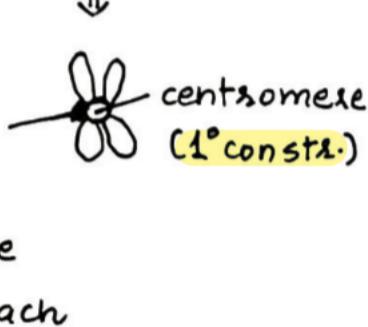


NUCLEUS & CHROMOSOME



- has 2 membranes
- space b/w 2 memb. is perinuclear space
- Nucleoplasm contains chromatin & nucleolus
 - ↓
 - DNA + RNA + Histone + Non-Histone proteins
 - ∴ Nucleoprotein
 - ↓ mRNA Factory

- Interphase chromatin $\xrightarrow{\text{Packs}}$ Chromosome



- Some chromosomes have small non-staining region called 2° constriction which bears bulb like satellite (SAT - chromosomes)

- Chromosome Types:

- ① Metacentric: centromere at centre
- ② Sub-metacentric: slightly away from centre
- ③ Acrocentric: subterminal centromere
- ④ Telocentric: terminal centromere

NOTE: Small arm = p ; long arm = q