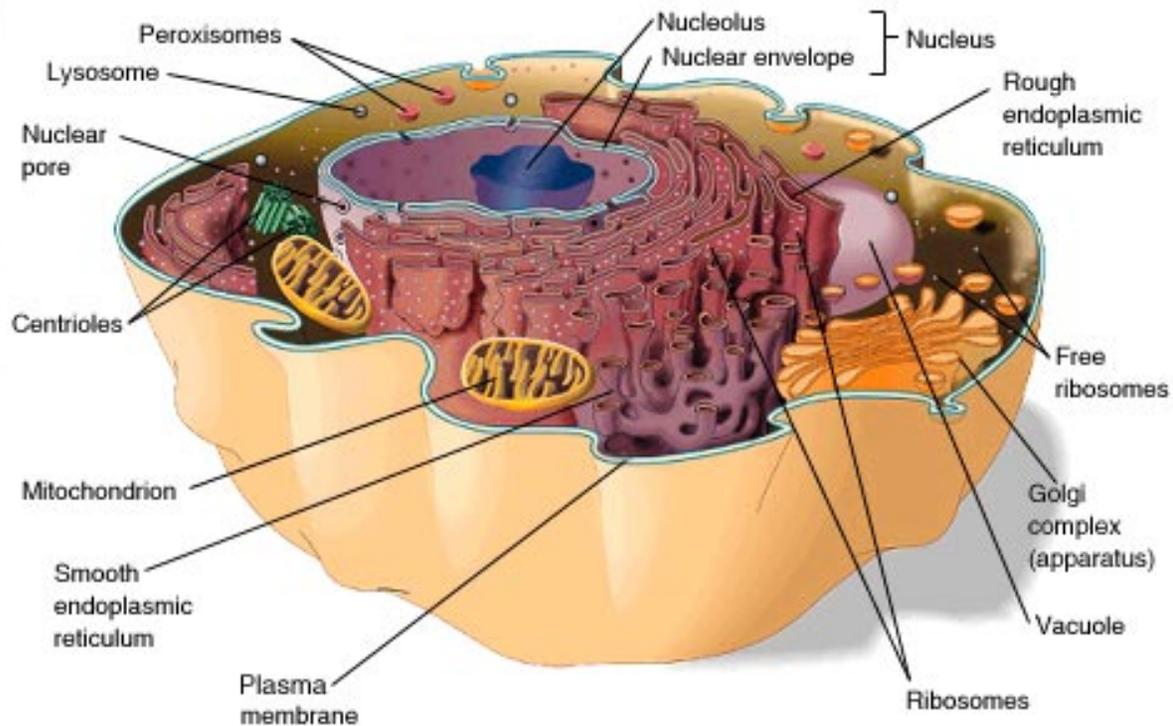


Microanatomy-Cytology (cells)



Levels of Organization

least complex

most complex

Chemical level>**cellular level**>Tissue level>Organ level>Organ system level>Organism level

Cytology

- **Cytology**-the study of the structure and function of cells
- Cells are:
 - the structural “building blocks” of all life
 - smallest structural unit that performs all vital functions
- The humans body is made of 75 trillion cells
- Two main types-
 - **Reproductive cells**-sperm & ova-reproductive cells
 - Cells are produced by division of preexisting cells
 - **Somatic cell**-all other cells of the body (muscle, bones, fat, neural, skin, blood, immune cells...)

Fig
2.3

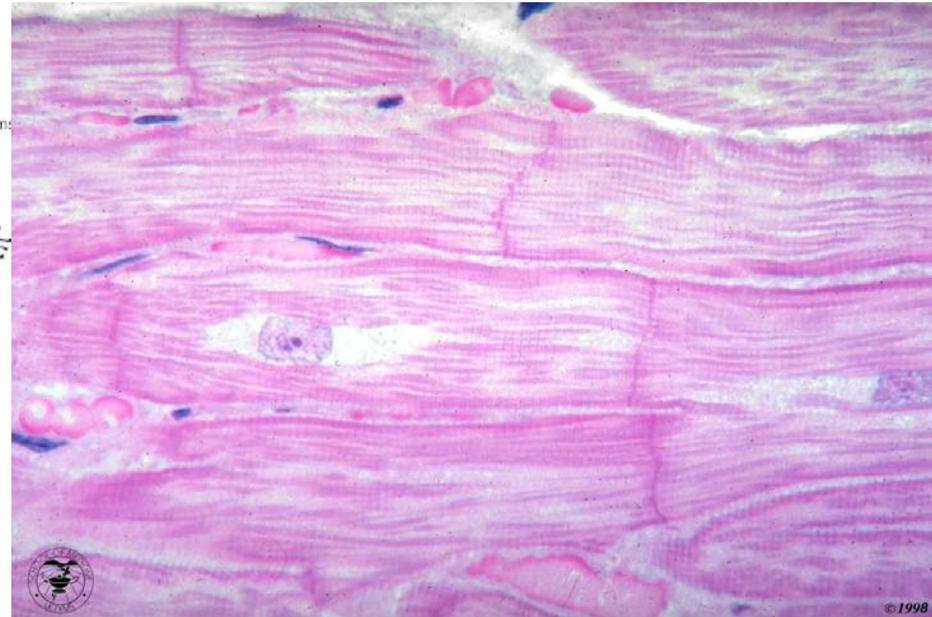
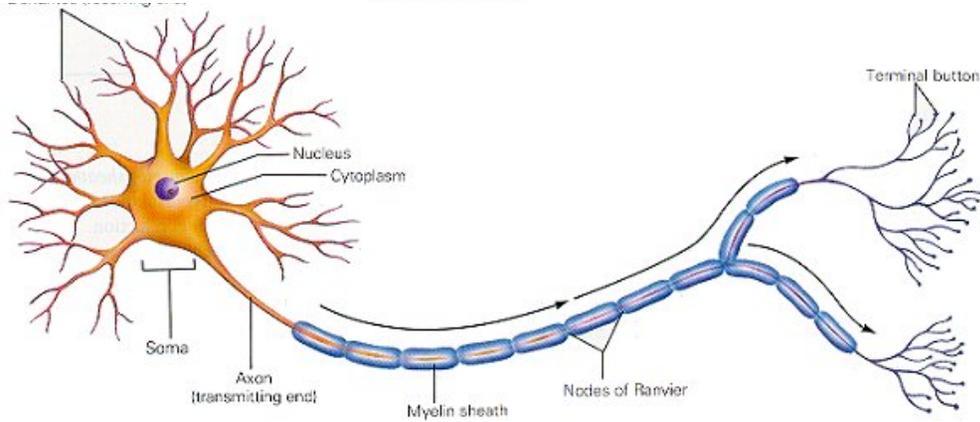
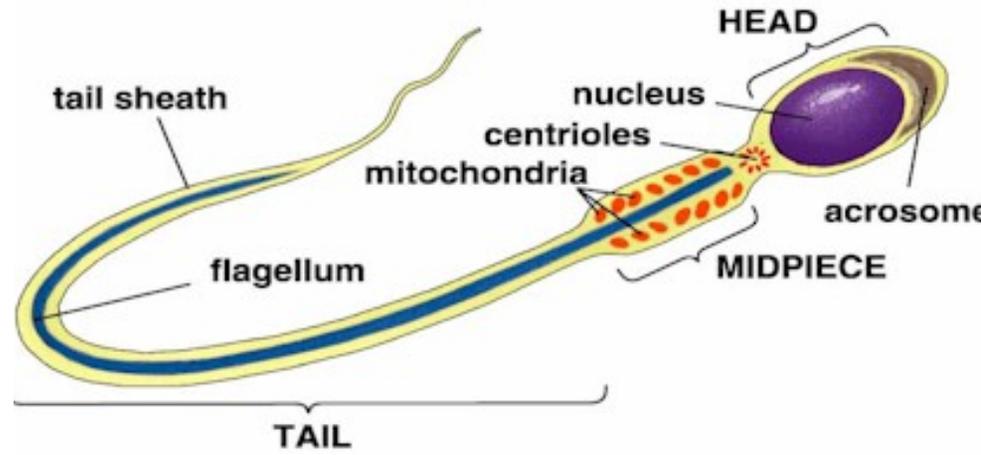
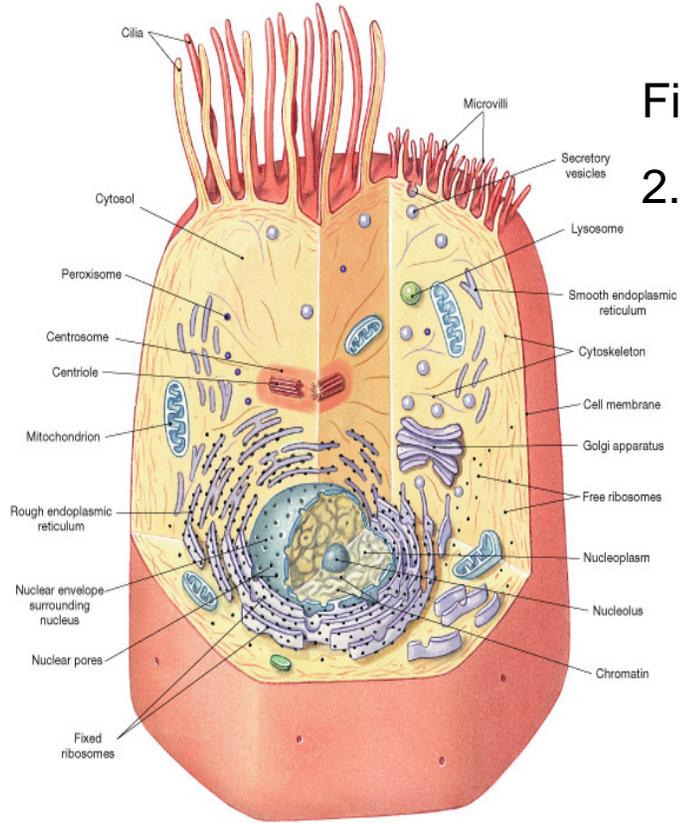
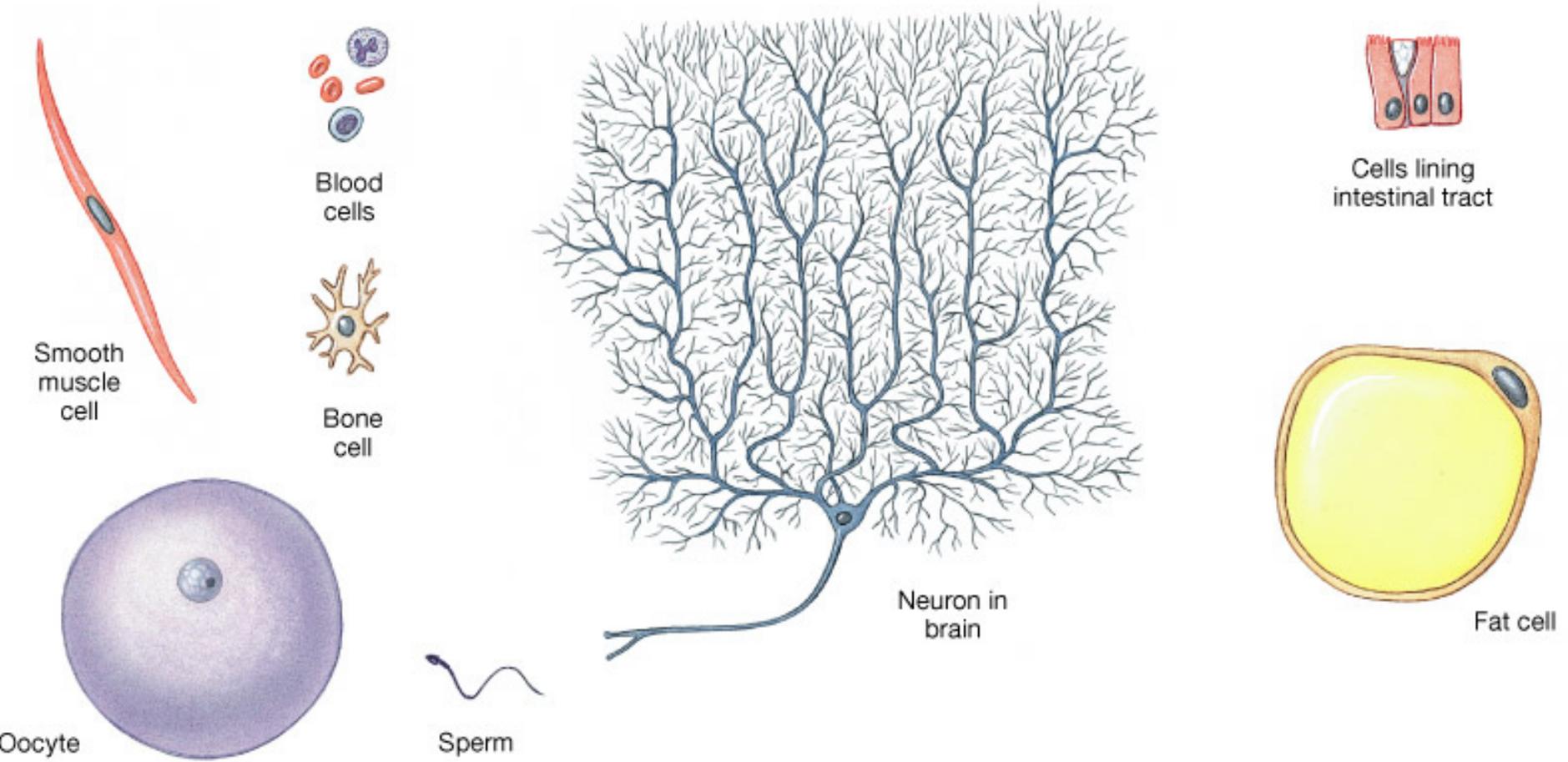


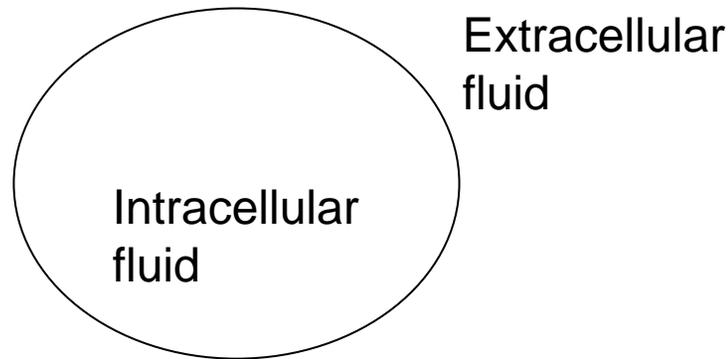
Fig
2.2





plasma membrane/ phospholipid bilayer/cell membrane/ plasmalemma

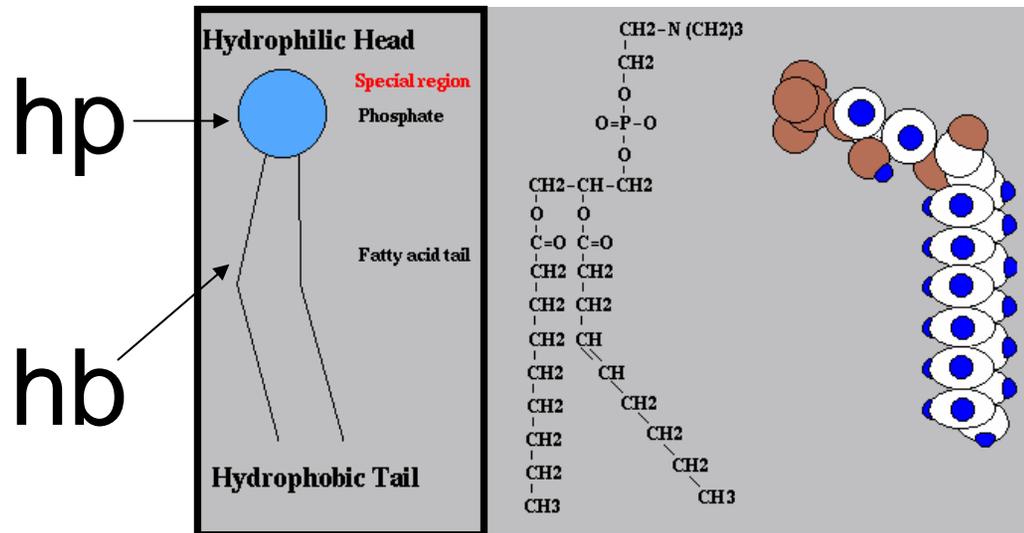
- Isolates the cell from the environment
- Structural support-intercellular attachment
- The membrane regulates interaction with the environment



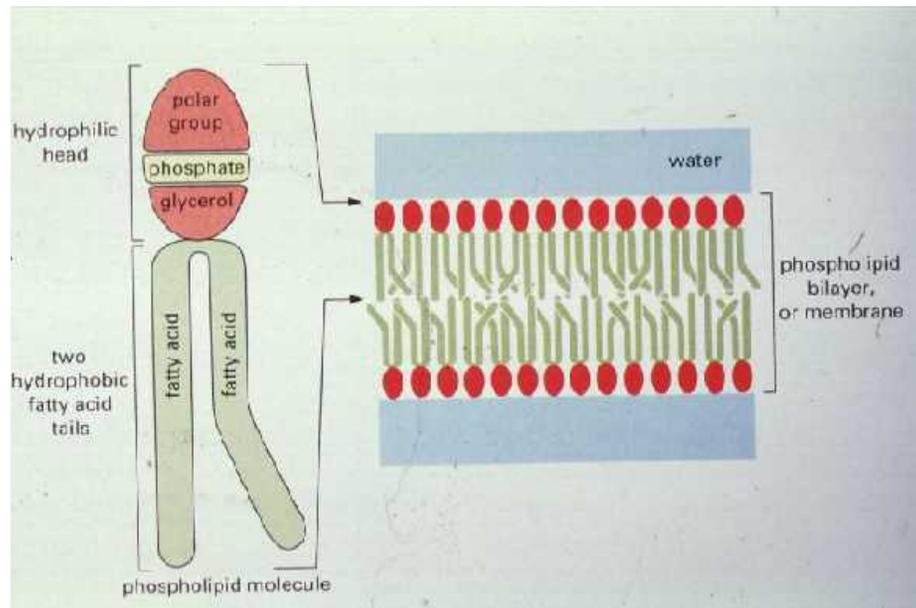
- The membrane selectively allows the passage of water, nutrients, gases, wastes, secretory products, ions, & gases into/out of the cell
 - The structure of the plasma membrane allows for its selectivity
- (Remember structure follows function!)**

Membrane Structure

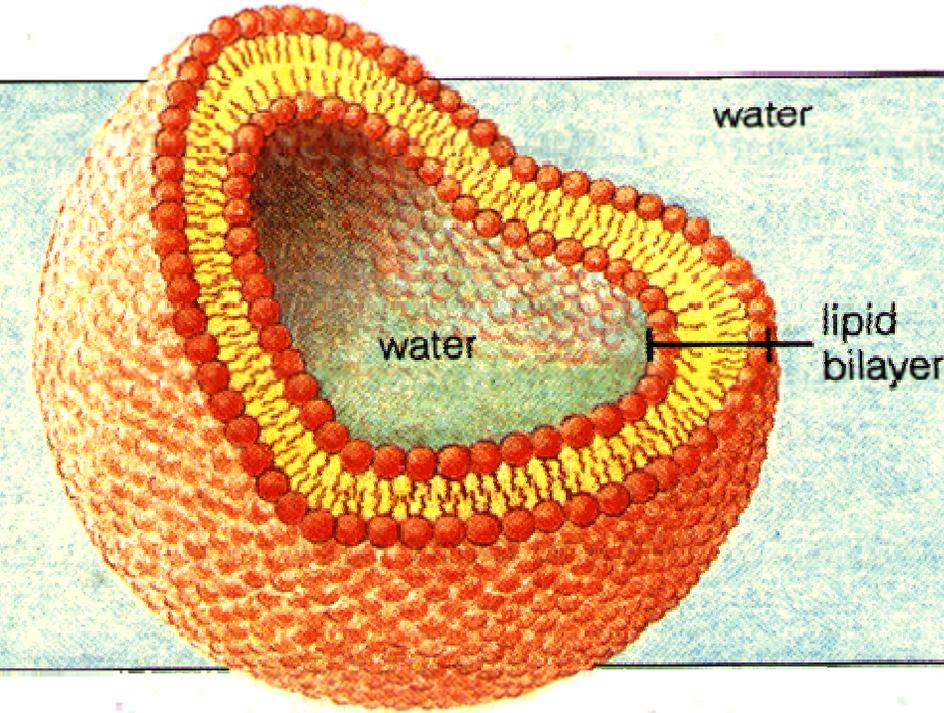
- The plasma membrane is made of phospholipid molecules
- Phospholipids are amphipathic molecules
- **Amphipathic** - opposite ends of the molecule have a different affinity for H₂O



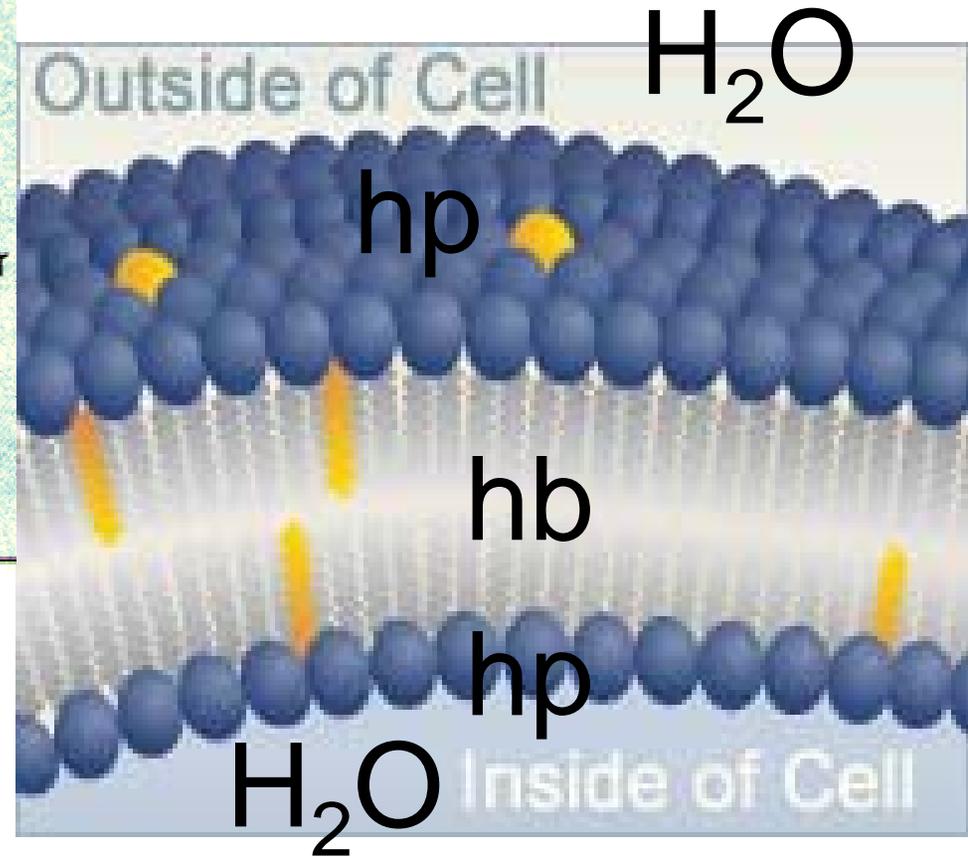
- Hp-hydrophilic “loves”, interacts with water
- Hb-hydrophobic “hates”, will not interact with water
- A phospholipid bilayer has two layer of phospholipids arranged with the hb regions facing each other



Membrane Structure



Membrane structure is fluid



Proteins

- Types:
 - Integral proteins-span across the membrane
 - Peripheral proteins-on one side of the membrane

Proteins function as:

Channels thru a membrane

Receptors

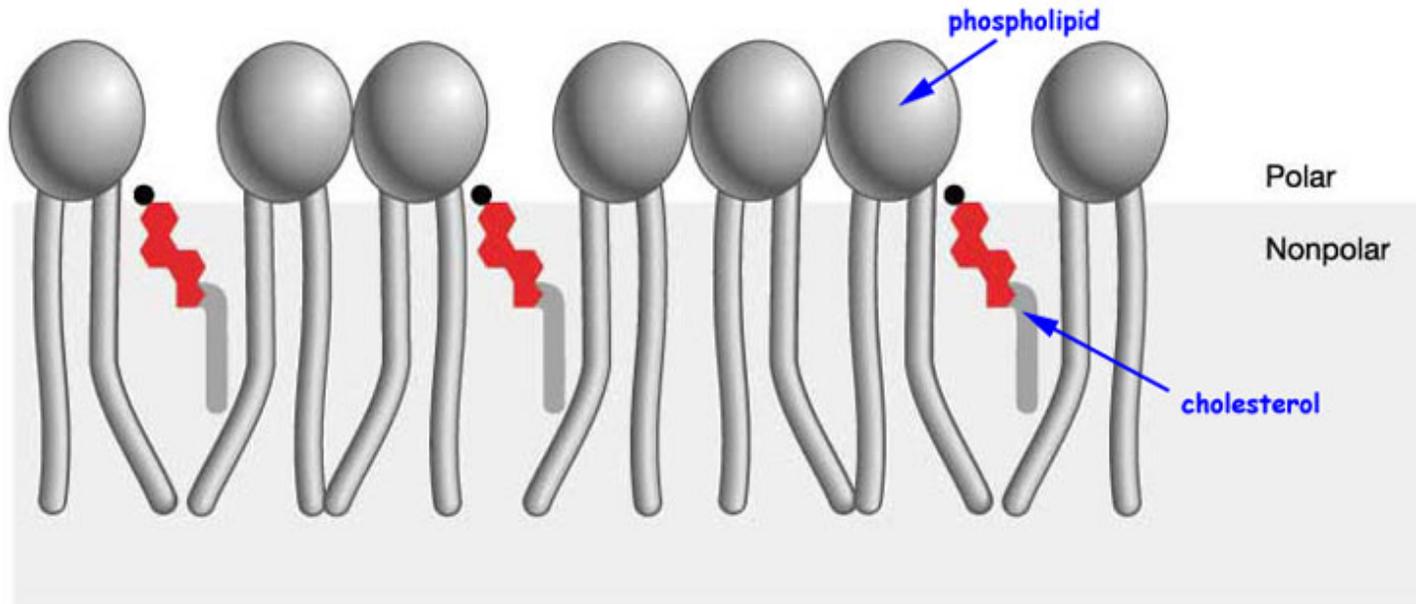
Carbohydrates-sugar

- On outer surface of membrane
- Function as receptors

- Glycolipids
- Glycoproteins

Cholesterol

- Adds stability to a membrane

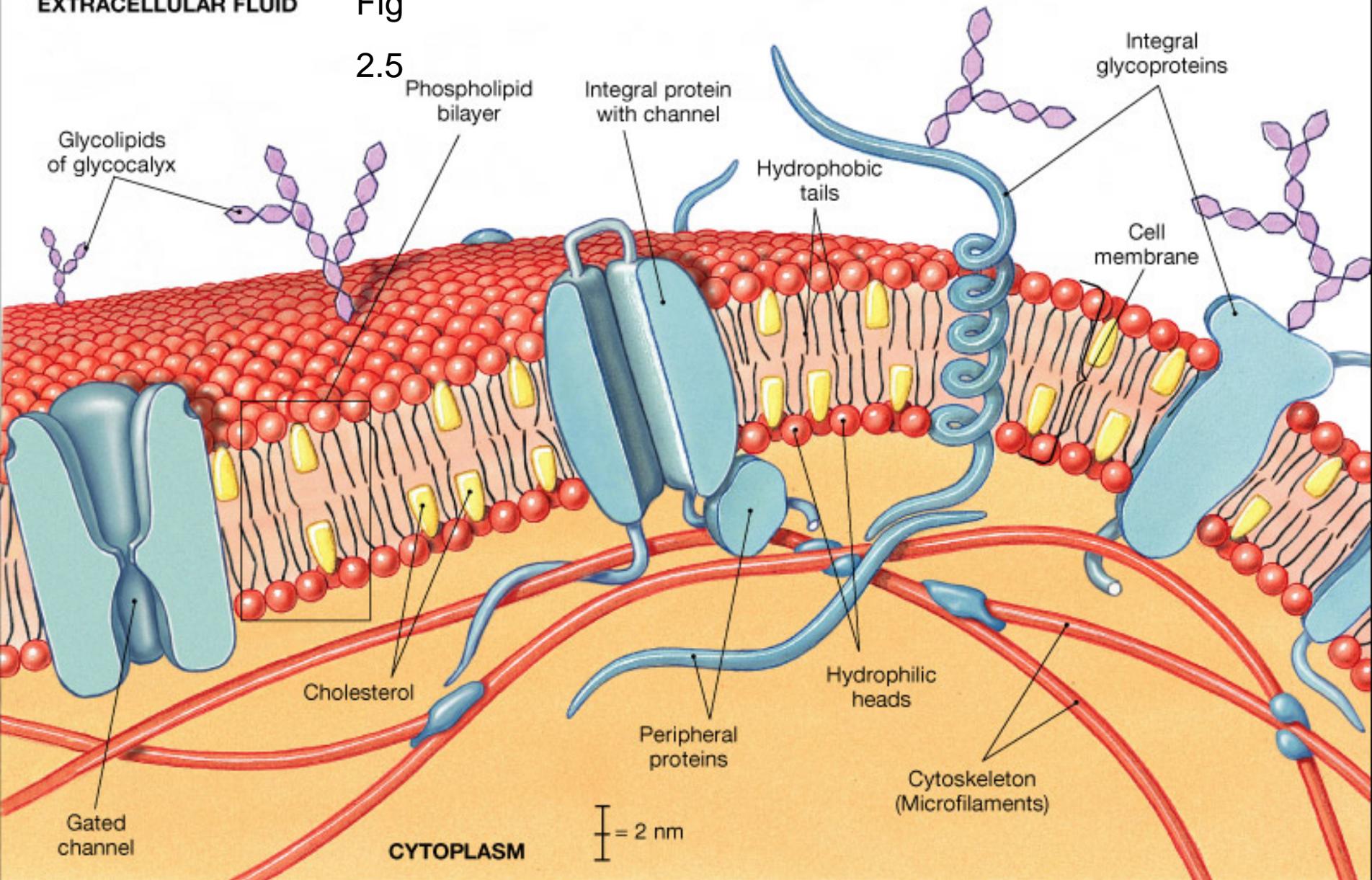


Relative sizes of phospholipids and cholesterol molecules.
Cholesterol fills the gaps created by unsaturated (kinked) hydrocarbon tails.

EXTRACELLULAR FLUID

Fig

2.5



Cholesterol

Gated channel

CYTOPLASM

2 nm

Peripheral proteins

Hydrophilic heads

Cell membrane

Integral glycoproteins

Hydrophobic tails

Integral protein with channel

Phospholipid bilayer

Glycolipids of glycocalyx

Membrane permeability

Passive transport

- Passive transport
 - Dependant on a concentration gradient
 - Passive = requires no energy
- The cell membrane is selectively permeable
- Some material can pass thru the membrane
some material can't
- Distinction based on size, charge, shape, & solubility

- Diffusion
- Osmosis
- Filtration
- Facilitated diffusion

Diffusion

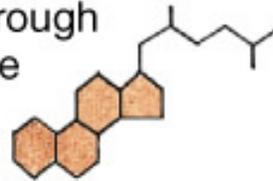
- Tendency for molecules to spread out from each other
- Molecules move from a concentrated area to a less concentrated area
- The membrane **selectively restricts diffusion** in & out of the cell



EXTRACELLULAR FLUID

Fig
2.6

Lipid-soluble molecules
diffuse through
membrane
lipids



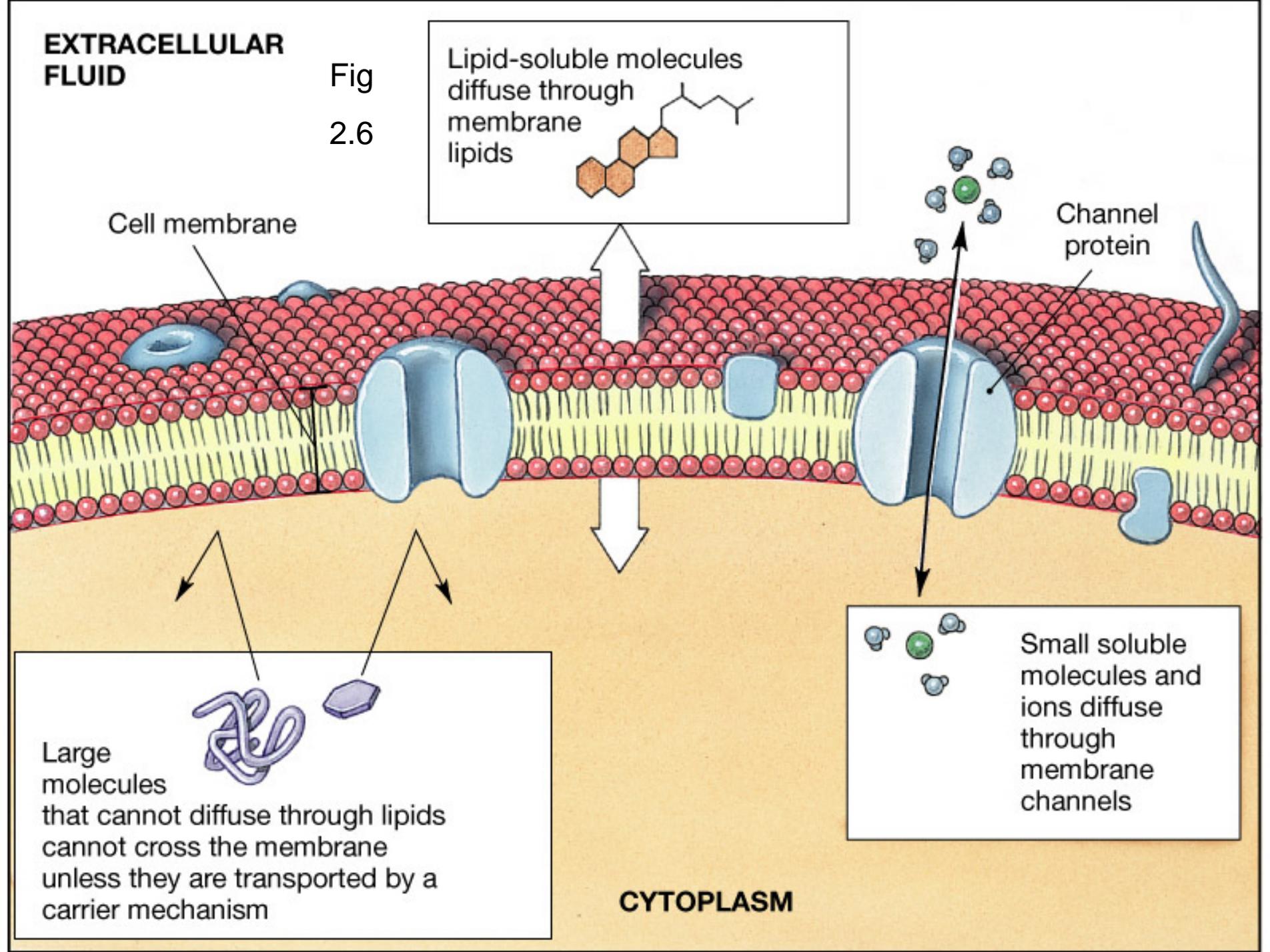
Cell membrane

Channel protein

Large molecules
that cannot diffuse through lipids
cannot cross the membrane
unless they are transported by a
carrier mechanism

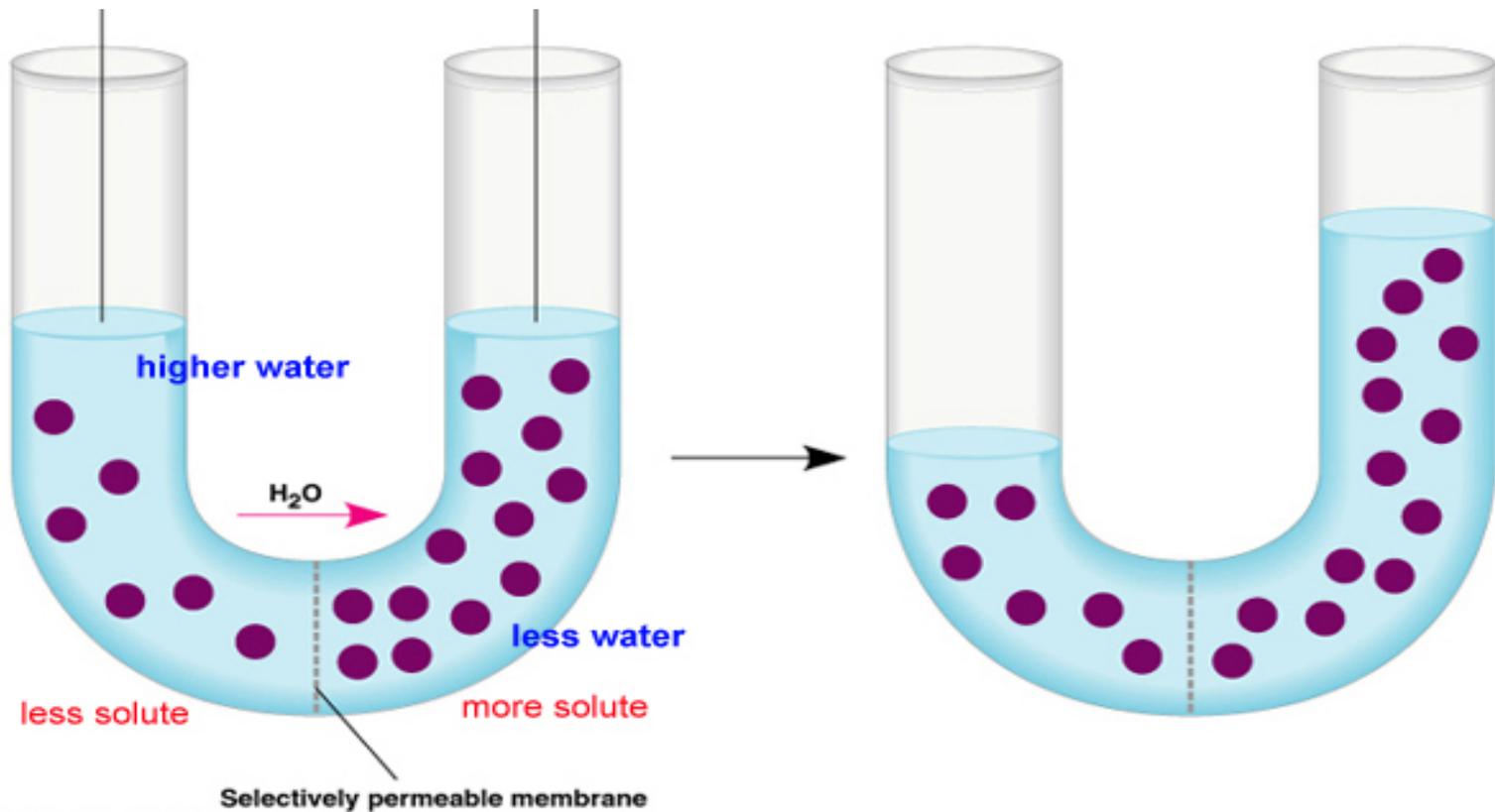
Small soluble
molecules and
ions diffuse
through
membrane
channels

CYTOPLASM



Osmosis-diffusion of water

- Diffusion of H_2O across a membrane from a region of high $[H_2O]$ to a region of low $[H_2O]$
- If an osmotic gradient exists water will diffuse until the gradient is eliminated



The difference in solute concentration and the selectively permeable membrane allows for osmosis

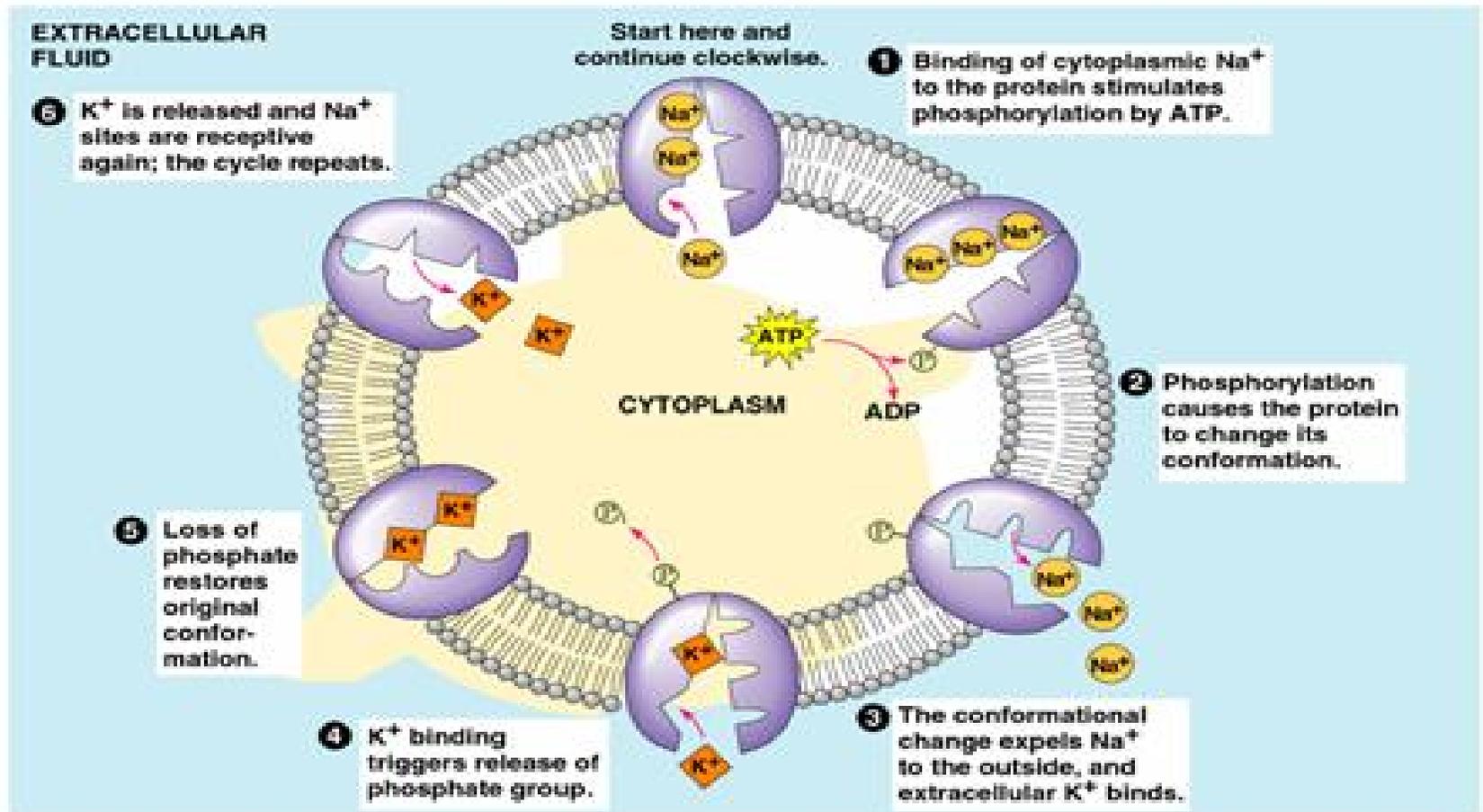
- Facilitated diffusion-receptors aid in diffusion
- Filtration-hydrostatic pressure forces movement of water and solutes

Membrane permeability-

Active Transport

- Uses energy to move molecules across a membrane
- Movement of molecules from a [lower] to a [higher]
- Involves the use of proteins and energy
- Cells use energy call ATP
 - Adenosine Triphosphate

- Ion pumps



Membrane & endocytosis

- Membrane distorts its shape to move molecules
- Endocytosis-moving molecules into the cell
- three types:
- phagocytosis, pinocytosis, receptor mediated endocytosis

Phagocytosis

- Pseudopodia surround the molecule and the membranes fuse to trap the molecules in the cell

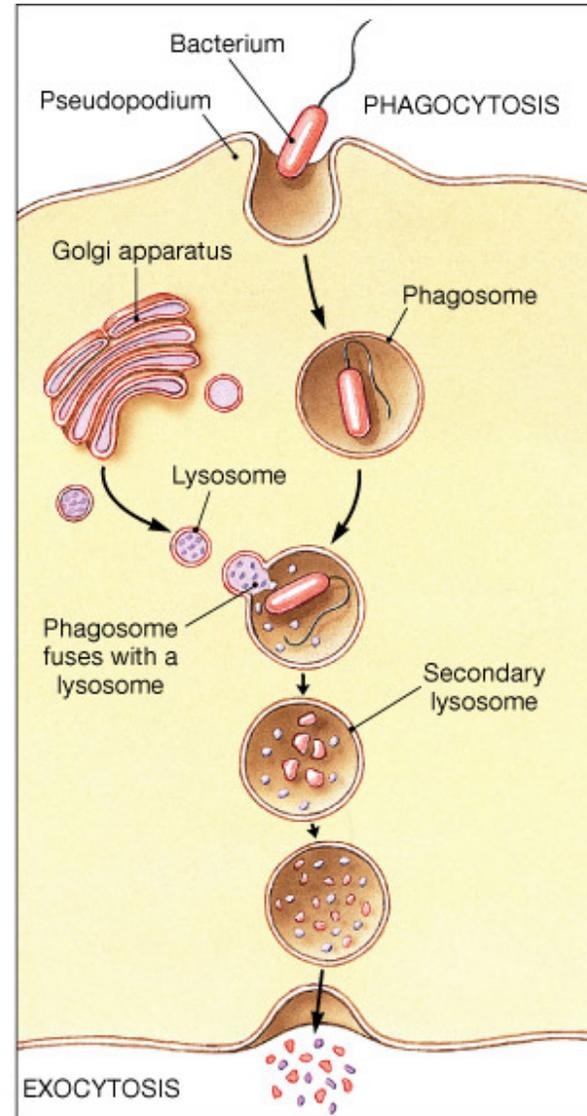
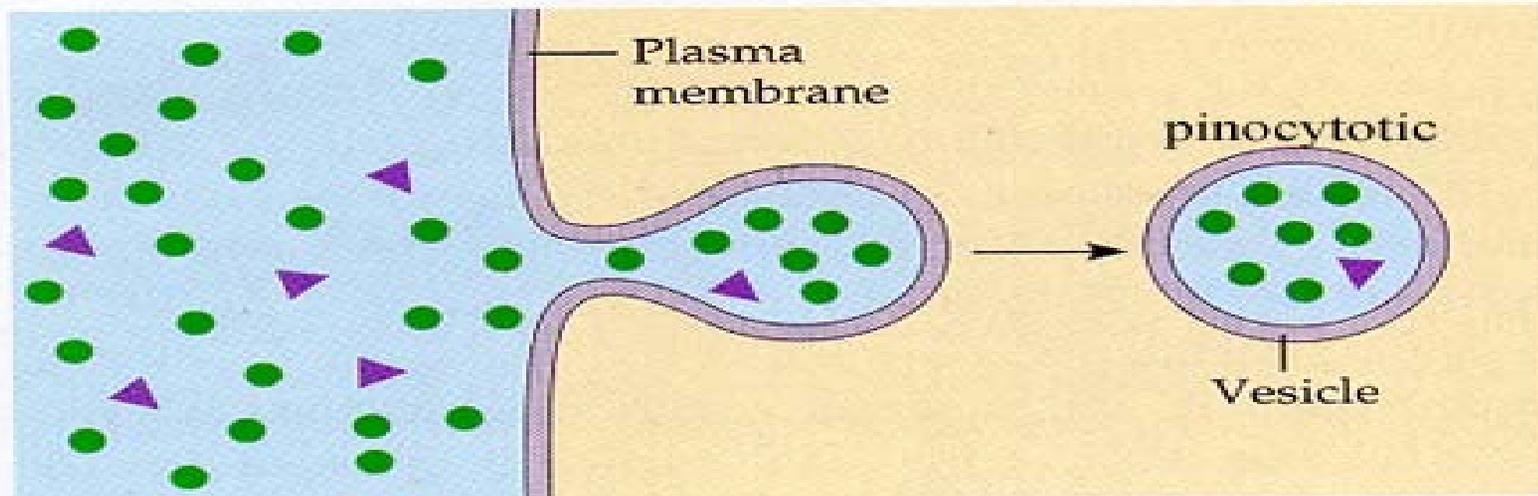


Fig
2.7

(b)

Pinocytosis

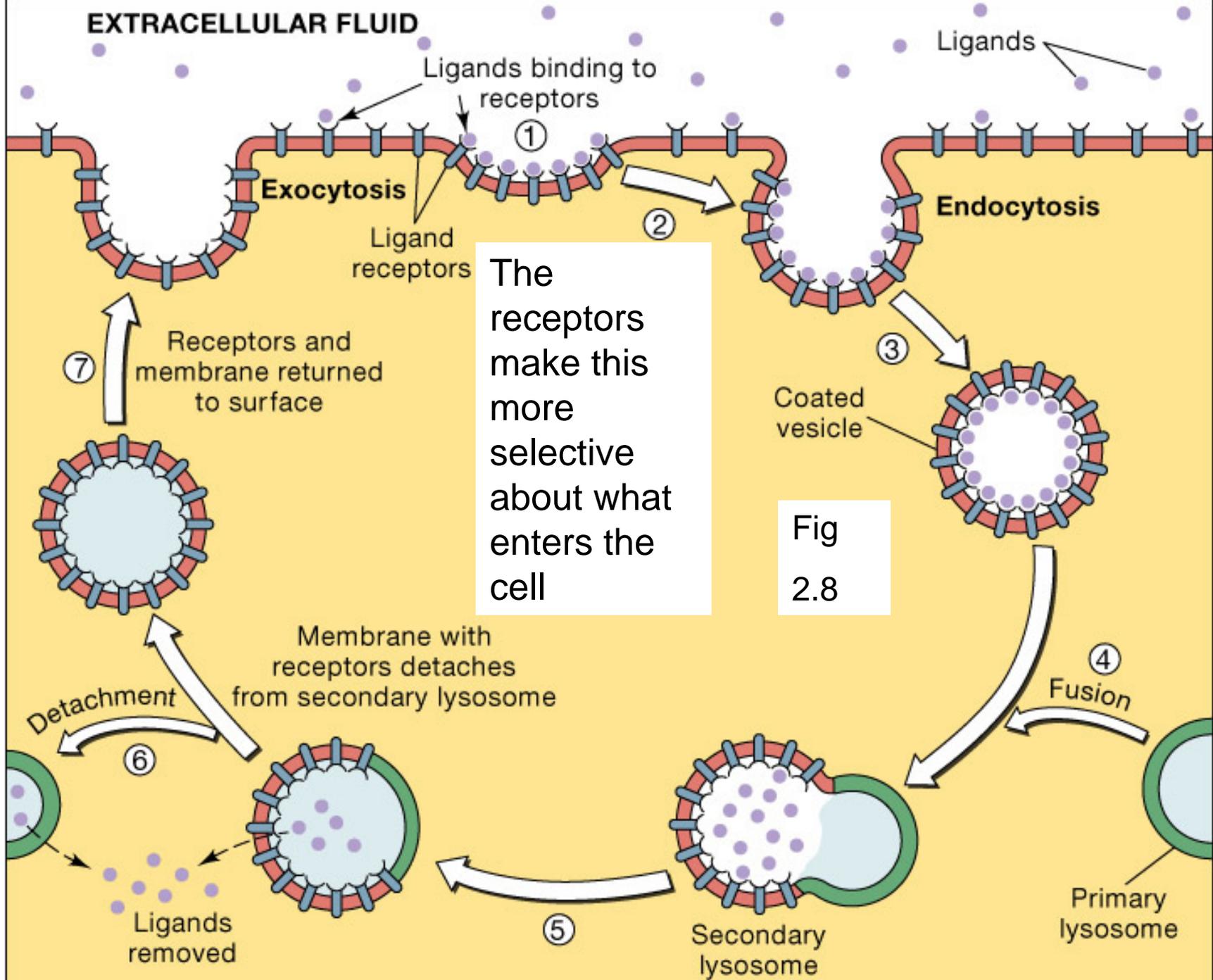
- The cell membrane forms an invagination then pinches it off trapping the molecules in the cell



(b) Pinocytosis

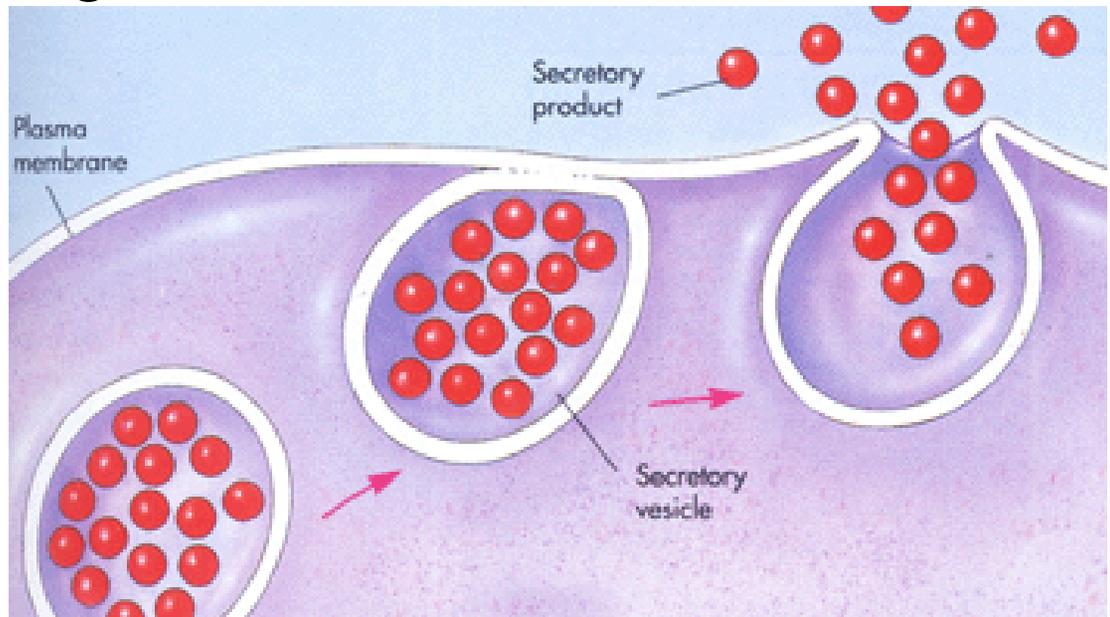
Receptor Mediated Endocytosis

- A more selective form of pinocytosis
- The vesicles contain a specific molecule in higher concentration than in pinocytosis
- The ligands bind to the receptors then the vesicle forms bringing specific molecules into the cell



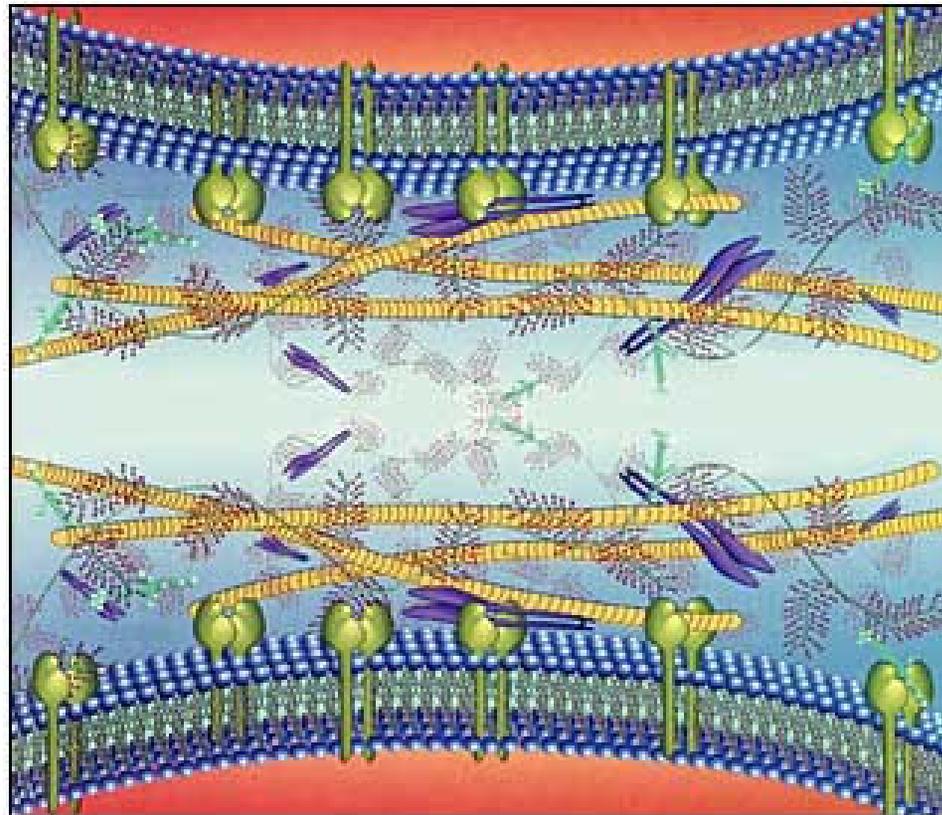
Exocytosis

- Moving molecules out of the cell
- A vesicle fuses to the inside of the membrane releasing contents to the extracellular fluid



Intercellular attachment

- Extra Cellular Matrix
- Proteins & sugars that hold adjoining cells together



Cell Junctions

- There are three major types of cell junctions:
- Tight junction
- Desmosome
- Gap junction

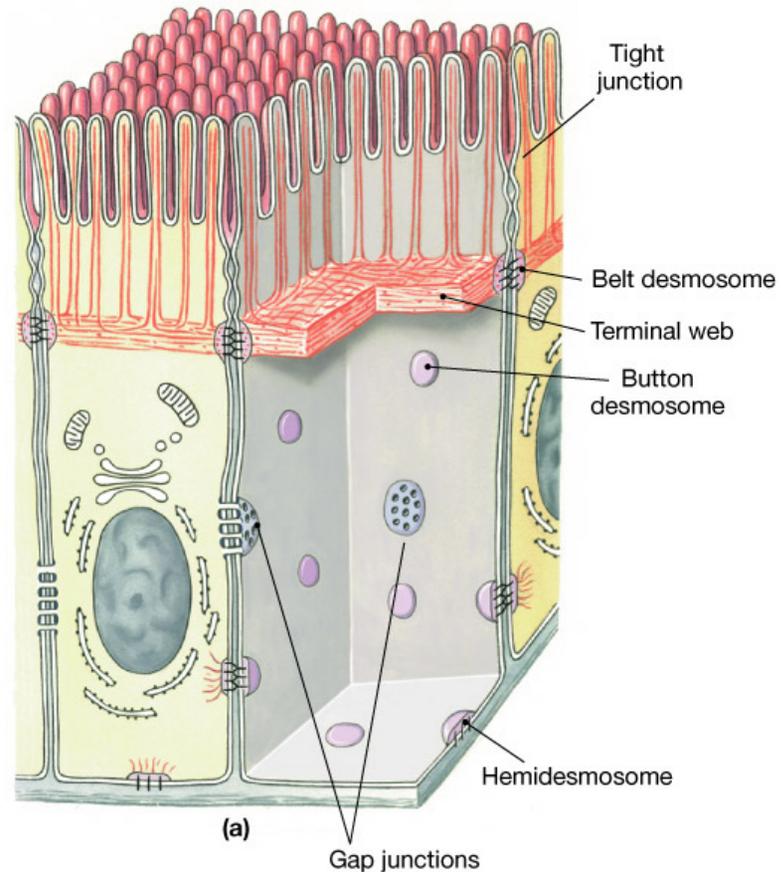
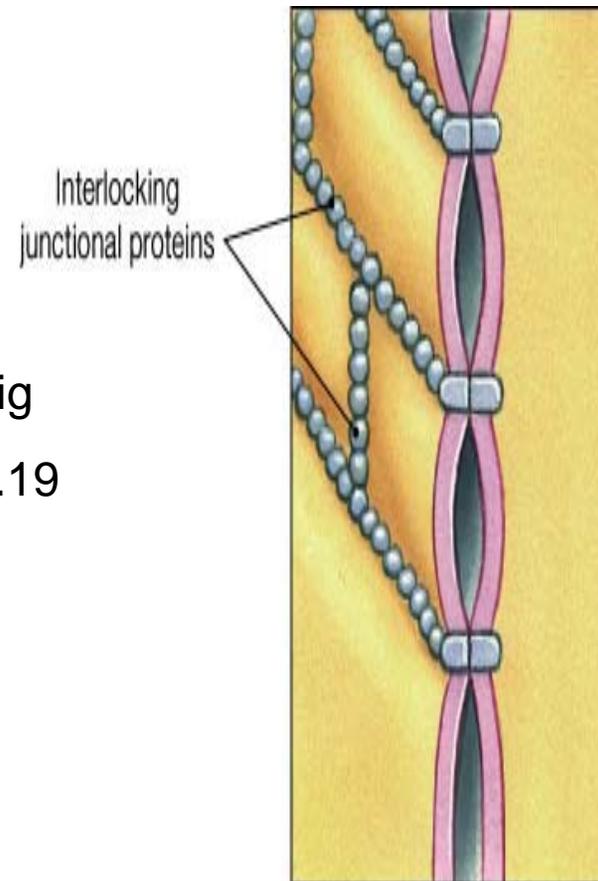


Fig
2.19

- **Tight junction**-holds cells together
- Does not allow molecules & water to pass between adjacent cells.
- Found near the surface of exposed tissues

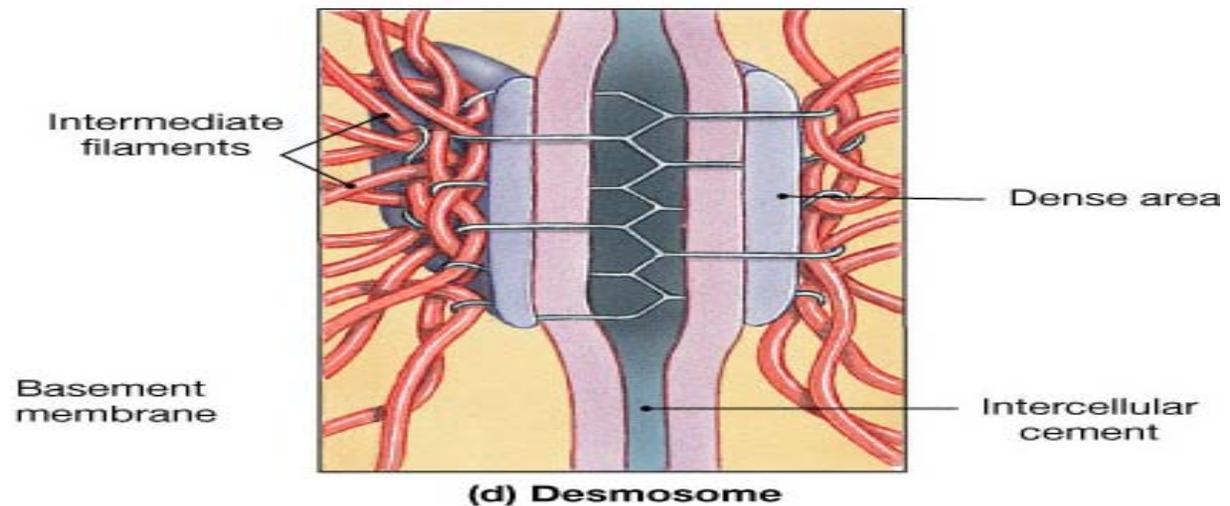
Fig
2.19



(b) Tight junction

- **Desmosome**-holds cells together, much stronger than tight junctions

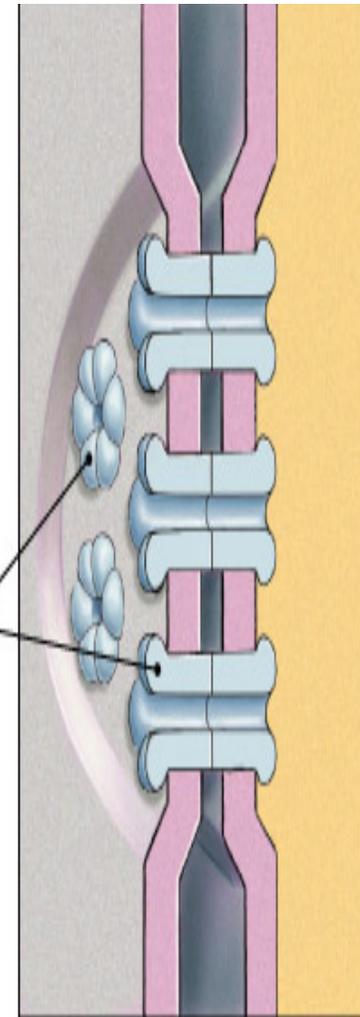
Fig
2.19



- **Gap junction**-a channel between adjoining cells.
- Allows molecules to directly pass from one cell to another

Fig
2.19

Embedded
proteins
(connexons)



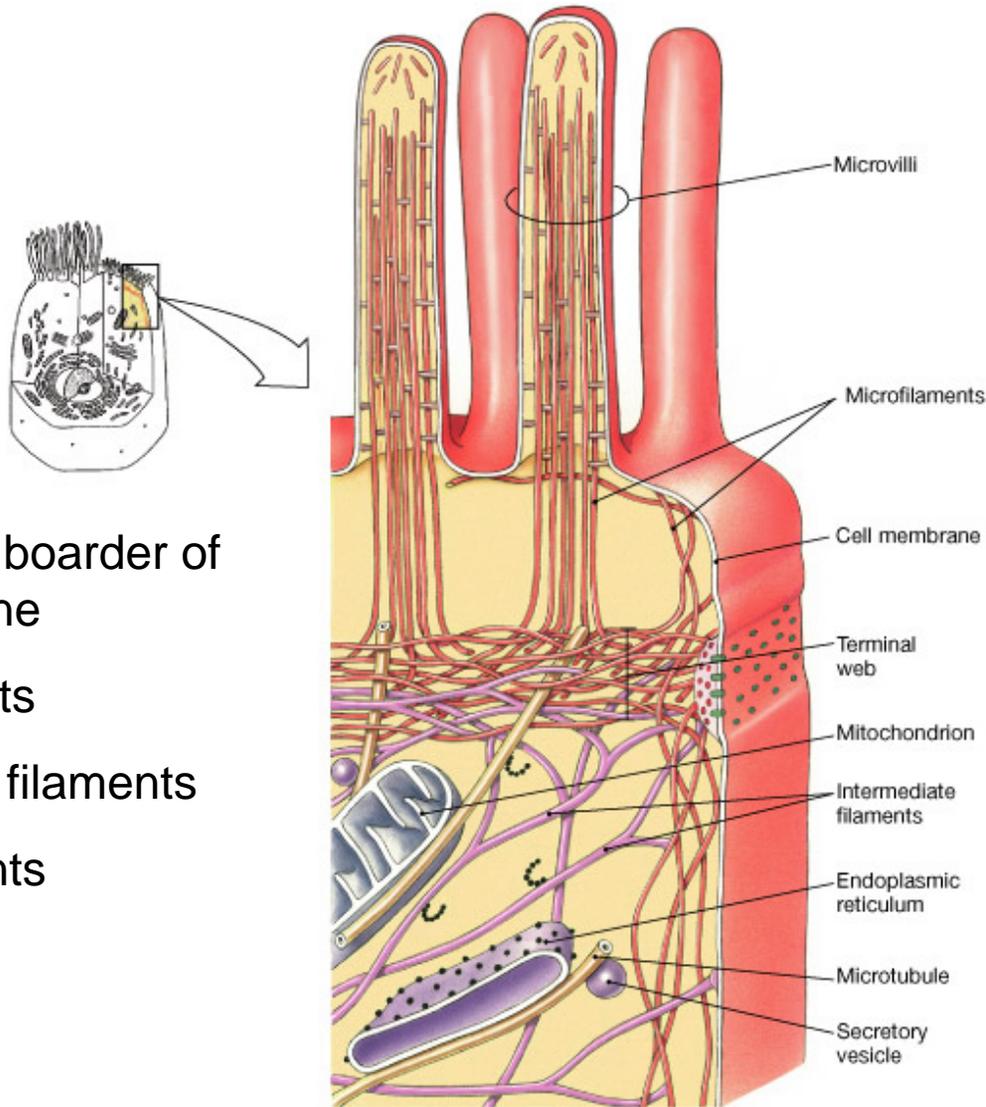
(c) Gap junction

Organelles

- The space inside of a cell is called the cytoplasm.
- Many organelles (tiny organs) are located within the cytoplasm
- Intracellular fluid is cytosol
 - Membrane regulates contents of cytosol

Cytoskeleton

Fig
2.9



At the inside boarder of
cell membrane

Microfilaments

Intermediate filaments

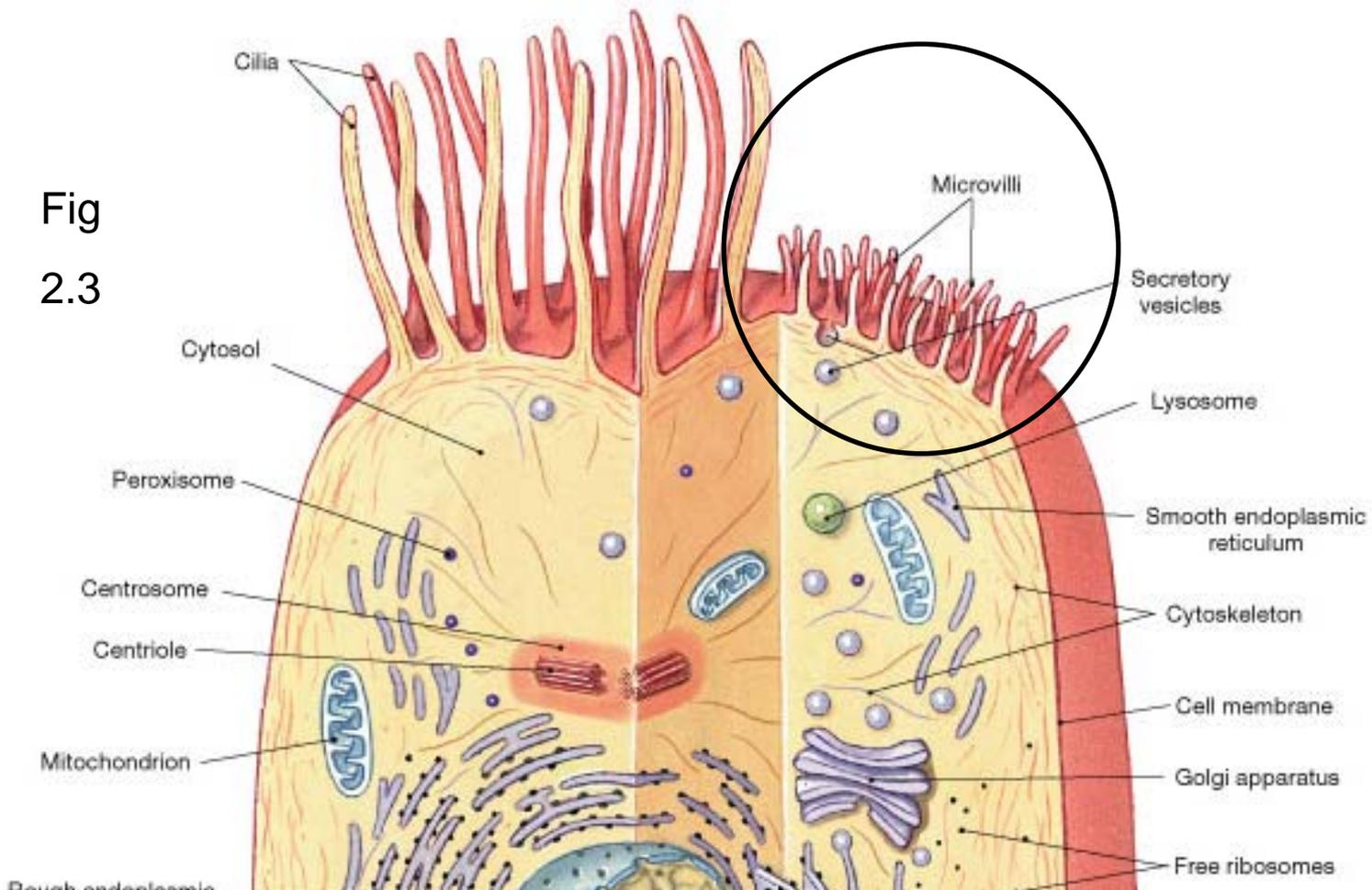
Thick filaments

microtubules

(a)

Microvilli

Fig
2.3



Centrioles

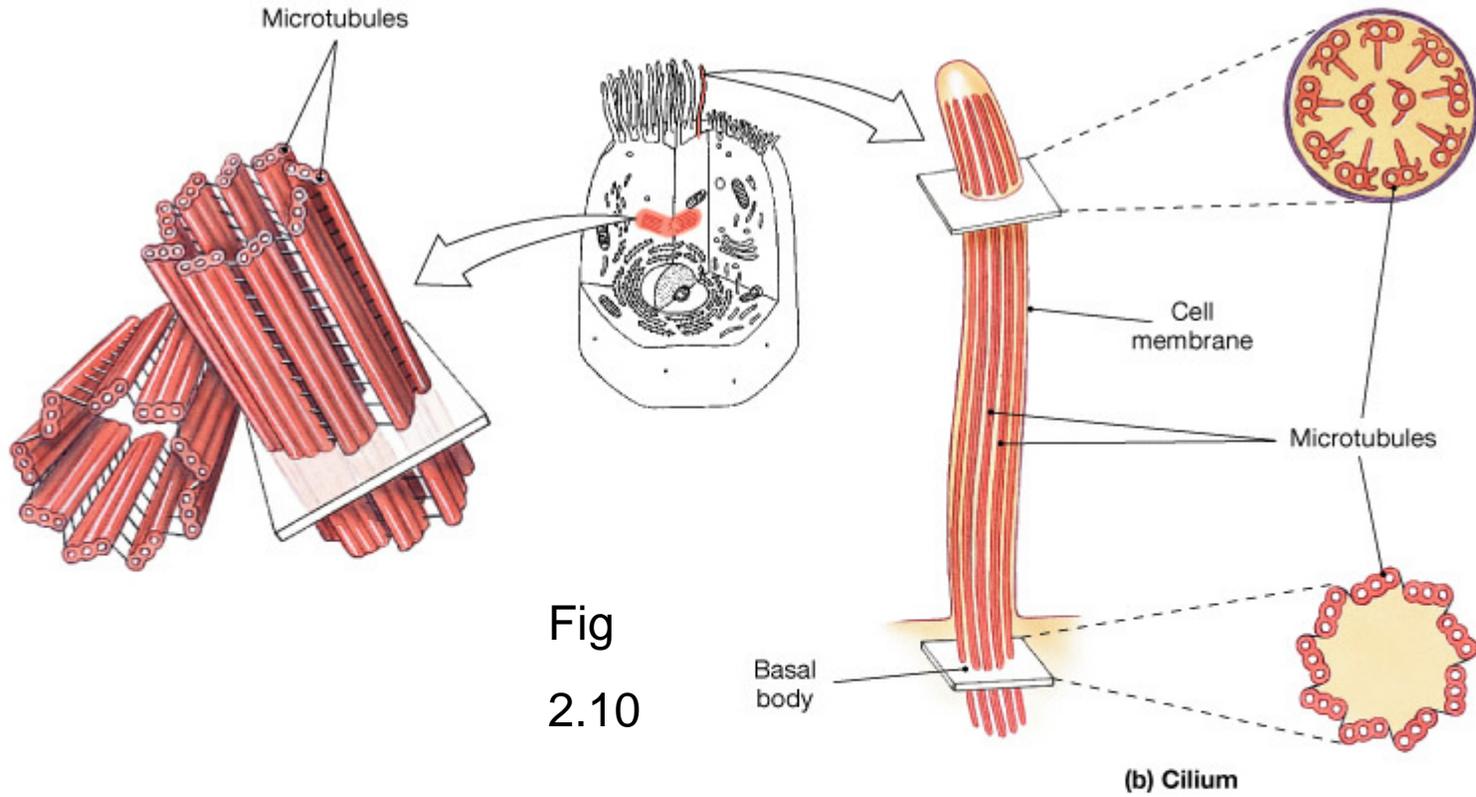
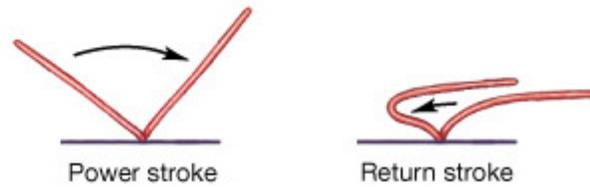


Fig
2.10



(c)

Fig
2.3

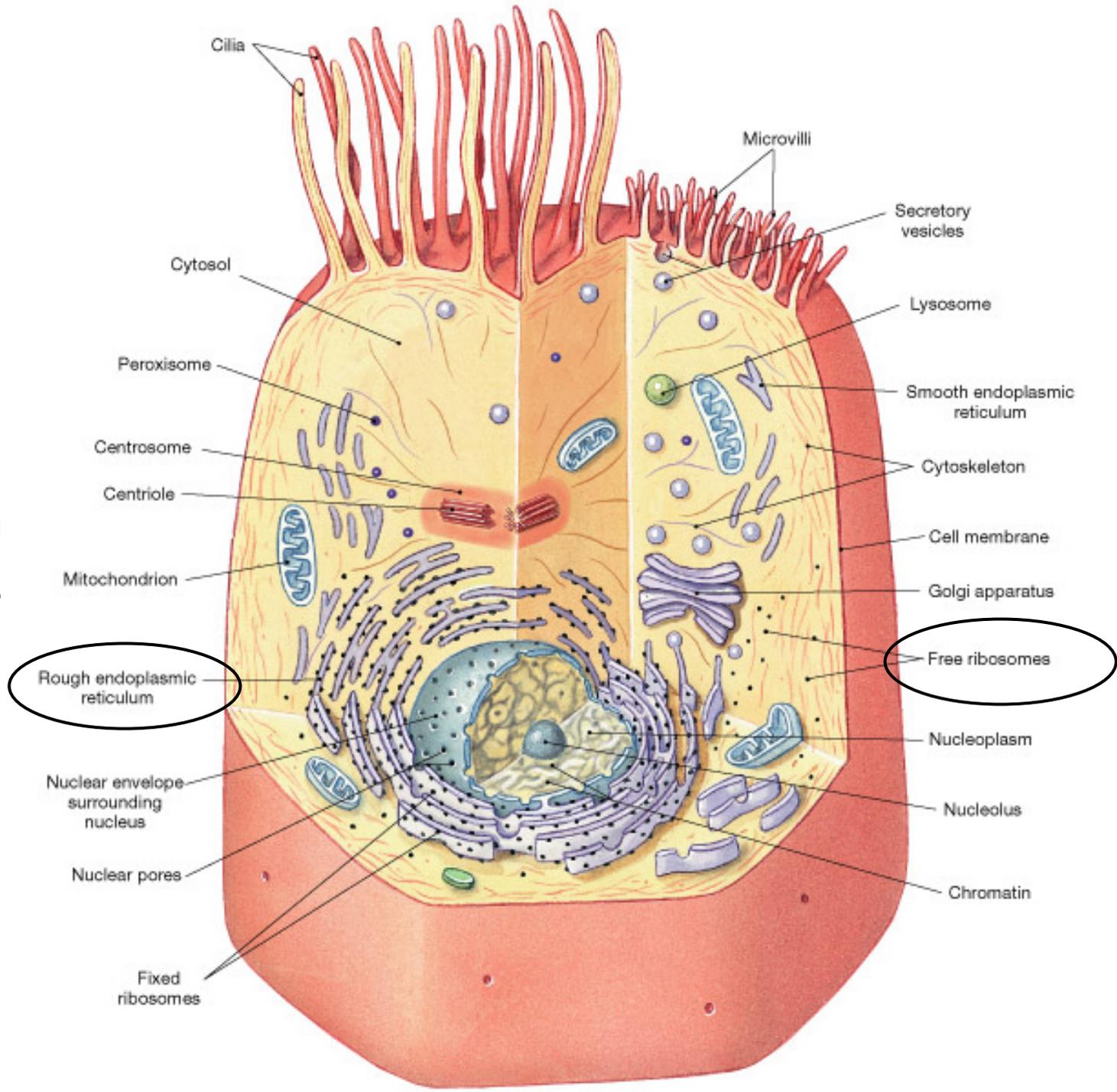


Fig
2.3

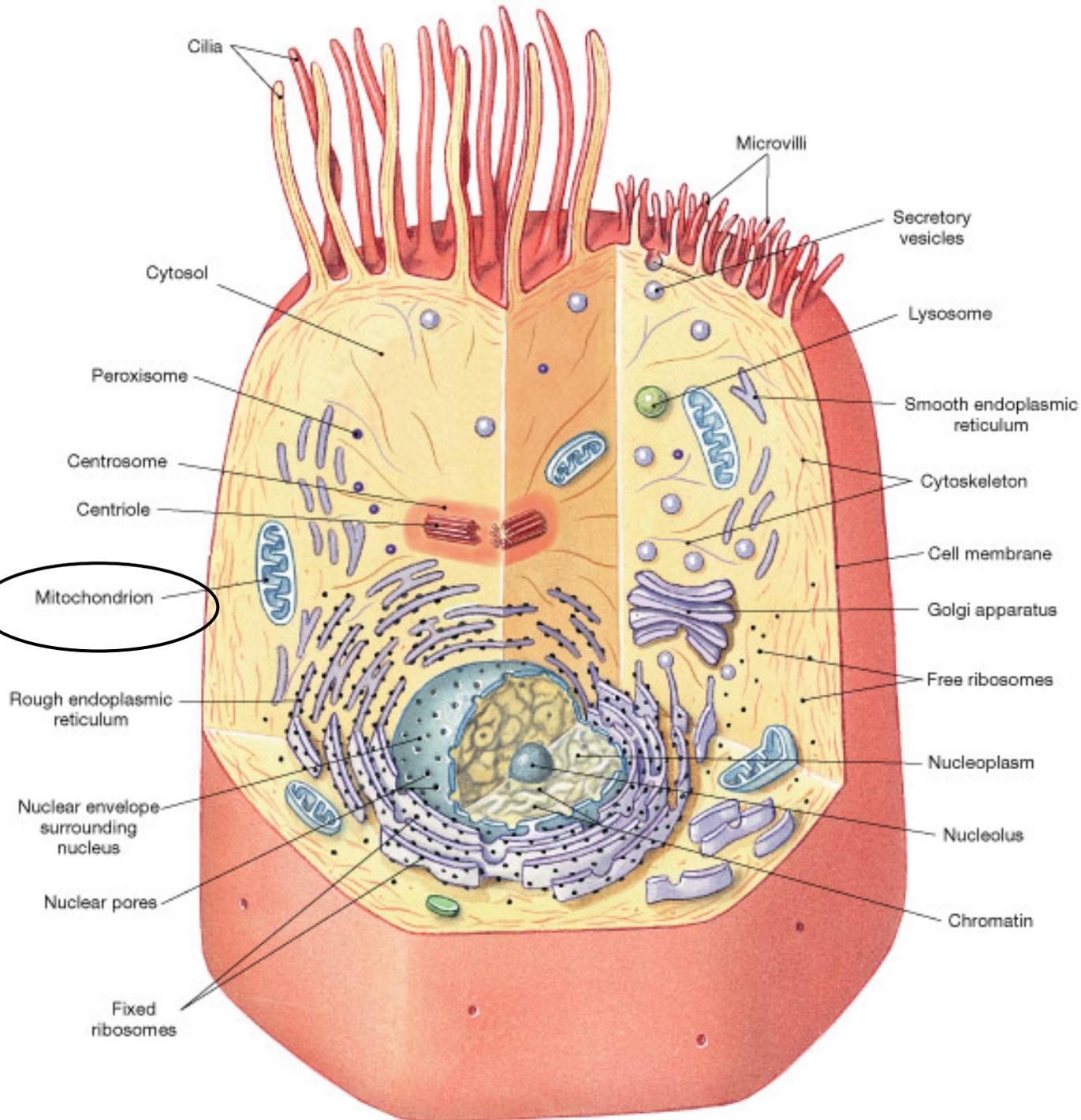


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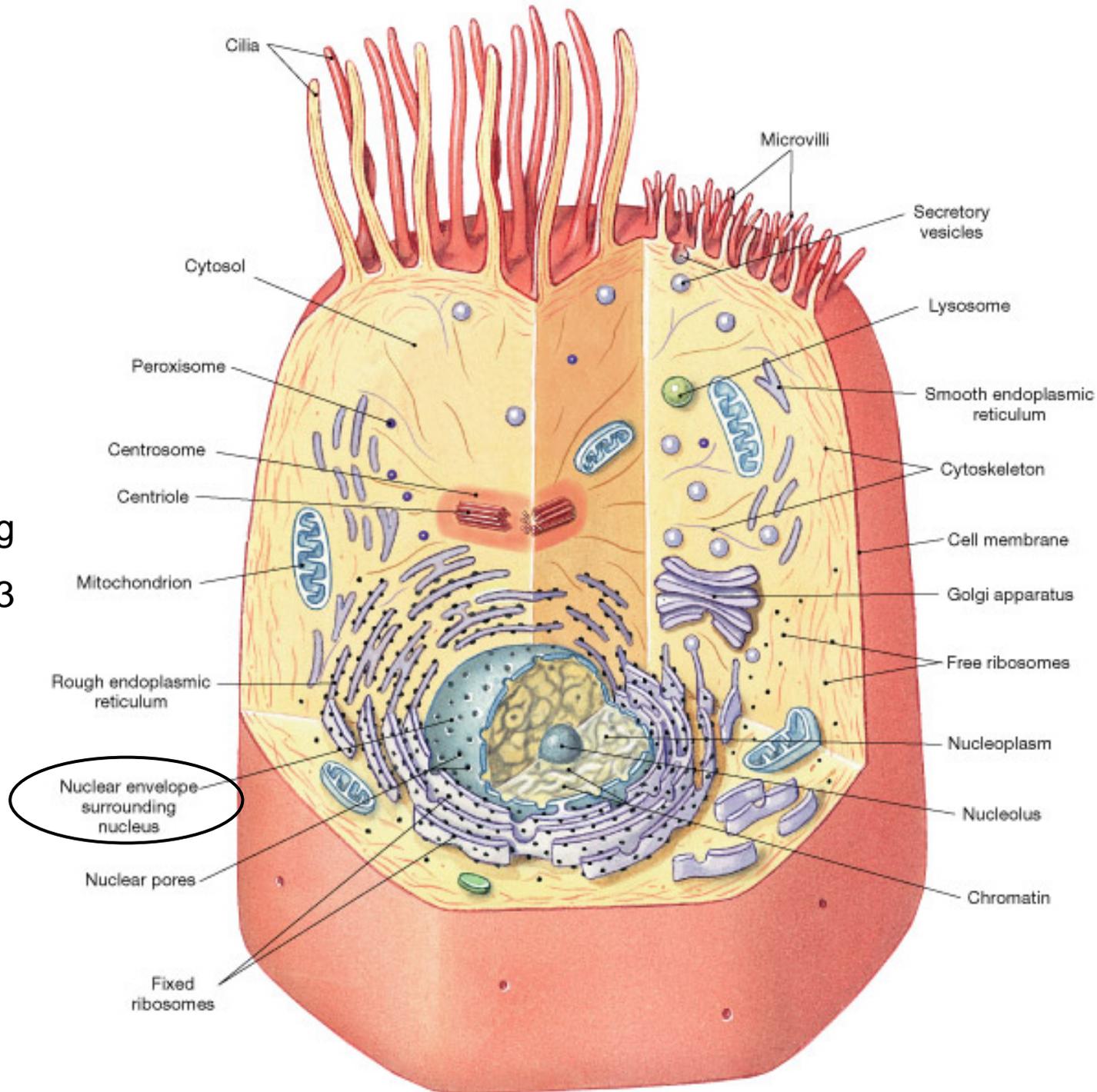


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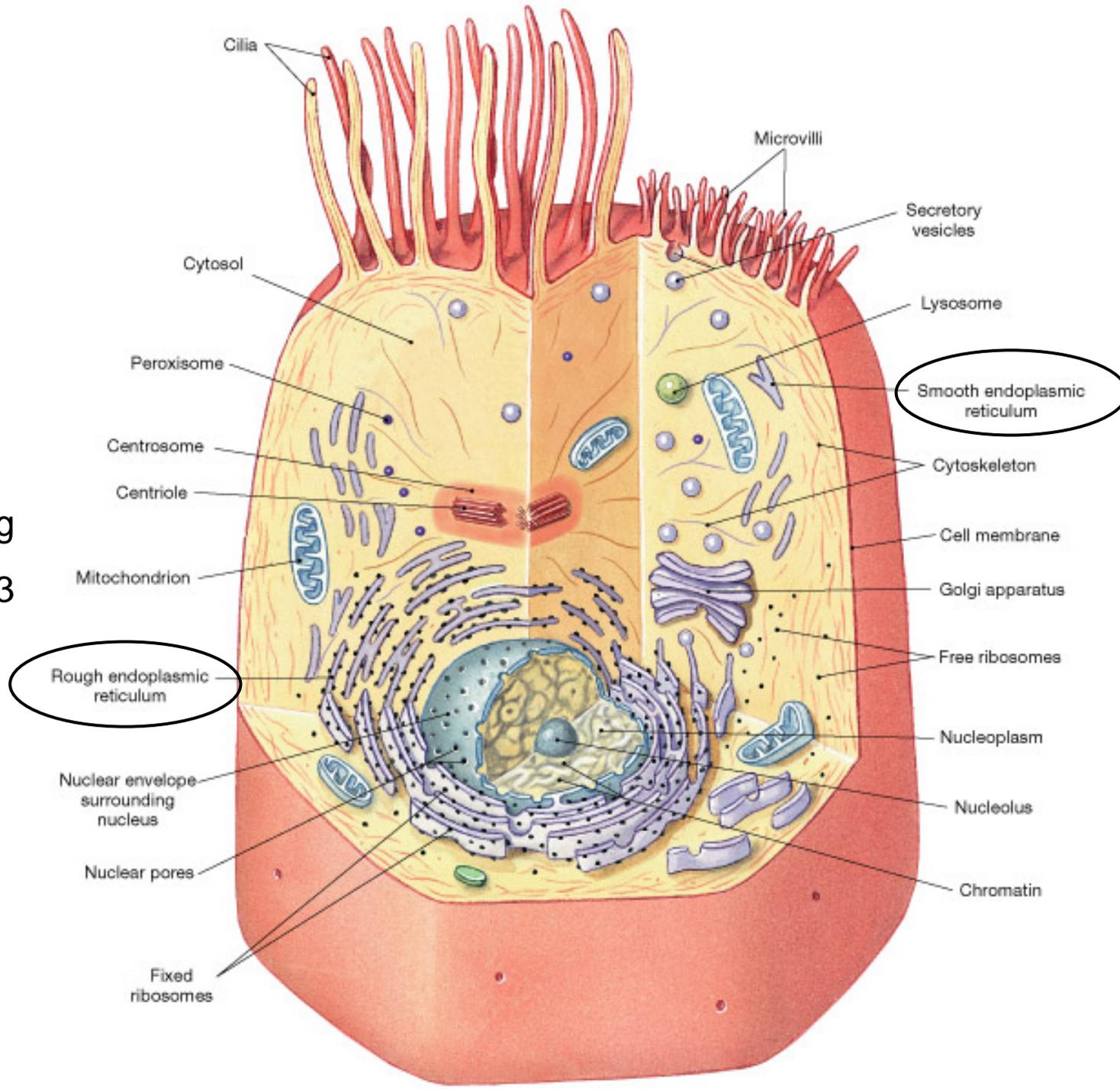


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2.3

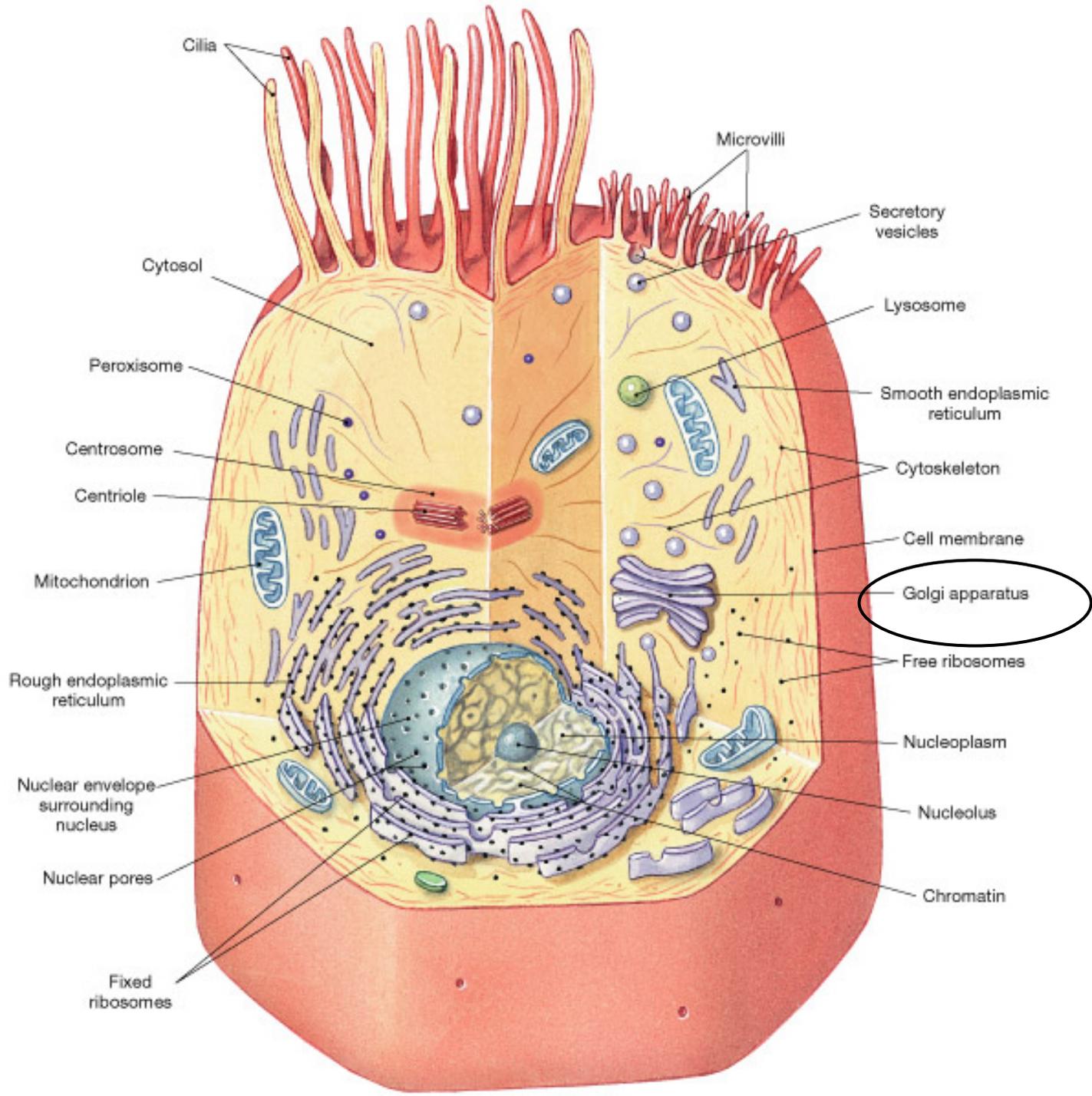
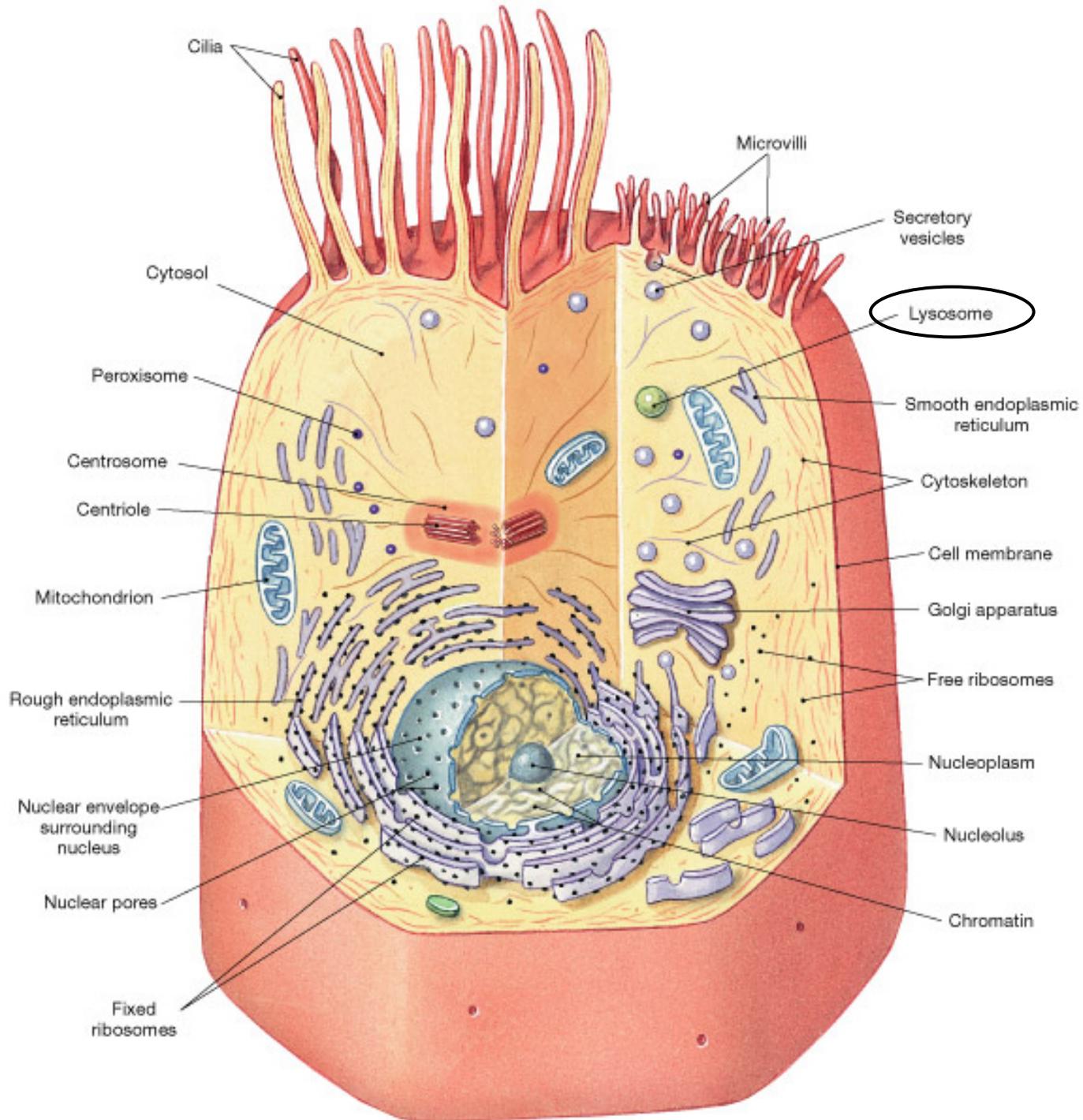


Fig
2.3



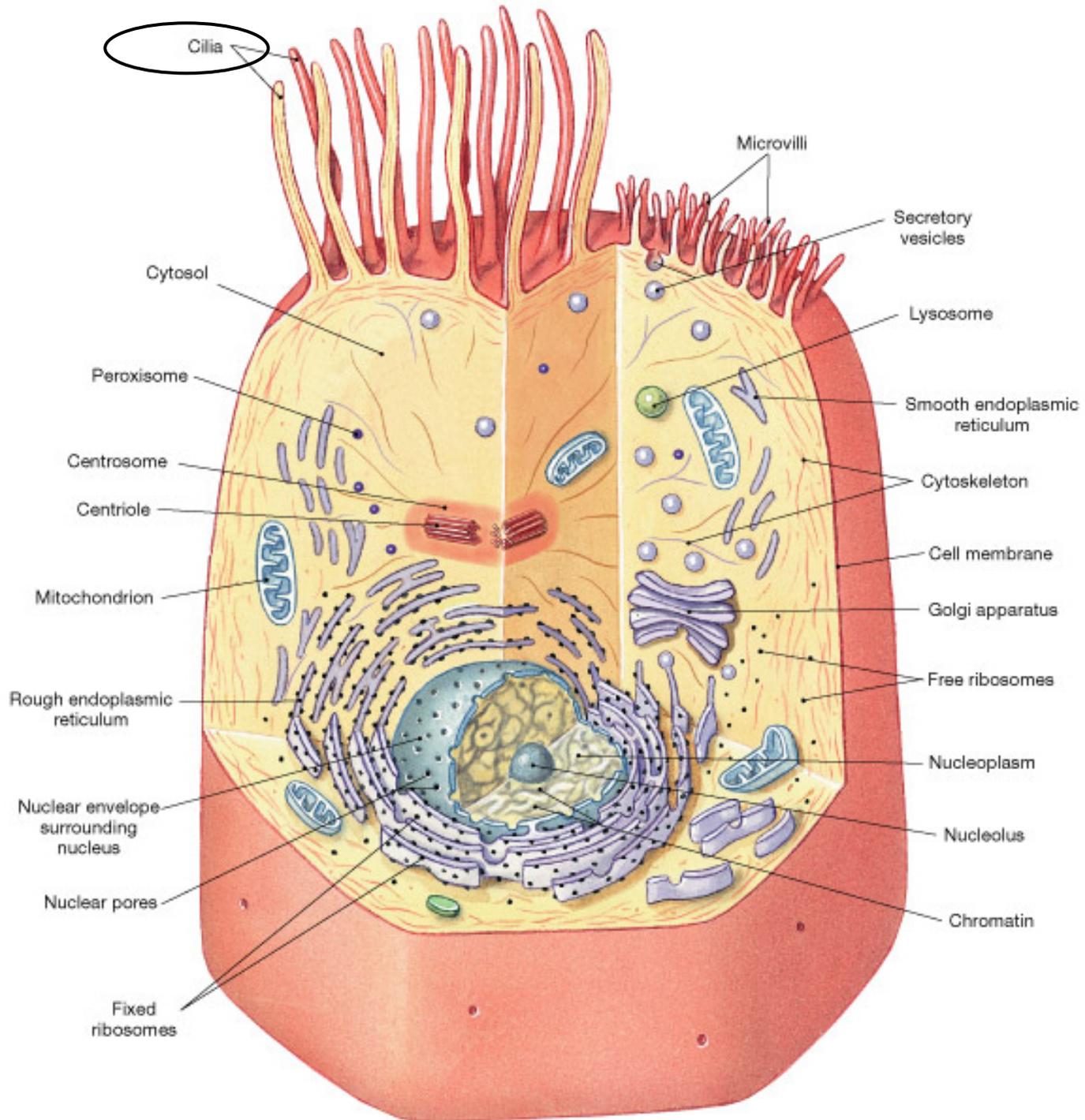
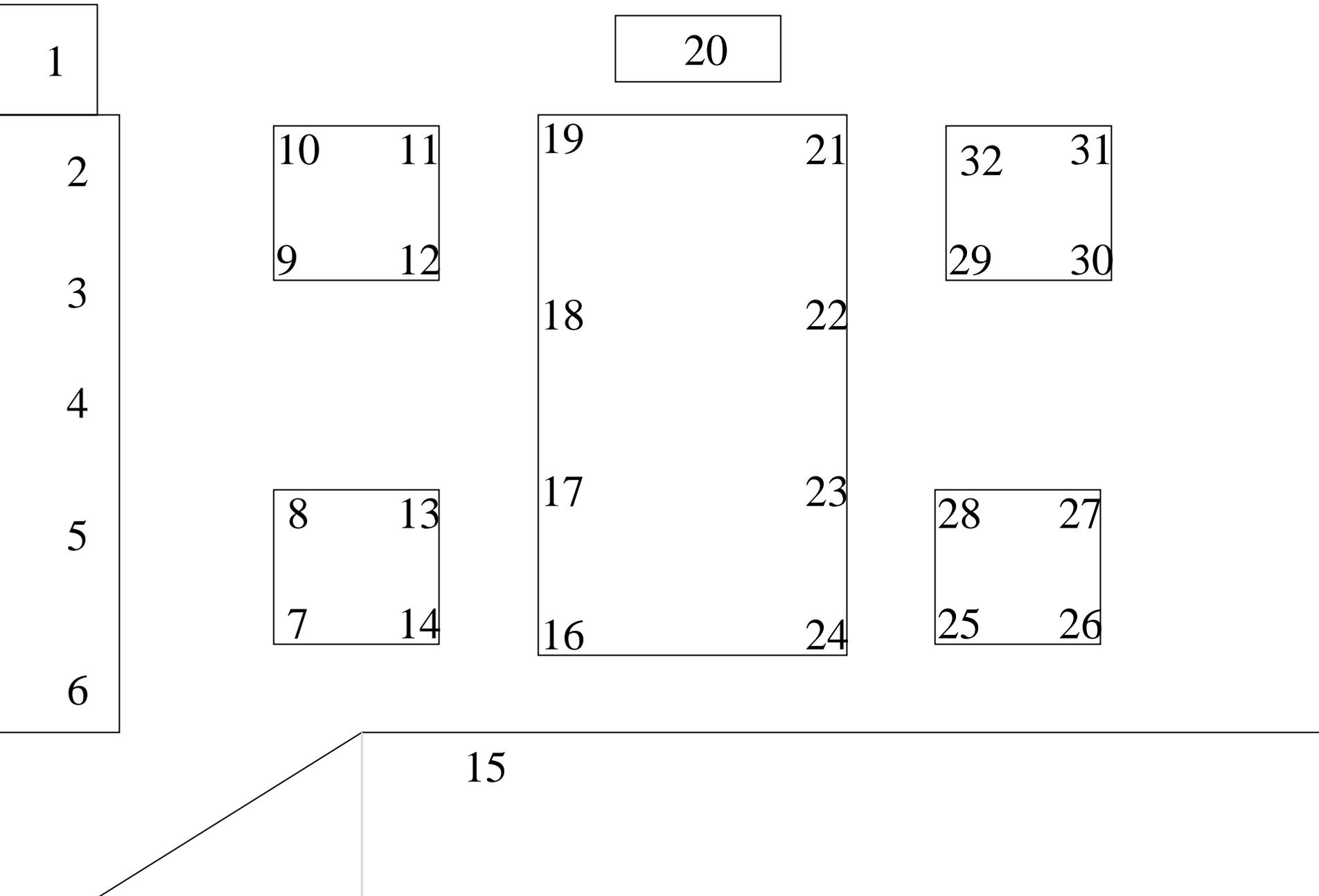


Fig
2.3

- **Quiz 1-1st two lectures, lab 1 & 3**
- **Lab clean up- chairs & models**
- Labs 2 & 3 in 10 minutes

Door

Projector screen



Microscopes

- Carry with both hands
- When finished:
- Turn off lamp, turn intensity to zero
- Lower & center stage
- Put to low power objective
- Wrap up cord
- Place in appropriate space in cabinet

Cross sections

