

# Cells

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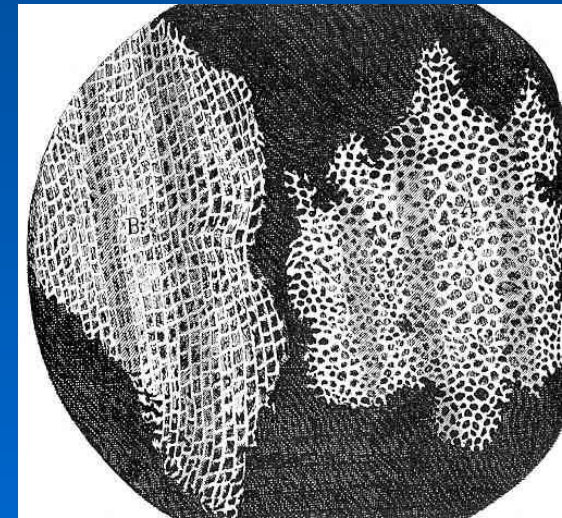
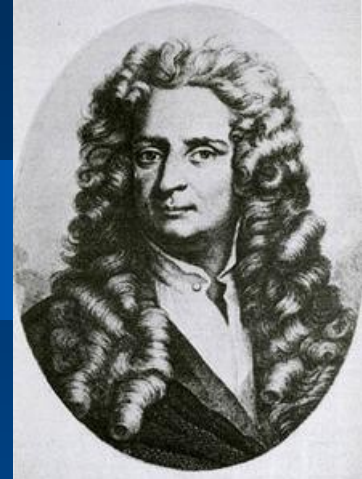
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# Introduction to the Cell

## Structure and Function

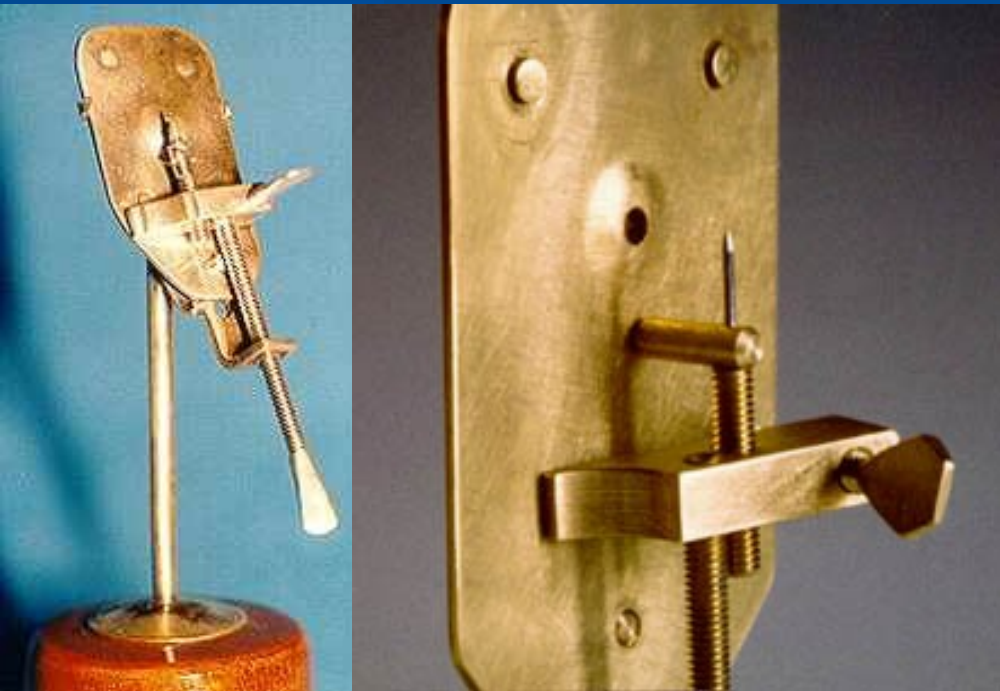
# Discovery of Cells

- The invention of the lens
- Robert Hooke (1665):  
observed a thin slice of cork  
(dead plant cells) with a  
microscope. He described  
what he observed as “little  
boxes” (cells).



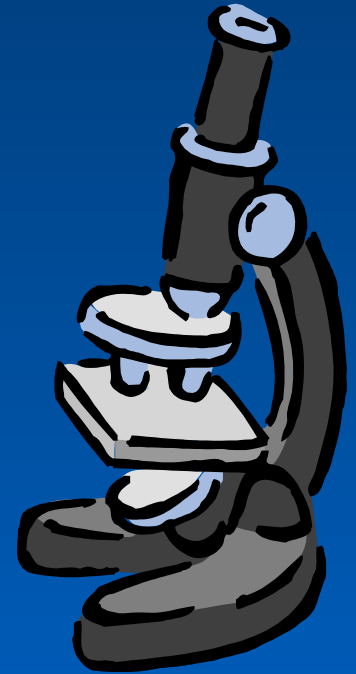
# Discovery of Cells

- **Anton van Leeuwenhoek (1675):** was the first person to observe living cells.



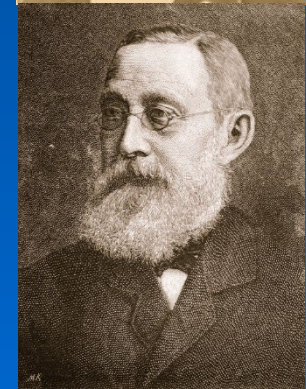
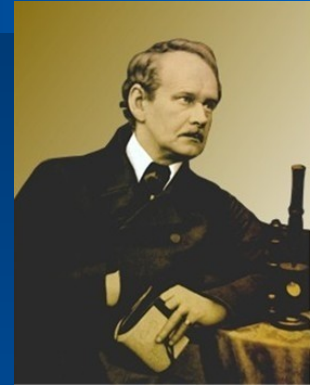
# Microscopes

- **Magnification:** refers to the microscope's power to increase an object's apparent size
- **Resolution:** refers to the microscope's power to show detail clearly



# The Cell Theory

- **Who developed the cell theory?**
  - **Matthias Schleiden (1838):**  
concluded that all plants are composed of cells
  - **Theodor Schwann (1839):**  
concluded that all animals are composed of cells
  - **Rudolph Virchow (1855):**  
determined that cells come only from other cells



# The Cell Theory

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- **What is the cell theory?**
  - 1. All living things are composed of one or more cells.**
  - 2. Cells are organisms' basic units of structure and function.**
  - 3. Cells come only from existing cells.**

# Cell Diversity

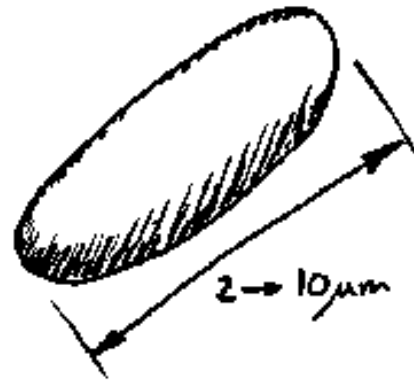
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- **Size**
- **Shape**
- **Internal Organization**



Smallest Cells:

BACTERIUM



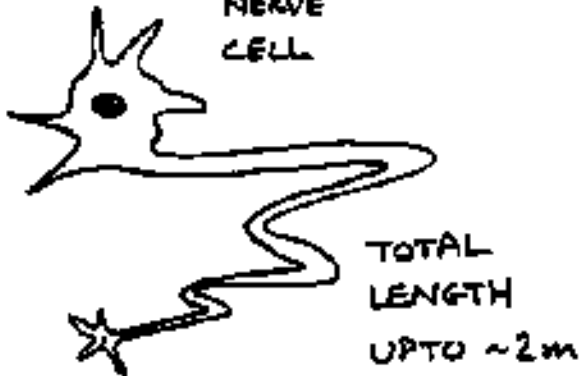
# Cell Diversity- Size

Biggest Cells:

Longest Cells:

6 inches long, 5 inches wide, 3 pounds

GIRAFFE  
NERVE  
CELL

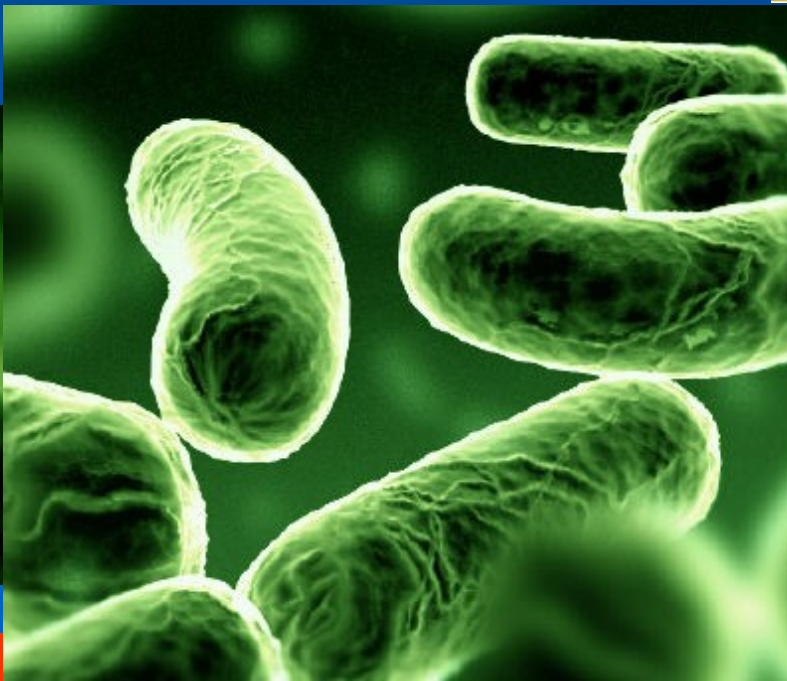
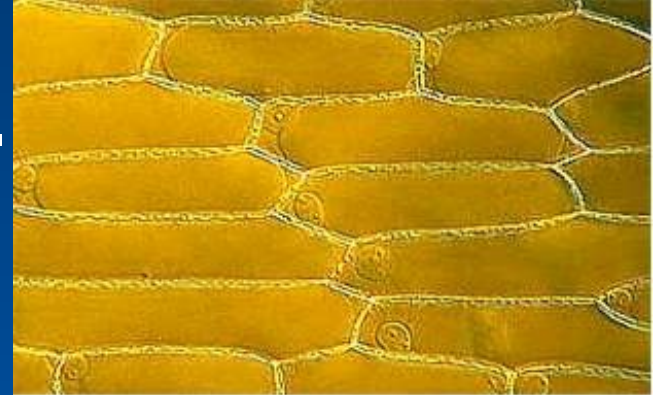


Ostrich Egg



# Cell Diversity- Shape

- Cells differ widely in shape.
- Most cells are roughly cuboidal or spherical.

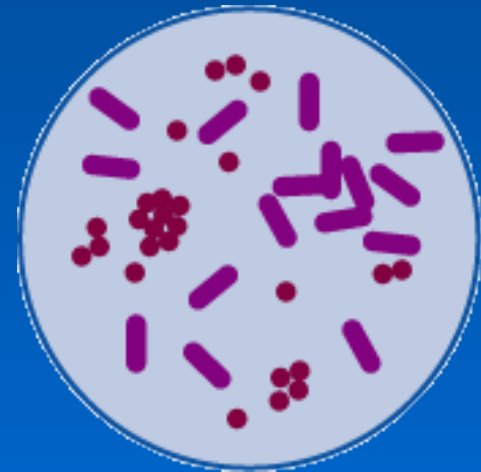
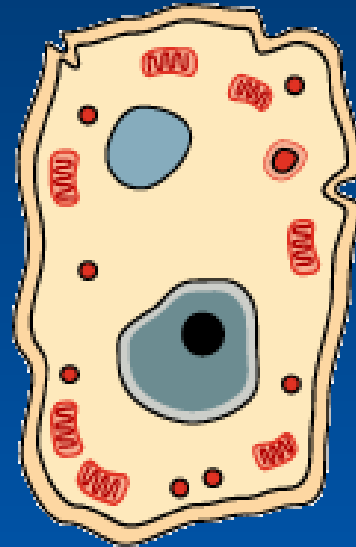


# Cell Diversity- Internal Organization

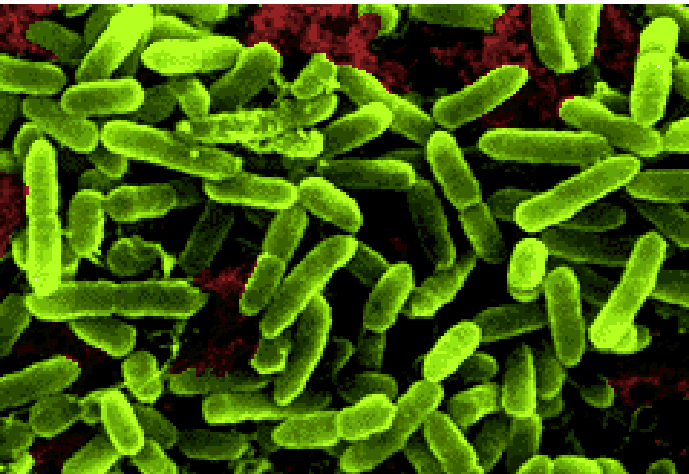
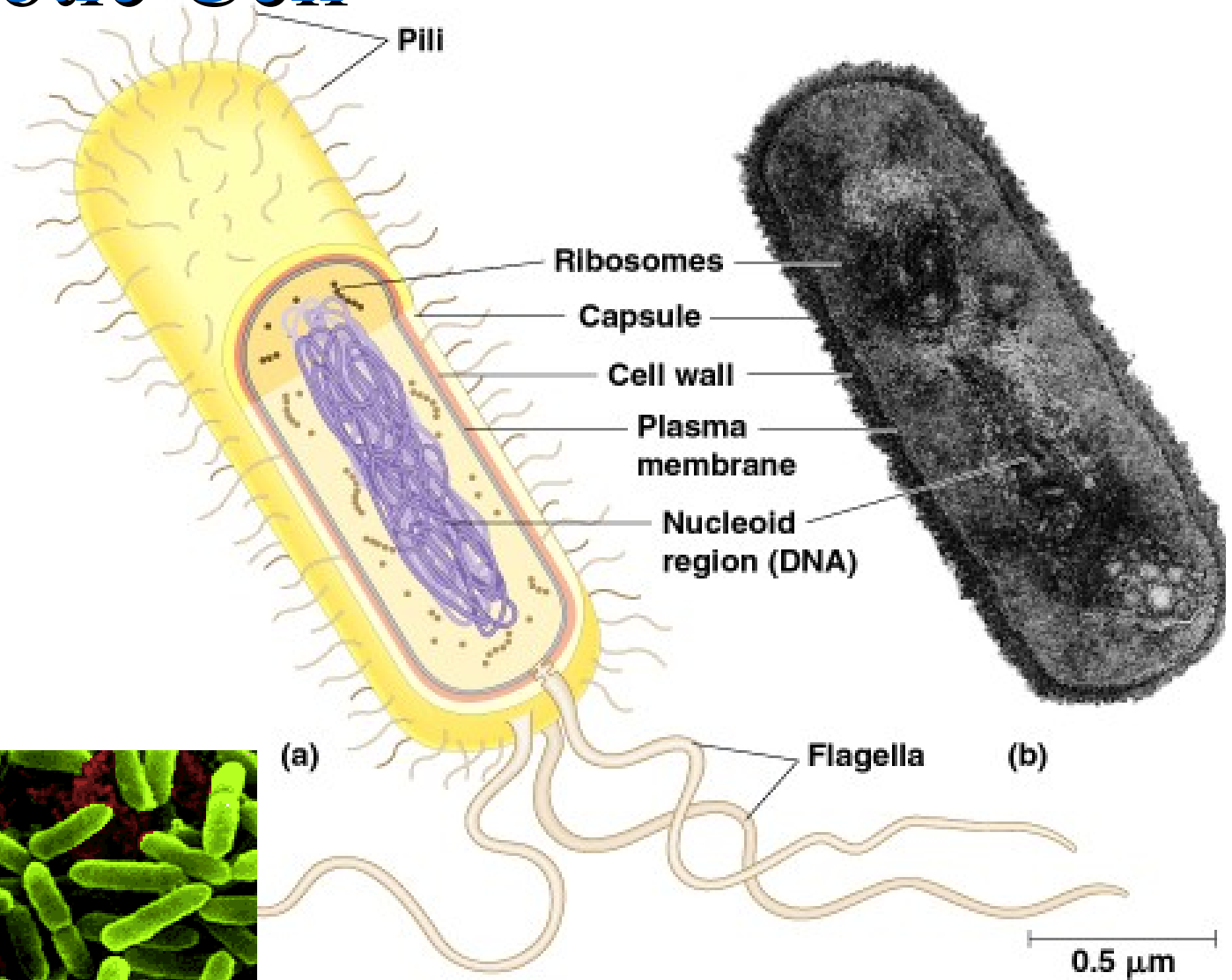
- **Nucleus:** contains DNA which directs the activity of the cell
- **Organelle:** a cell component that performs specific functions in the cell
- **Eukaryotes:** cells that contain a nucleus and membrane-bound organelles
- **Prokaryotes:** cells that lack nuclei and membrane-bound organelles

# Eukaryotes vs. Prokaryotes

- Eukaryotes (animals, plants, fungi, protists) and prokaryotes (bacteria) differ greatly in structure.



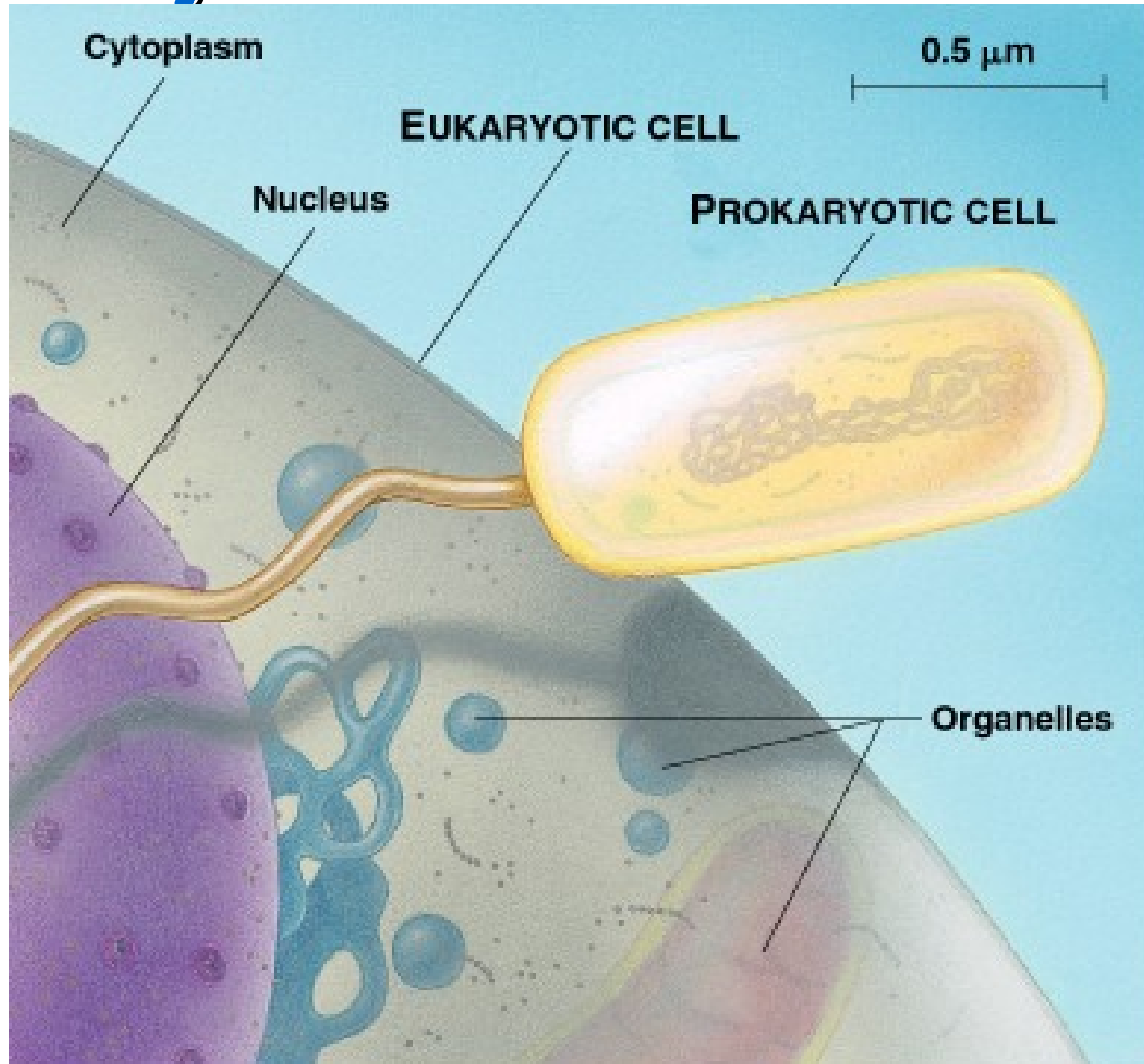
# Prokaryotic Cell



	<b>Prokaryotes</b>	<b>Eukaryotes</b>
nucleus?	NO (nucleoid)	YES
membrane-bound organelles?	NO	YES (Many)
size	1 - 10 $\mu\text{m}$	10 - 50 $\mu\text{m}$
when evolved?	3.5 billion years ago	1.5 billion years ago
cytoplasm?	YES	YES
cell membrane?	YES	YES
cell wall?	Some Do	Plants
ribosomes?	YES	YES
DNA?	Circular Free Floating	Chromosomes in Nucleus
examples	Bacteria	Plants, Animals, Fungi, and Protists

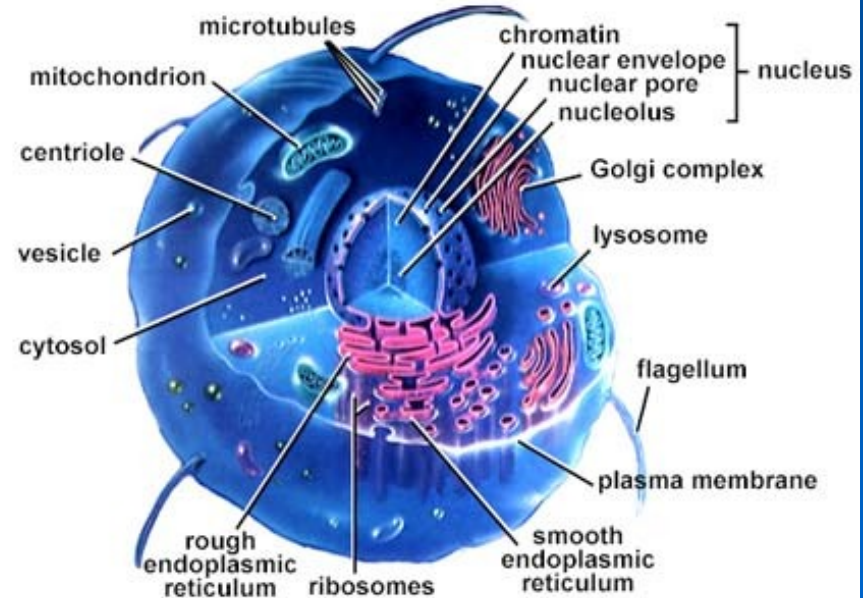


# Structural Organization of Eukaryotic and Prokaryotic Cells



# The Parts of the Cell

- Each living cell carries out the tasks of taking food, transforming food into energy, getting rid of wastes, and reproducing.
- Most eukaryotic cells have three main components:
  - Cell Membrane
  - Cytoskeleton
  - Nucleus





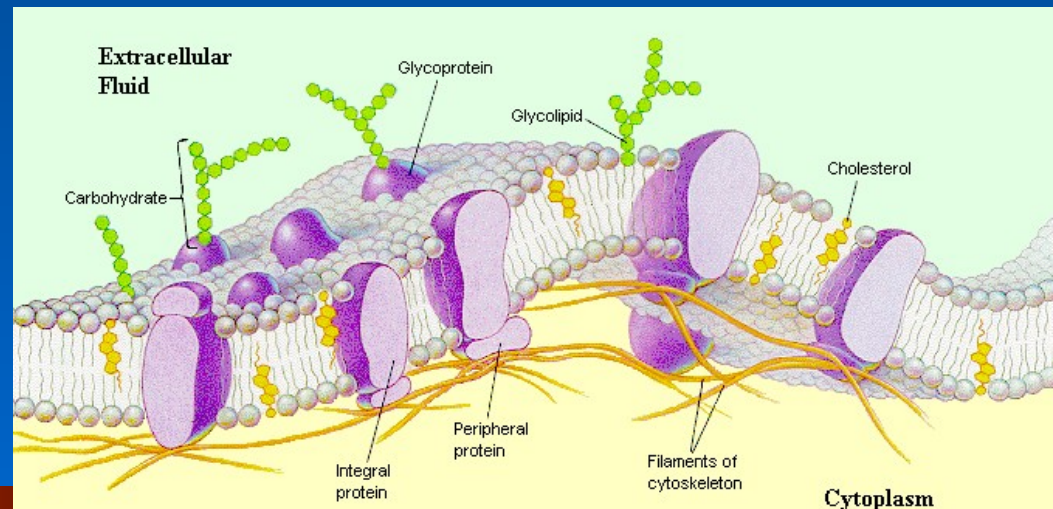
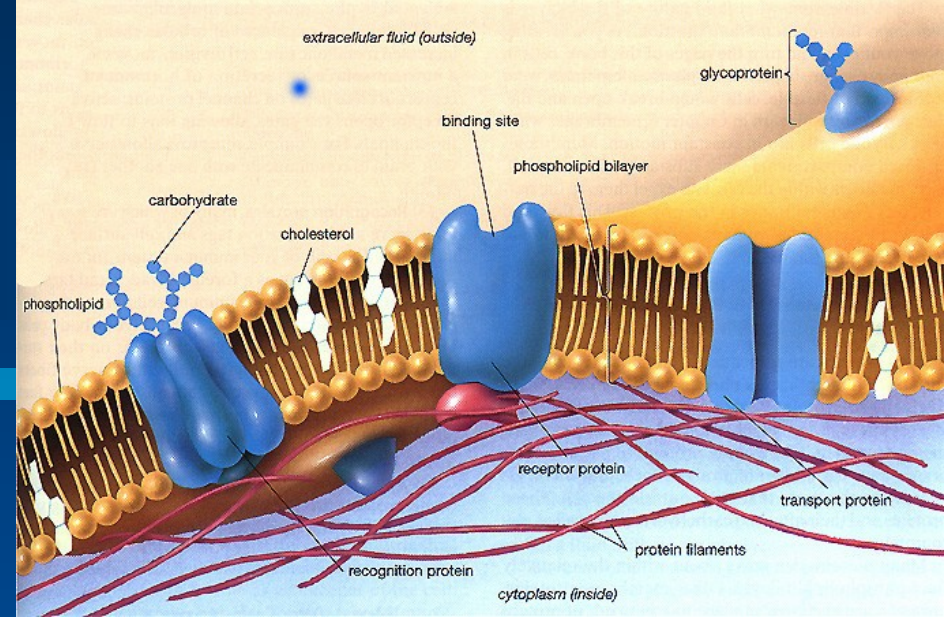
# Structure and Function of Organelles

- **The Structure and Function of the following organelles will be discussed:**

- Cell Membrane
- Nucleus
- Cell Wall
- Cytoplasm
- Cytoskeleton
- Ribosomes
- Endoplasmic Reticulum
- Golgi Apparatus
- Mitochondria
- Lysosomes
- Peroxisomes
- Cilia and Flagella
- Basal Bodies
- Centrioles
- Vacuoles
- Plastids

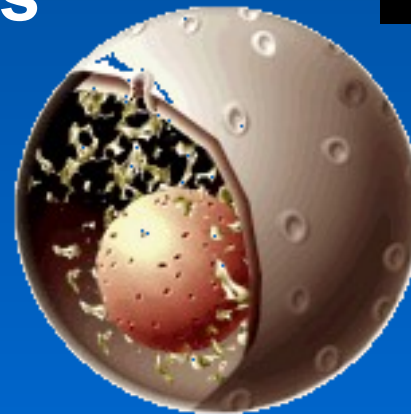
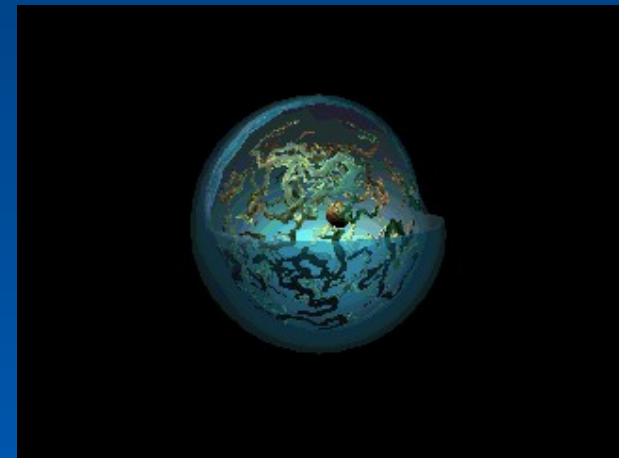
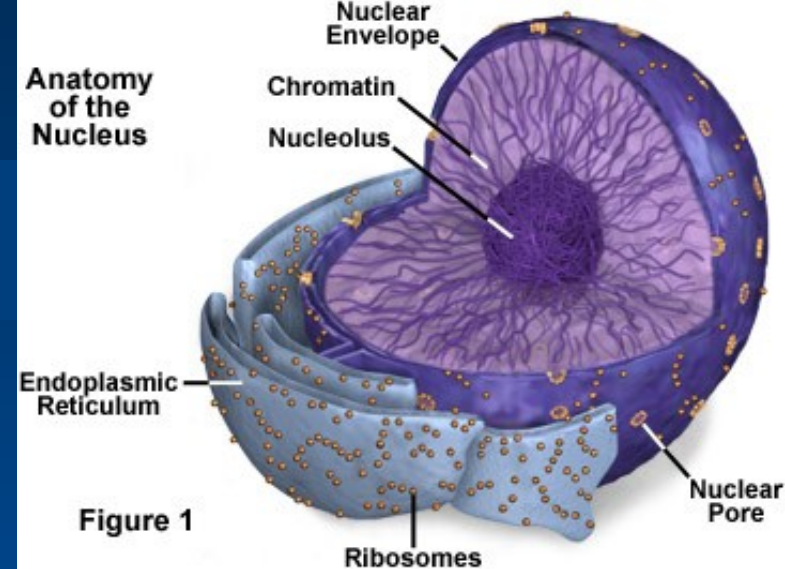
# Cell Membrane

- **Structure:** phospholipid bilayer with proteins that function as channels, markers, and receptors -also contains cholesterol which provides rigidity
- **Function:** selectively permeable boundary between the cell and the external environment



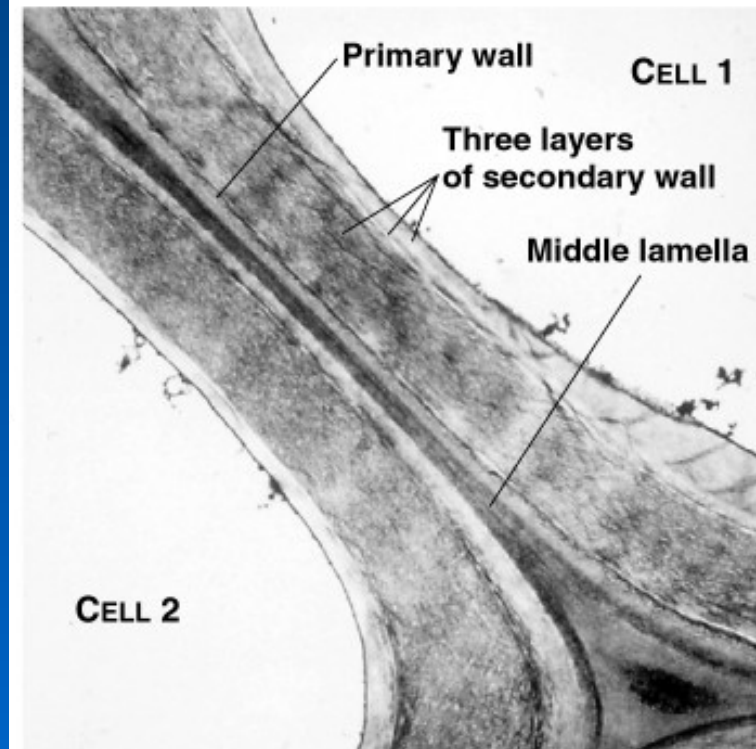
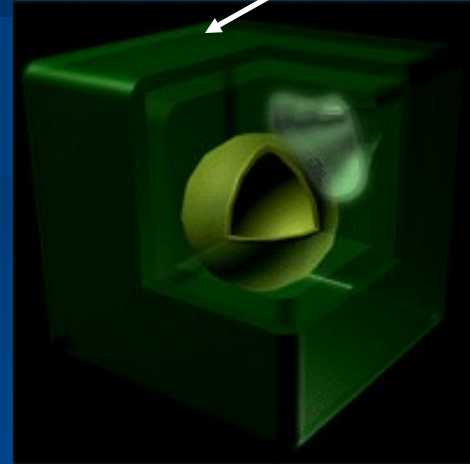
# Nucleus

- **Structure:** the nucleus is a sphere that contains another sphere called a nucleolus
- **Function:** -storage center of cell's DNA  
-manages cell functions



# Cell Wall

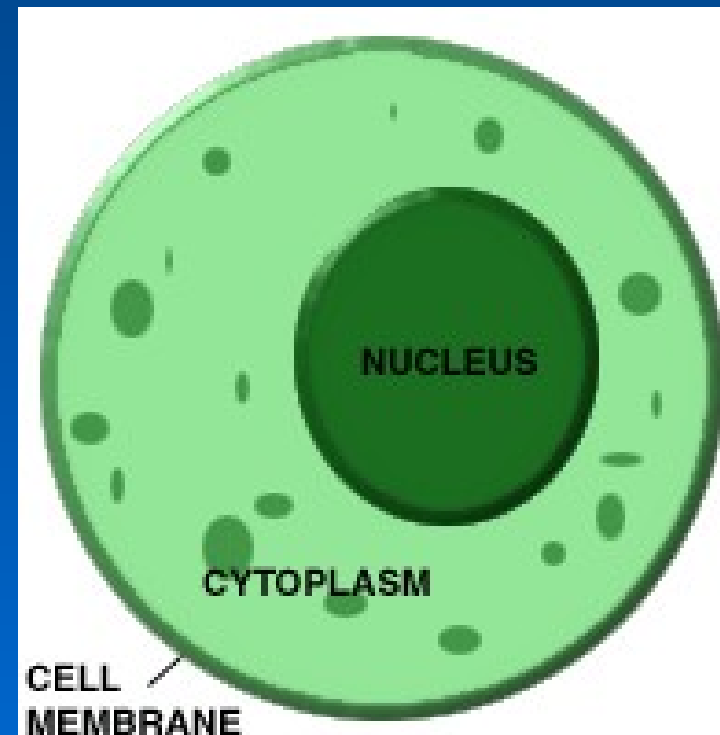
- **Structure:** rigid wall made up of cellulose, proteins, and carbohydrates
- **Function:** boundary around the plant cell outside of the cell membrane that provides structure and support



1 μm

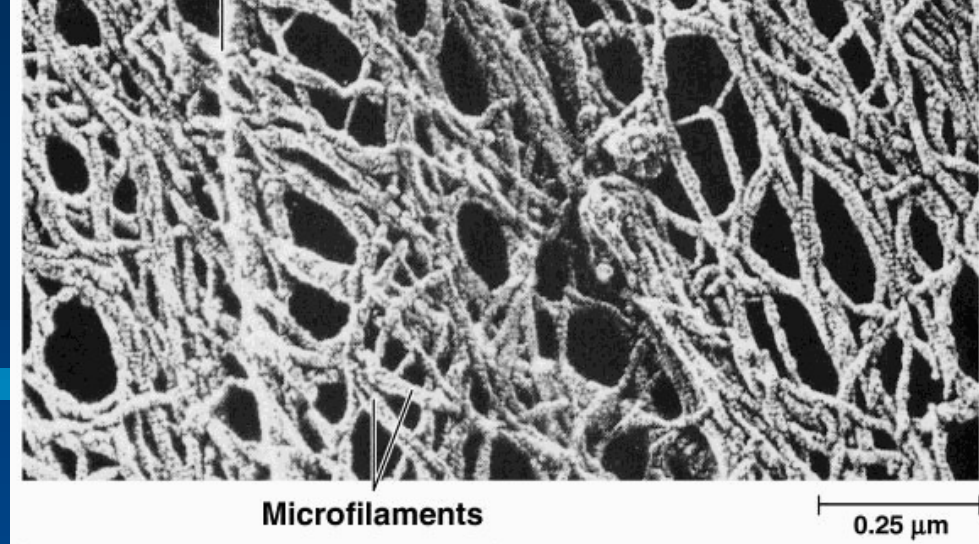
# Cytoplasm

- **Structure:** gelatin-like fluid that lies inside the cell membrane
- **Function:** -contains salts, minerals and organic molecules  
-surrounds the organelles

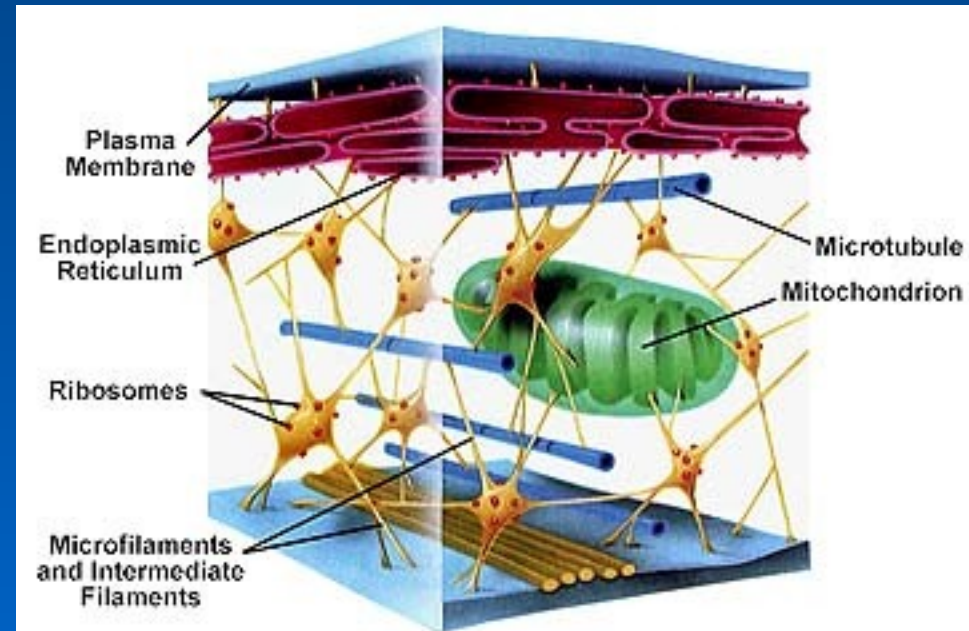




# Cytoskeleton

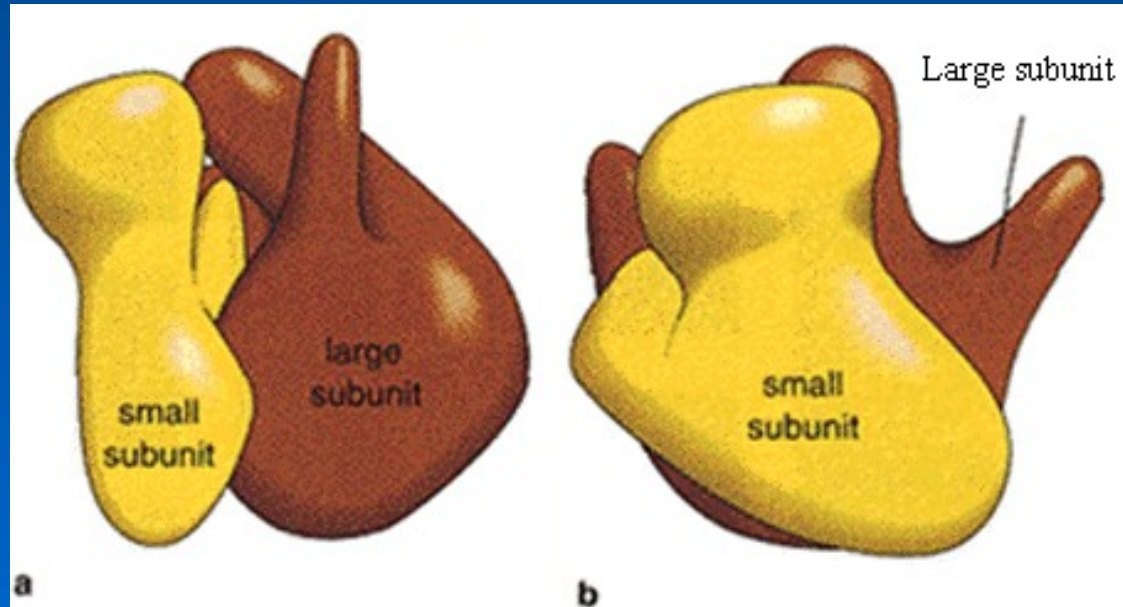
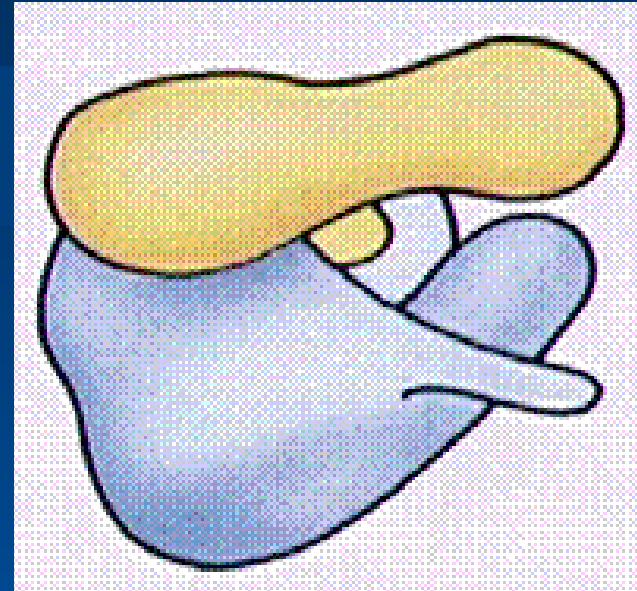


- **Structure:** a network of thin, fibrous elements made up of microtubules (hollow tubes) and microfilaments (threads made out of actin)
- **Function:** -acts as a support system for organelles  
-maintains cell shape



# Ribosomes

- Structure: consist of two subunits made of protein and RNA
- Function: location of protein synthesis



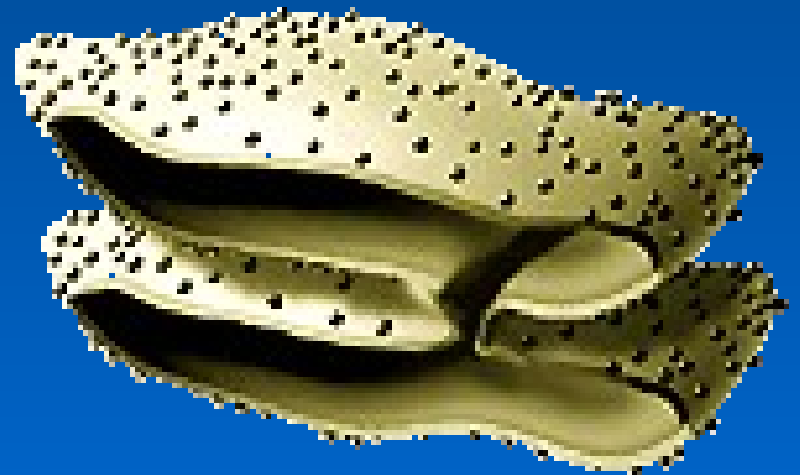
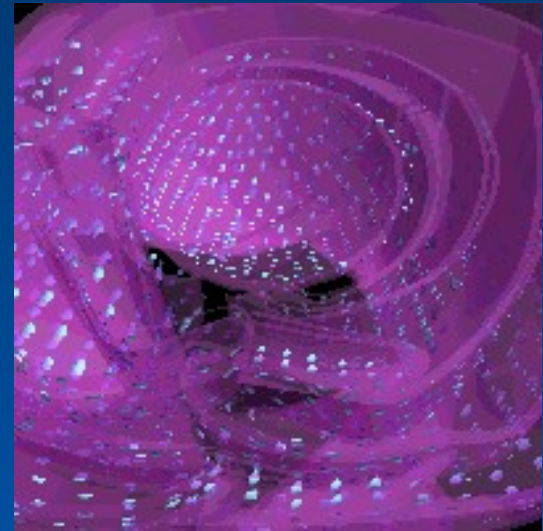
# Endoplasmic Reticulum

- **Structure: a system of membranous tubules and sacs**
- **Function: intercellular highway (a path along which molecules move from one part of the cell to another)**
- **Two types:**
  - **Rough Endoplasmic Reticulum**
  - **Smooth Endoplasmic Reticulum**



# Rough Endoplasmic Reticulum

- **Rough Endoplasmic Reticulum (rER):**  
prominent in cells that make large amounts of proteins to be exported from the cell or inserted into the cell membrane
  - Covered with ribosomes



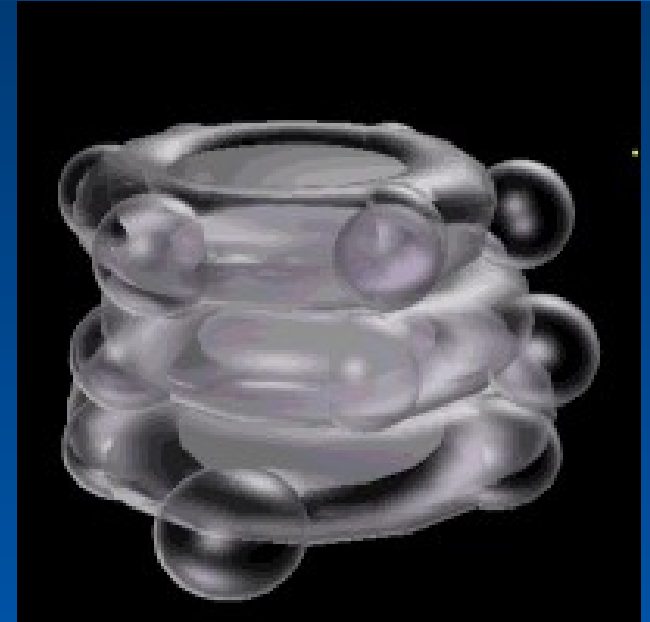
# Smooth Endoplasmic Reticulum

- **Smooth Endoplasmic Reticulum (sER):** involved in the synthesis of lipids and breakdown of toxic substances
  - Not covered with ribosomes



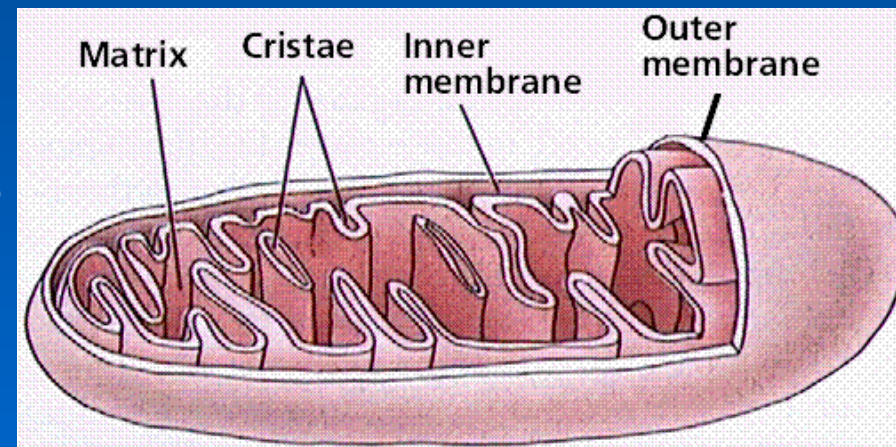
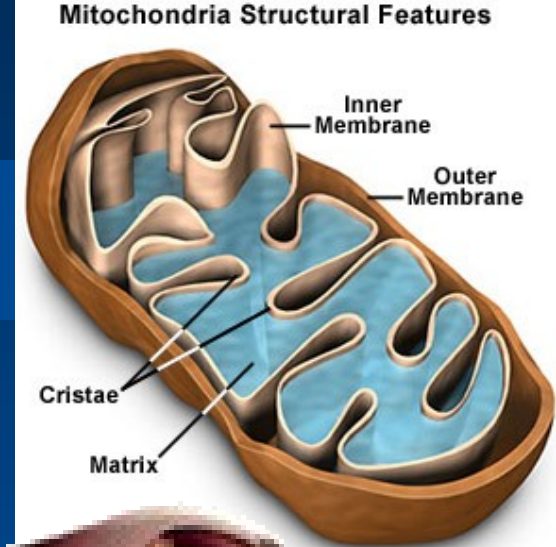
# Golgi Apparatus

- **Structure: stacked flat sacs**
- **Function: receives proteins from the rER and distributes them to other organelles or out of the cell**  
(receiving, processing, packaging, and shipping)



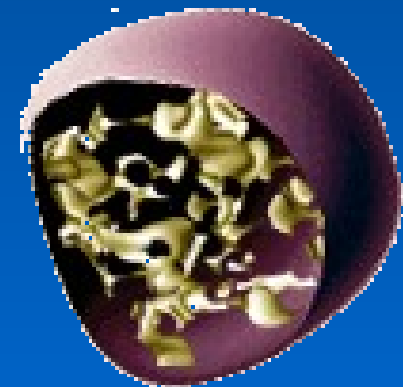
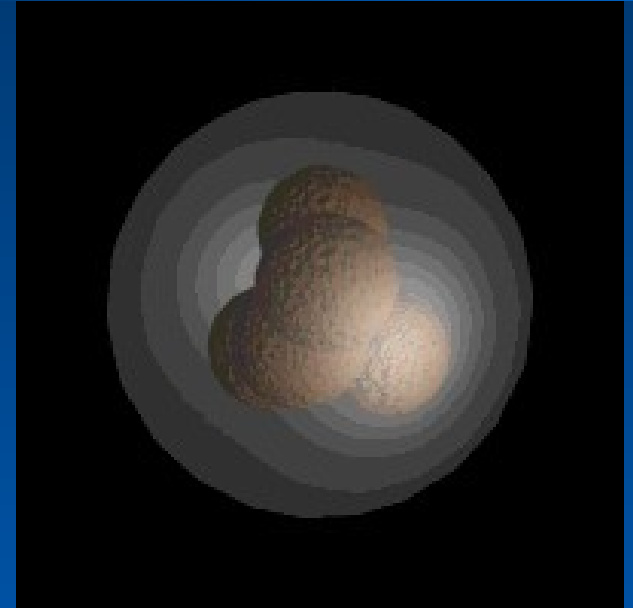
# Mitochondria

- **Structure:** folded membrane within an outer membrane
  - The folds of the inner membrane are called cristae
- **Function:** -converts energy stored in food into usable energy for work
  - cellular respiration

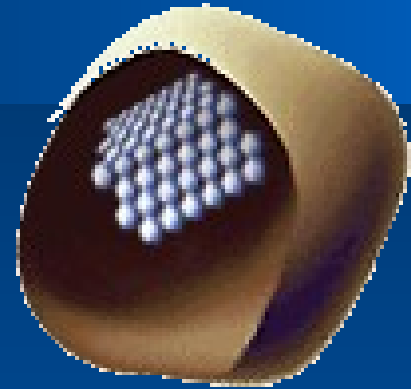


# Lysosomes

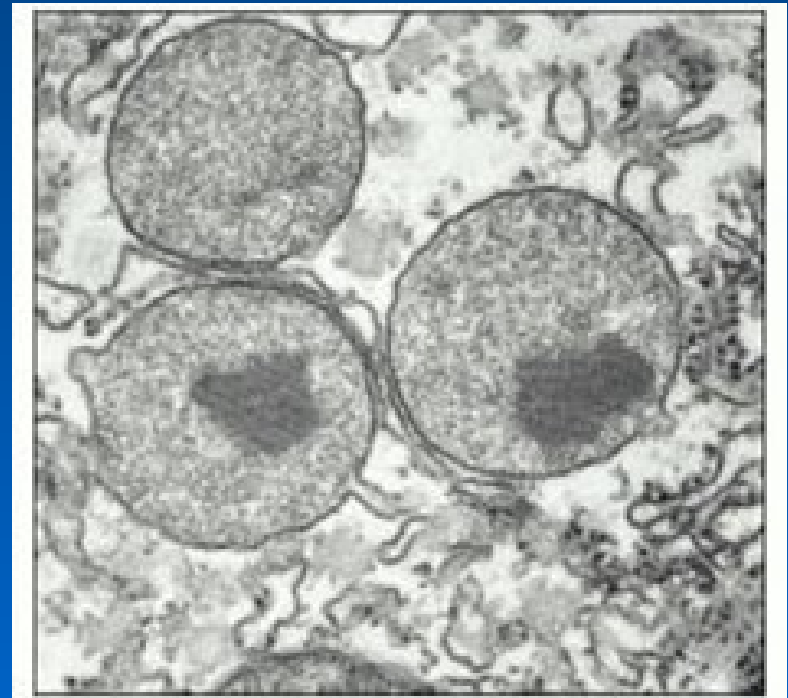
- **Structure:** spherical organelles that contain hydrolytic enzymes within single membranes
- **Function:** breaks down food particles, invading objects, or worn out cell parts



# Peroxisomes



- **Structure:** spherical organelles that contain enzymes within single membranes
- **Function:** Degrade hydrogen peroxide, a toxic compound that can be produced during metabolism.

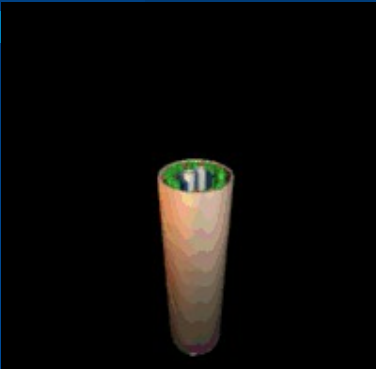
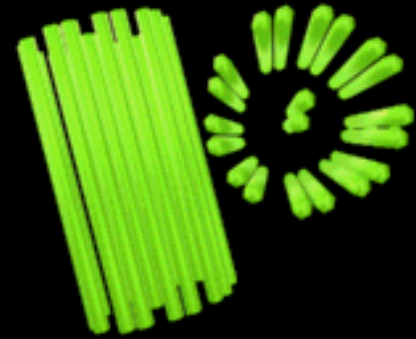


200 nm

# Cilia and Flagella

- **Structure: hair-like organelles that extend from the surface of cells**
  - When they are present in large numbers on a cell they are called cilia
  - When they are less numerous and longer they are called flagella
  - Both organelles are composed of nine pairs of microtubules arranged around a central pair.
- **Function: cell motility**

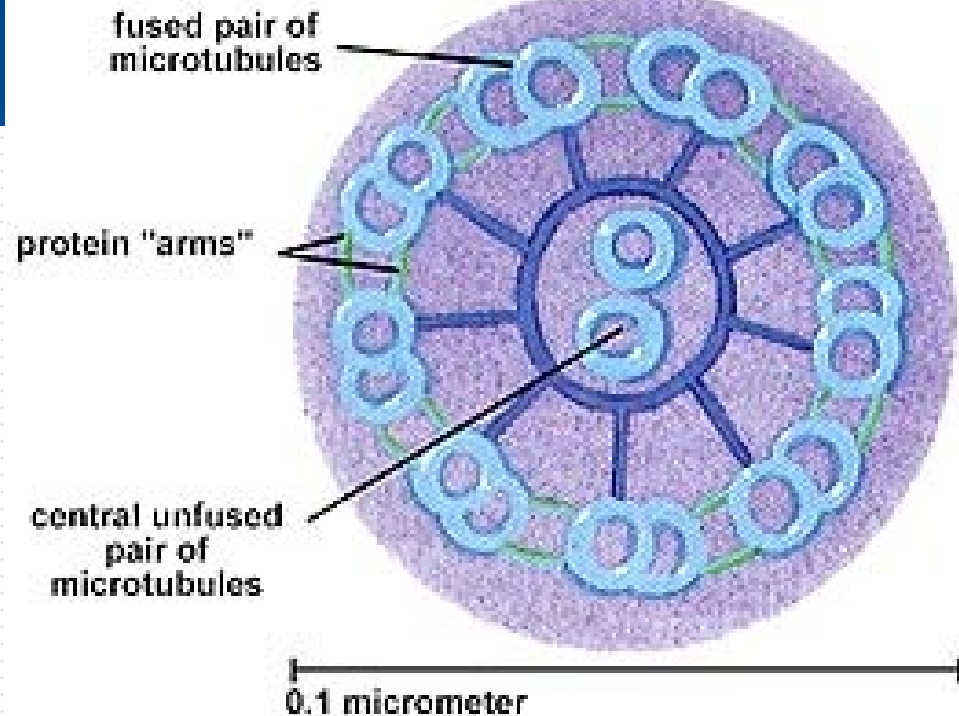
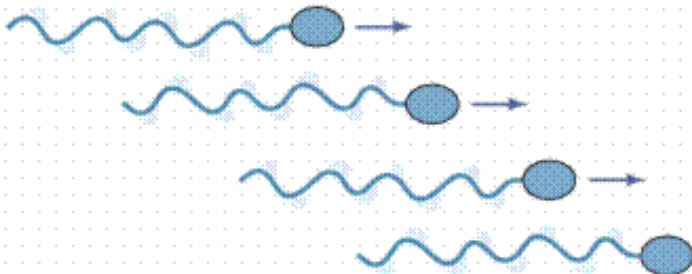
# Cilia and Flagella



Movement of cilium



Movement of flagellum



fused pair of microtubules

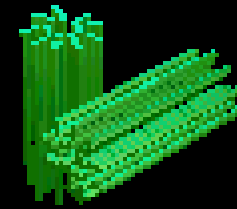
protein "arms"

central unfused pair of microtubules

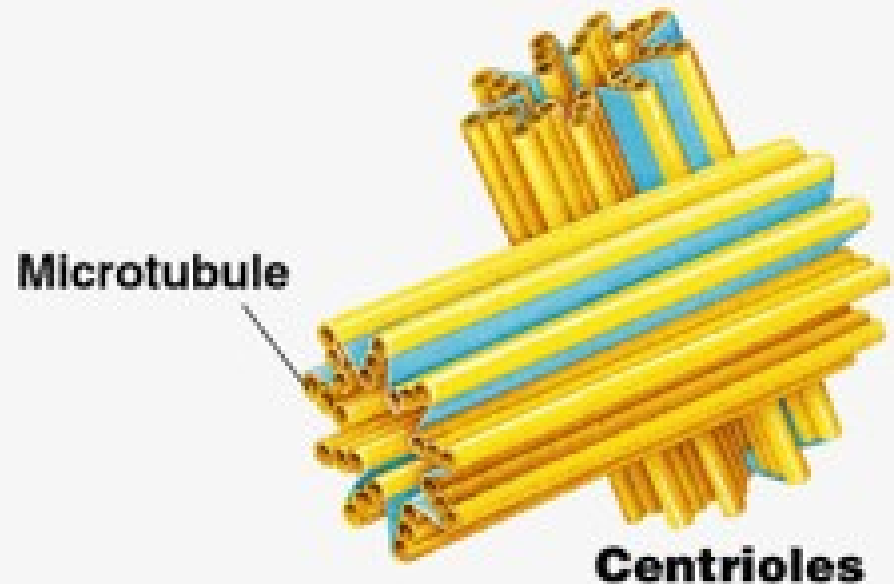
0.1 micrometer



# Centrioles

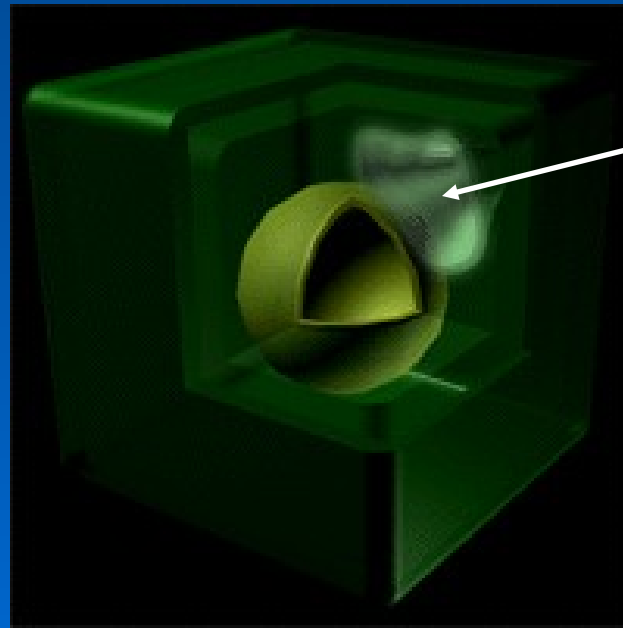


- **Structure:**  
composed of nine sets of triplet microtubules arranged in a ring
  - Exist in pairs
- **Function:**  
centrioles play a major role in cell division (mitosis)



# Vacuoles

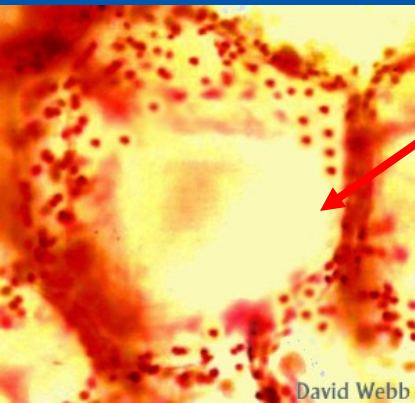
- **Structure:** a sac of fluid surrounded by a membrane
  - Very large in plants
- **Function:** used for temporary storage of wastes, nutrients, and water



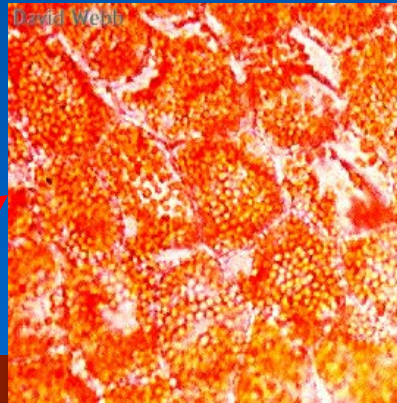
# Plastids

- There are three types of plastids in plant cells:
  - Chloroplasts (discussed on next slide)
  - Chromoplasts: synthesize and store pigments
  - Leucoplasts: store food such as starches, proteins, and lipids

Chromoplasts

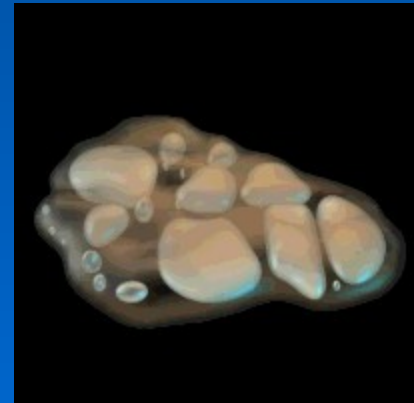


Red Pepper



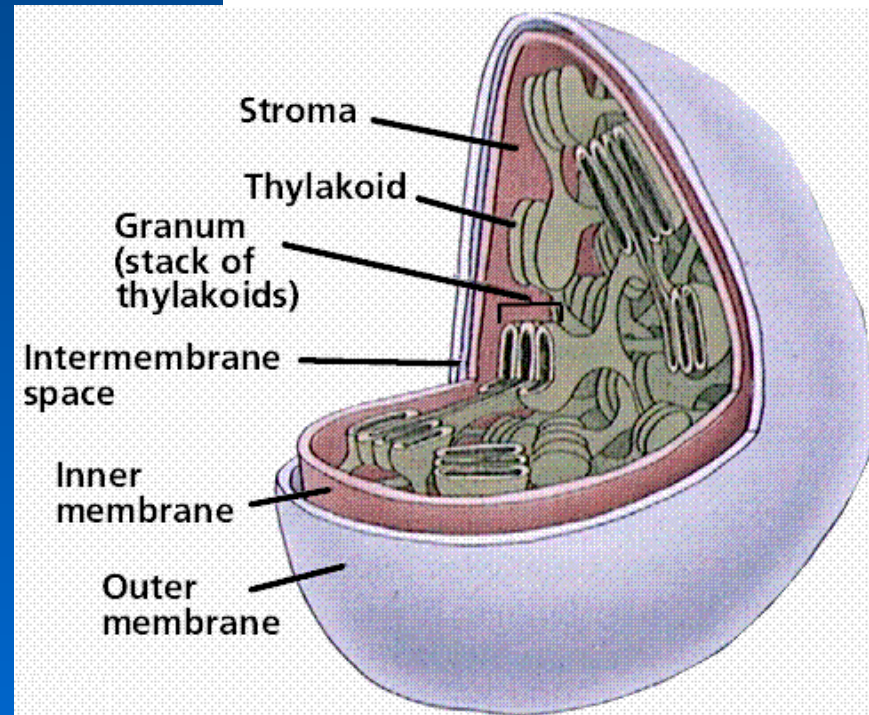
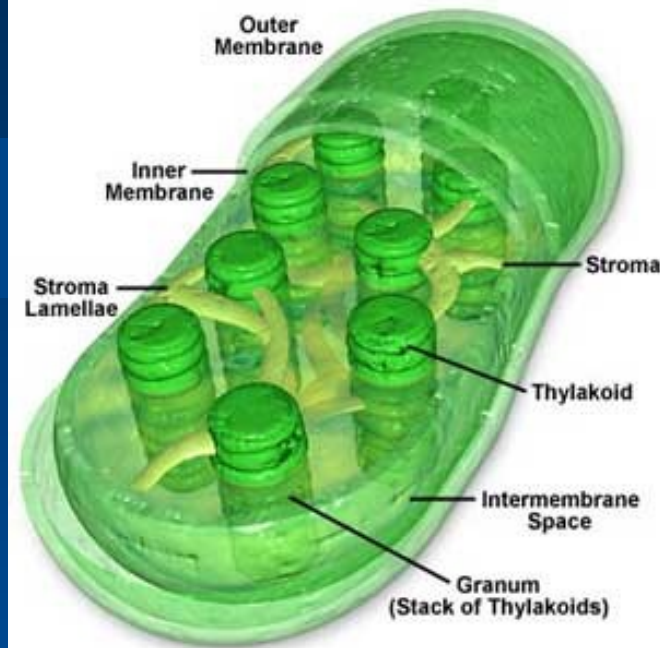
Flower

Leucoplasts



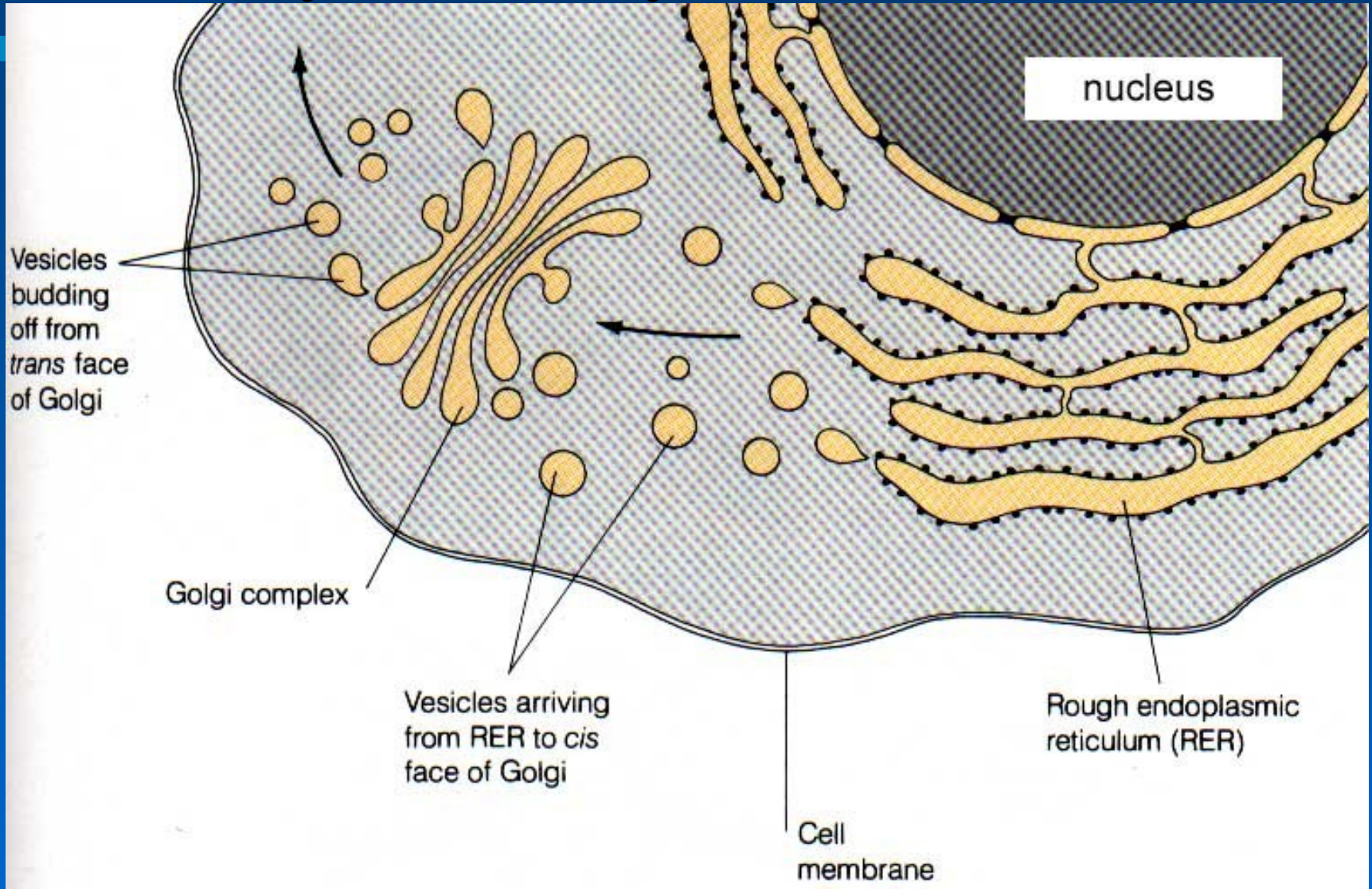
# Chloroplasts

- Structure: stacked sacs (thylakoids) that contain chlorophyll surrounded by a double membrane
- Function: photosynthesis (conversion of light energy to chemical energy stored in the bonds of glucose)



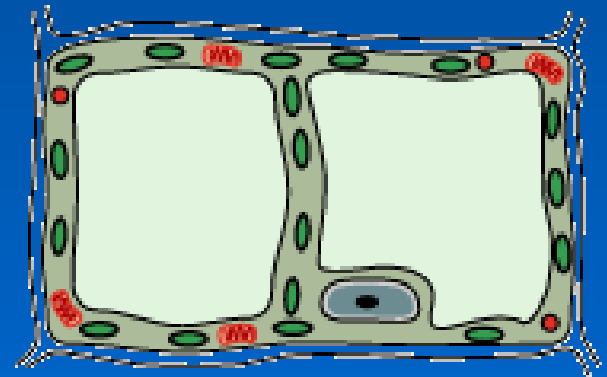
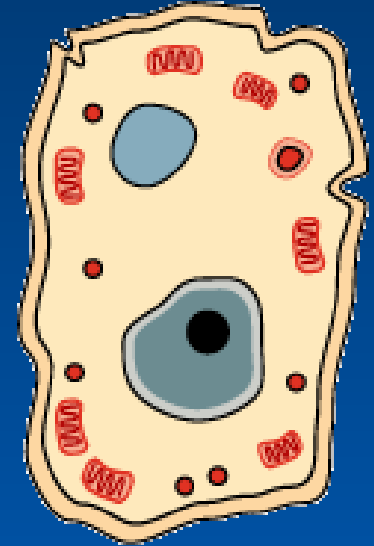


# Secretory Pathway

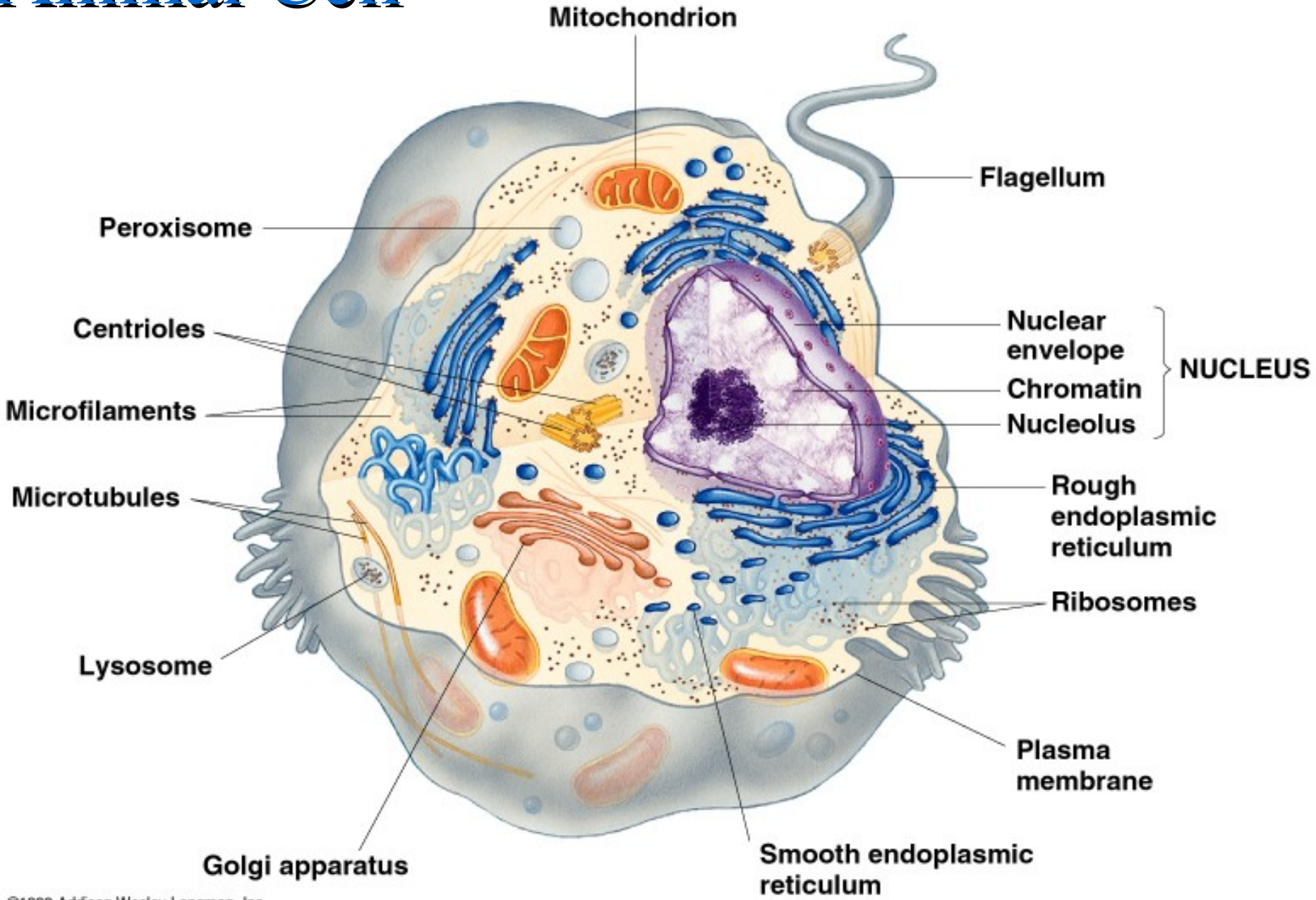


# Plant Cells vs. Animal Cells

- Animal cells are very similar to plant cells except for the following major differences:
  - Animal cells do not contain chloroplasts
  - Animal cells are not surrounded by cell walls
  - The vacuoles in plants are much larger than those of animals

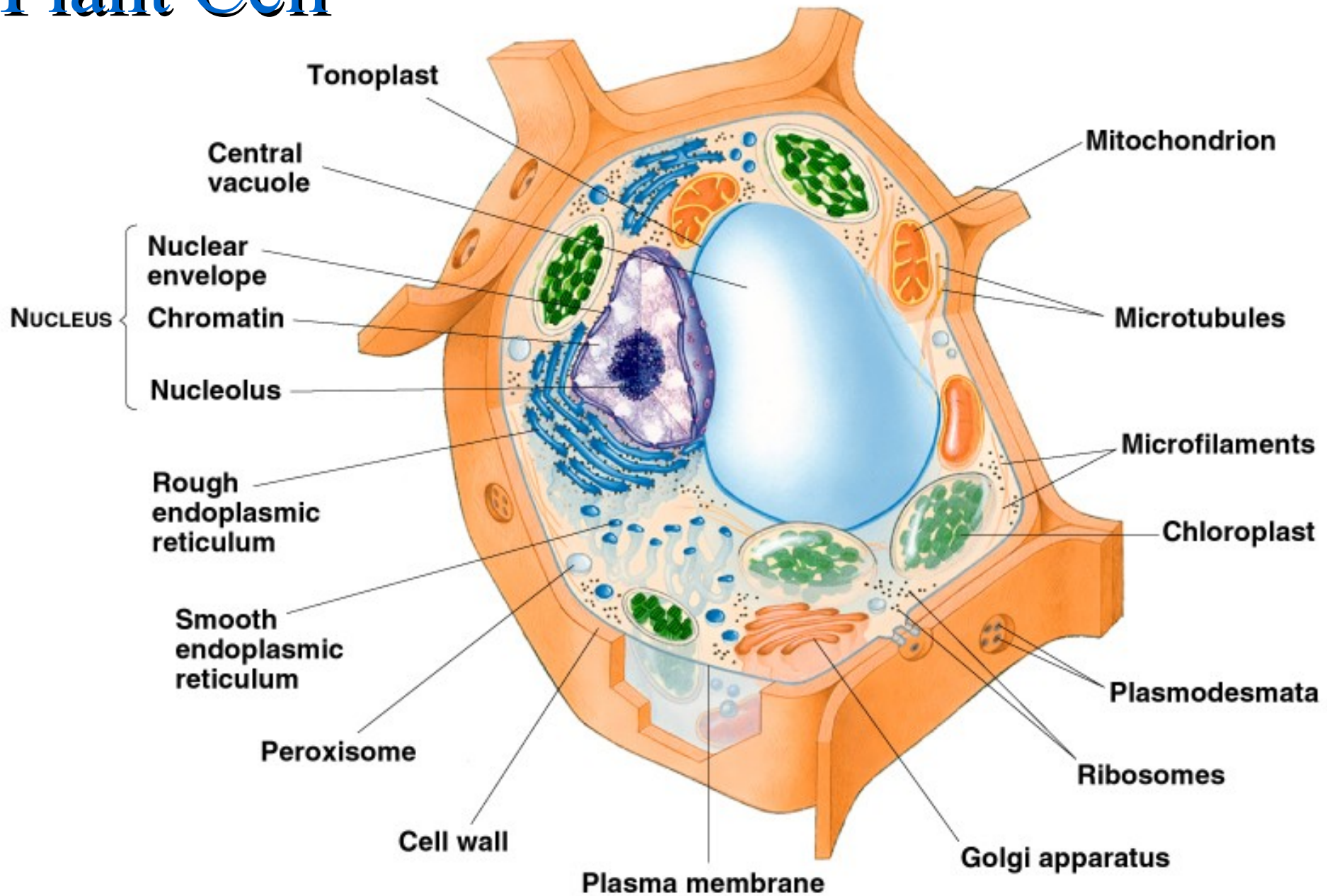


# Animal Cell





# Plant Cell





THE END!