

# Cell Structure and Function

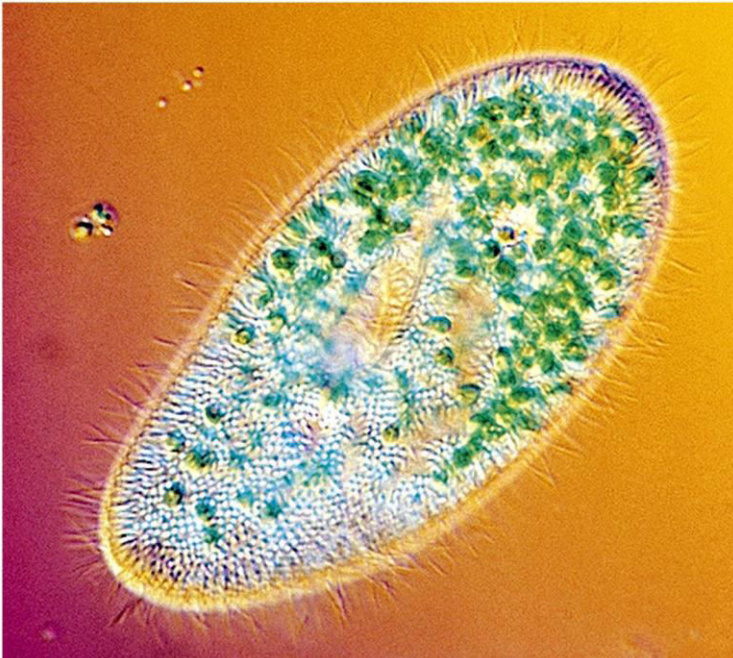
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Wildlife Institute of India

# Cell

- 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

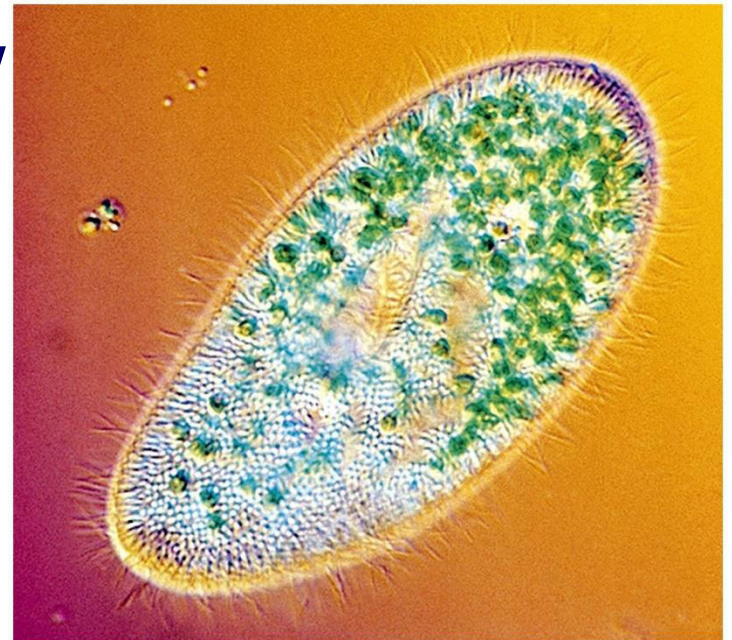


# Definition of Cell

A cell is the smallest unit that is capable of performing life functions.

# Cell theory

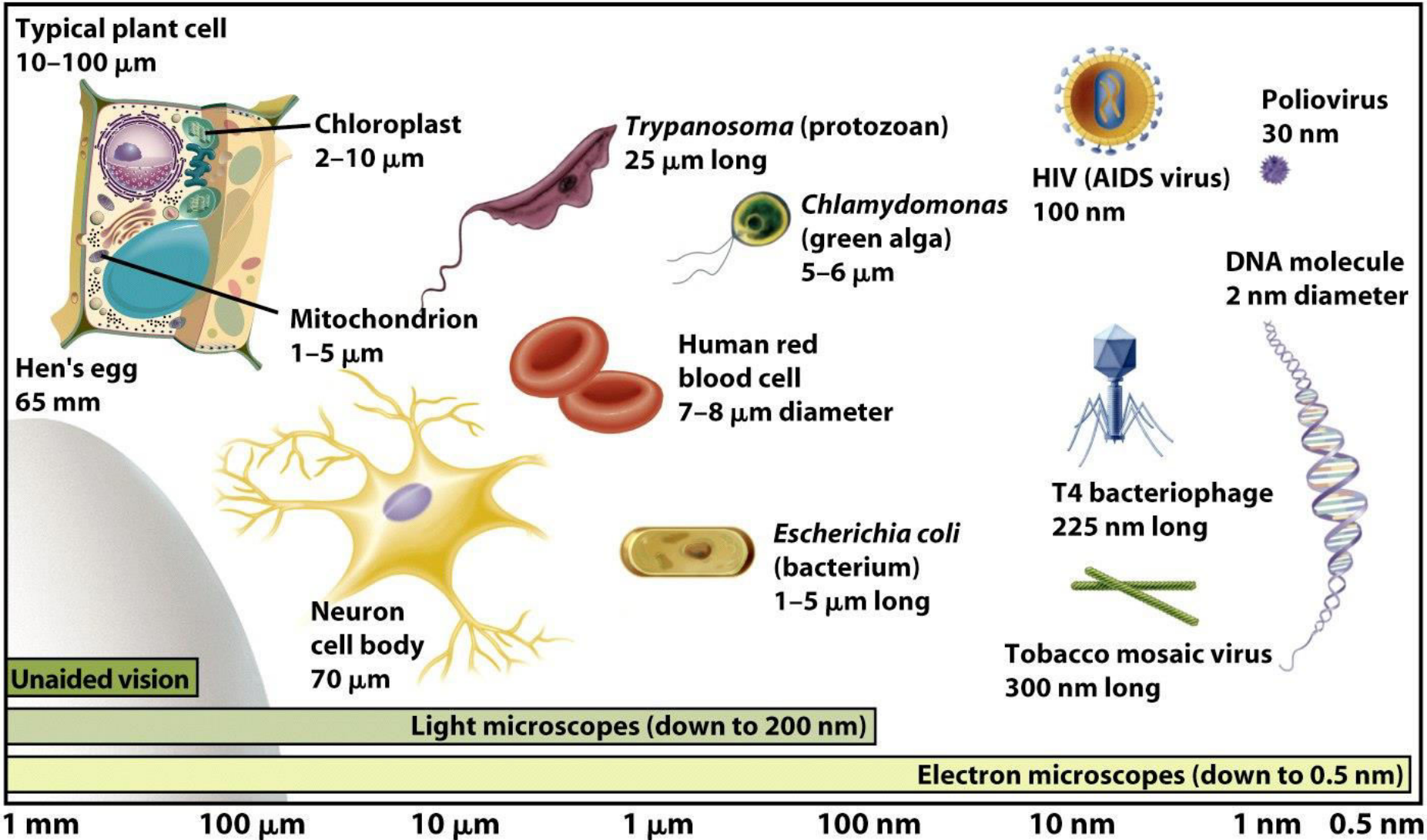
- (1839)Theodor Schwann & Matthias Schleiden  
“ all living things are made of cells”
- (50 yrs. later) Rudolf Virchow  
“all cells come from cells”



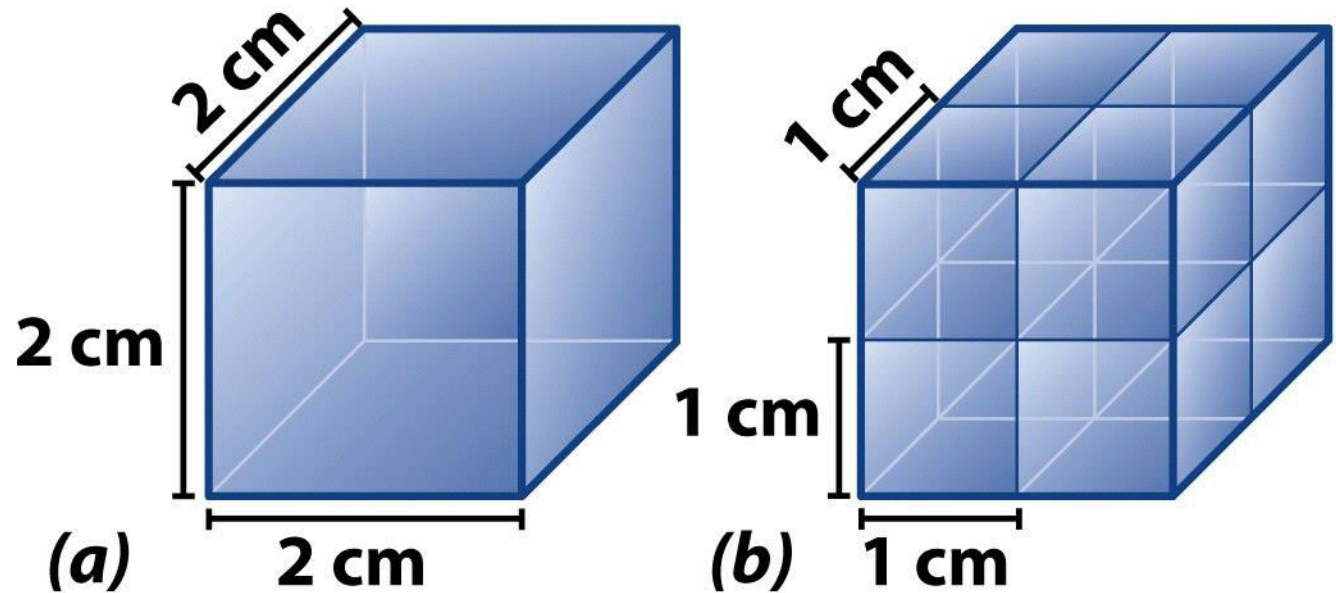
# Principles of Cell Theory

- 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 through cell division.  
(this principle discarded the idea of spontaneous generation)

# Cell Size



# Cells Have Large Surface Area-to-Volume Ratio



Number of cells	1	8
Total surface area	24 cm <sup>2</sup>	48 cm <sup>2</sup>
Total volume	8 cm <sup>3</sup>	8 cm <sup>3</sup>
Surface area/volume	<b>24/8 = 3:1</b>	<b>48/8 = 6:1</b>



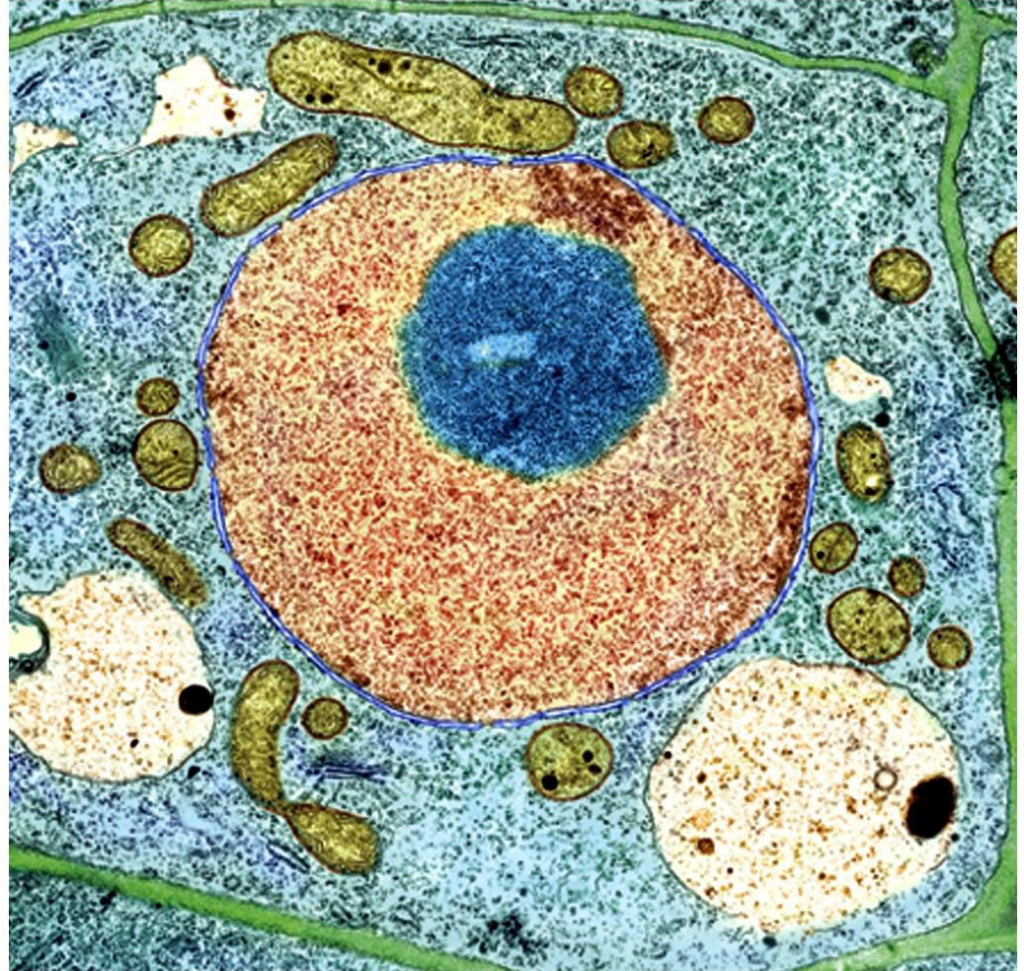
# Characteristics of All Cells

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



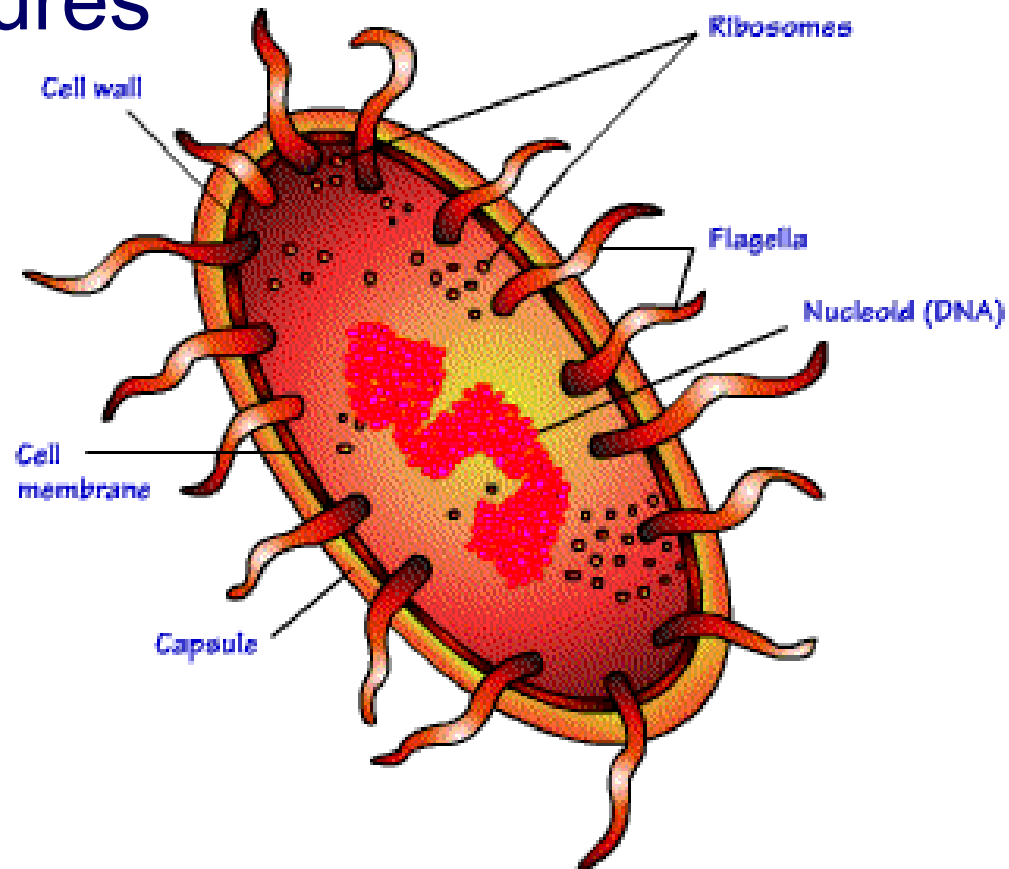
# Cell Types

- Prokaryotic
- Eukaryotic



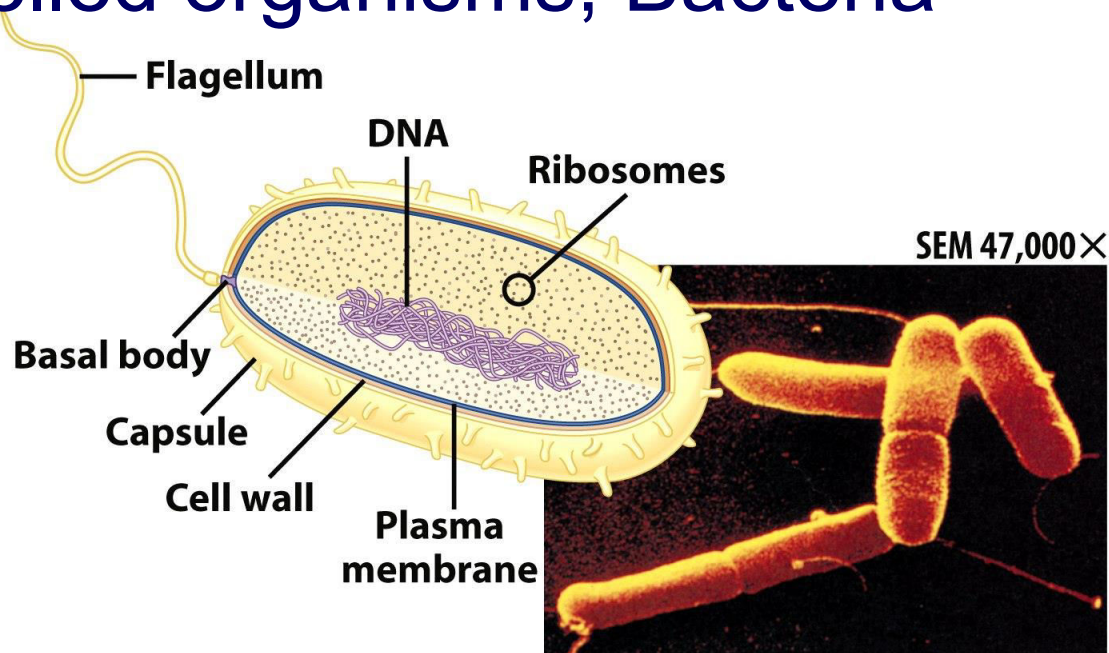
# Prokaryotic Cells

- First cell type on earth
- Cell type of one-celled organisms Bacteria
- Few internal structures



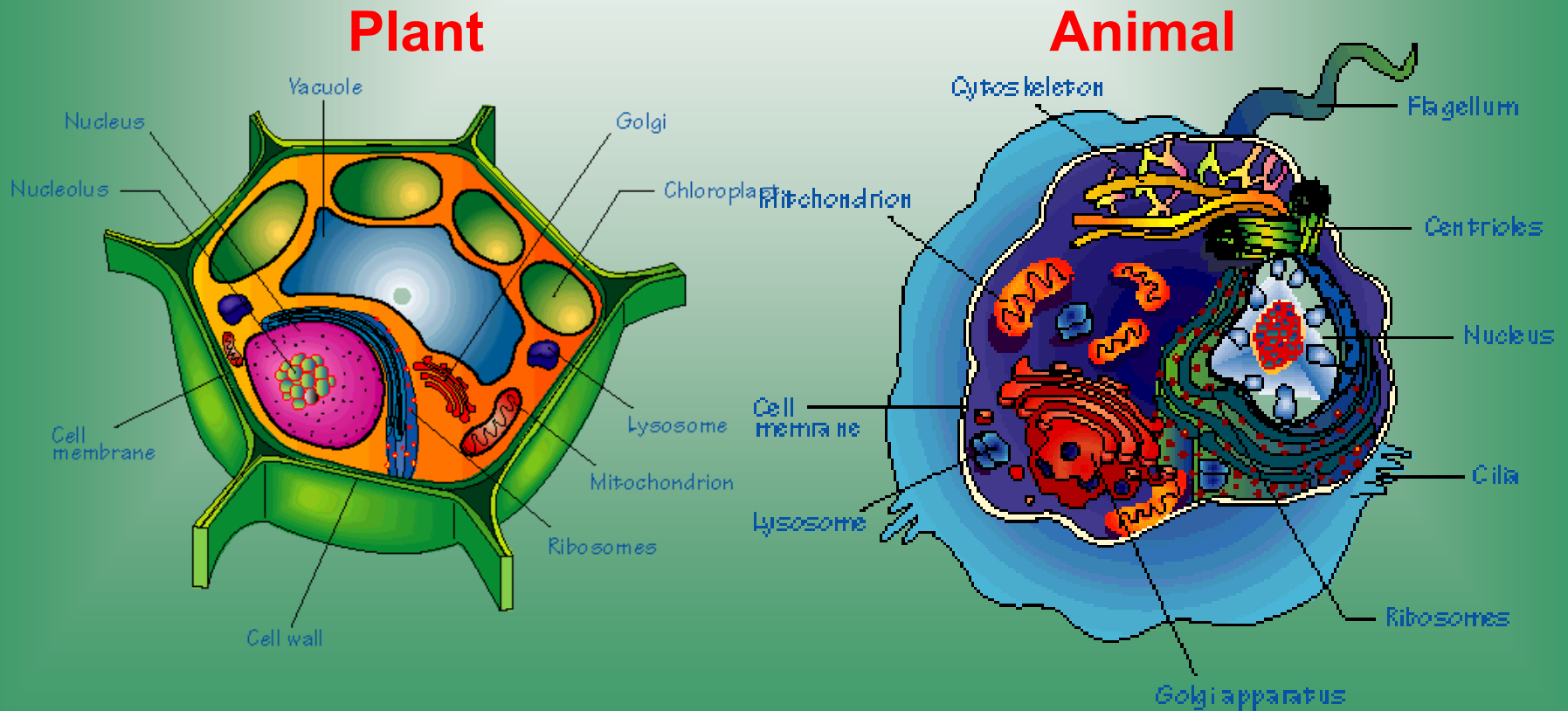
# Prokaryotic Cells

- No membrane bound nucleus or Do not have structures surrounded by membranes
- Nucleoid = region of DNA concentration
- Organelles not bound by membranes
- One-celled organisms, Bacteria



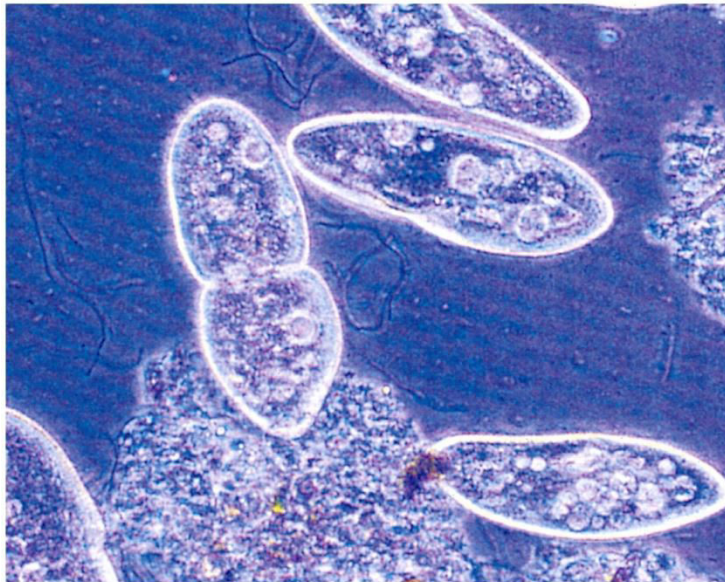
# Eukaryotic cells

- Contain organelles surrounded by membranes
- Most living organisms



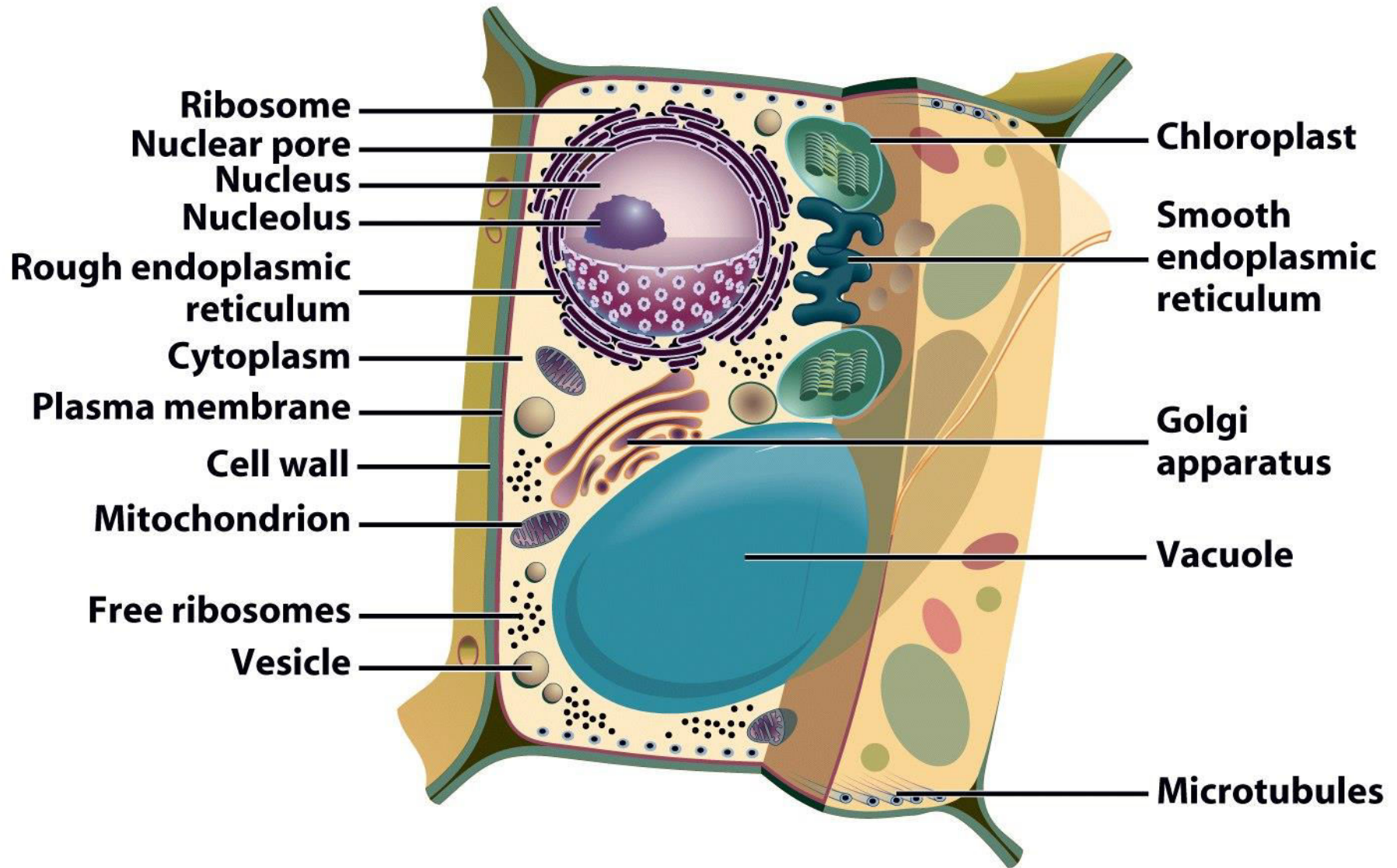
# Eukaryotic Cells

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

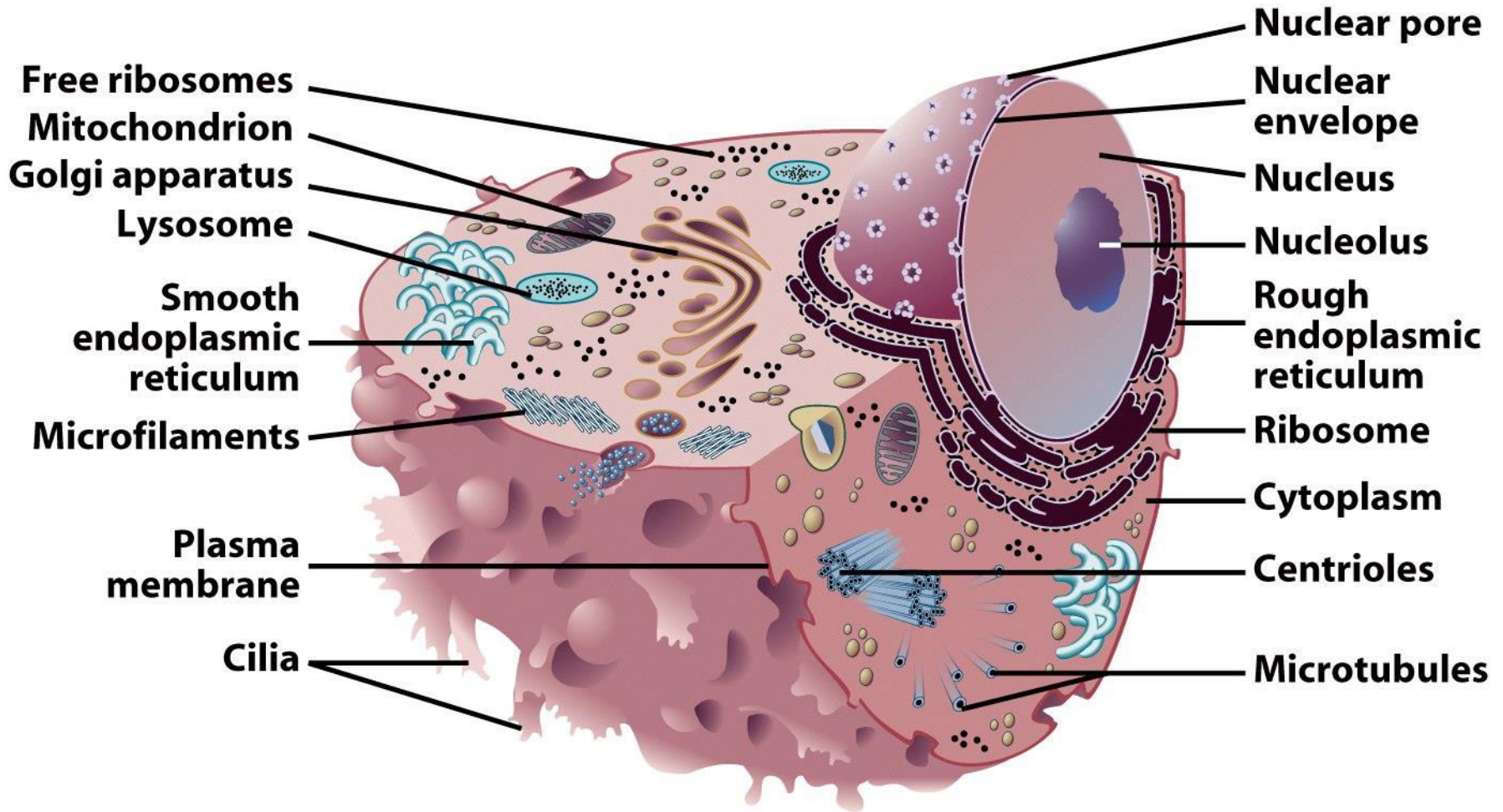


**Protozoan**

# Representative Plant Cell



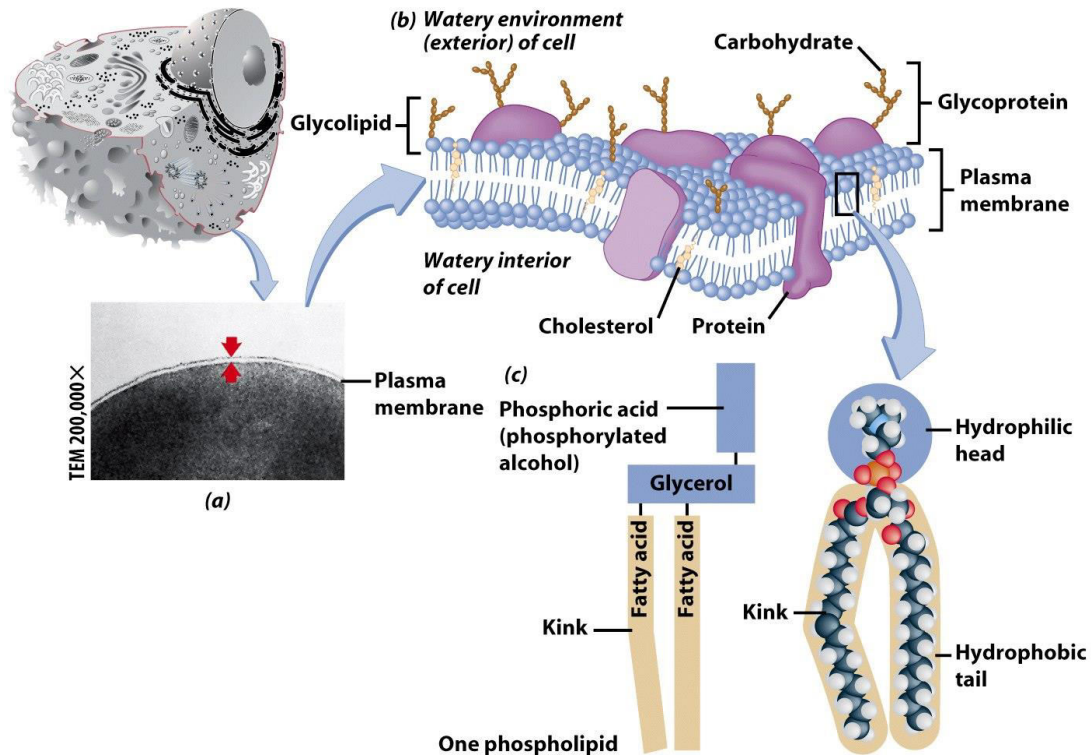
# Representative Animal Cell





# Plasma Membrane

- Contains cell contents
- Double layer of phospholipids & proteins



# Cell Walls

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



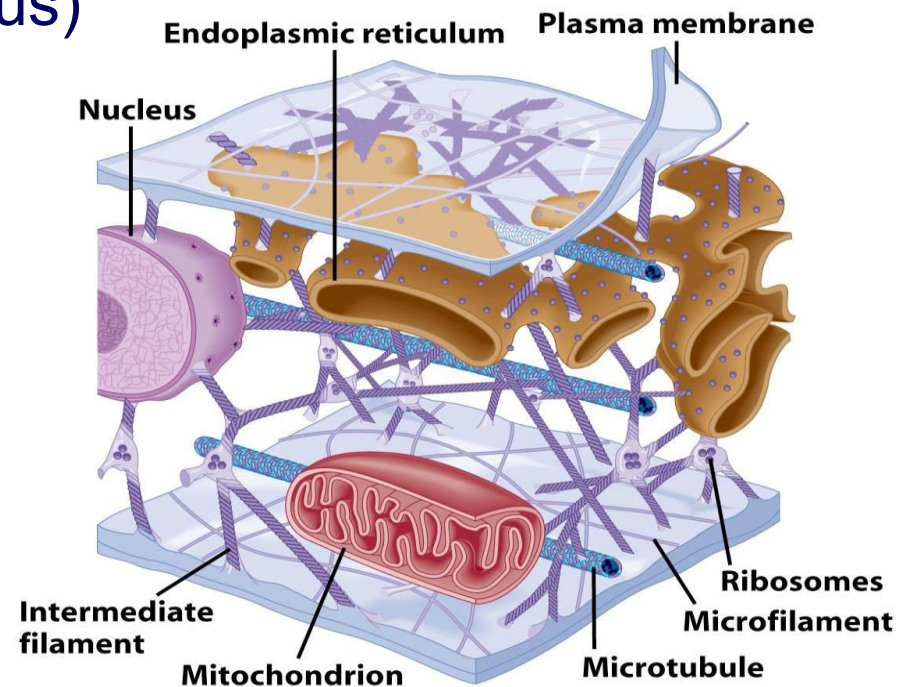
# Cell Wall Differences

- Plants – mostly cellulose
- Fungi – contain chitin



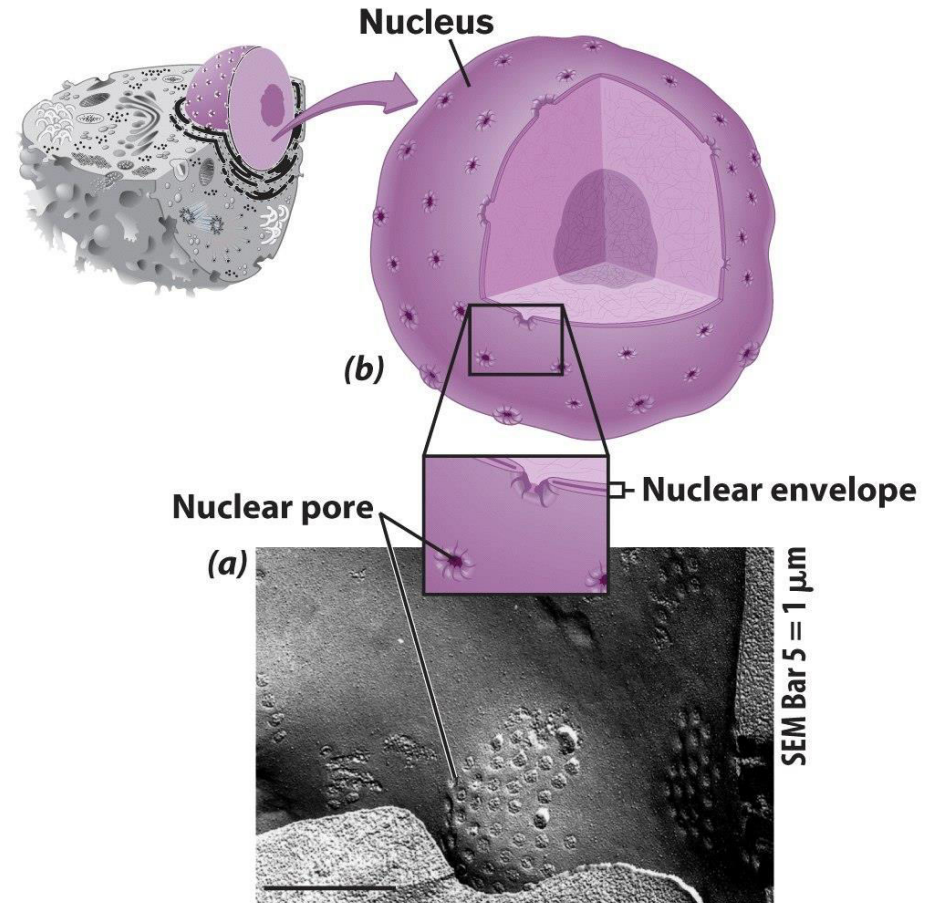
# Cytoplasm

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



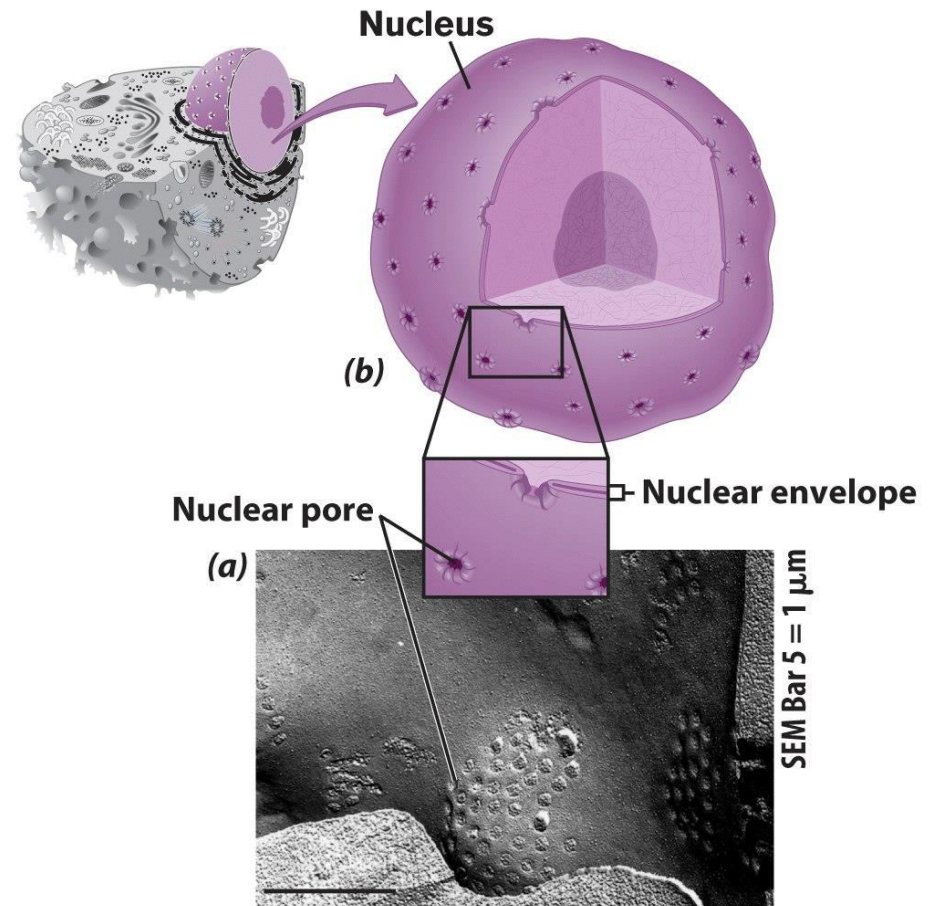
# Nucleus

- Control center of cell
- Double membrane
- Contains
  - Chromosomes
  - Nucleolus



# Nuclear Envelope

- Separates nucleus from rest of cell
- Double membrane
- Has pores



# DNA

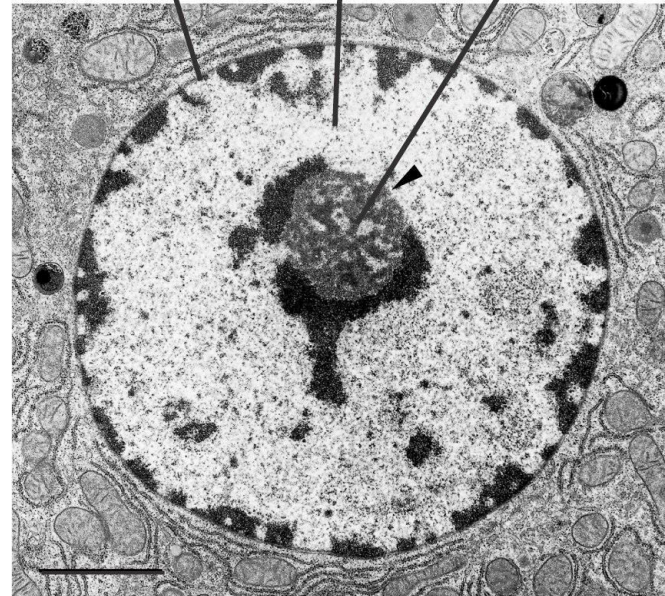
- Hereditary material
- Chromosomes
  - DNA
  - Proteins
  - Form for cell division
- Chromatin



# Nucleolus

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

Nuclear membrane Nucleus Nucleolus



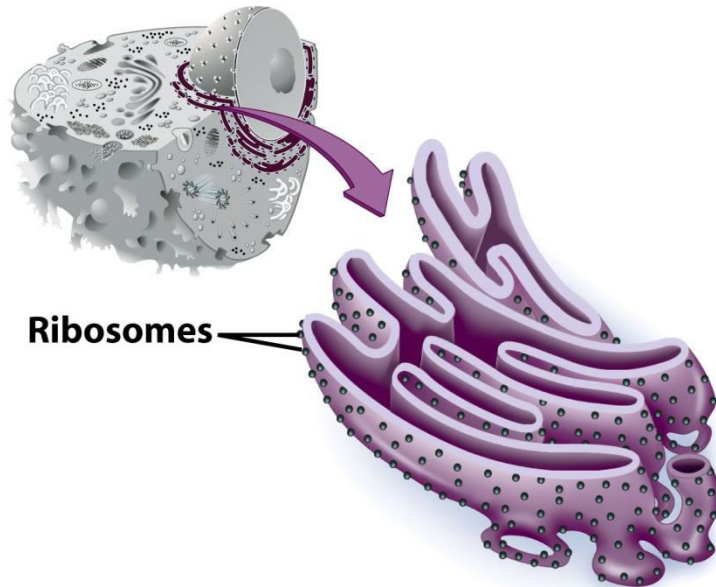


# Endoplasmic Reticulum

- Helps move substances within cells
- Network of interconnected membranes
- Two types
  - Rough endoplasmic reticulum
  - Smooth endoplasmic reticulum

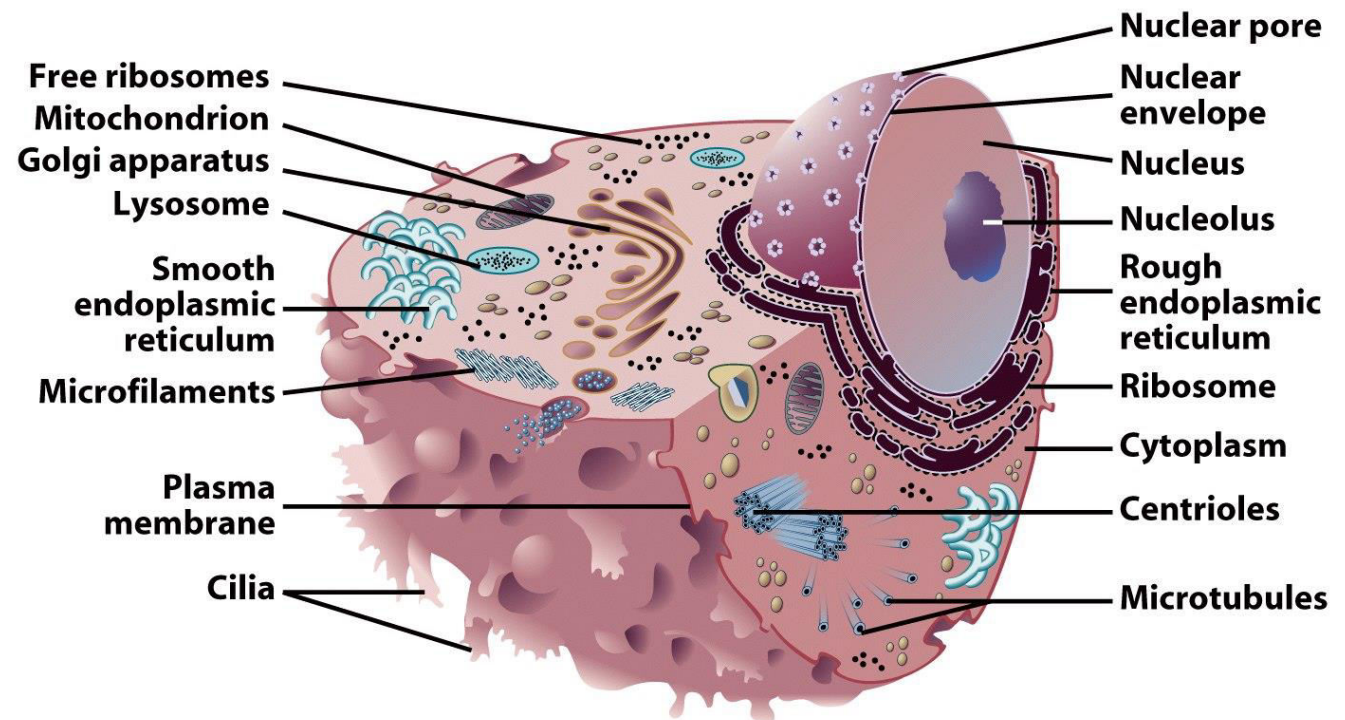
# Rough Endoplasmic Reticulum

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



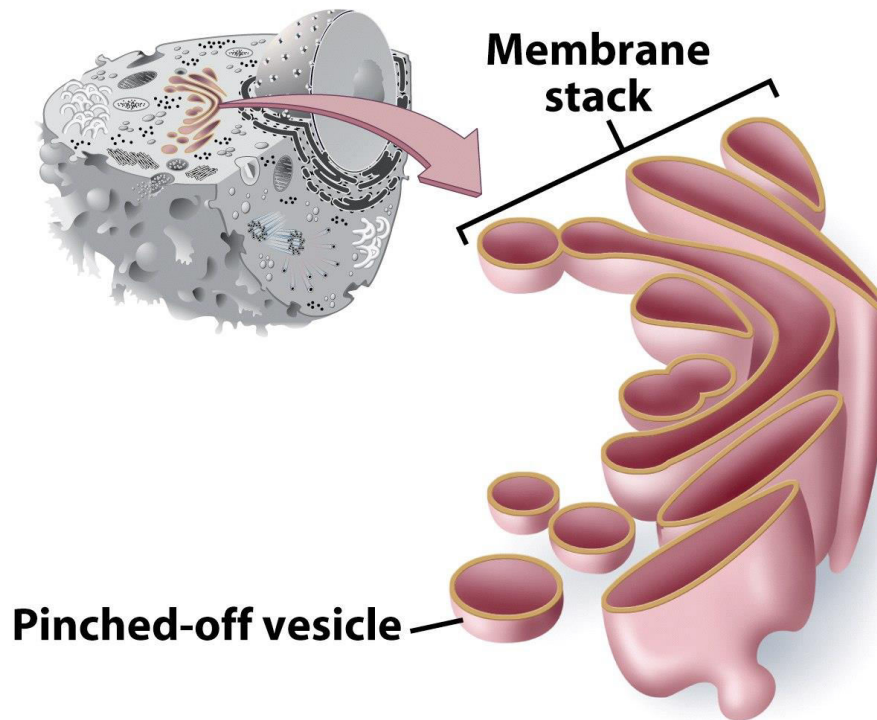
# Smooth Endoplasmic Reticulum

- No attached ribosomes
- Has enzymes that help build molecules
  - Carbohydrates
  - Lipids



# Golgi Apparatus

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

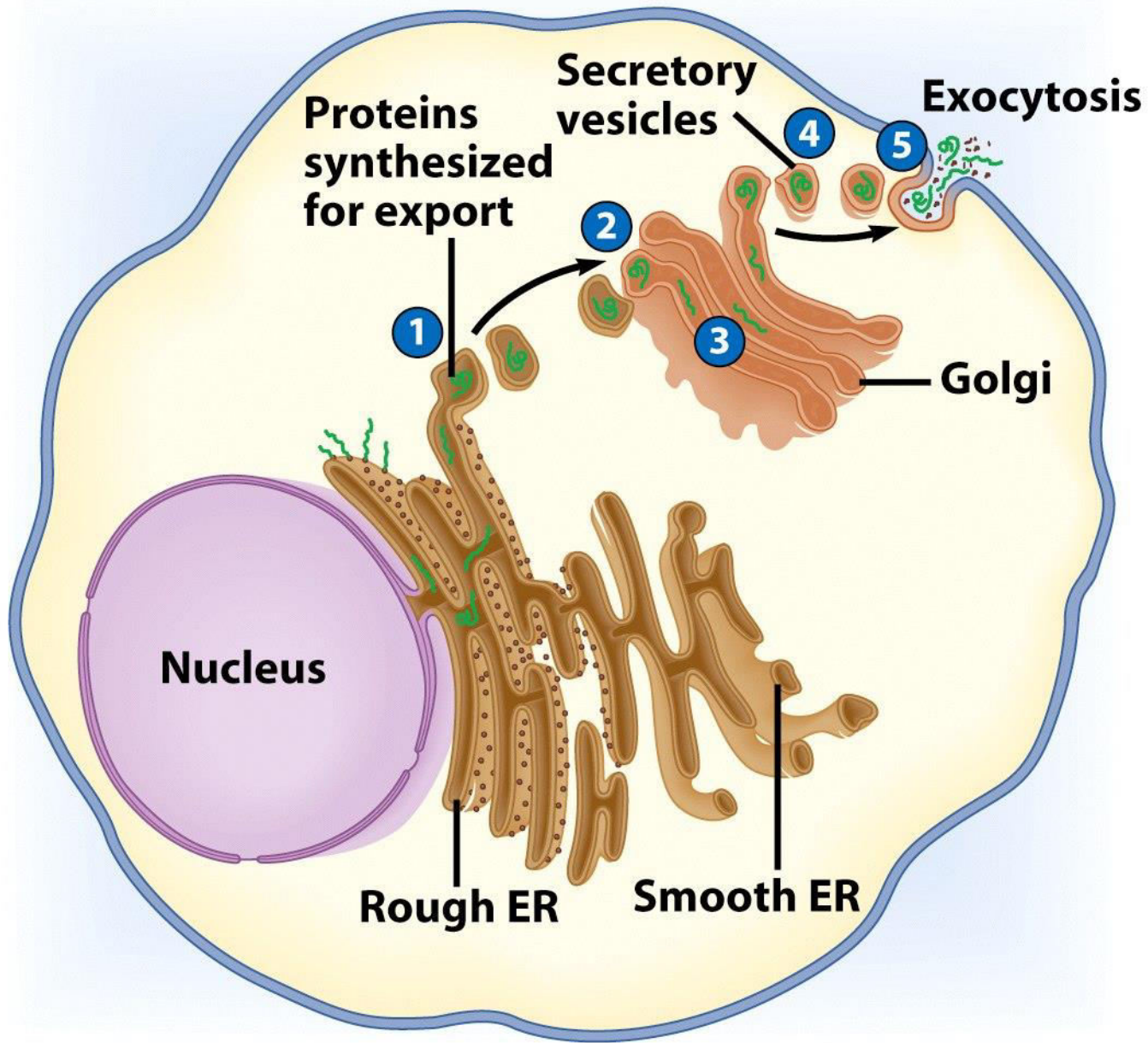


# Golgi Apparatus Function

1. Molecules come in vesicles
2. Vesicles fuse with Golgi membrane
3. Molecules may be modified by Golgi

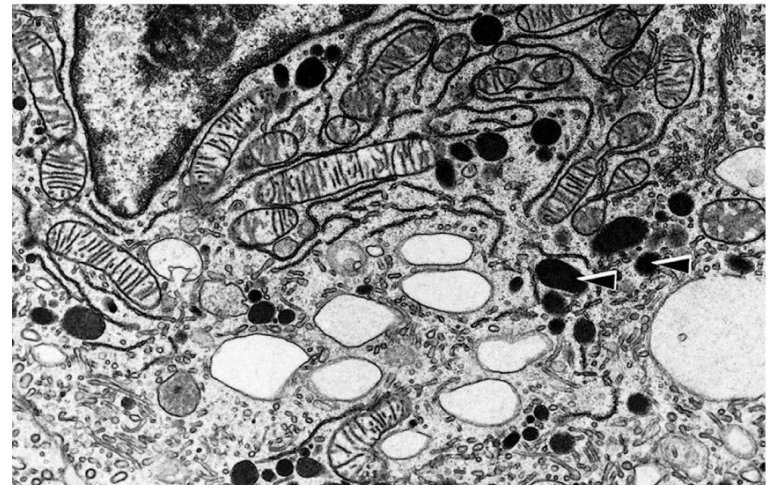
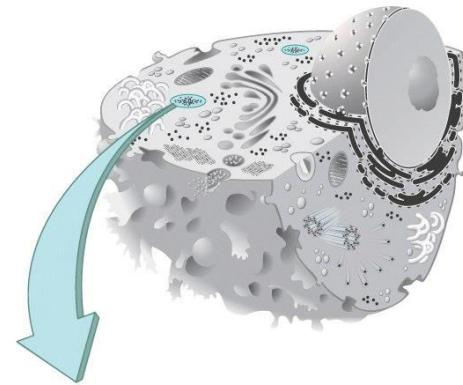
# **Golgi Apparatus Function (Continued)**

4. Molecules pinched-off in separate vesicle
5. Vesicle leaves Golgi apparatus
6. Vesicles may combine with plasma membrane to secrete contents



# Lysosomes

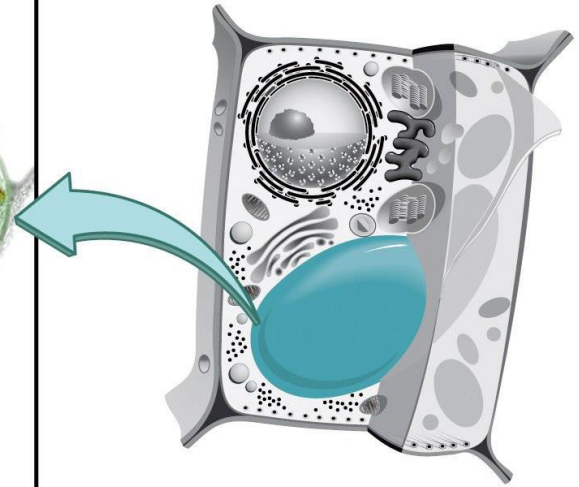
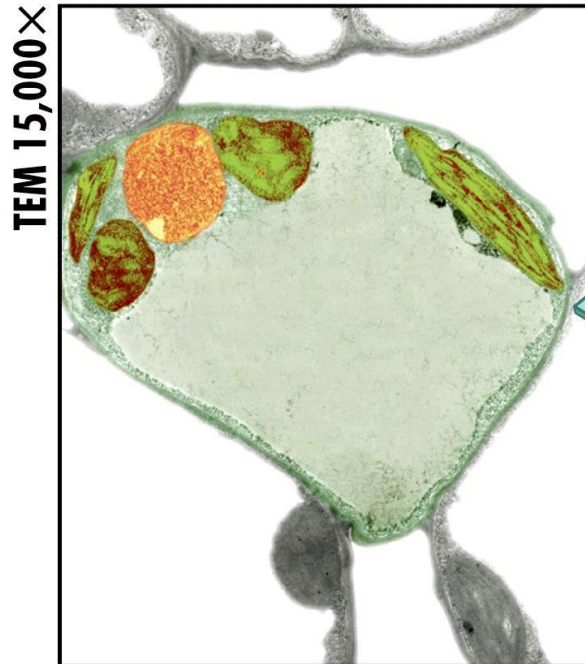
- Contain digestive enzymes
- Functions
  - Aid in cell renewal
  - Break down old cell parts
  - Digests invaders





# Vacuoles

- Membrane bound storage sacs
- More common in plants than animals
- Contents
  - Water
  - Food
  - wastes

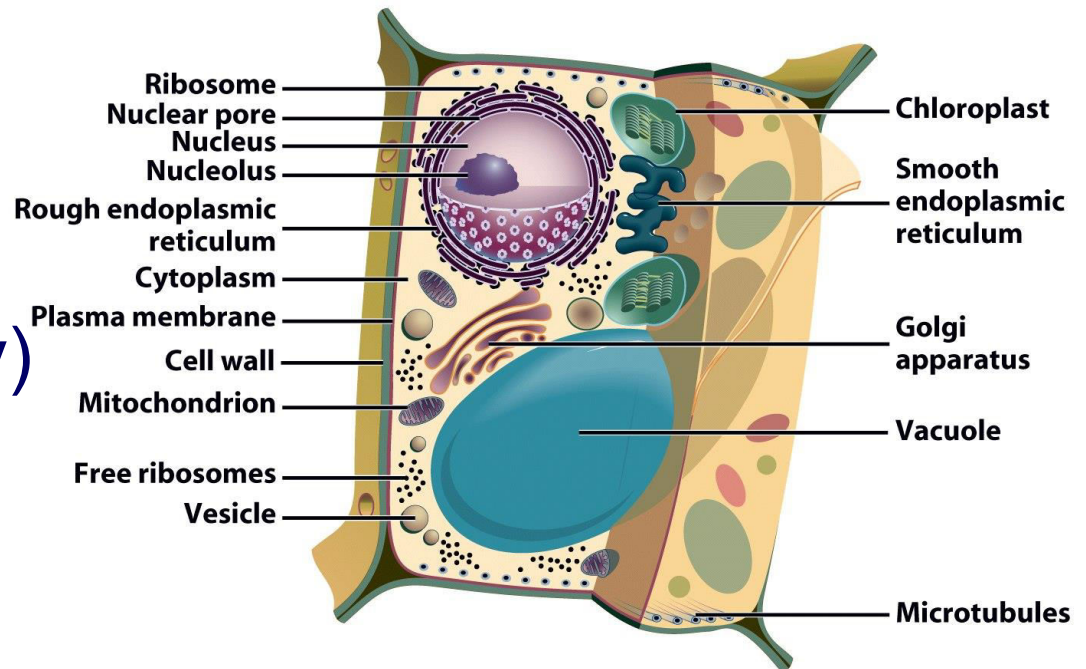


# Bacteria-Like Organelles

- Release & store energy

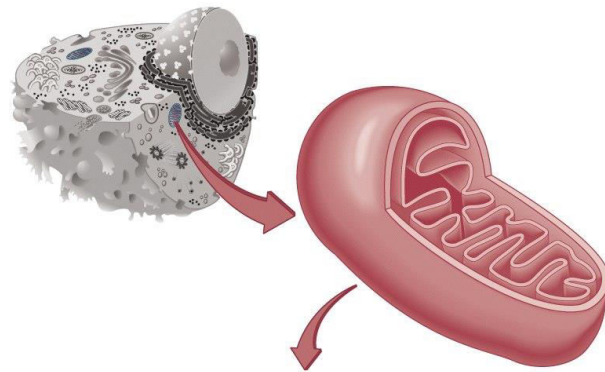
- Types

- Mitochondria  
(release energy)
- Chloroplasts  
(store energy)



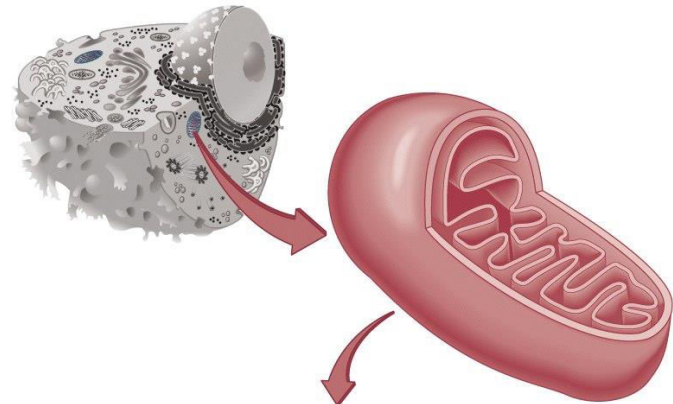
# Mitochondria

- Have their own DNA
- Bound by double membrane



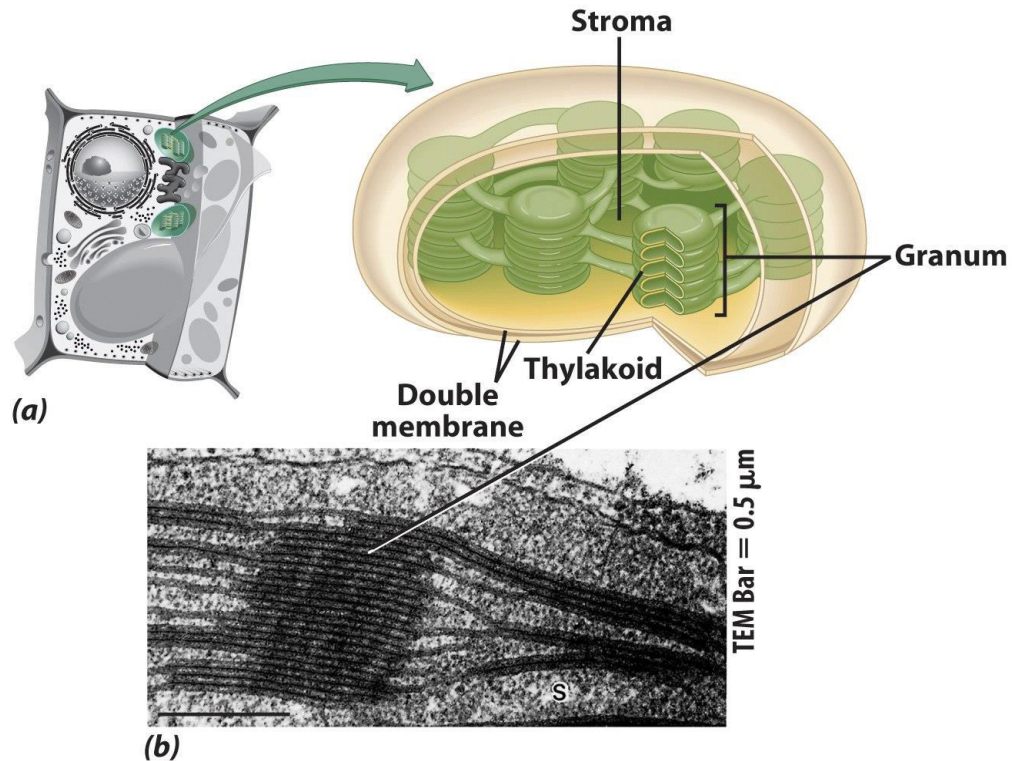
# Mitochondria

- Break down fuel molecules (cellular respiration)
  - Glucose
  - Fatty acids
- Release energy
  - ATP



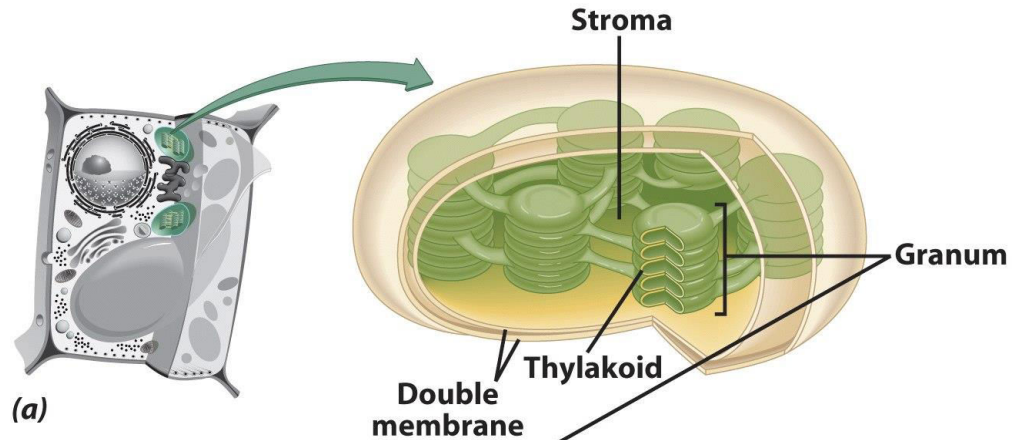
# Chloroplasts

- Derived from photosynthetic bacteria
- Solar energy capturing organelle

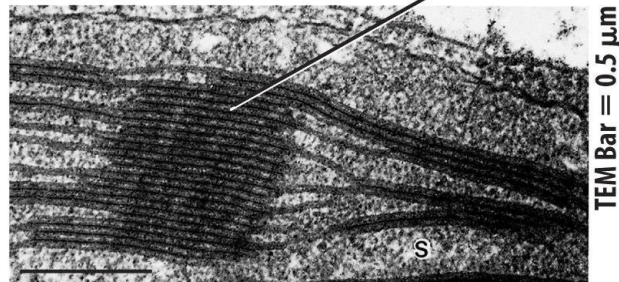


# Photosynthesis

- Takes place in the chloroplast
- Makes cellular food – glucose



(a)



(b)

# Review of Eukaryotic Cells

**TABLE 5.1**

**Eukaryotic Cell Structures and Their Functions**

<b>Structure</b>	<b>Description</b>	<b>Function</b>
<b>Exterior Structures</b>		
<b>Cell wall</b>	<b>Outer layer of cellulose or chitin, or absent</b>	<b>Protection, support</b>
<b>Plasma membrane</b>	<b>Lipid bilayer in which proteins are embedded</b>	<b>Regulation of what passes in and out of cell, cell-to-cell recognition</b>
<b>Flagella (cilia)</b>	<b>Cellular extensions with 9 + 2 arrangement of pairs of microtubules</b>	<b>Motility or moving fluids over surfaces</b>

# Review of Eukaryotic Cells

**TABLE 5.1**

**Eukaryotic Cell Structures and Their Functions**

Structure	Description	Function
<b>Interior Structures and Organelles</b>		
Endoplasmic reticulum (ER)	Network of internal membranes	Formation of compartments and vesicles; modification and transport of proteins; synthesis of carbohydrates and lipids
Ribosomes	Small, complex assemblies of protein and RNA, often bound to ER	Sites of protein synthesis
Nucleus	Spherical structure bounded by a double membrane, site of chromosomes	Control center of cell
Chromosomes	Long threads of DNA associated with protein	Sites of hereditary information
Nucleolus	Site within nucleus of rRNA synthesis	Synthesis and assembly of ribosomes
Golgi apparatus	Stacks of flattened vesicles	Packaging of proteins for export from cell
Lysosomes	Membranous sacs containing digestive enzymes found in animal cells	Digestion of various molecules
Cytoskeleton	Network of protein filaments, fibers, and tubules	Structural support, cell movement
Mitochondria	Bacteria like elements with inner membrane highly folded	“Power plant” of the cell
Chloroplasts	Bacterial like elements with inner membrane forming sacs containing chlorophyll, found in plant cells and algae	Site of photosynthesis



**TABLE 5.2****A Comparison of Bacterial, Animal, and Plant Cells**

	<b>Bacterium</b>	<b>Animal</b>	<b>Plant</b>
<b>Exterior Structures</b>			
<b>Cell wall</b>	<b>Present (protein polysaccharide)</b>	<b><i>Absent</i></b>	<b>Present (cellulose)</b>
<b>Plasma membrane</b>	<b>Present</b>	<b>Present</b>	<b>Present</b>
<b>Flagella (cilia)</b>	<b>Sometimes present</b>	<b>Sometimes present</b>	<b>Sperm of a few species possess flagella</b>
<b>Interior Structures and Organelles</b>			
<b>Endoplasmic reticulum</b>	<b><i>Absent</i></b>	<b>Usually present</b>	<b>Usually present</b>
<b>Microtubules</b>	<b><i>Absent</i></b>	<b>Present</b>	<b>Present</b>
<b>Centrioles</b>	<b><i>Absent</i></b>	<b>Present</b>	<b><i>Absent</i></b>
<b>Golgi apparatus</b>	<b><i>Absent</i></b>	<b>Present</b>	<b>Present</b>
<b>Nucleus</b>	<b><i>Absent</i></b>	<b>Present</b>	<b>Present</b>
<b>Mitochondria</b>	<b><i>Absent</i></b>	<b>Present</b>	<b>Present</b>
<b>Chloroplasts</b>	<b><i>Absent</i></b>	<b><i>Absent</i></b>	<b>Present</b>
<b>Chromosomes</b>	<b>A single circle of naked DNA</b>	<b>Multiple units, DNA associated with protein</b>	<b>Multiple units, DNA associated with protein</b>
<b>Ribosomes</b>	<b>Present</b>	<b>Present</b>	<b>Present</b>
<b>Lysosomes</b>	<b><i>Absent</i></b>	<b>Present</b>	<b>Present</b>
<b>Vacuoles</b>	<b><i>Absent</i></b>	<b><i>Absent</i> or small</b>	<b>Usually a large single vacuole in mature cell</b>

Thank  
you  
for  
not  
Sleeping 😊