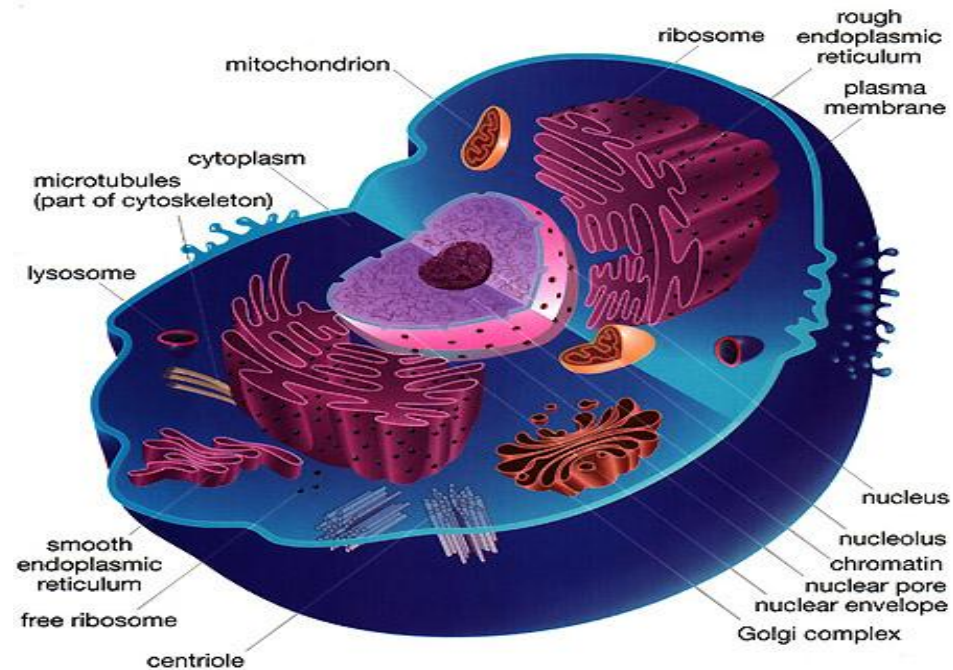
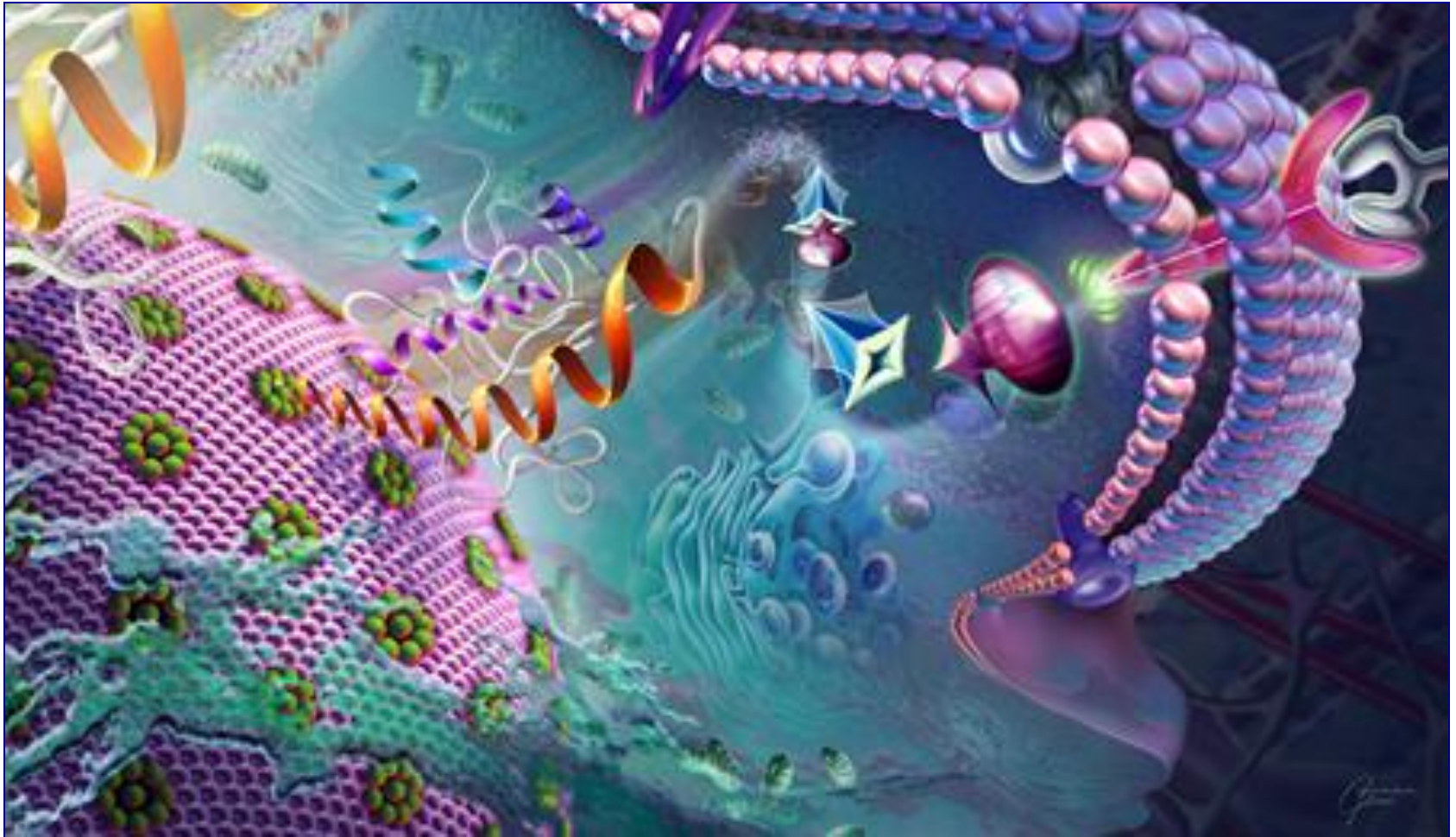


Cell Structure & Function

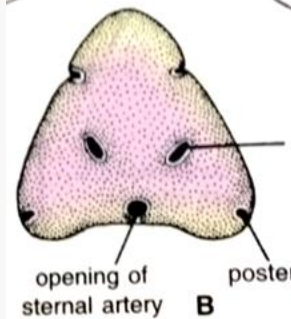
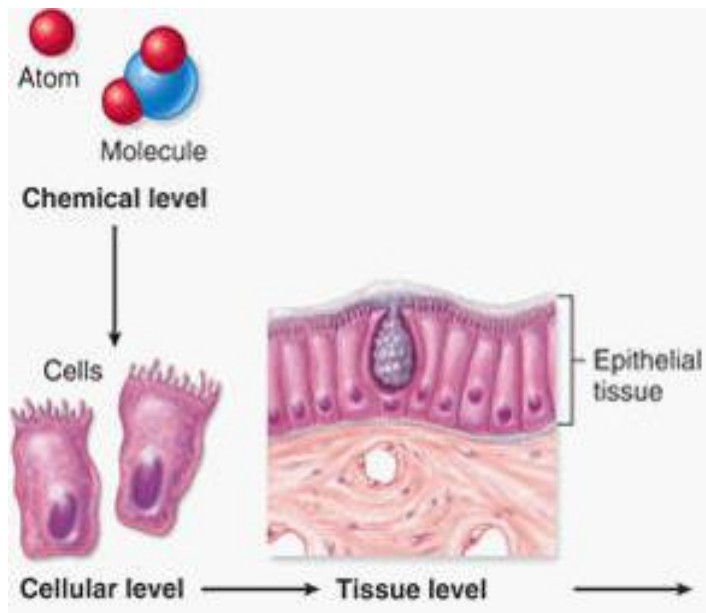


The Cell as the Fundamental Unit of Life

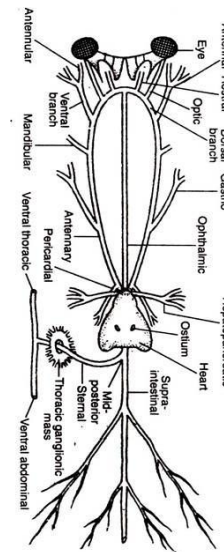


Levels Of Organization

Cells are the basic unit of Structure and Function



Organ



Organ system



Organism

Cell Theory

- The cell is the smallest unit of life.
- All organisms are composed one or more cells.
- New cells arise from previously existing cells.

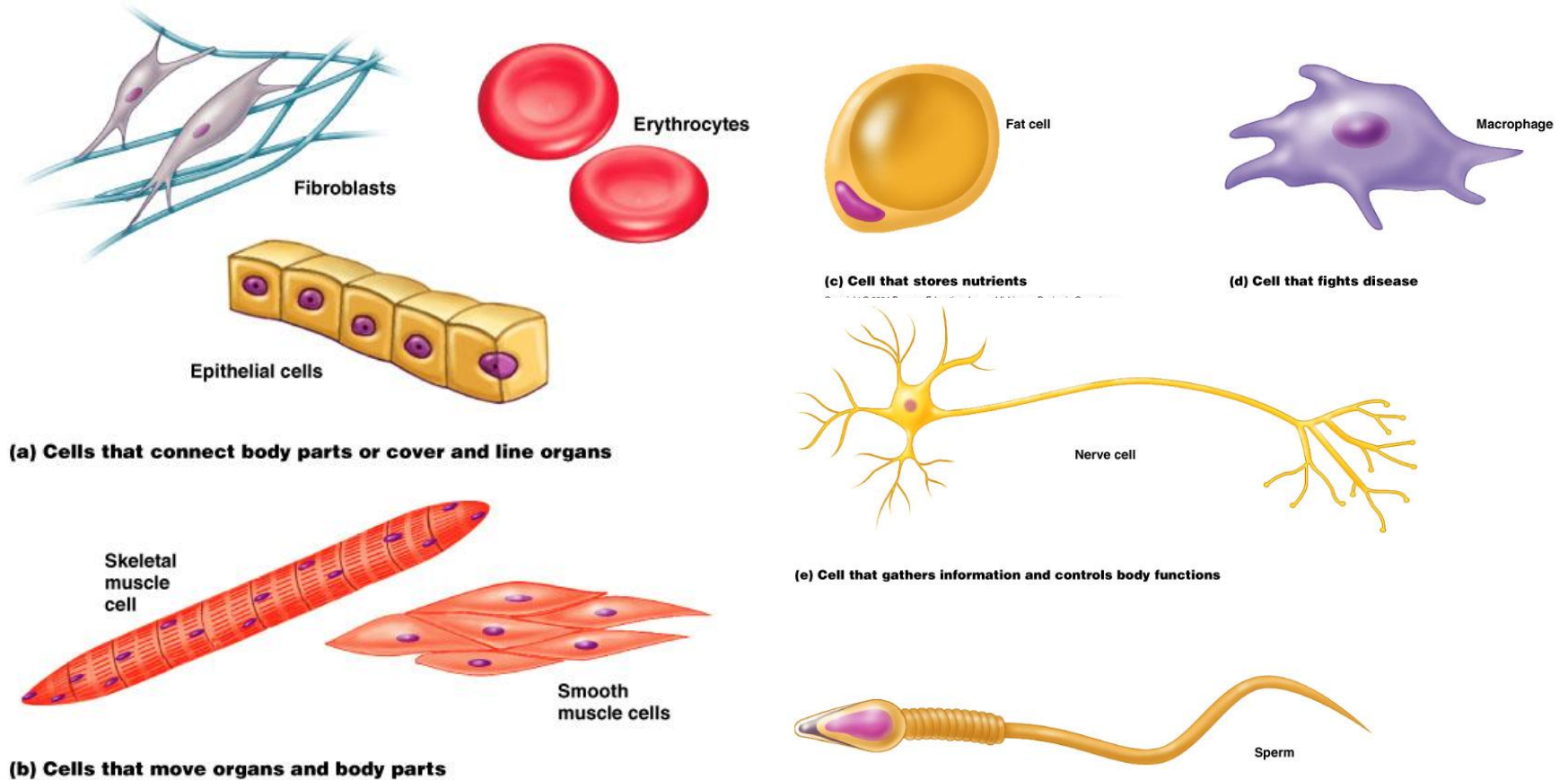
The Nature of Cells

Basic Cell Structure

Each cell has four common components:

1. Plasma membrane
2. Region containing DNA/RNA (genetic material)
3. Cytoplasm
4. Biochemical molecules & biochemical pathways

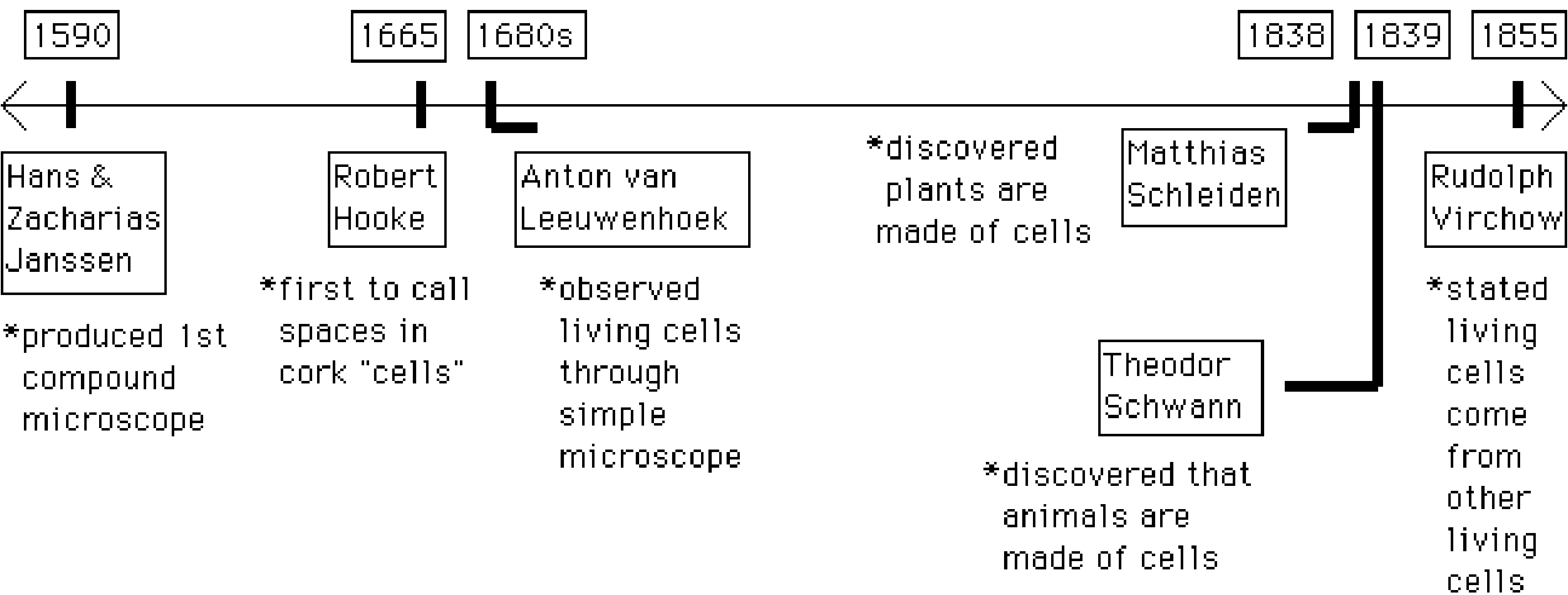
Cell Diversity



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Cells

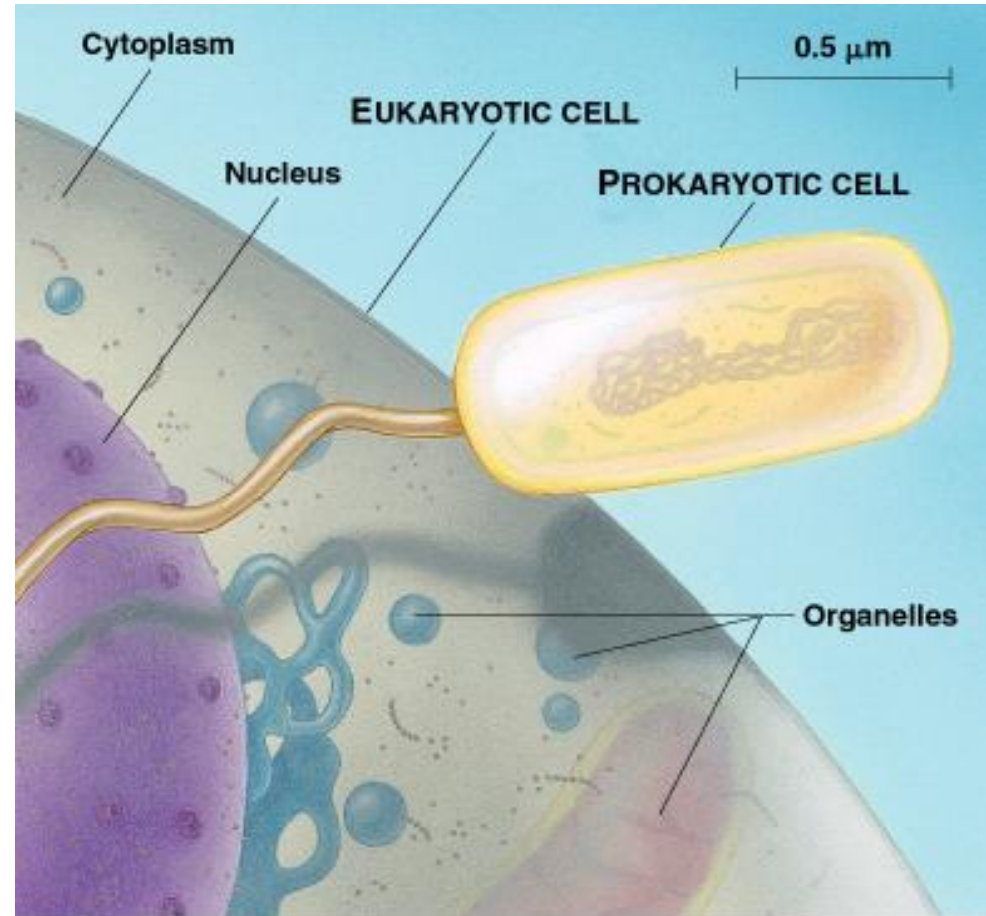
Two fundamental types:

Prokaryotic

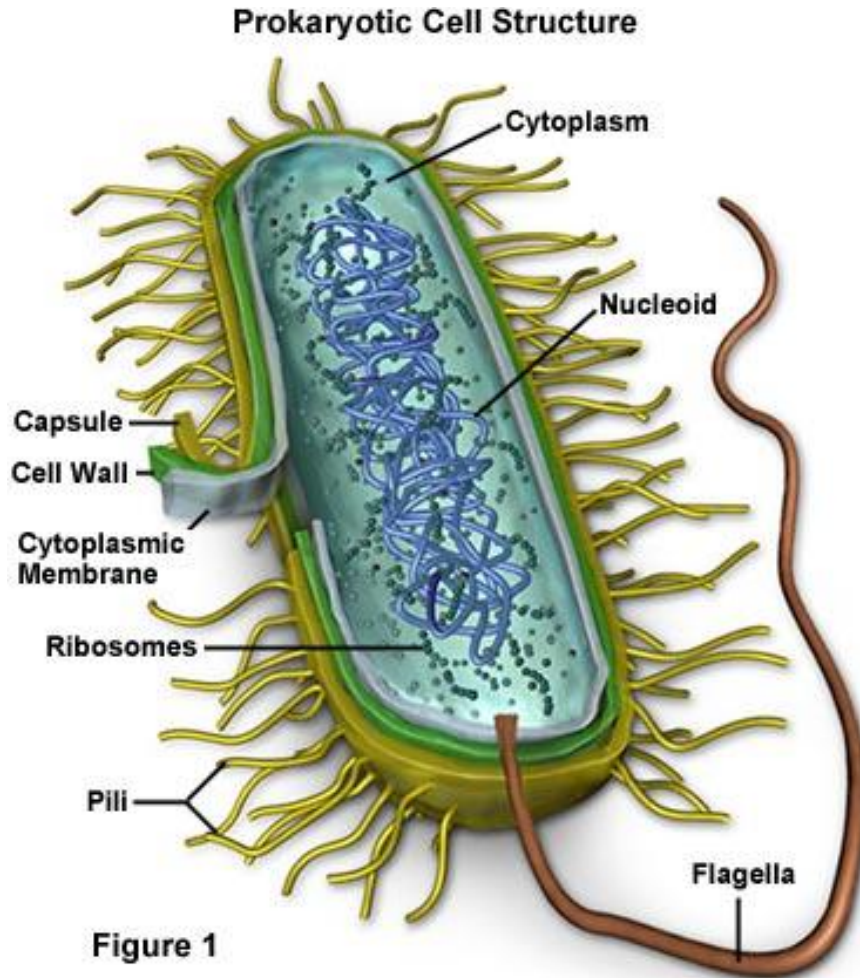
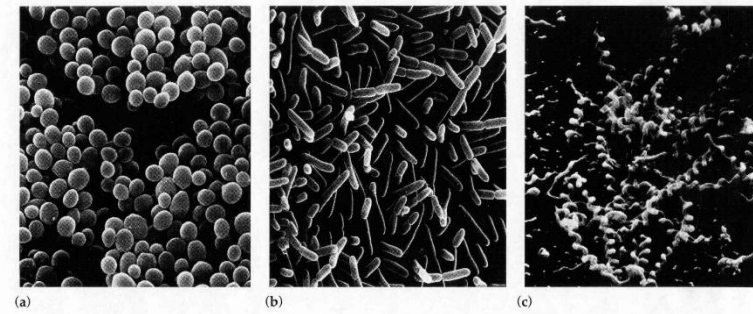
- No Nucleus
- No organelles
- Small 100nm-5um

Eukaryotic

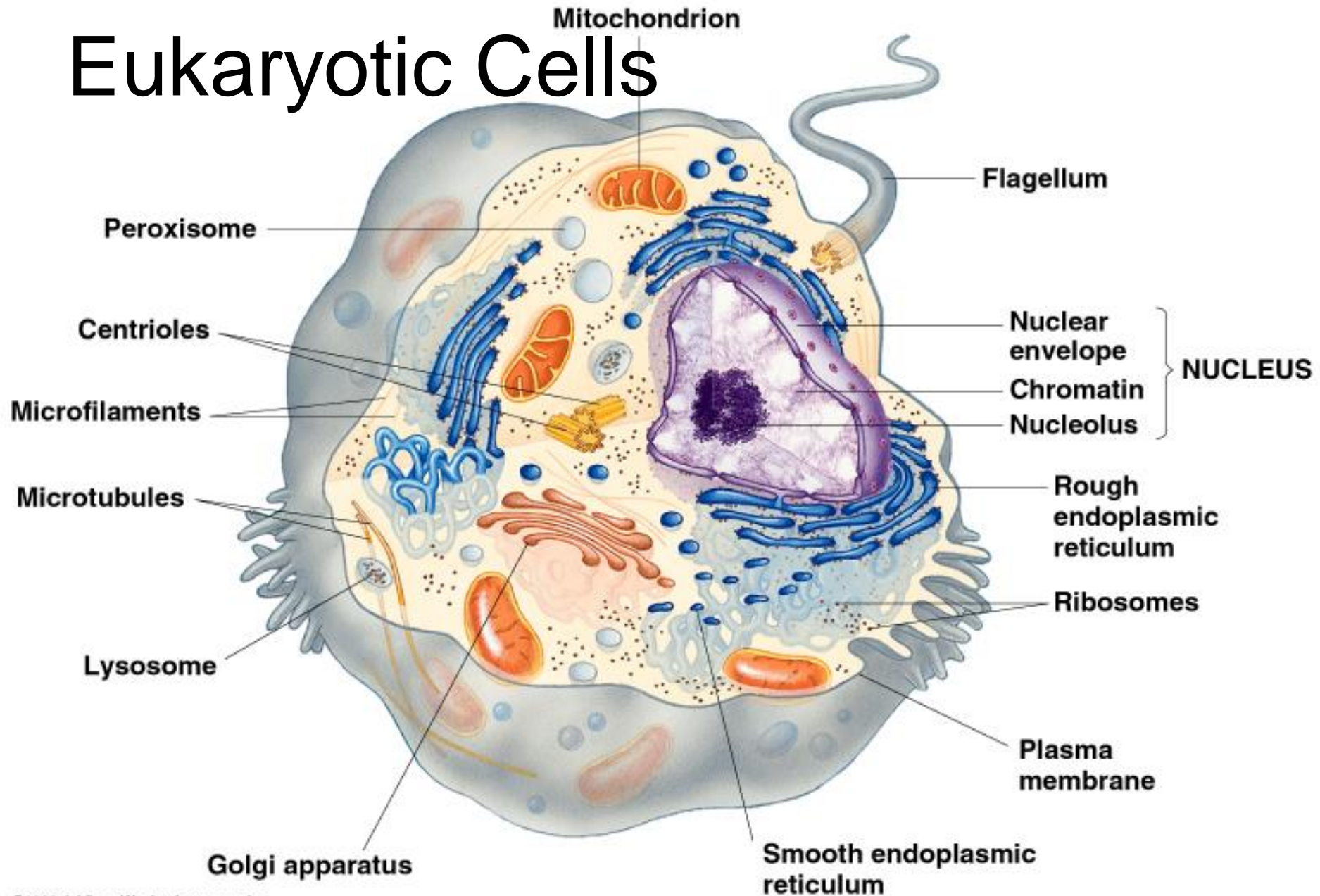
- True Nucleus
- Membrane bound organelles
- 10-100um
- Some are larger



Prokaryotic Cells



Eukaryotic Cells



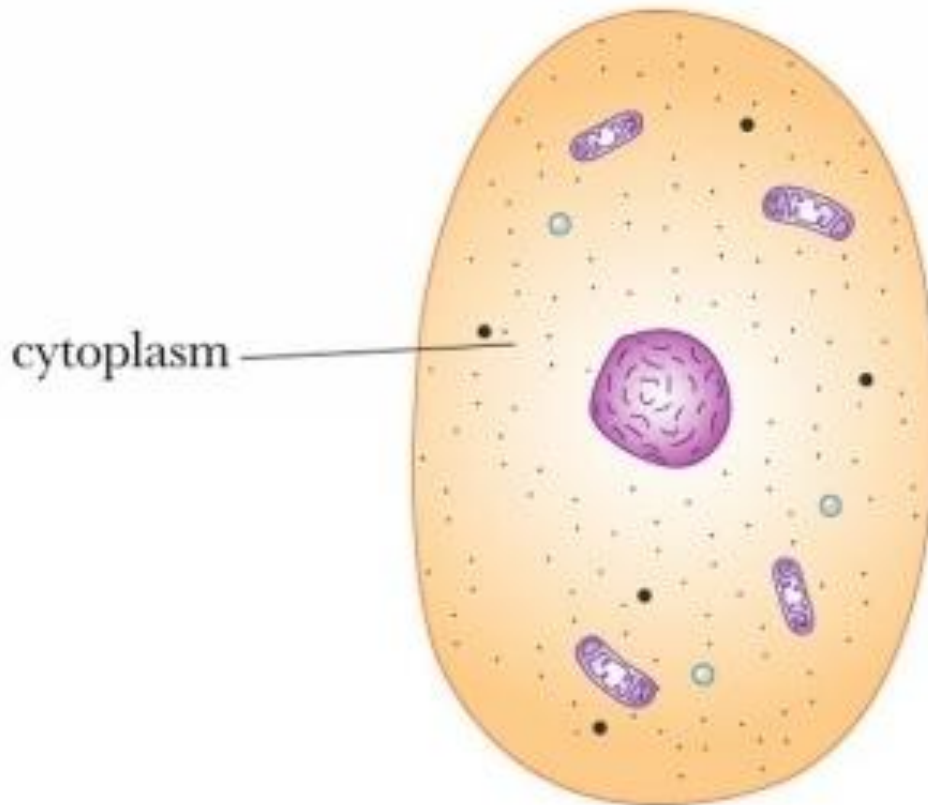
Cell Organelles

- What are organelles?
- Internal compartments that carry out **specific cell functions**
- How are organelles beneficial to a cell?
- They allow the cell to **grow larger and become more specialized**

The Cytoplasm

Physical basis of Life

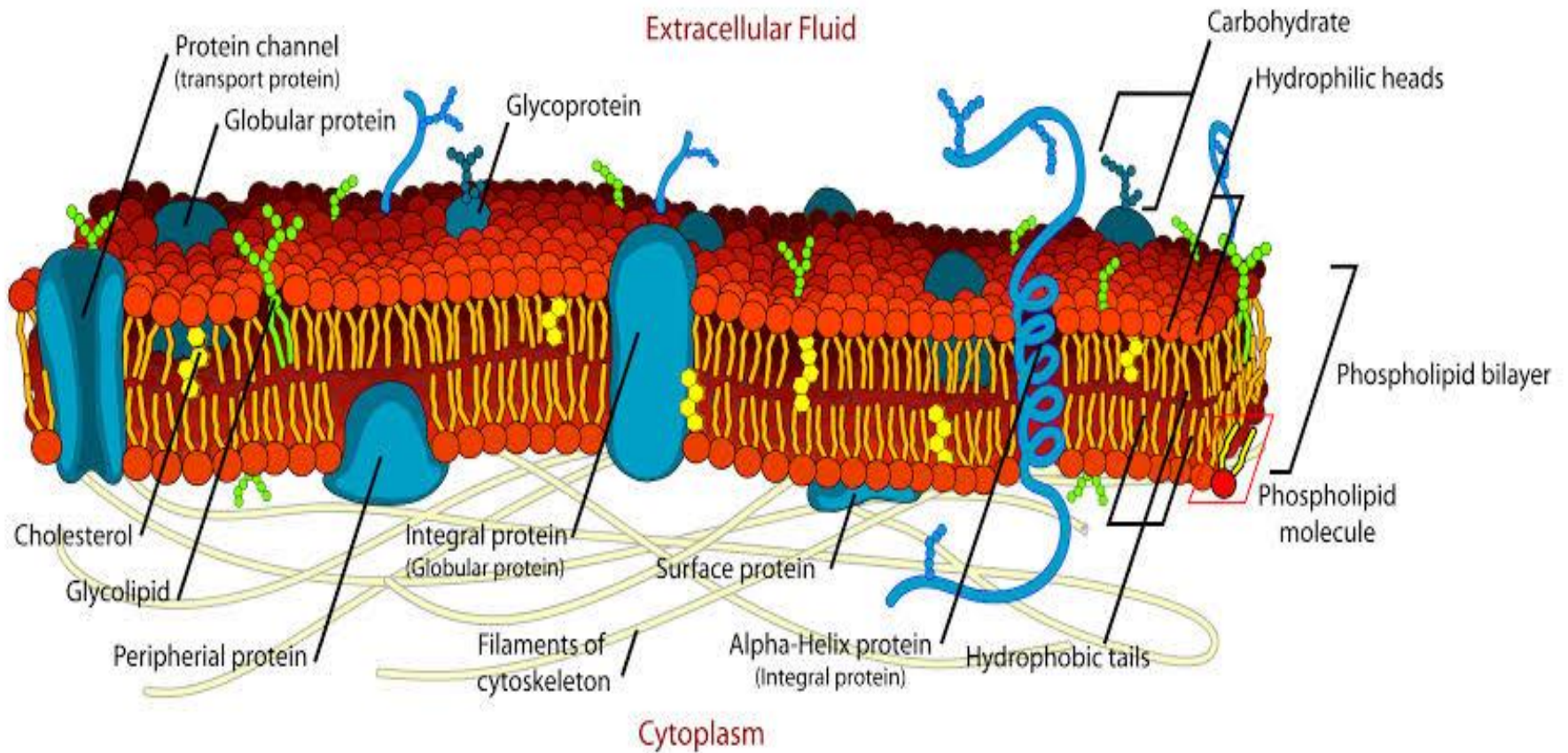
Fluid portion of the cell



Cell Membrane

- ✓ The cell membrane (also called the *plasma membrane* or *plasmalemma*) is a biological membrane separating the interior of a cell from the outside environment
- ✓ It appears in thin sections with the electron microscope as a triple-layered structure about 7.5–10 nanometers thick
- ✓ Term coined by *C. Nageli and C. Cramer* in 1855, and Plasmalemma coined by *J. Q. Plowe* in 1931

Cell Membrane



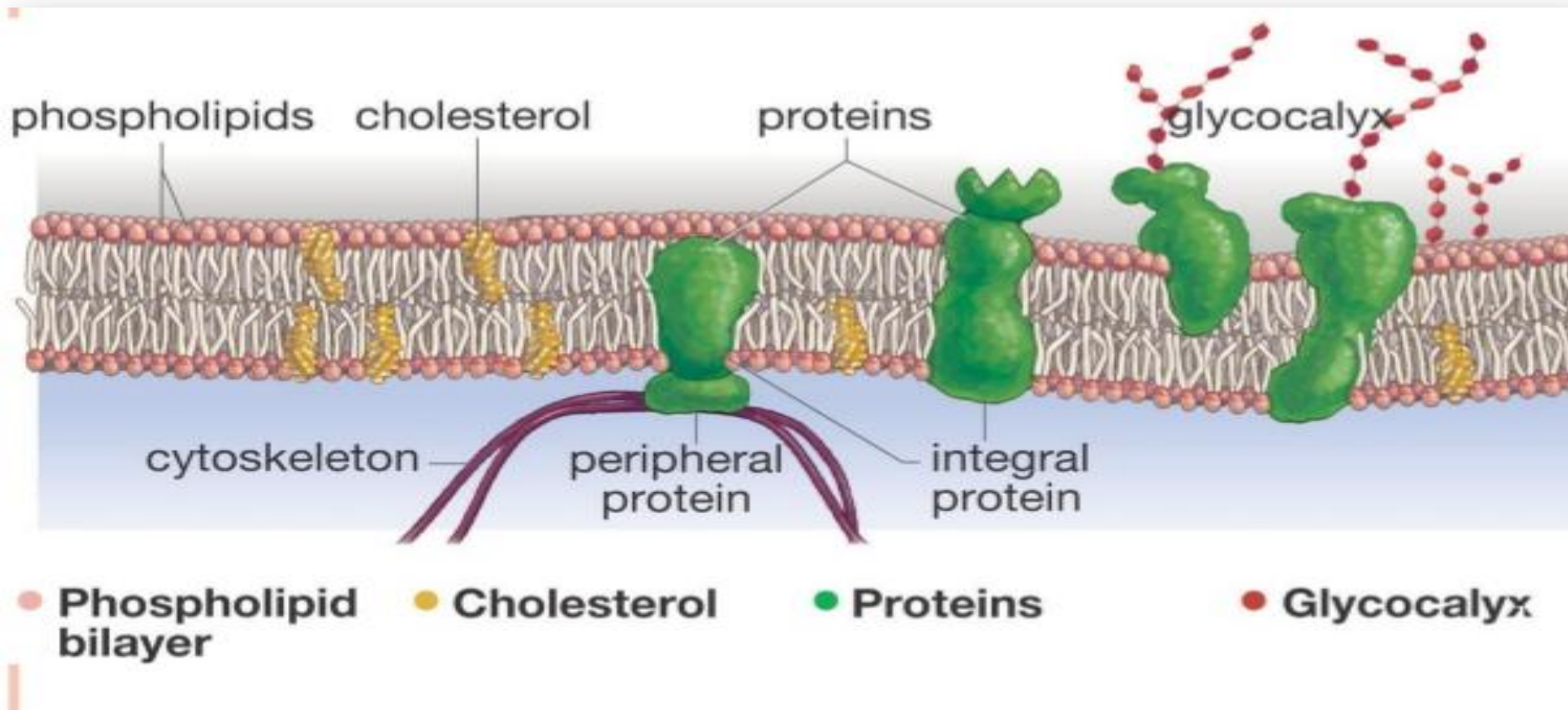
Chemical Composition

1. Lipids -four major classes of lipids are commonly present in the plasma membrane: *phospholipids (most abundant)*, sphingolipids, glycolipids and sterols (e.g. cholesterol). All of them are amphipathic. Cholesterol is abundant in mammalian cell and is absent in prokaryotic cells

2. Proteins-plasma membrane contains about 50% protein. Amount and type is variable. Myelin cells contains about 25% protein internal membranes of chloroplast and mitochondria contains 50% protein. Proteins of plasma membranes are of two types *ectoproteins* and *endoproteins*. Plasma membranes contains structural proteins, transport proteins and enzymes. Some of them acts as receptors.

3. Carbohydrates- they are present only in the plasma membrane and are present exterior (glycoproteins) or polar end of phospholipids at the external surface of plasma membrane

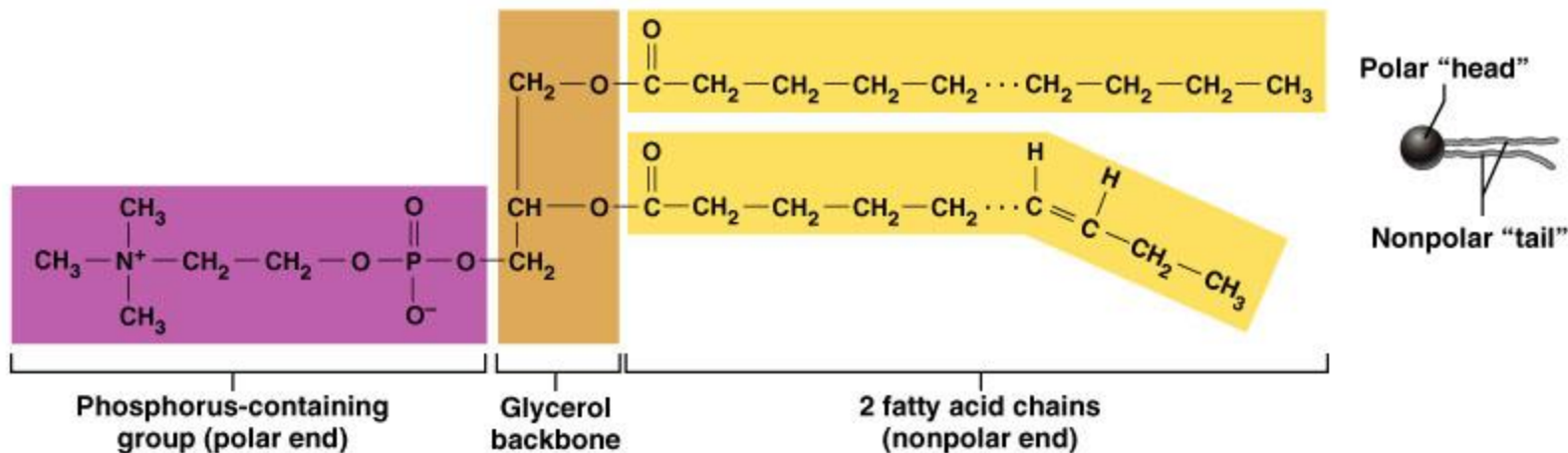
Membrane Component



Structure of the Cell Membrane

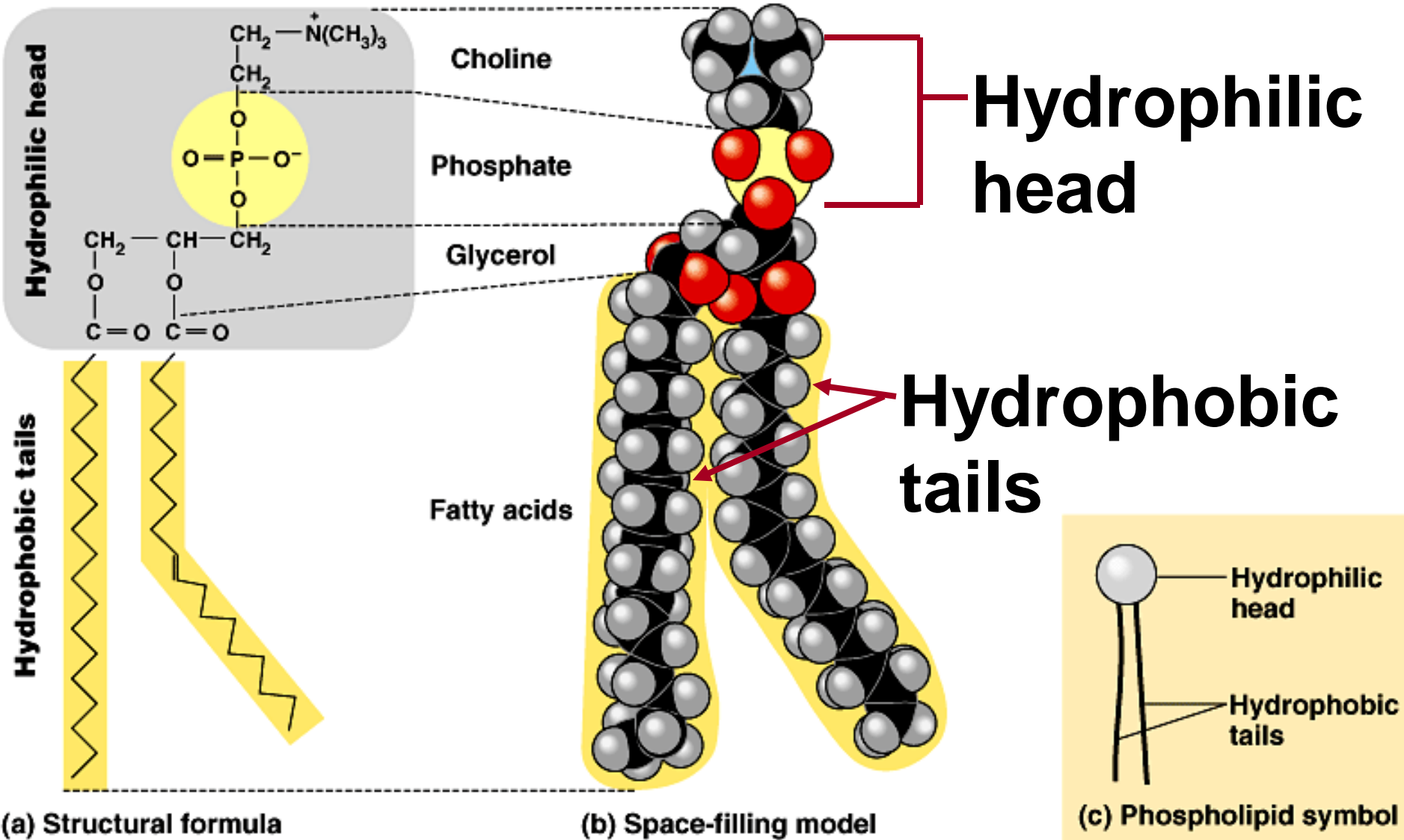
Phospholipids

- Most abundant lipid
- Polar/hydrophilic head(attracted to water)
- Pair of nonpolar/hydrophobic tails(repelled by water)



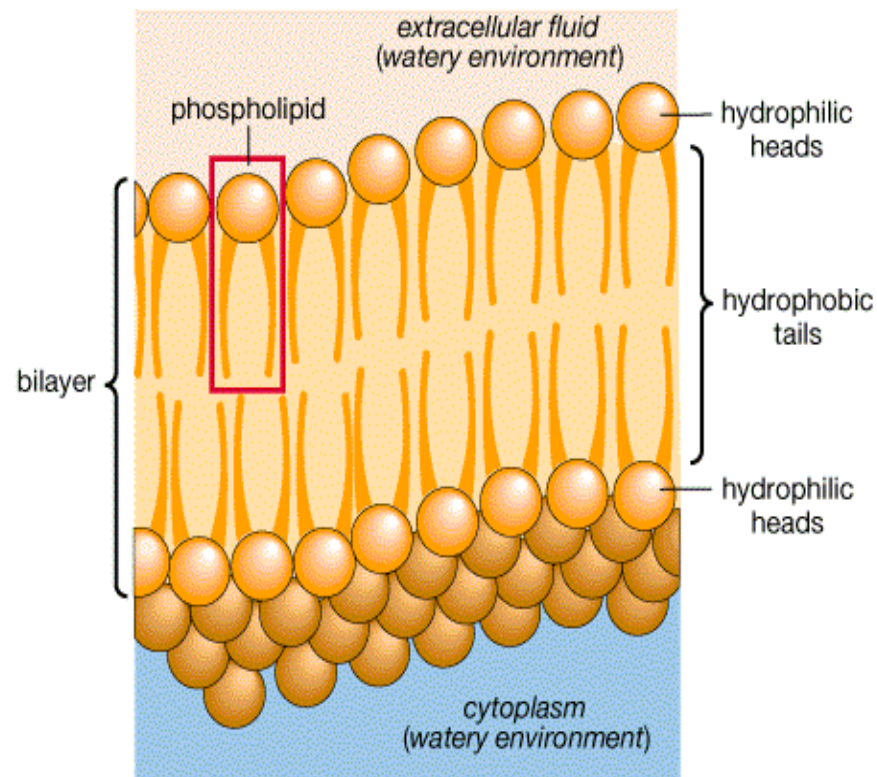
(b) Phospholipid molecule (phosphatidylcholine)

Phospholipids



Phospholipid bilayer:

- Polar heads, outside & inside
- Nonpolar tails in the interior
- Cell Membranes



Function of Cell Membrane

- ✿ Keeps a cell intact
- ✿ Protective barrier
- ✿ Regulate transport in & out of cell (selectively permeable)
- ✿ Small lipid-soluble molecules, e.g. oxygen and carbon dioxide can pass easily
- ✿ Water can freely cross the membrane

Function of Cell Membrane

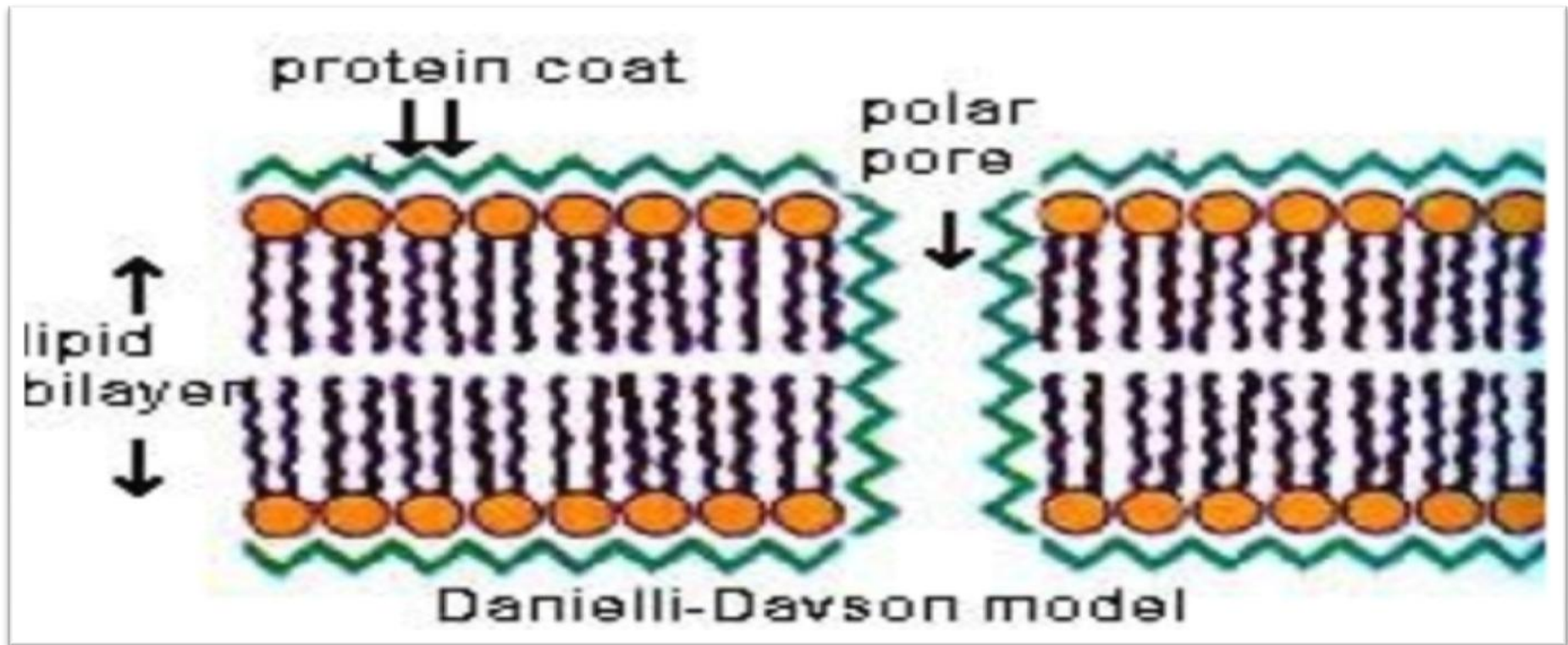
- ✿ Ions and large molecules cannot cross without assistance
- ✿ Allow cell recognition
- ✿ Provide anchoring sites for filaments of cytoskeleton
- ✿ Provide a binding site for enzymes
- ✿ Interlocking surfaces bind cells together (junctions)
- ✿ Contains the cytoplasm (fluid in cell)

Model of Plasma Membrane

DANIELLI AND DAVSON MODEL

- In 1935, *Danielli and Davson* studied triglyceride lipid bilayers over a water surface
- They found that they arranged themselves with the polar heads facing outward
- It always formed droplets (oil in water) and the surface tension was much higher than that of cells
- *Called as Sandwich model*

Danielli-Davson Model (Sandwich Model)

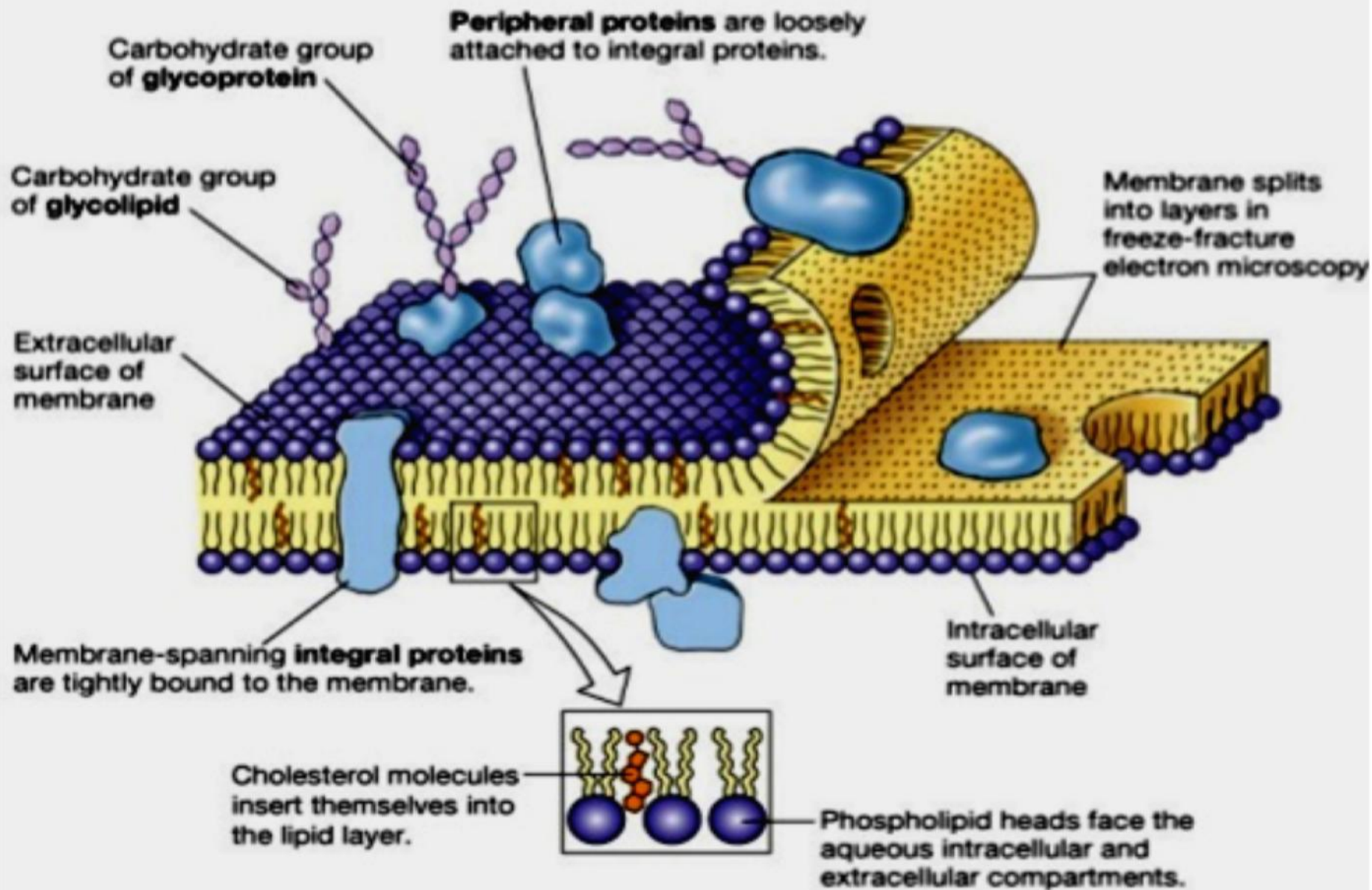


Fluid Mosaic Model

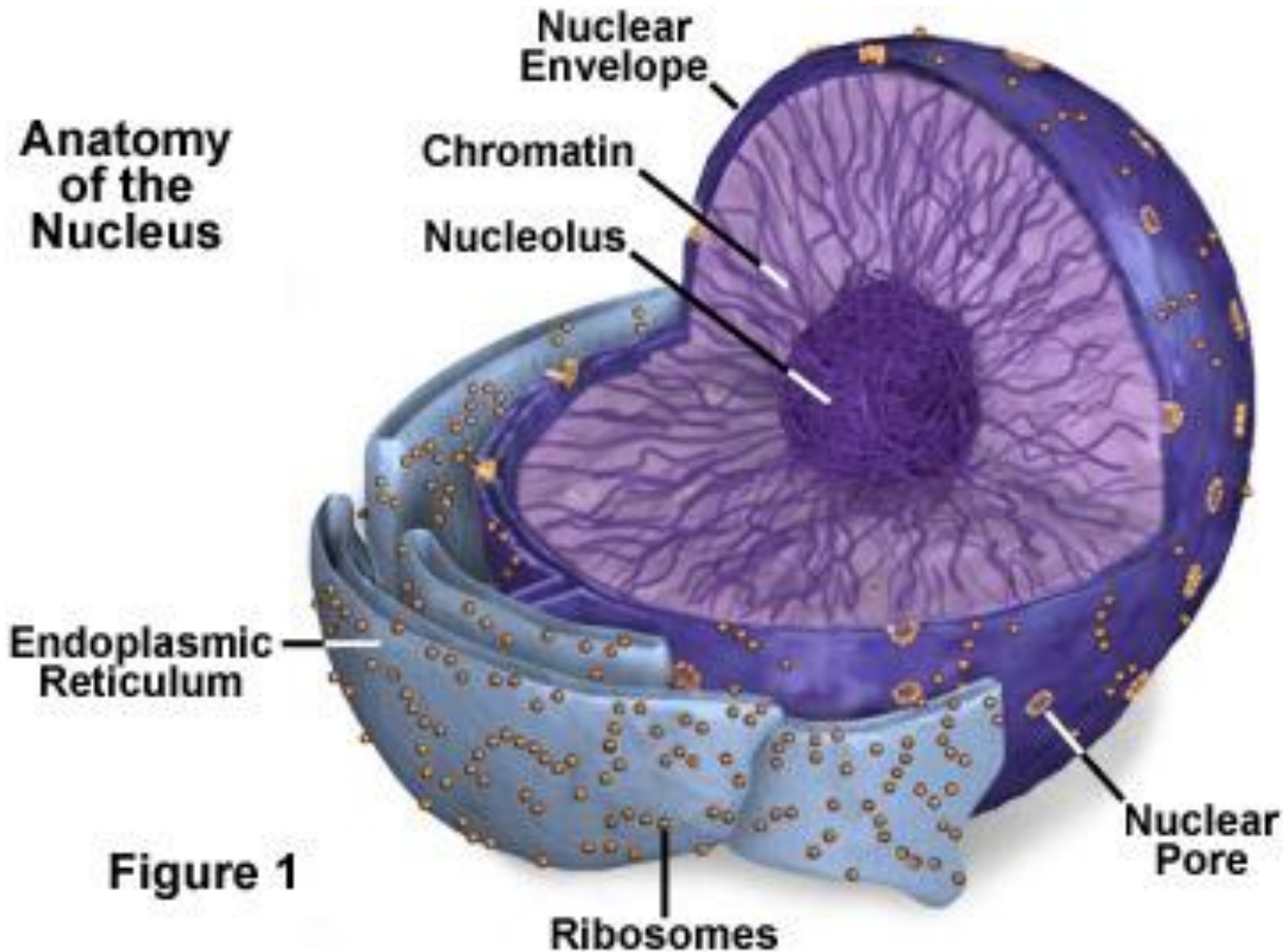
- According to ***S. J. Singer and Garth Nicolson 1972***, the biological membranes can be considered as a two-dimensional liquid where all lipid and protein molecules diffuse more or less freely
- Singer studied phospholipid bilayers and found that they can form a flattened surface on water, with no requirement for a protein coat
- It occurs in form of globular protein
- *Widely accepted model*

Fluid Mosaic Model:

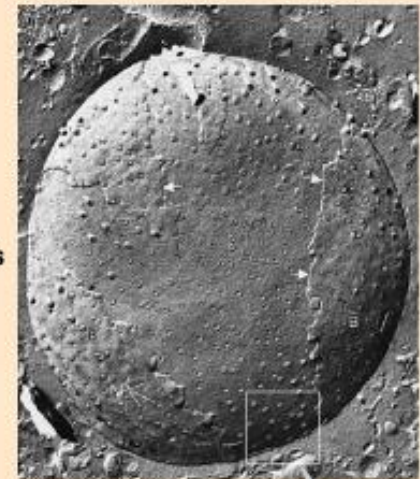
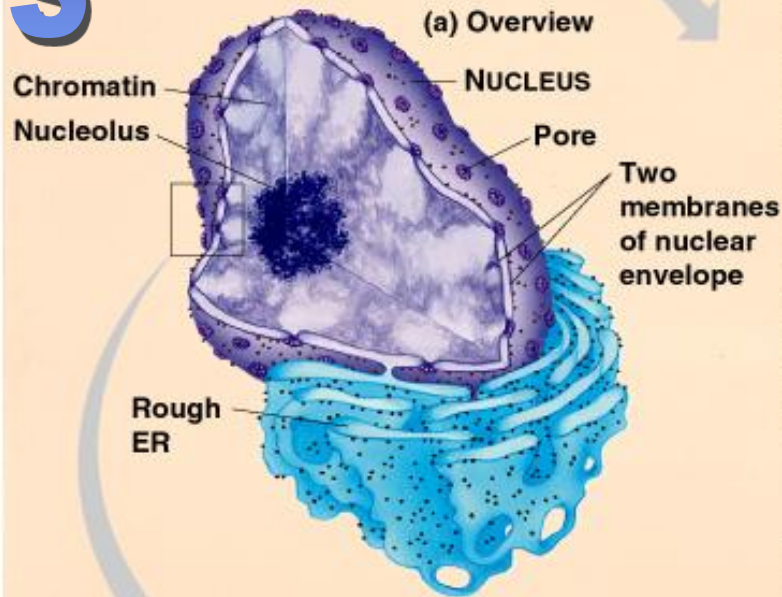
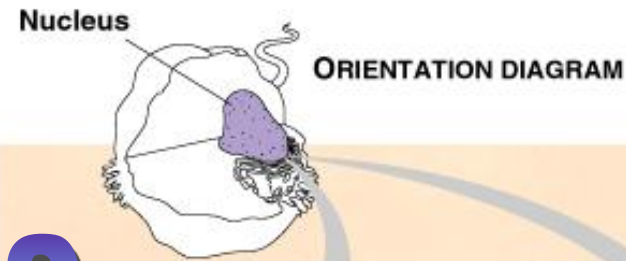
- Most accepted working model of the membrane
- Protein molecules bobbing in phospholipid sea
- Proteins determine membrane's specific functions



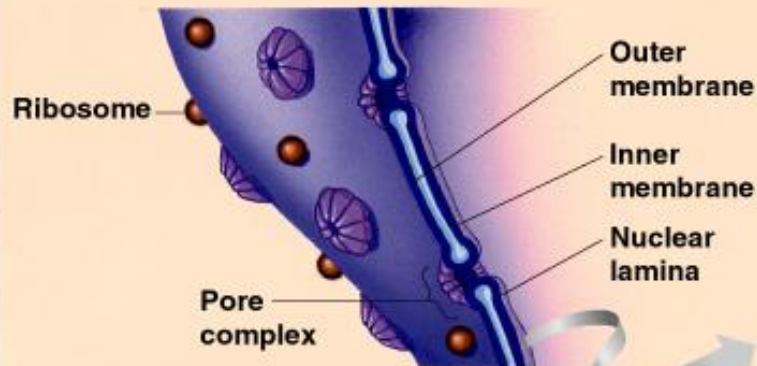
Nucleus



Nucleus



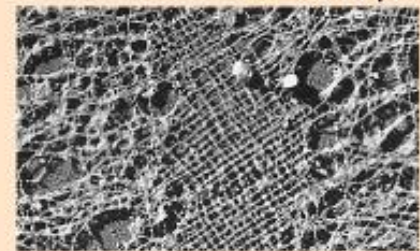
(b) Surface of nuclear envelope 1 μm



(c) Close-up of nuclear envelope



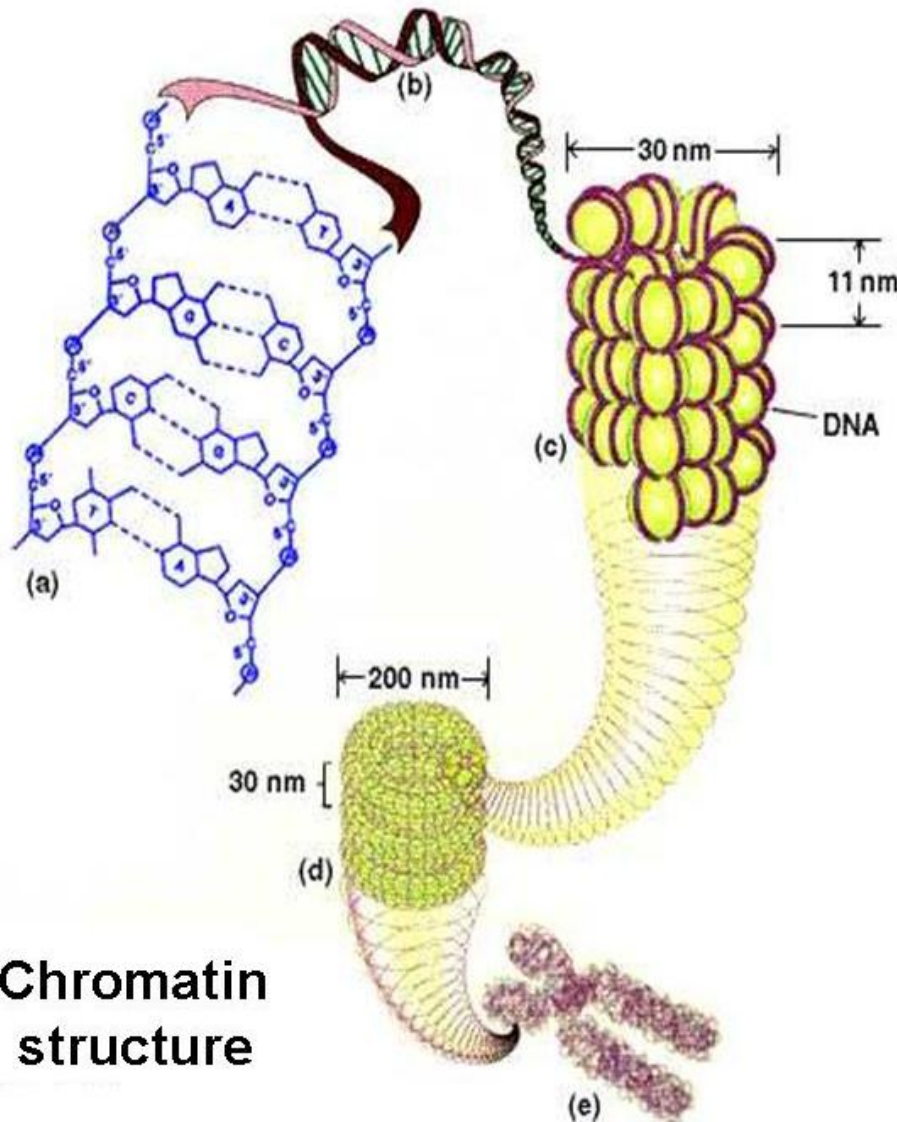
(d) Pore complexes 0.25 μm



(e) Nuclear lamina 1 μm

- **Nucleus:** control center; houses DNA; directs activities of the cell
- **Nucleolus:** producing ribosomes
- **Nuclear envelope:** encloses the nucleus and its contents
- **Nuclear pore:** pore in nucleus; can allow substances (RNA) to leave

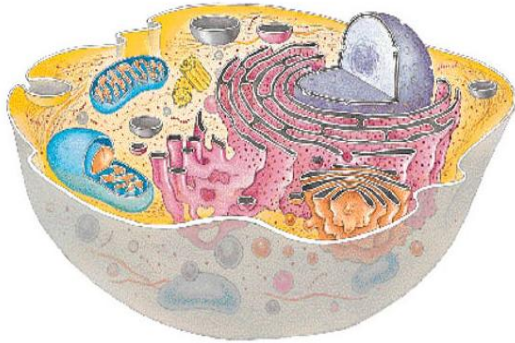
Genetic Material



Chromatin
structure

- Hereditary informer
- Material consisting of DNA and proteins only visible during cell division.

Endoplasmic Reticulum

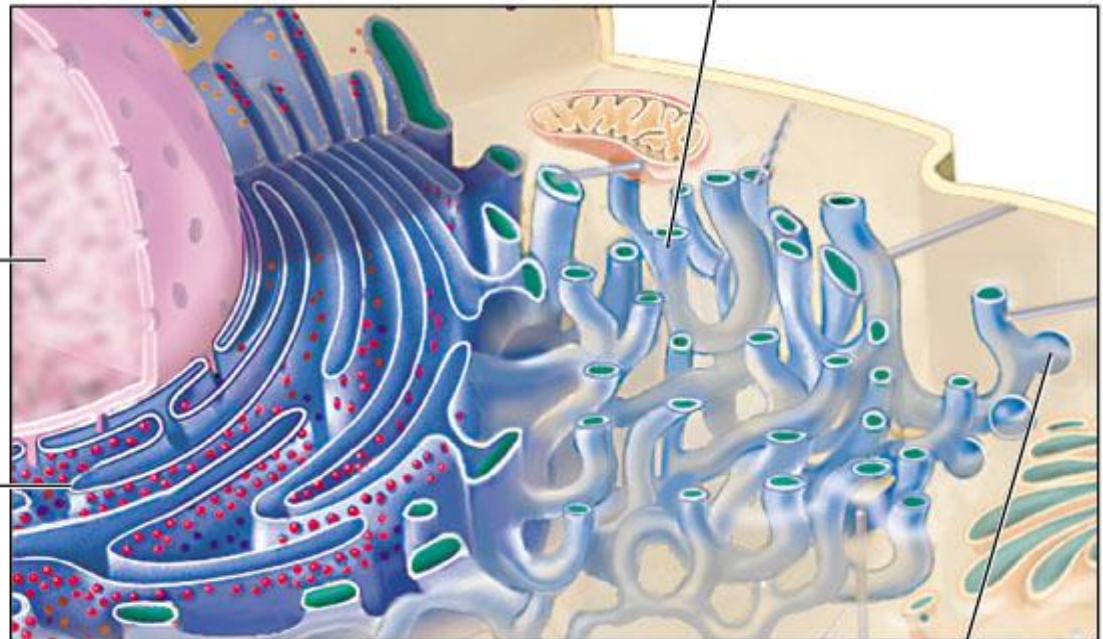


**Rough and
Smooth ER**

Nucleus

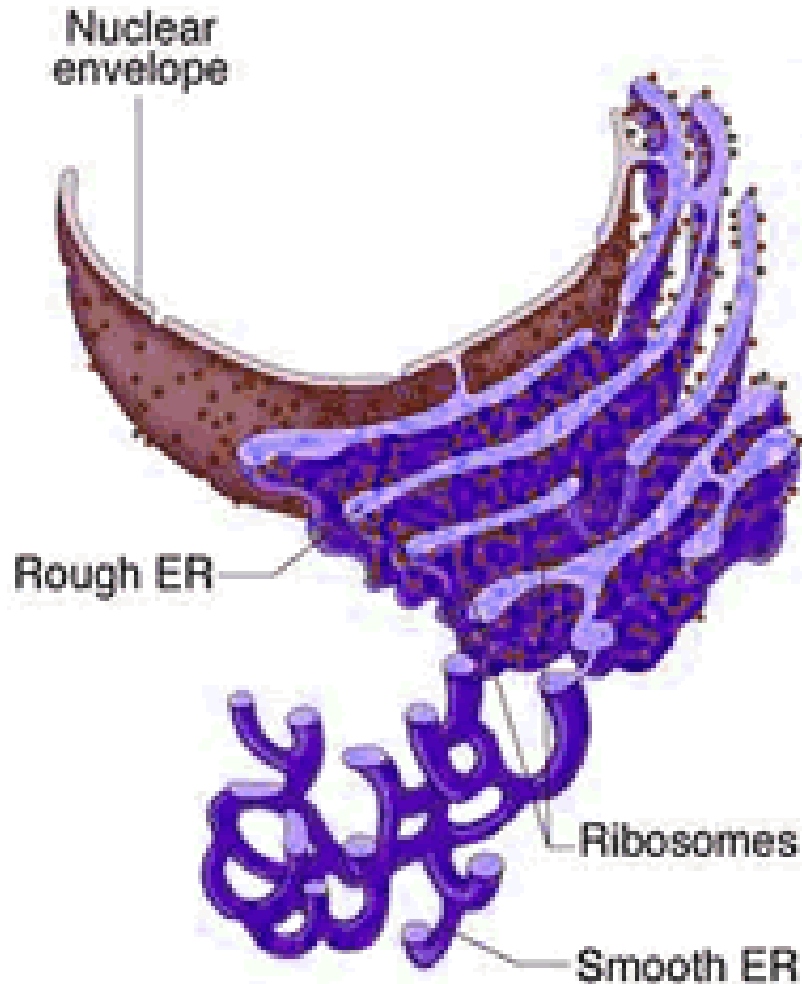
**Rough
E.R.**

**Smooth
E.R.**



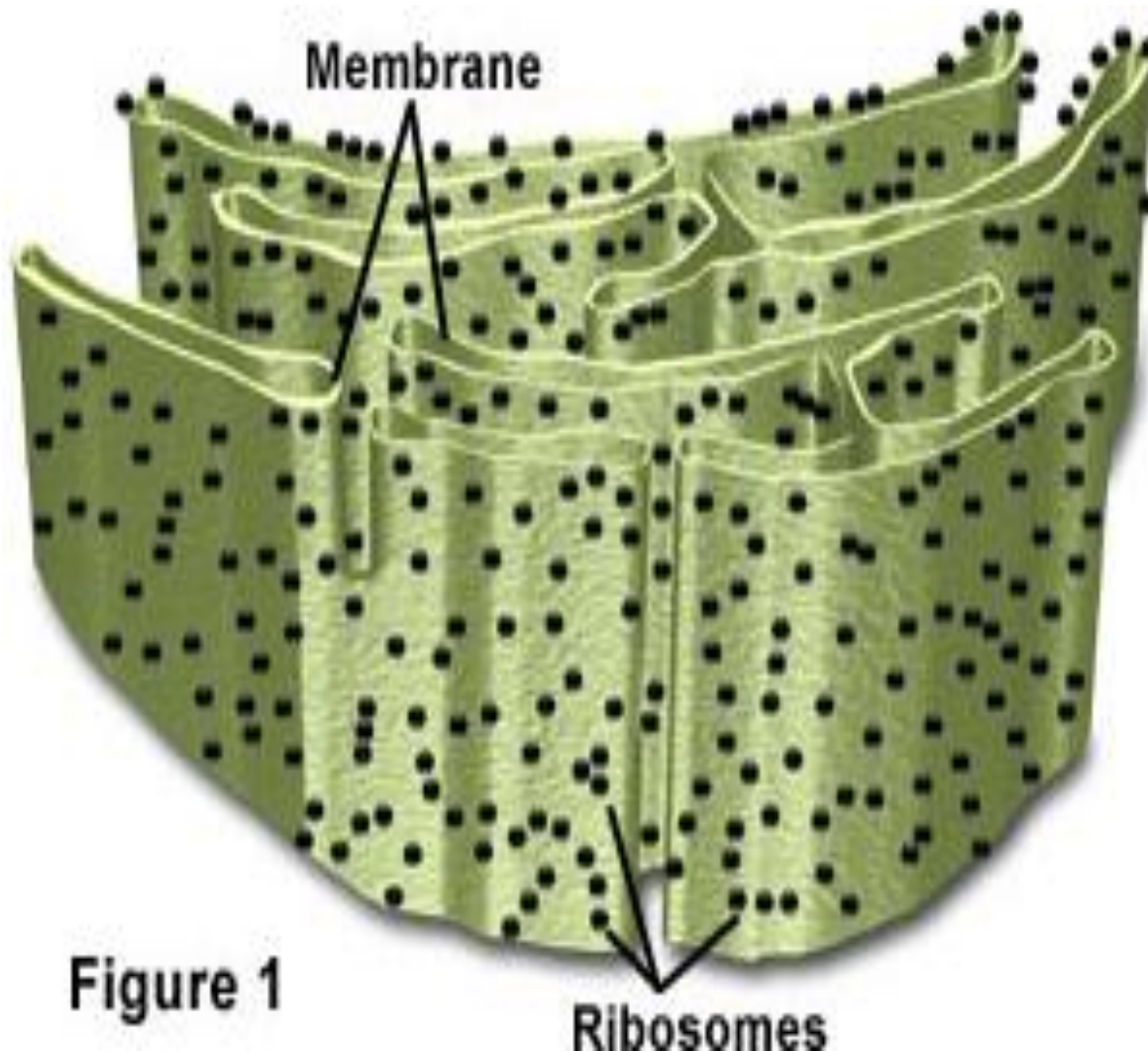
Vesicle

Smooth endoplasmic reticulum



- **Synthesizes steroids**
- **Detoxifies poisons (alcohol)**
- **Transports substances**
- **Regulates calcium levels for muscle contraction**

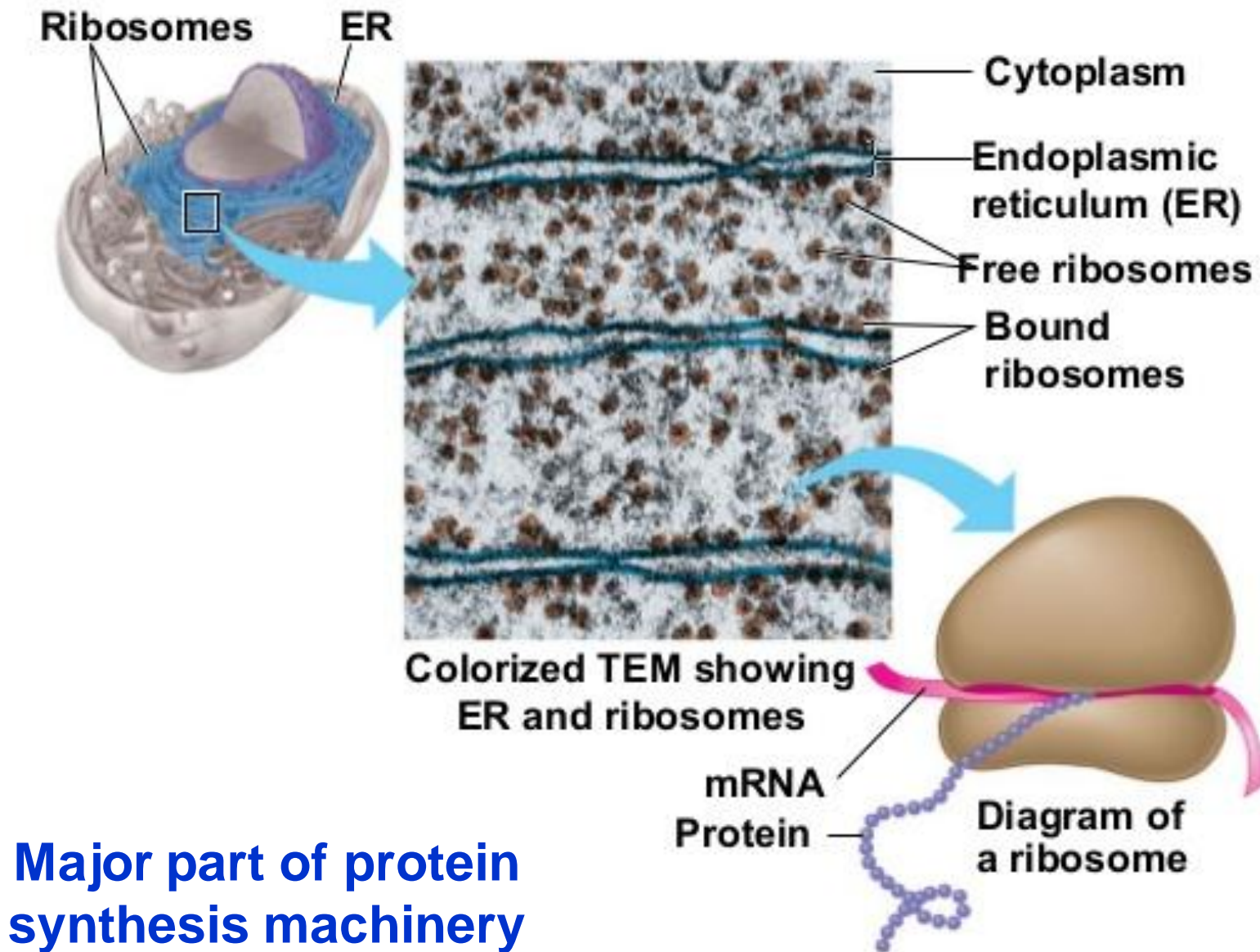
Rough Endoplasmic Reticulum



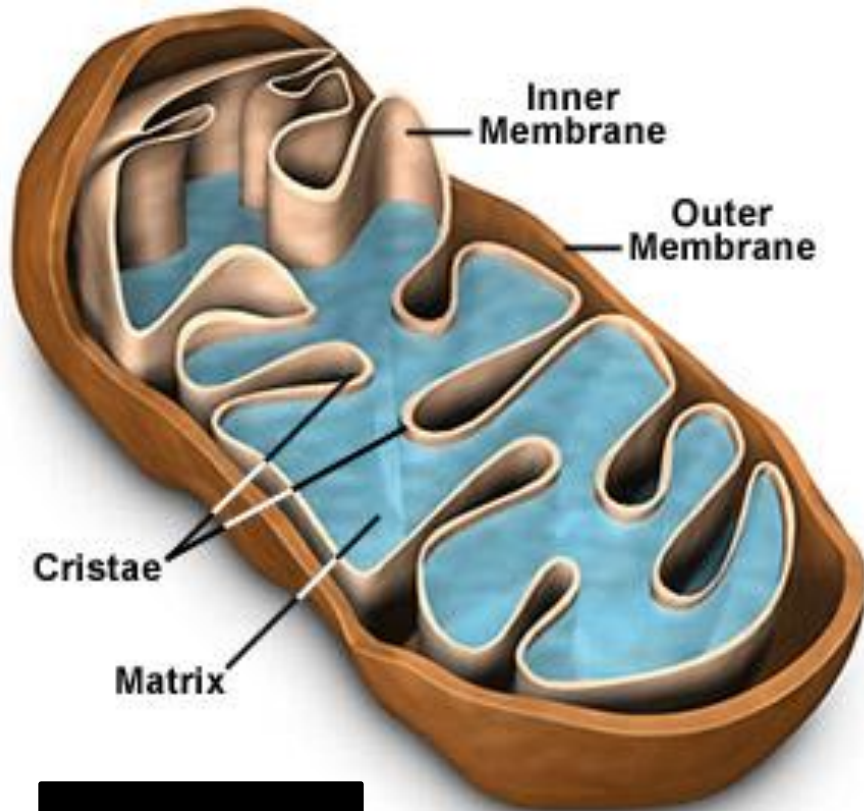
**Transports
proteins**

Figure 1

Ribosomes



Mitochondria



Powerhouse of the cell

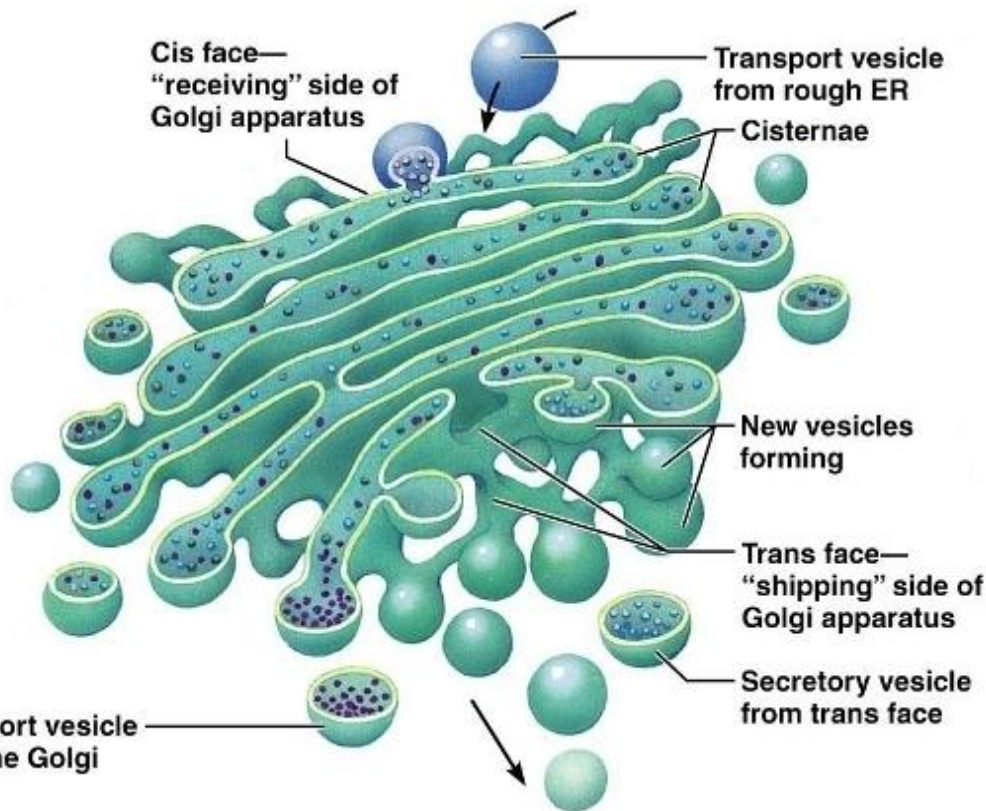
Energy production for cells
(ATP)

Sites of aerobic respiration

“mitochondria makes me
mighty”

Golgi Complex

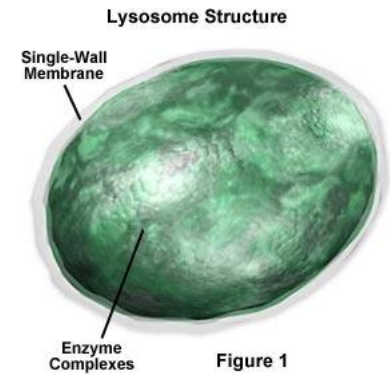
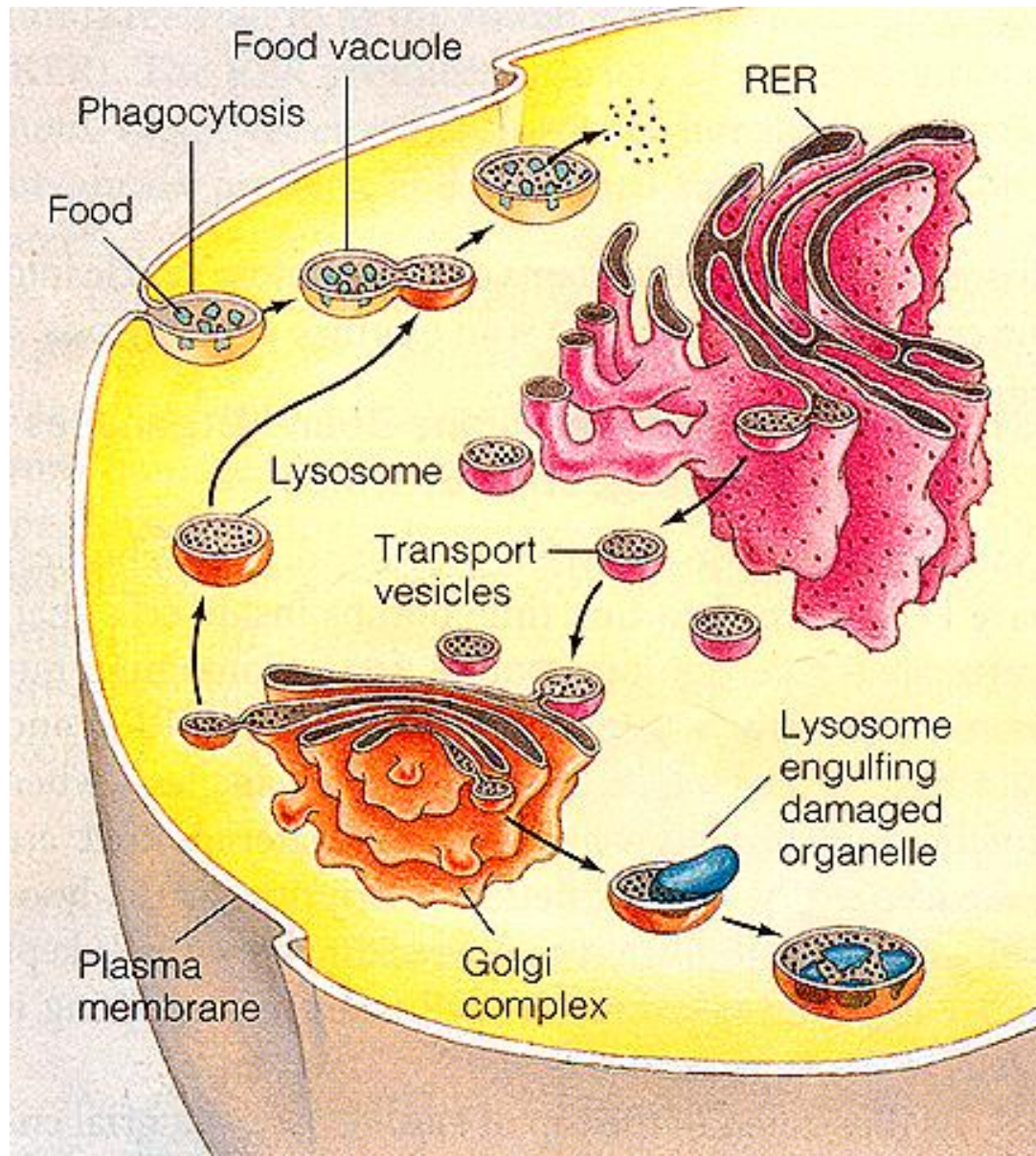
Receives substances from ER, refines and packages them



Membrane-bound structure

Organelle modifies molecules and packages them into small membrane bound sacs called vesicles

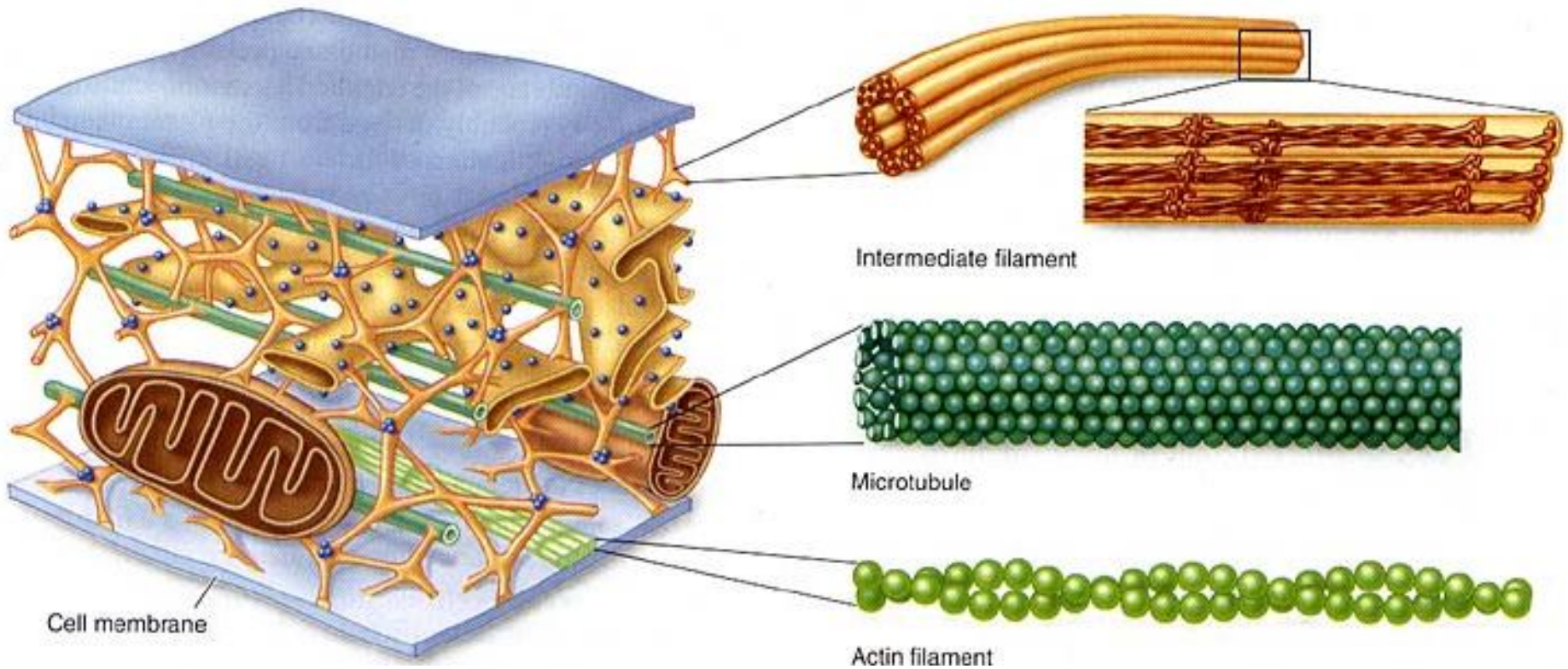
Lysosome



Digests waste materials and food within the cell

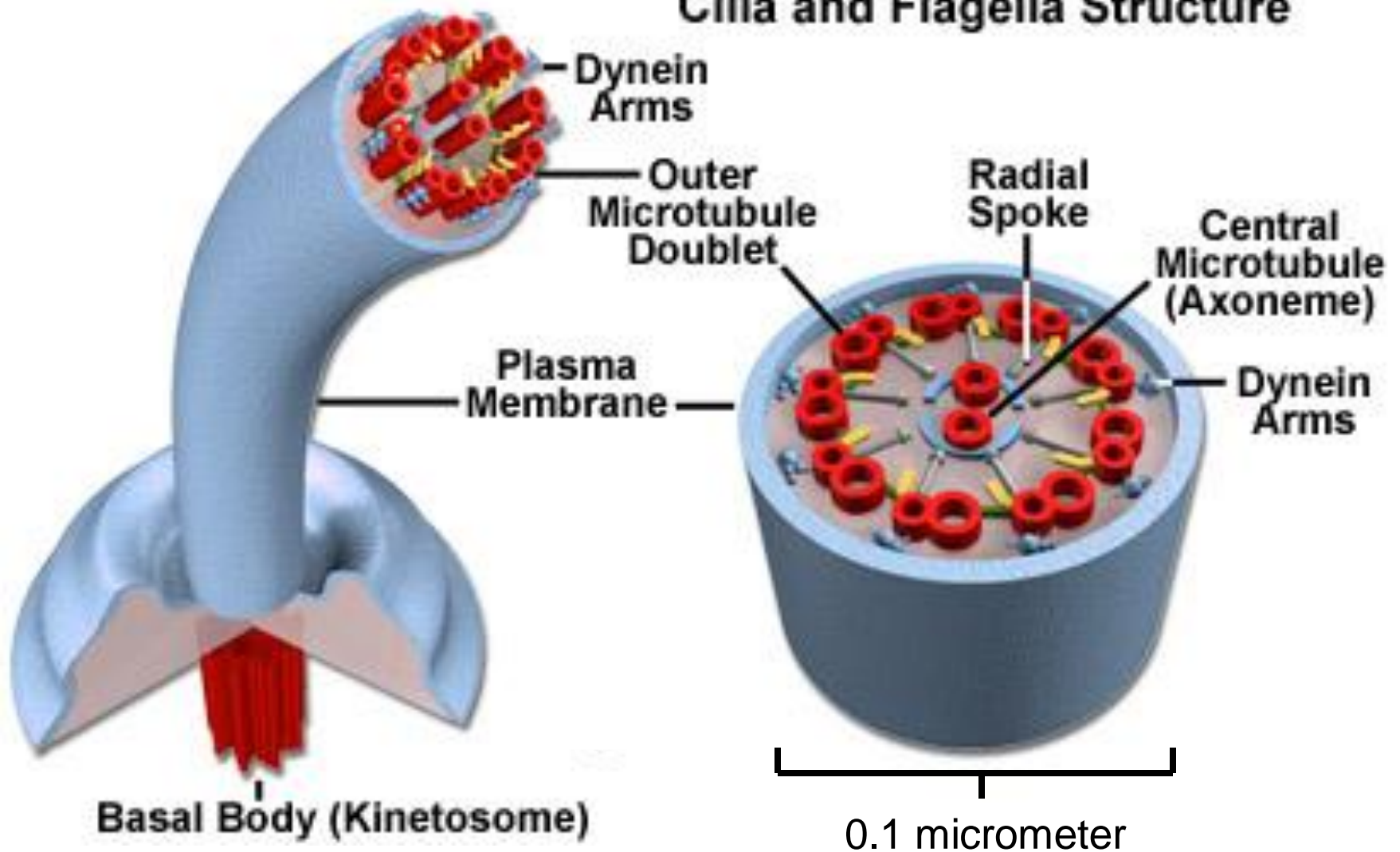
Breaks down molecules into their base components with strong digestive enzymes

Cytoskeleton

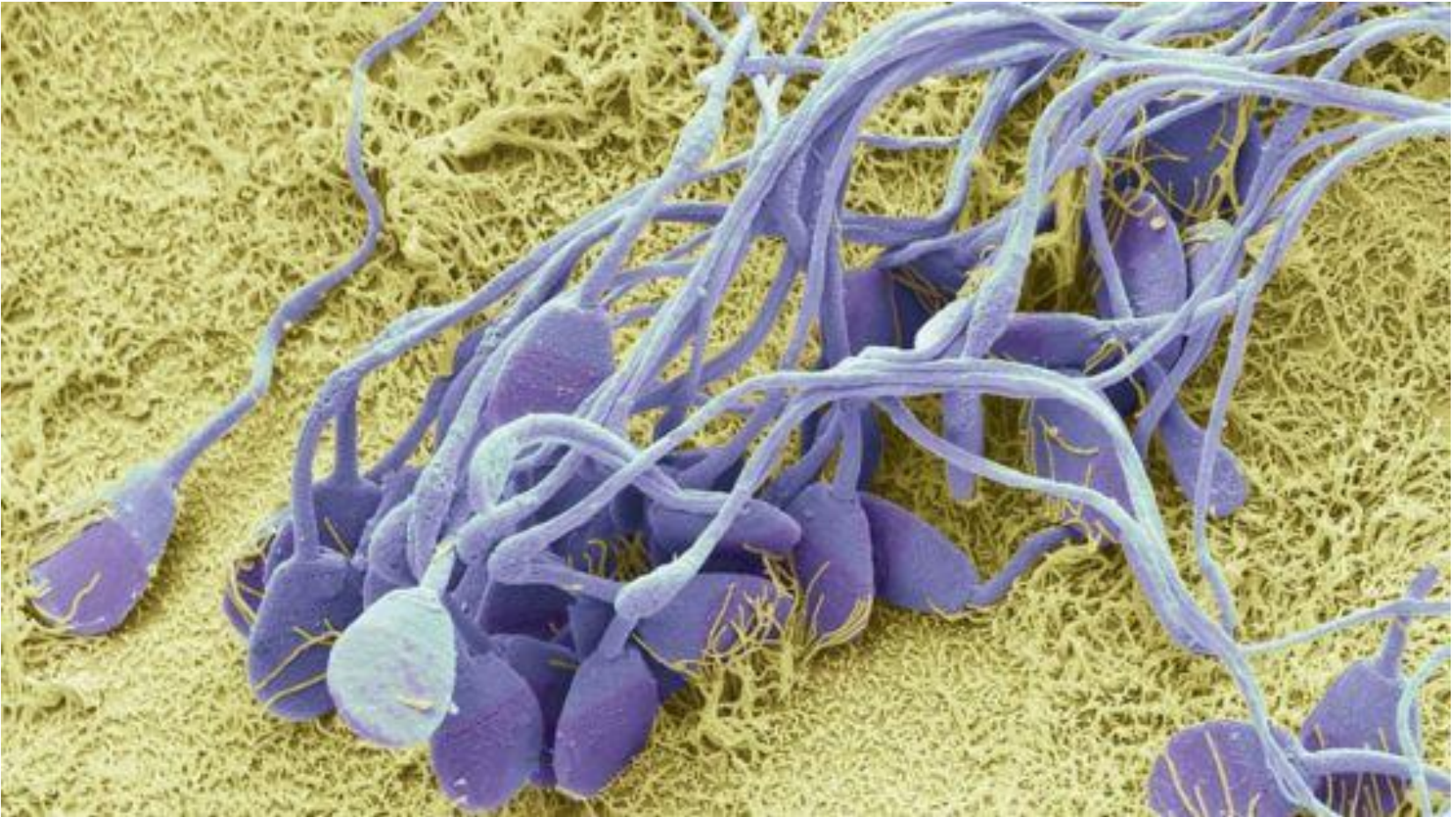


Cilia & Flagella- 9x2 arrangement

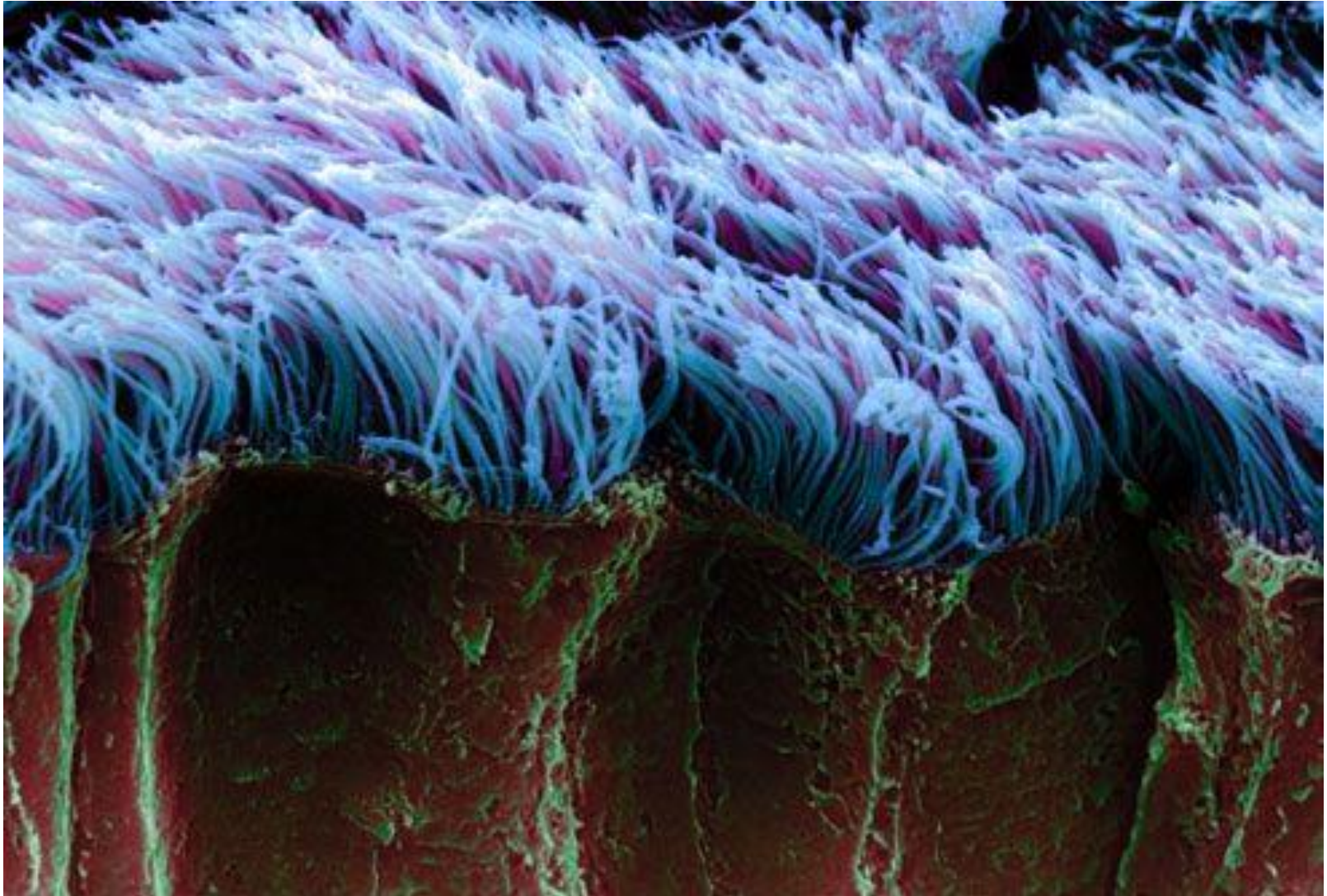
Cilia and Flagella Structure



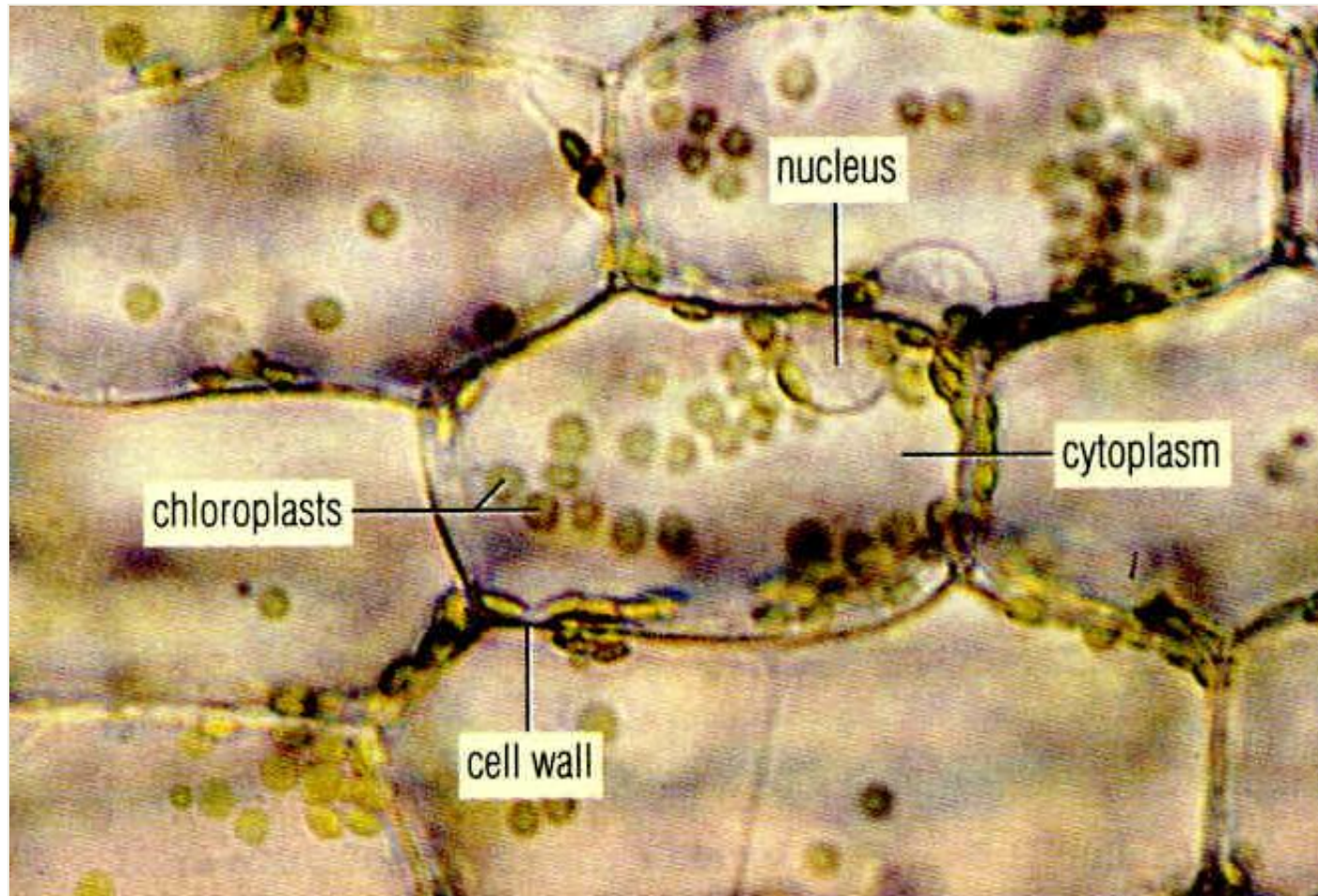
Flagellum

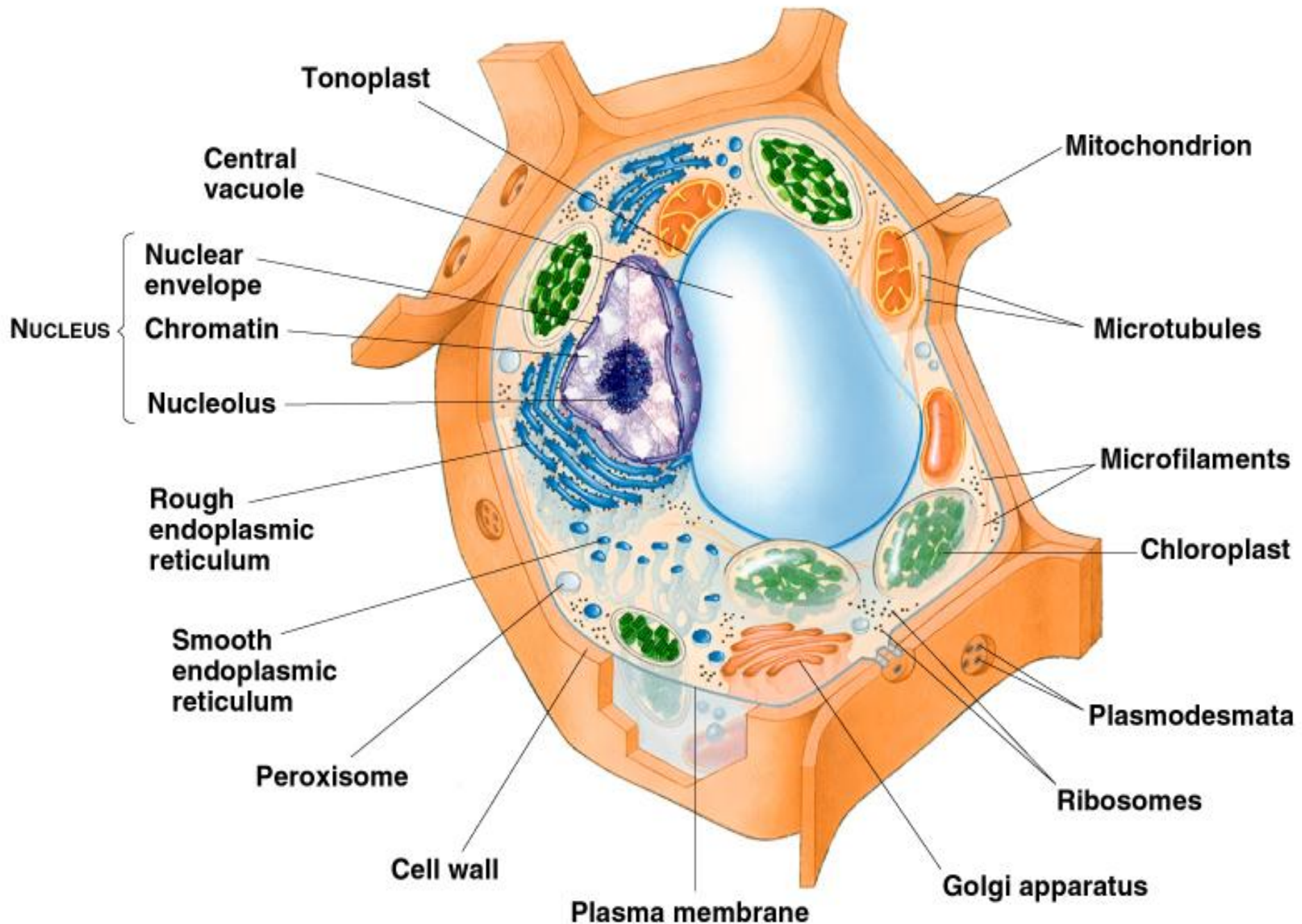


Ciliated Epithelium



Typical Plant Cell

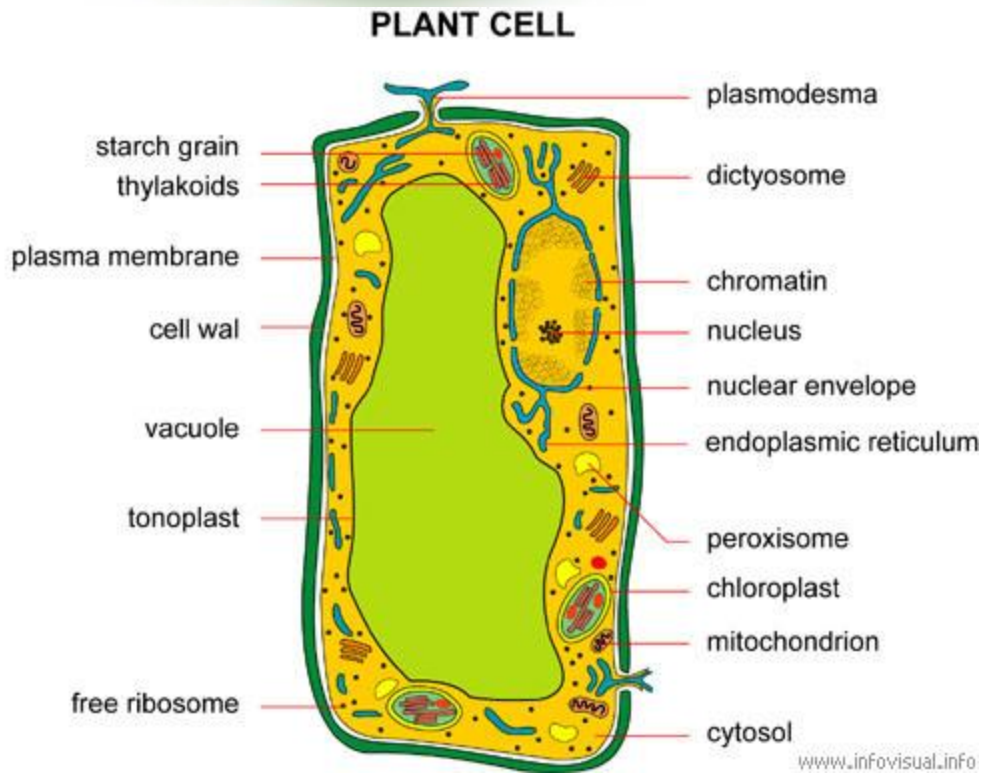




Plant Cell

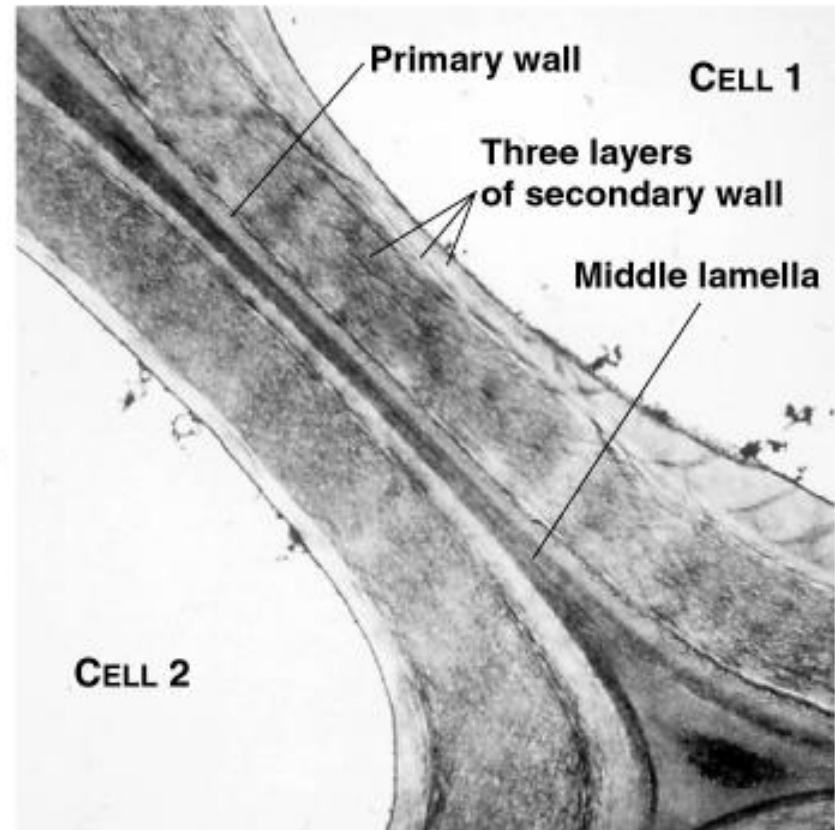
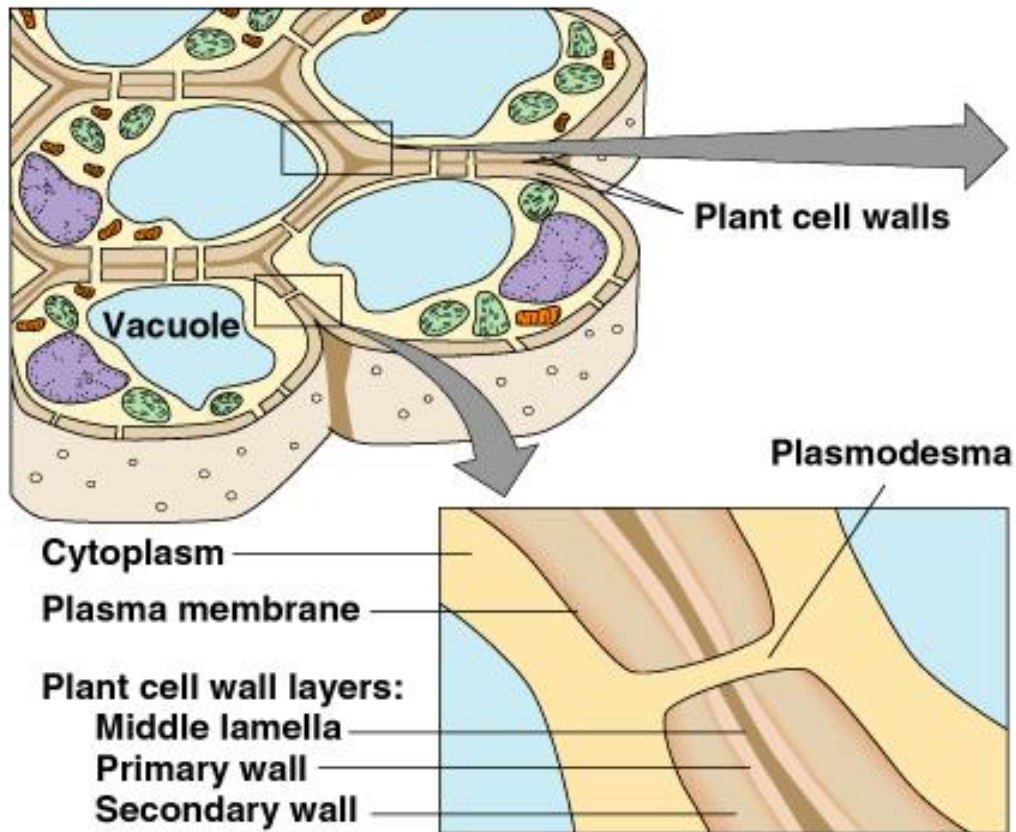


- Plant cells have different structures
- Contains:

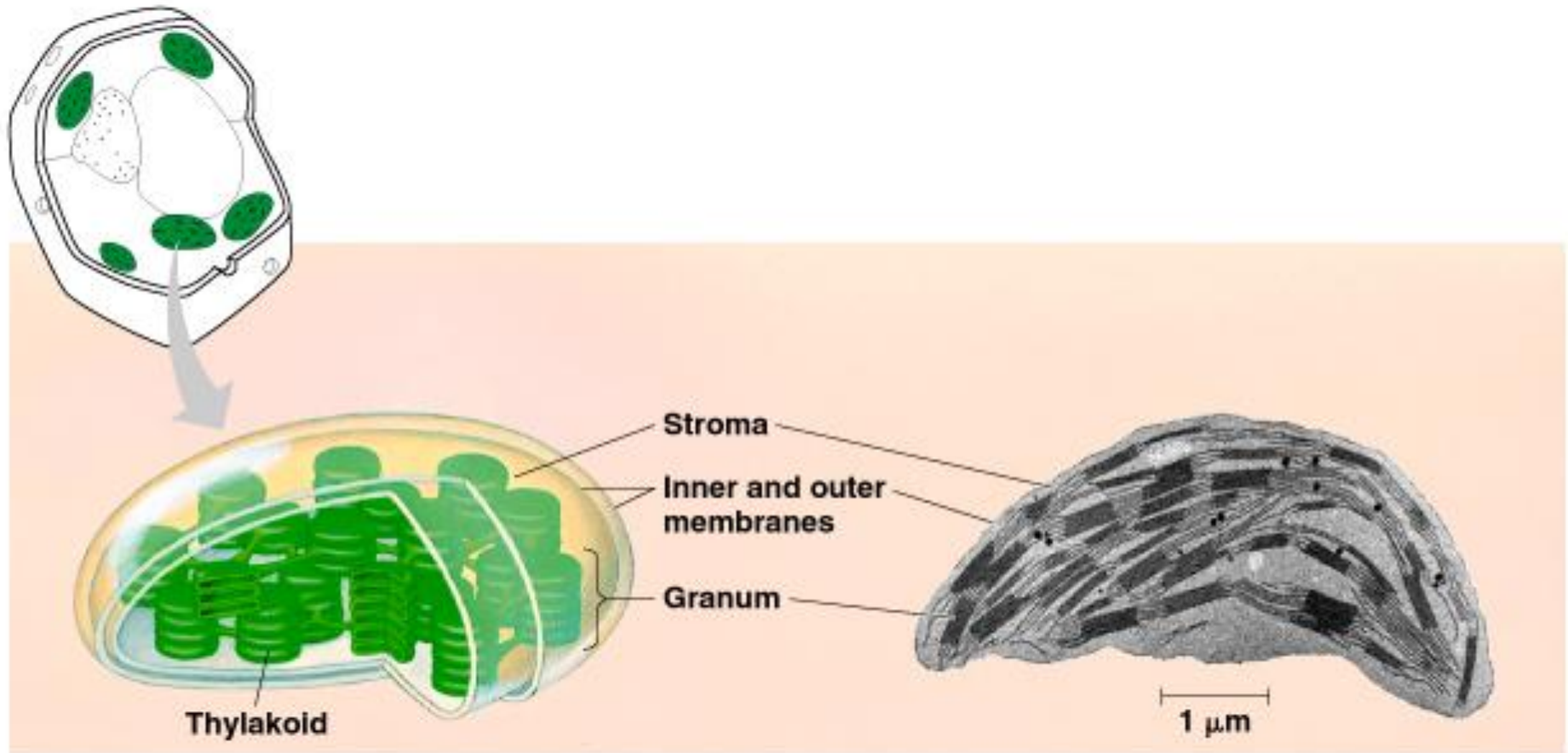


- Cell wall
 - Great wall of China
- Chloroplast
 - Site of photosynthesis
- Vacuole (large central, takes up most part of cell)

Cell Walls



Chloroplasts



Plant Cell Central Vacuole

