



# CHAPTER 01

## INTRODUCTION TO CELL BIOLOGY

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# Cell biology

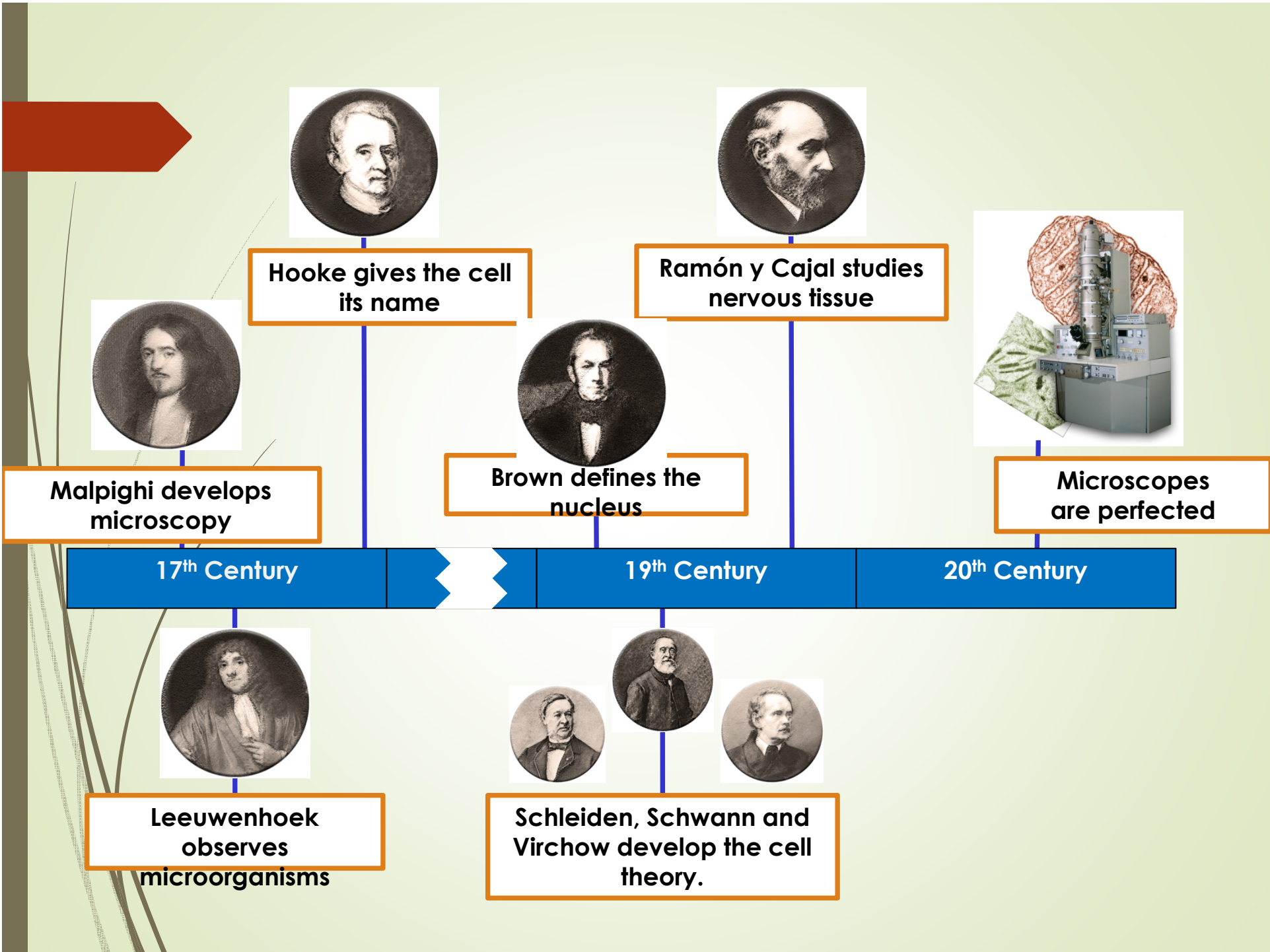
Branch of biology dealing with the study of structure, function, molecular organization, growth, reproduction and genetics of the cells, is called **cytology or cell biology**

- **1665** - **Robert Hooke** looks at cork under a microscope.

Calls the chambers he see "cells"

- **1665 -1675 Anton van Leeuwenhoek**, the invention of the microscope ,studies organisms living in pond water (like you did in lab). He calls them "Animalcules."

- **1838-1839** German scientists **Schleiden and Schwann** ,all living organisms are made of cells. This forms the basis of the **Cell Theory of Biology.**



# Cell

**A CELL IS DEFINED AS THE SMALLEST, BASIC UNIT OF LIFE THAT IS RESPONSIBLE FOR ALL OF LIFE'S PROCESSES."**



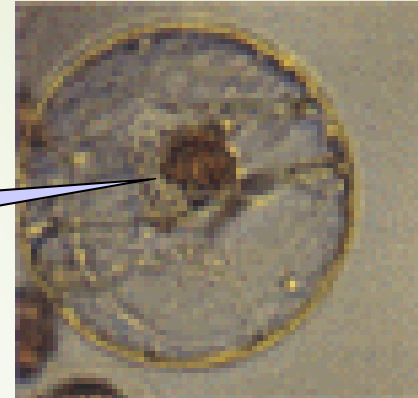
**Amoeba Proteus**



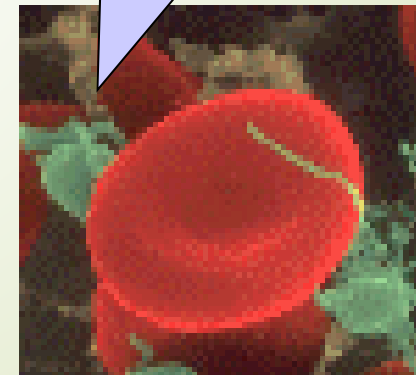
**Bacteria**



**Nerve Cell**



**Plant Stem**



**Red Blood Cell**

# The Cell Theory

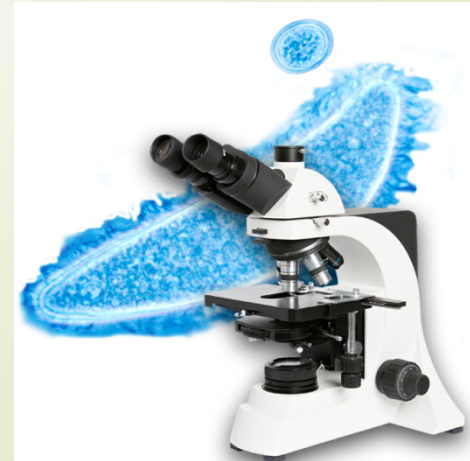
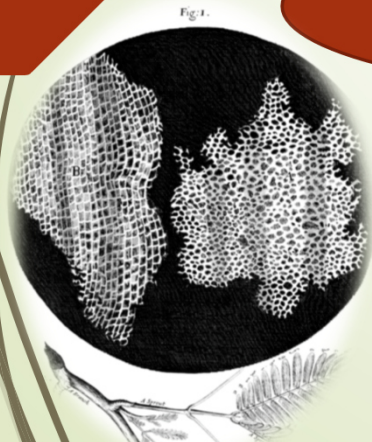
The cell theory (proposed independently in 1838 and 1839) is a cornerstone of biology



All organisms are composed of one or more cells

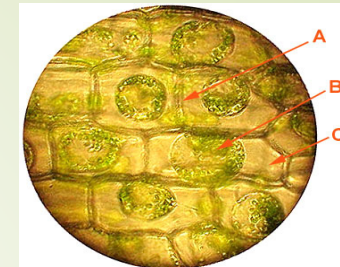
Cells arise only by division of previously existing cells

Cells are the smallest living things



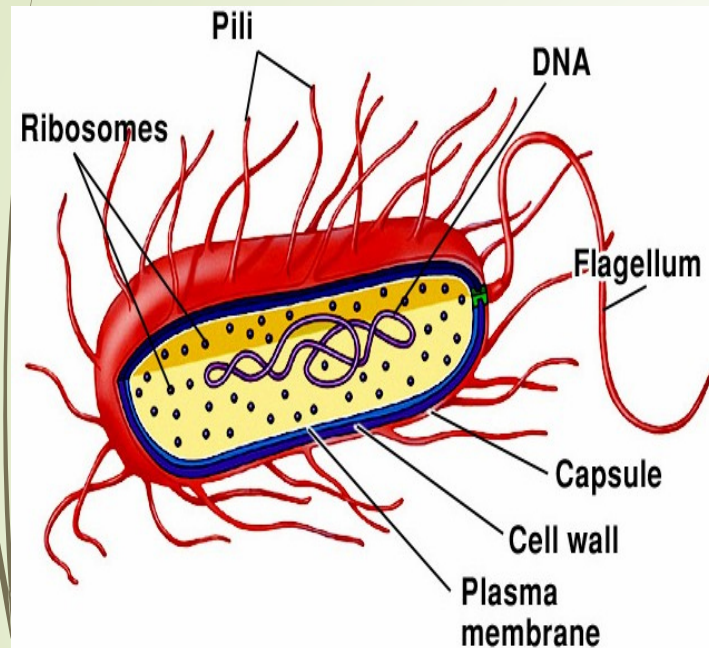


# Two Fundamentally Different Types of Cells



Characteristic	Prokaryotic Cells	Eukaryotic Cells
<b>Extracellular Structures</b>		
Cell wall	Peptidoglycan found on most cells	Cellulose, chitin, or both found on plant and fungal cells
External layer	Capsule or slime layer	Pellicle, test, or shell in certain protists
Flagella	When present, consist of fibrils of flagellin	When present, consist of complex membrane-enclosed structure with "9 + 2" microtubule arrangement
Cilia	Absent	Present as structures shorter than, but similar to, flagella in some eukaryotic cells
Pili	Present as attachment or conjugation pili in some prokaryotic cells	Absent
<b>Reproductive Process</b>		
Cell division	Binary fission	Mitosis and/or meiosis
Sexual exchange of genetic material	Not part of reproduction	Meiosis
Sexual or asexual reproduction	Only asexual reproduction	Sexual or asexual reproduction

# A prokaryotic cell



## Cytoplasm

Gel-like matrix of water, enzymes, nutrients, wastes, and gases and contains cell structures.

## Ribosomes

Made of protein & rRNA.  
Composed of two subunits

## Nucleoid

Region of cytoplasm where prokaryote's **genome** (DNA) is located.

Usually a singular, circular chromosome.

## Plasmid

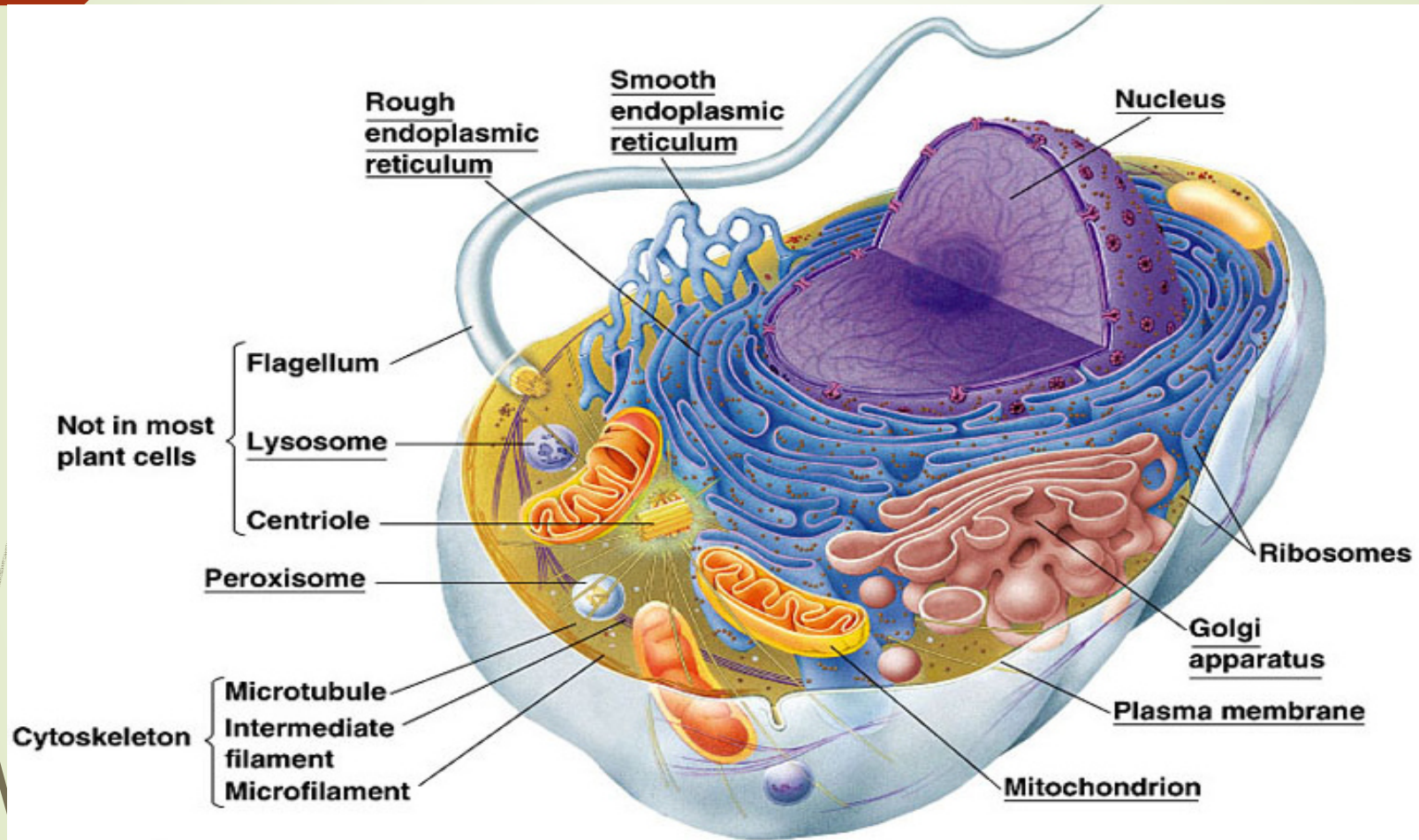
Small extra piece of chromosome/genetic material (5 - 100 genes)

Can provide genetic information to promote:

- Antibiotic resistance
- Virulence factors
- Promote conjugation



# A eukaryotic cell





# Cell Membrane

- Protects the cell;
- Selectively permeable ;
- It is composed of a double layer of phospholipids with proteins embedded throughout
- Made of hydrophobic and hydrophilic components

# Cytoplasm



Provides storage and work areas for the cell; the work and storage elements

of the cell, called organelles, are the ribosomes, endoplasmic reticulum, Golgi

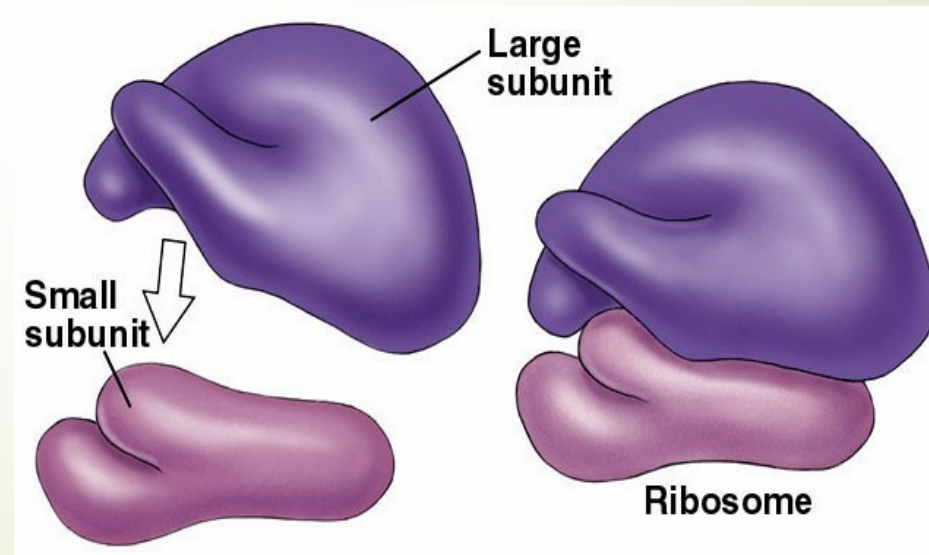
apparatus, mitochondria, lysosomes, and centrioles

# Ribosomes

Two subunits – large (big) and small –  
Each made of protein and  
ribosomal RNA (rRNA)

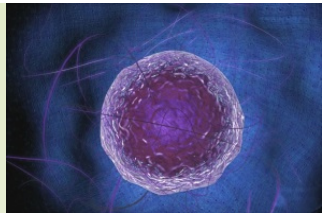
## Functions:

Protein synthetic  
machinery

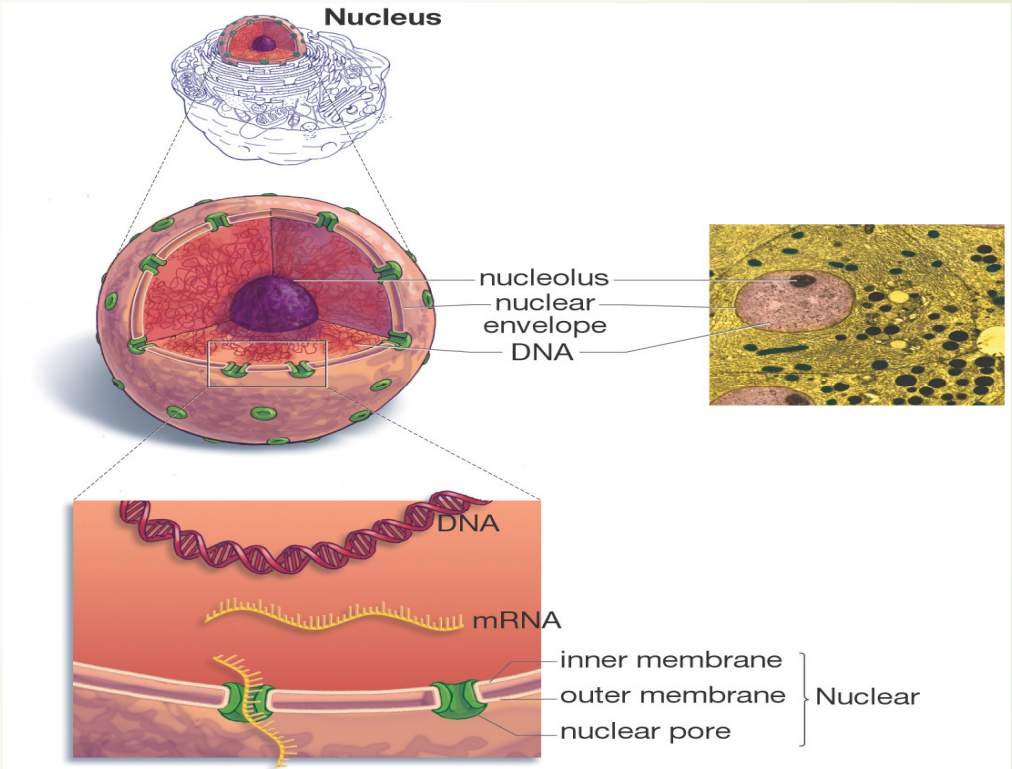




# The Nucleus

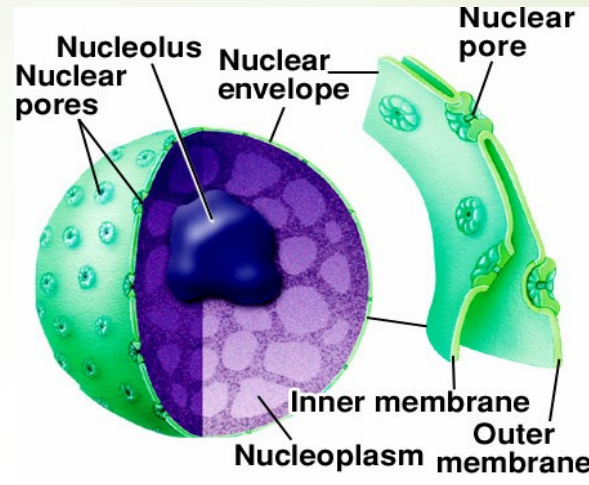


Contains the hereditary material of the cell.



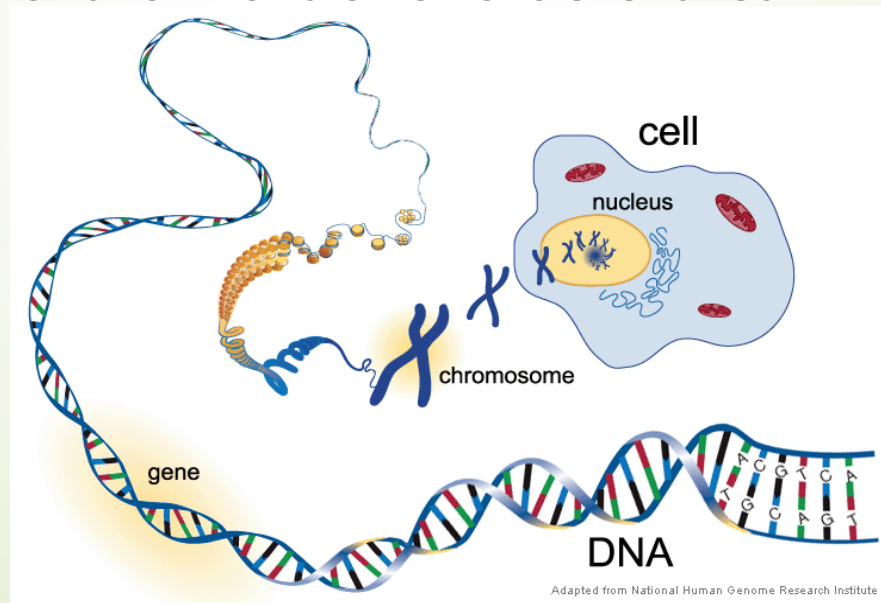
# Nuclear Membrane

- Surrounds nucleus
- Made of two layers
- Openings allow material to enter and leave nucleus
  - Pores regulate the entry and exit of molecules from the nucleus
  - The shape of the nucleus is maintained by the **nuclear lamina**, which is composed of protein



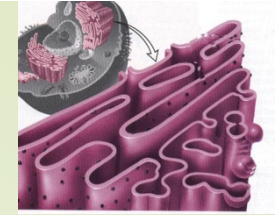
# Chromosomes

- In nucleus
- Made of DNA
- Contain instructions for traits et characteristics





# Endoplasmic Reticulum

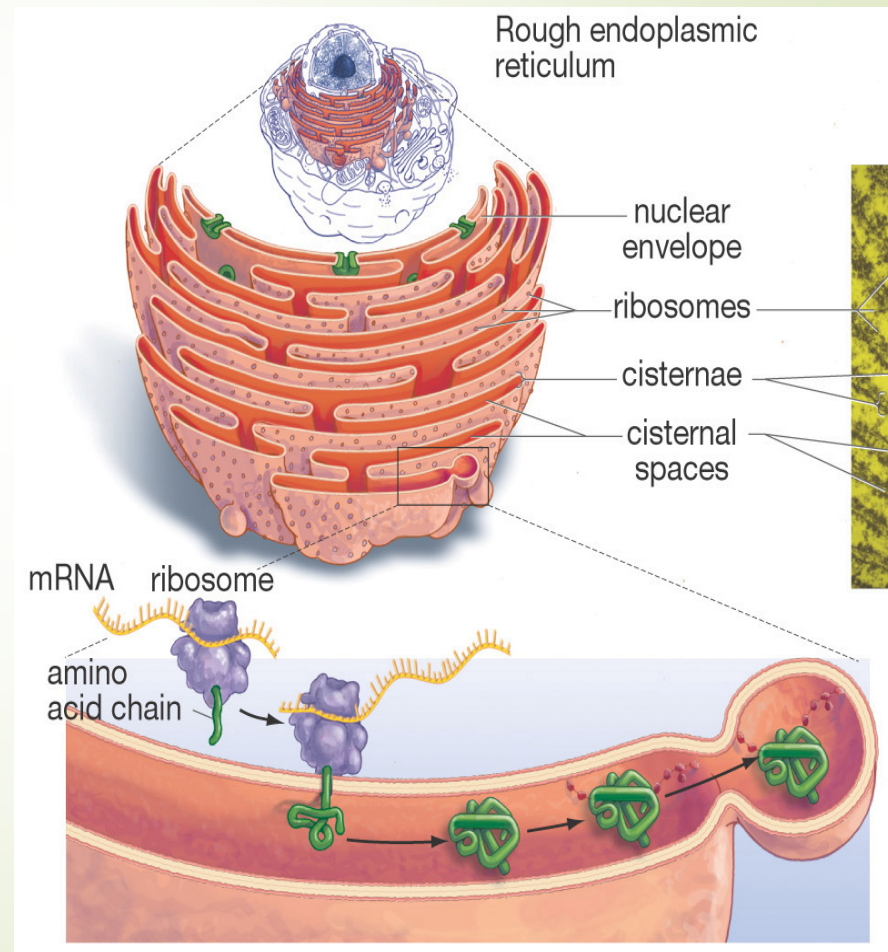


Accounts for more than half of the total membrane in many eukaryotic cells

The ER membrane is continuous with the nuclear envelope

There are two distinct regions of ER

- **Smooth ER**, which lacks ribosomes
- **Rough ER**, surface is studded with ribosomes



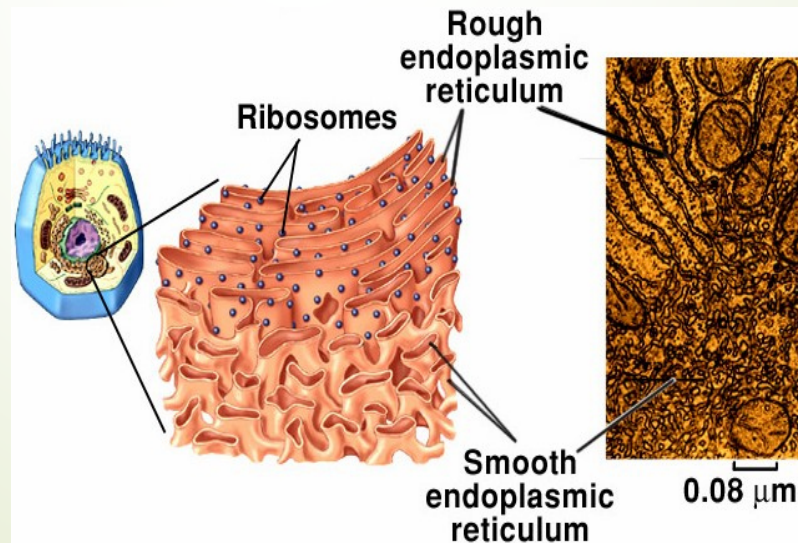


# Functions of Rough ER

- Protein synthesis (about half the cell's proteins are made here).
- Protein movement (trafficking)

# Functions of Smooth ER

- Synthesizes lipids
- Metabolizes carbohydrates
- Detoxifies drugs and poisons
- Stores calcium ions



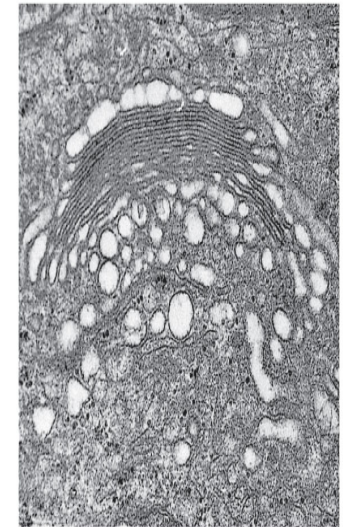
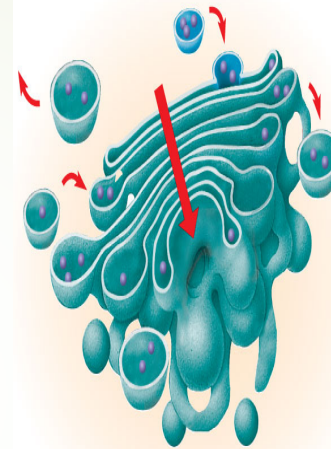


# Golgi apparatus

Consists of flattened membranous sacs called cisternae

## Functions of the Golgi apparatus

- Modifies products of the ER
- Manufactures certain macromolecules
- Sorts and packages materials into transport vesicles



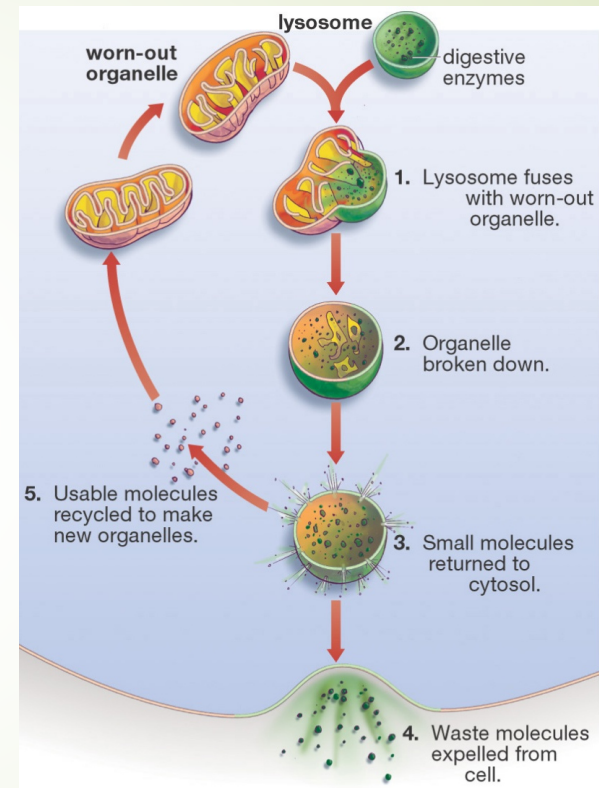
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# The Lysosome

- Is a membranous sac of hydrolytic enzymes that can digest macromolecules
- Lysosomal enzymes work best in the **acidic environment** inside the lysosome

## Functions:

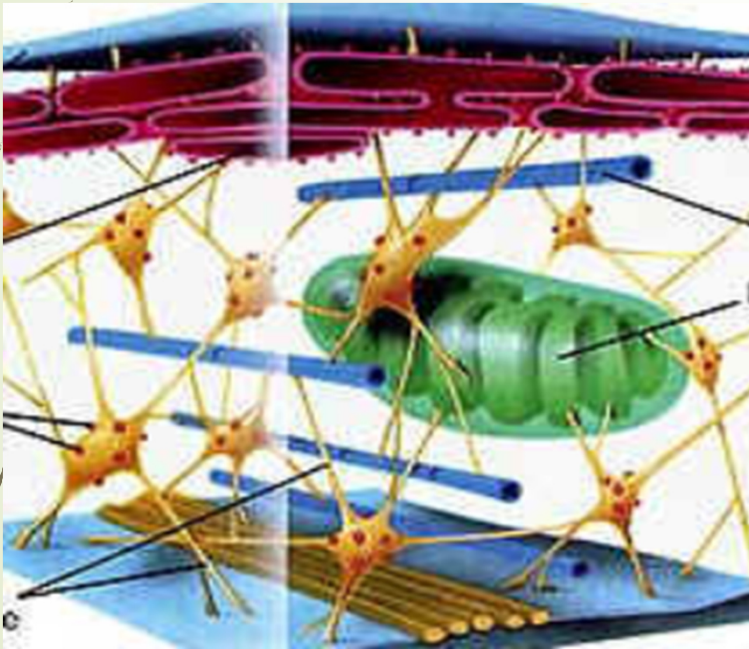
- Digesting food or cellular invaders
- Recycling cellular components



**The lysosome is not found in plant cells**

# Cytoskeleton

scaffolding of proteins that transport materials, position and move organelles



## **3 components :**

- Actin filaments,
- Microtubules
- Intermediate filaments

# Centrosome

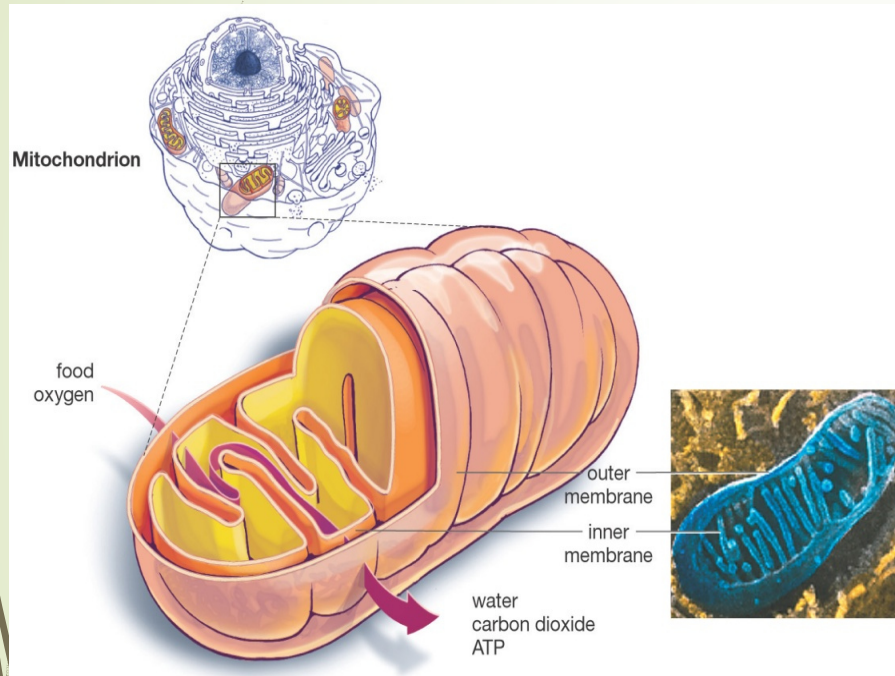
- Centrioles - are part of specialized region of the cell called the **centrosome**
- cell center
  - Play an important role in cell reproduction
  - Found in animals and most protists
  - Involved in the production of **microtubules**
  - 9 triplets of microtubules



# Mitochondrion



- Oblong shaped



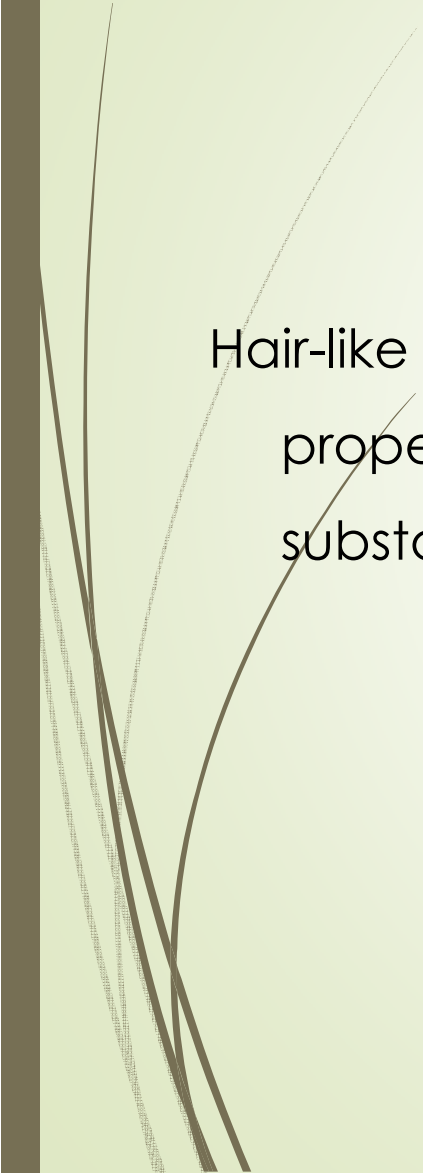
- Have double membrane structure inner membrane folded into inward projections called **cristae**

- Site of cellular respiration which is the process of making ATP (energy) which cells need to survive and function

- Two spaces within the mitochondrion the **matrix** and the **intermembrane space**



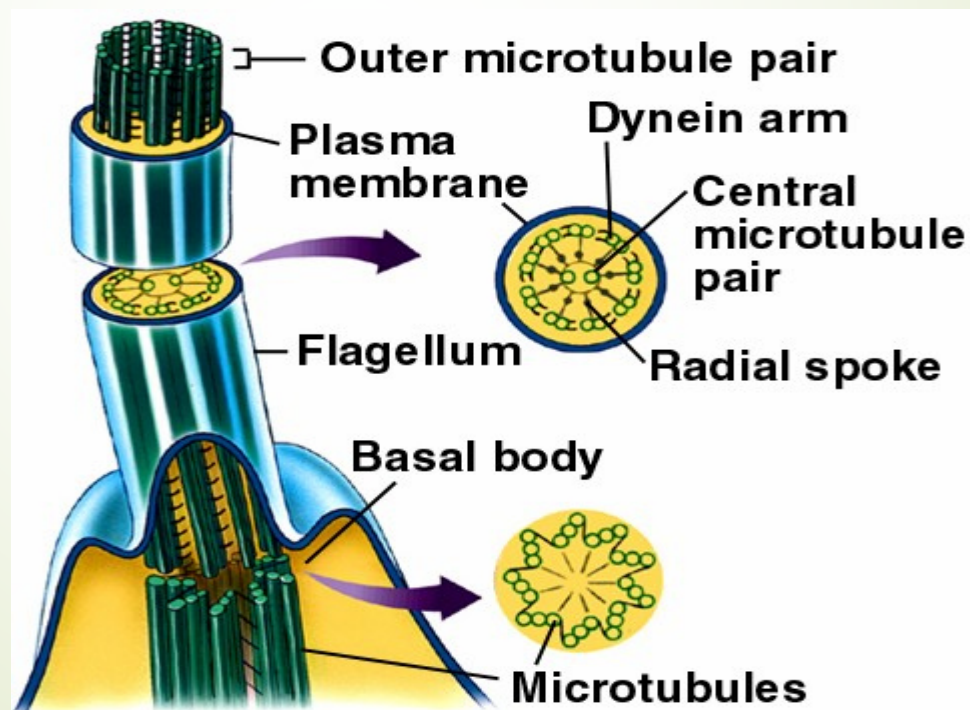
# Cilia



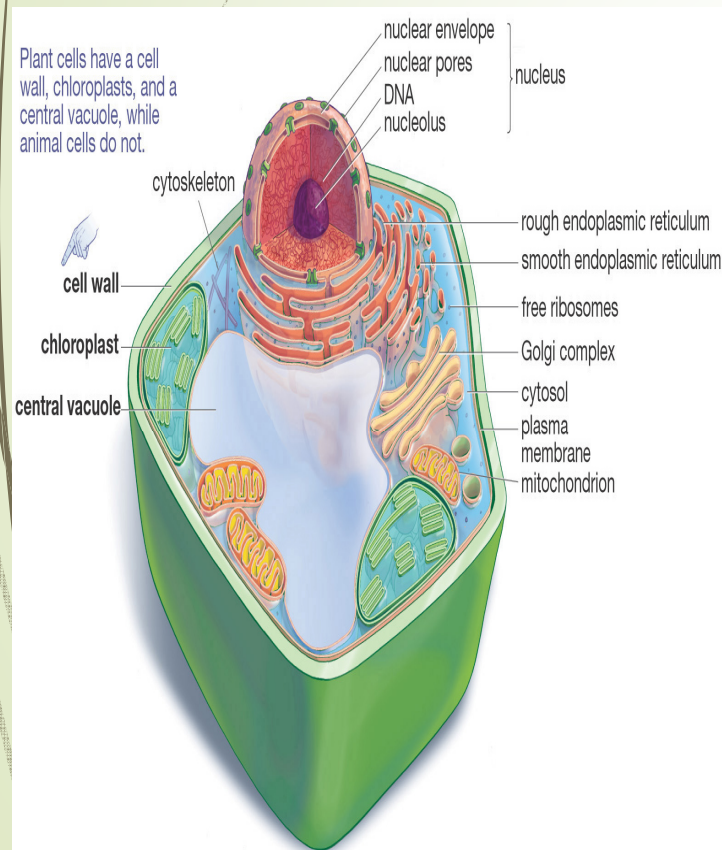
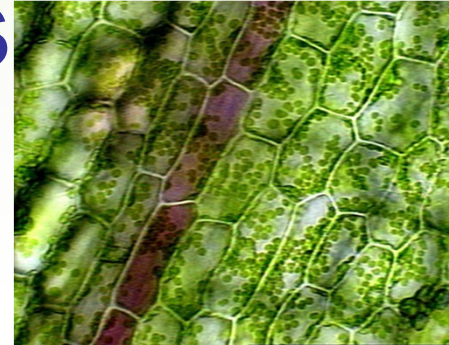
Hair-like processes that project from epithelial cells; help propel mucus, dust particles, and other foreign substances from the respiratory tract

# Flagellum

Tail" of the sperm that enables for the sperm to "swim"  
or move toward the ovum



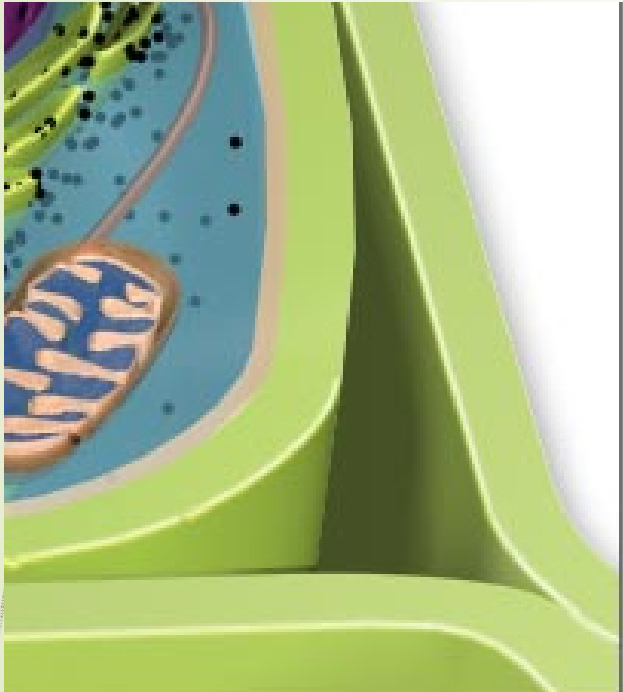
# Two Other Unique Features of Plant Cells



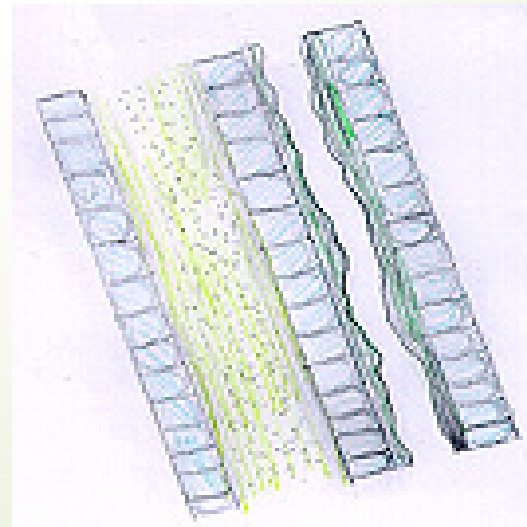
- Plant cells, like animal cells, have a nucleus, cytoplasm, a cell membrane, mitochondria and ribosomes.
- Unlike animal cells, plant cells also have a cell wall made of cellulose (a carbohydrate), which strengthens the cell.
- The central vacuole may occupy 90% of a plant cell.



# Cell Wall

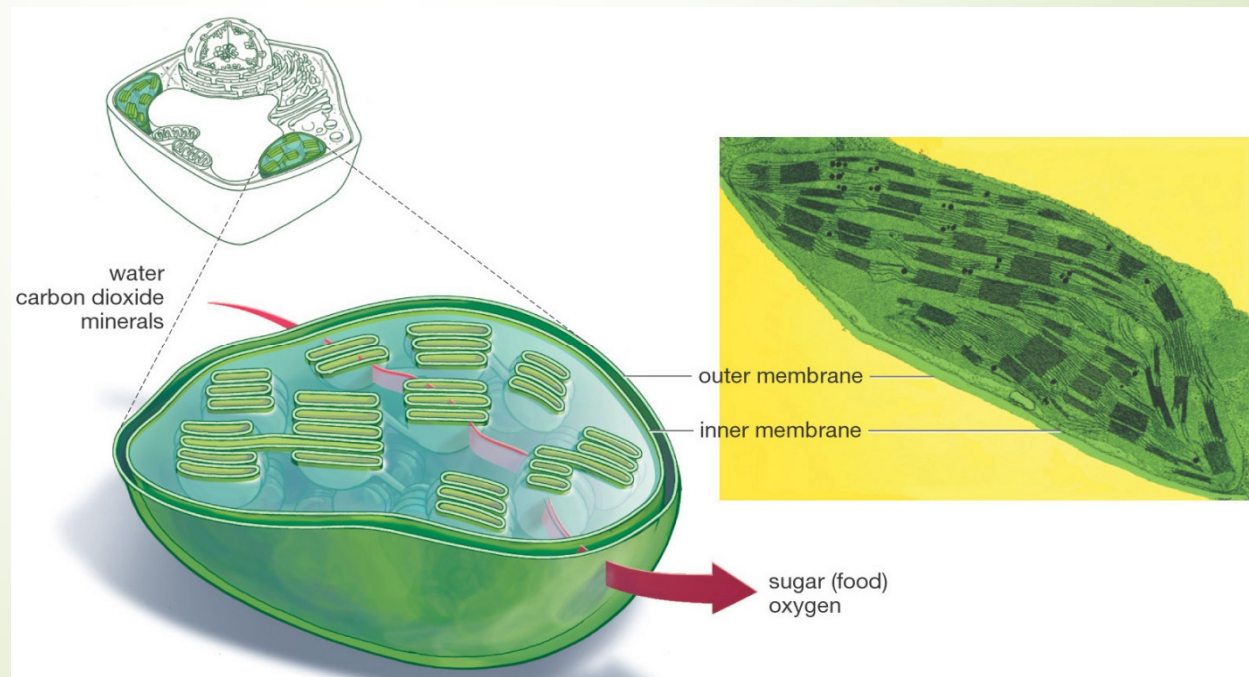


Most commonly found in plant cells &  
bacteria  
Supports & protects cells



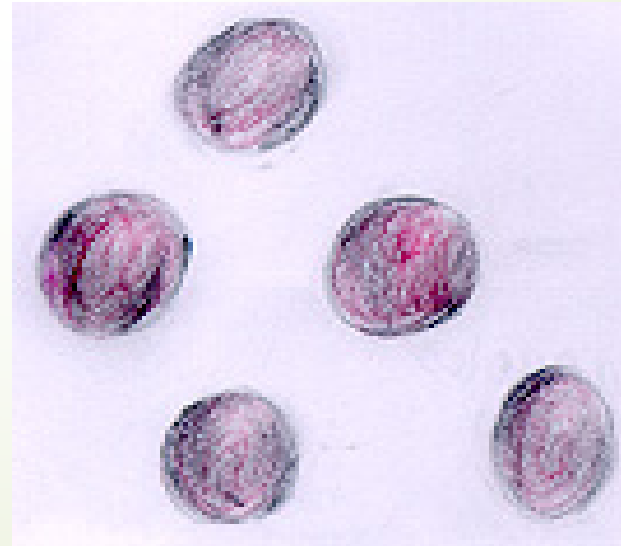
# The Chloroplast

- Usually found in plant cells
- Contains green chlorophyll
- Where photosynthesis takes place



# Vacuoles

- Membrane-bound sacs for storage, digestion, and waste removal
- Contains water solution
- Help plants maintain shape



THANK YOU

