Shree H. N. Shukla Institute of Pharmaceutical Education and Research, Rajkot

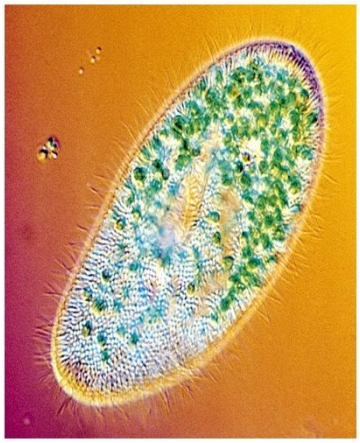
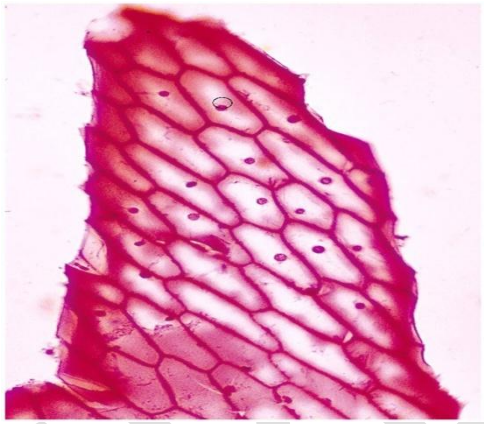
B. Pharm
Semester-I

Subject Name: Human Anatomy & Physiology-I
Subject Code: BP101TP

Chapter-1

Cell Structure and Function

- Smallest living unit
- Most are microscopic

Discovery of Cells

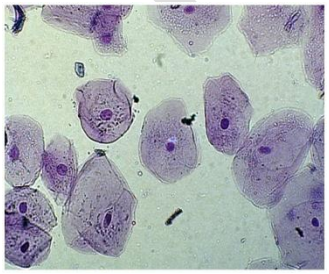
- Robert Hooke (mid-1600s)
  - Observed sliver of cork
  - Saw "row of empty boxes"
  - Coined the term cell

Principles of Cell Theory

- All living things are made of cells
- Smallest living unit of structure and function of all organisms is the cell
- All cells arise from preexisting cells
  (this principle discarded the idea of spontaneous generation)

Characteristics of All Cells

- A surrounding membrane
- Protoplasm – cell contents in thick fluid
- Organelles – structures for cell function
- Control center with DNA

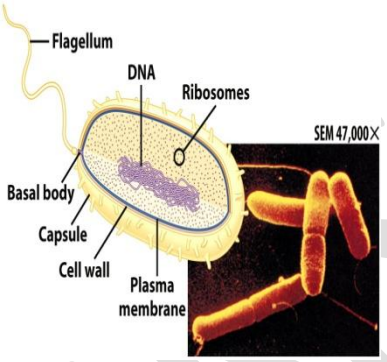


Cell Types

- Prokaryotic
- Eukaryotic

Prokaryotic Cells

- First cell type on earth
- Cell type of Bacteria and Archaea

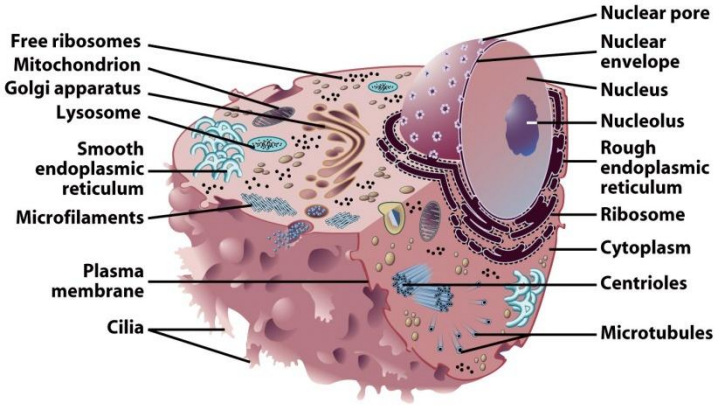


- No membrane bound nucleus
- Nucleoid = region of DNA concentration
- Organelles not bound by membranes

Eukaryotic Cells

- Nucleus bound by membrane
- Include fungi, protists, plant, and animal cells
- Possess many organelles

Representative Animal Cell

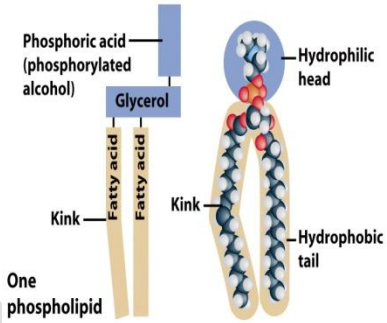


Plasma Membrane

- Contains cell contents
- Double layer of phospholipids & proteins

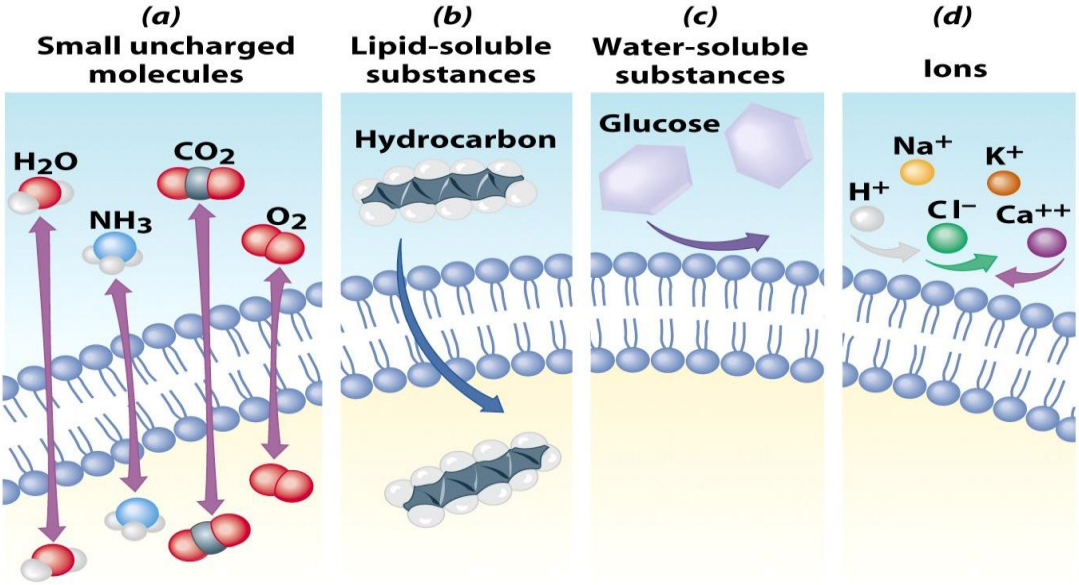
Phospholipids

- Polar
  - Hydrophylic head
  - Hydrophobic tail
  - Interacts with water



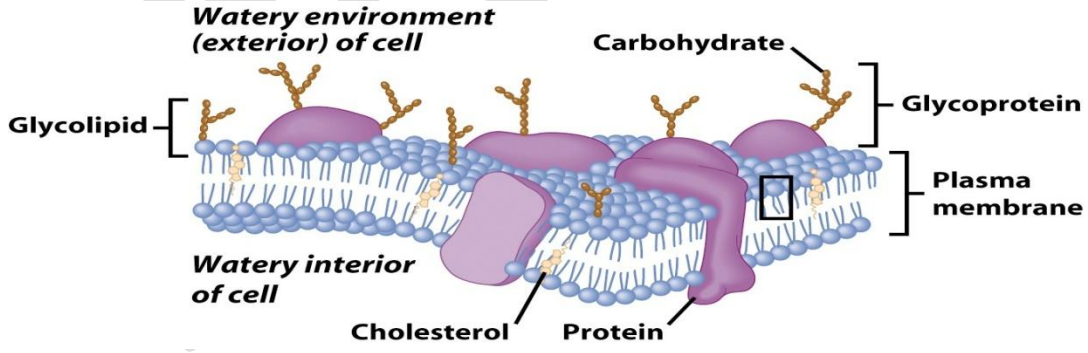
Movement Across the Plasma Membrane

- A few molecules move freely
  - Water, Carbon dioxide, Ammonia, Oxygen
  - Carrier proteins transport some molecules
  - Proteins embedded in lipid bilayer
  - Fluid mosaic model – describes fluid nature of a lipid bilayer with proteins



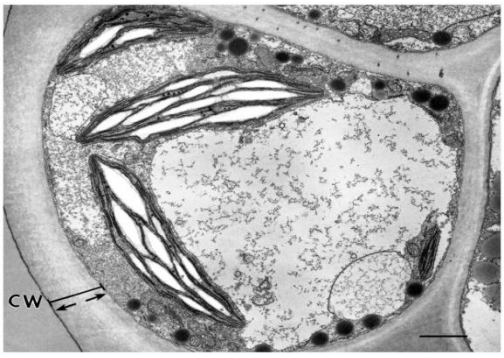
Membrane Proteins

1. Channels or transporters
   - Move molecules in one direction
2. Receptors
   - Recognize certain chemicals
3. Glycoproteins
   - Identify cell type
4. Enzymes
   - Catalyze production of substances



Cell Walls

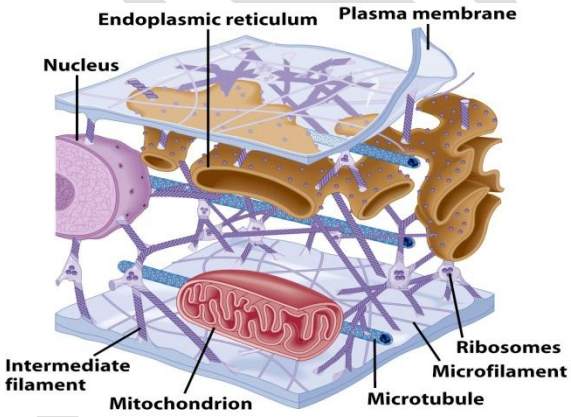
- Found in plants, fungi, & many protists
- Surrounds plasma membrane



- Plants – mostly cellulose
- Fungi – contain chitin

Cytoplasm

- Viscous fluid containing organelles
- components of cytoplasm
  - Interconnected filaments & fibers
  - Fluid = cytosol
  - Organelles (not nucleus)
  - storage substances
  -

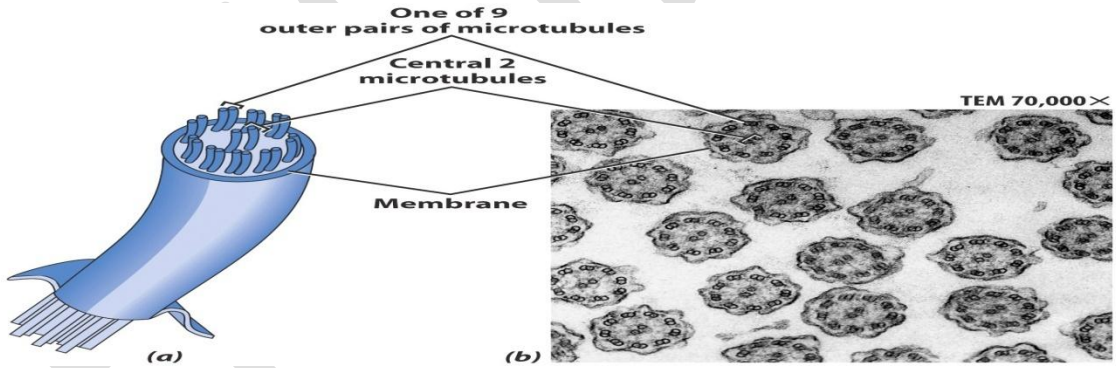


Cilia & Flagella

- Provide motility
- Cilia
  - Short

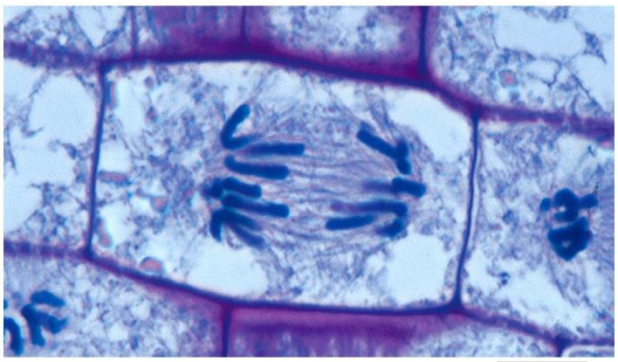
- Used to move substances outside human cells

- Flagella
  - Whip-like extensions
  - Found on sperm cells
- Basal bodies like centrioles
- Bundles of microtubules
- With plasma membrane



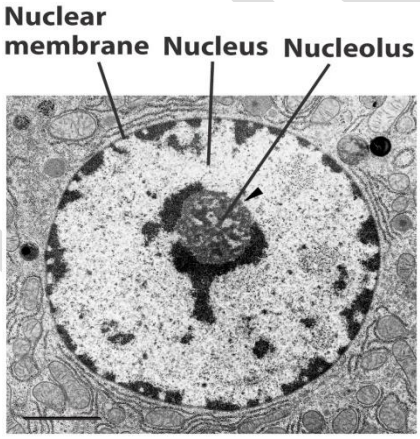
Centrioles

- Pairs of microtubular structures
- Play a role in cell division



Nucleolus

- Most cells have 2 or more
- Directs synthesis of RNA
- Forms ribosomes



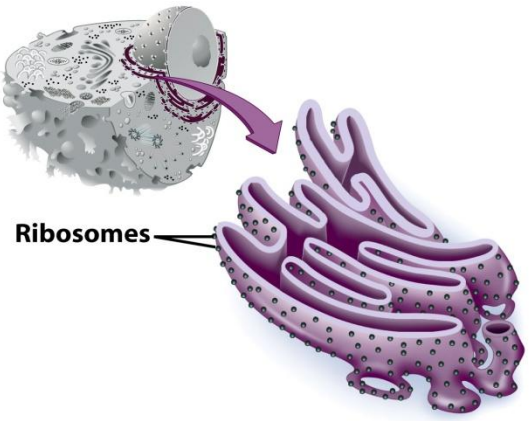
Endoplasmic Reticulum

- Helps move substances within cells
- Network of interconnected membranes
- Two types

- Rough endoplasmic reticulum
- Smooth endoplasmic reticulum

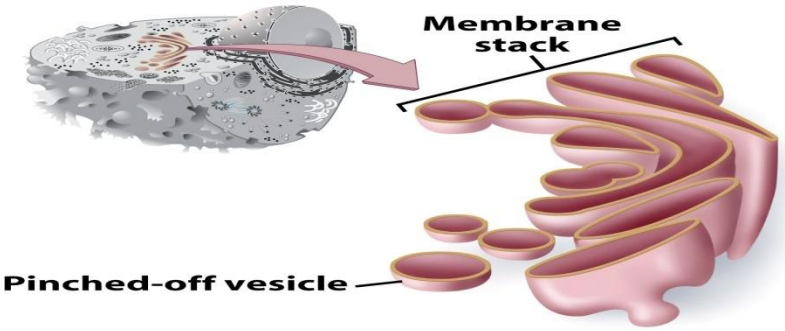
Rough Endoplasmic Reticulum

- Ribosomes attached to surface
  - Manufacture protiens
  - Not all ribosomes attached to rough ER
- May modify proteins from ribosomes



Golgi Apparatus

- Involved in synthesis of plant cell wall
- Packaging & shipping station of cell



1. Molecules come in vesicles
2. Vesicles fuse with Golgi membrane

3. Molecules may be modified by Golgi

4. Molecules pinched-off in separate vesicle

5. Vesicle leaves Golgi apparatus

6. Vesicles may combine with plasma membrane to secrete contents

Molecule Movement & Cells

- Passive Transport
- Active Transport
- Endocytosis

  (phagocytosis & pinocytosis)
- Exocytosis

Passive Transport

- No energy required
- Move due to gradient
  - differences in concentration, pressure, charge
  - Move to equalize gradient
  - High moves toward low

Types of Passive Transport

1. Diffusion

2. Osmosis

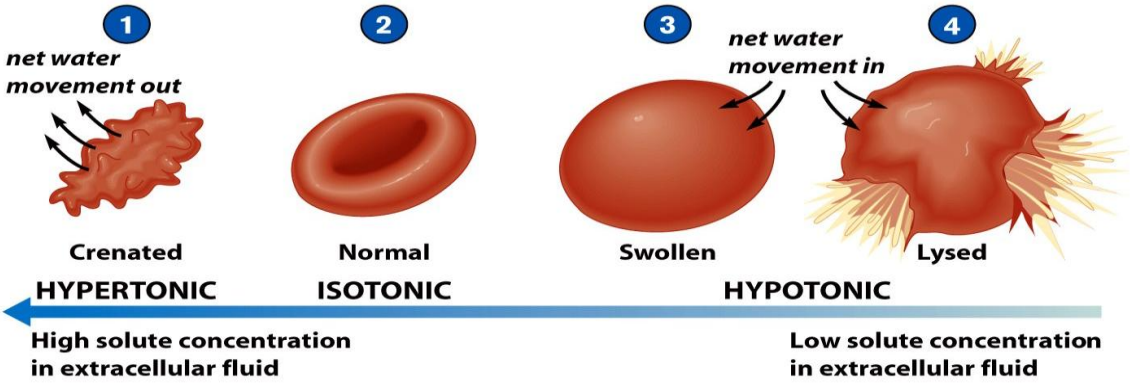
3. Facilitated diffusion

Diffusion

- Molecules move to equalize concentration

Osmosis

- Special form of diffusion
- Fluid flows from lower solute concentration
- Often involves movement of water
  - Into cell
  - Out of cell



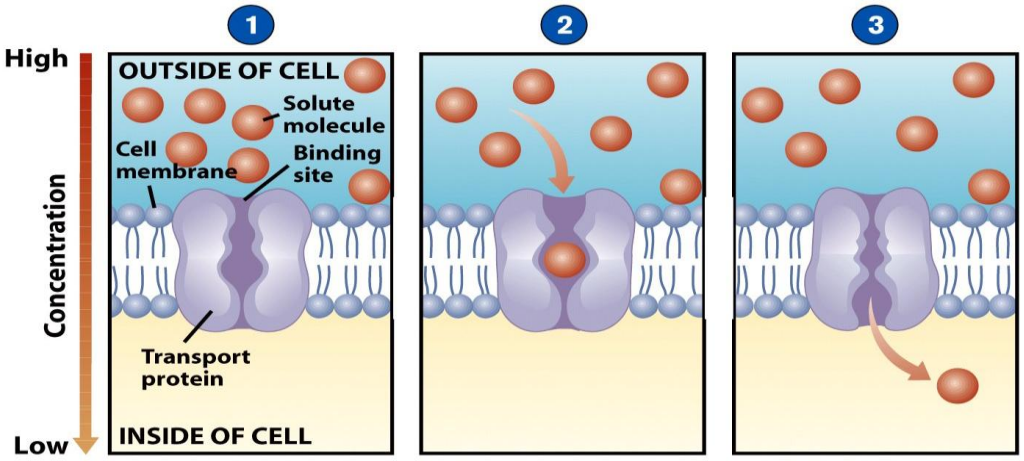
Facilitated Diffusion

- Differentially permeable membrane
- Channels (are specific) help molecule or ions enter or leave the cell
- Channels usually are transport proteins

  (aquaporins facilitate the movement of water)
- No energy is used

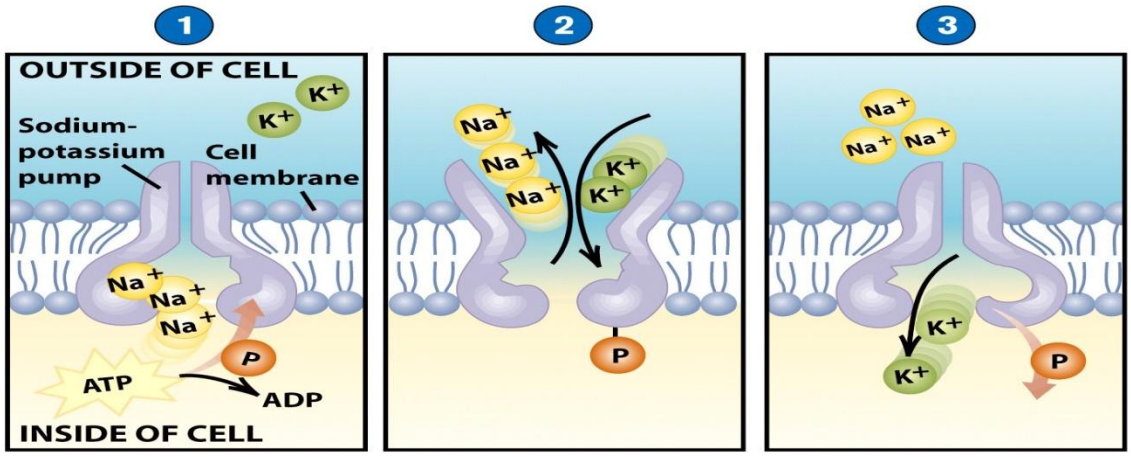
Process of Facilitated Transport

- Protein binds with molecule
- Shape of protein changes
- Molecule moves across membrane



Active Transport

- Molecular movement
- Requires energy (against gradient)
- Example is sodium-potassium pump

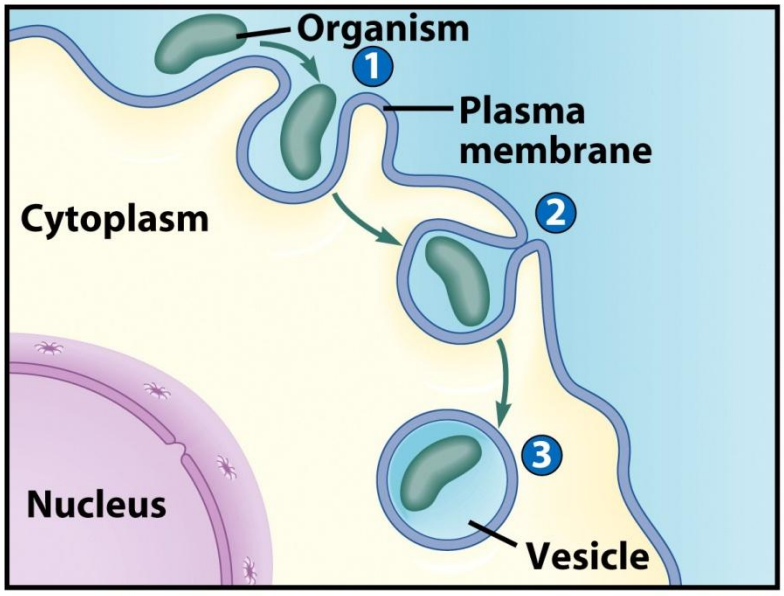


Endocytosis

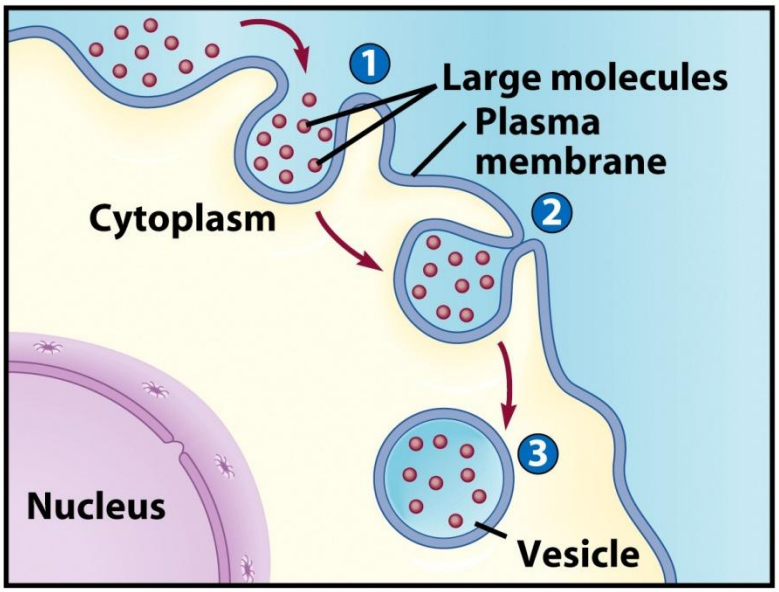
- Movement of large material
  - Particles
  - Organisms
  - Large molecules
- Movement is into cells
- Types of endocytosis
  - bulk-phase (nonspecific)
  - receptor-mediated (specific)

Process of Endocytosis

- Plasma membrane surrounds material
- Edges of membrane meet
- Membranes fuse to form vesicle



PHAGOCYTOSIS



PINOCYTOSIS

- Phagocytosis – cell eating
- Pinocytosis – cell drinking

Exocytosis

- Vesicle moves to cell surface

- Membrane of vesicle fuses
- Materials expelled