

# Chapter 3

## Cell Structure

# Looking at Cells

- The invention of microscopes allowed scientists to view cells for the first time
- Scientists use the metric system to measure the size of cells

- Metric Units vary on scales of 10

# Metric Units

- Length-Meter
- Mass-Gram
- Temperature-Celsius
- Time-Seconds
- Volume-Liter

## SI PREFIXES

Multiplication Factor	Prefix		Symbol
1 000 000 000 000	= $10^{12}$	tera	T
1 000 000 000	= $10^9$	giga	G
1 000 000	= $10^6$	mega	M
1 000	= $10^3$	kilo	k
100	= $10^2$	hecto	h
10	= $10^1$	deka	da
0.1	= $10^{-1}$	deci	d
0.01	= $10^{-2}$	centi	c
0.001	= $10^{-3}$	milli	m
0.000 001	= $10^{-6}$	micro	$\mu$
0.000 000 001	= $10^{-9}$	nano	n
0.000 000 000 001	= $10^{-12}$	pico	p

# Characteristics of Microscopes

- Robert Hooke in 1665 used a microscope to view cork cells
- Two common types of microscopes: Light and Electron

# Light Microscope

- Light passes through one or more lenses
- Compound Light Microscopes use two lenses

# Electron Microscope

- Uses a beam of electrons instead of light to create an image
- Transmission Electron Microscopes shoots a beam of electrons
- Scanning Tunneling Microscope measures the difference in voltage caused by electrons that leak from the object

- Magnification-the ability to make an image larger
- Resolution-the measure of clarity of an image



<http://science.nhmccd.edu/biol/biolab/microscope.htm>

# 3-2 Cell Features

# The Cell Theory

- Schleiden concluded that cells make up every part of a plant in 1838
- Schwann concluded that cells make up every part of animals in 1834
- Virchow determined that cells can only come from other cells in 1858

- 1. All living things are made of one or more cells
- 2. Cells are the basic unit of structure and function in organisms
- 3. All cells arise from existing cells

# Why must cells be small?

- If surface to volume ratio is too low, substances cannot move through the cell quickly enough
- Small cells are stronger than larger ones (water balloon)

# Common Features to Cells

- Cell Membrane-outer boundary, semi-permeable
- Cytoplasm-cell interior made of water and other molecules needed for cellular functions
- Cytoskeleton-microscopic fibers used for cellular structure
- Ribosomes-site of protein production

# Prokaryotes

- Single celled organisms (Bacteria)
- Lack a nucleus and membrane bound organelles
- Very small
- Evolved at least 3.5 billion years ago

# Characteristics of Bacteria

- Exist in a wide range of environments
- Can live without oxygen and make their own food
- DNA is circular in shape
- Have a cell wall surrounding the membrane

- Some have a capsule around the cell wall used for clinging to objects
- Some use a flagella (whip-like tail) for locomotion

# Eukaryotes

- Contain a nucleus and membrane bound organelles (structure that carries out specific function inside the cell)
- Evolved at least 1.5 billion years ago

- <http://programs.northlandcollege.edu/biology/Biology1111/animations/flagellum.html>

# Cell Membrane

- Selectively Permeable (like a bouncer)
- Made of phospholipids (lipid made of a phosphate group and two fatty acids)
- Have a polar head and two nonpolar tails

- Head portion is water loving (hydrophilic) and tails are water fearing (hydrophobic)
- Arrange in a lipid bilayer
- Ions and most polar molecules are repelled by the nonpolar interior

- <http://www.stolaf.edu/people/giannini/flashanimat/lipids/membrane%20fluidity.swf>

- Proteins are located in the membrane
- Marker, Receptor, Transport, and Enzyme Proteins
- Membrane is fluid!!!!!!!!!!

## 3-3 Cell Organelles

- Nucleus-control cellular functions in eukaryotes
- Surrounded by nuclear membrane or envelope (pores)

- Substances like ribosomal proteins and RNA made in nucleus pass through pores
- DNA stored in nucleus (wound with proteins)

- Ribosomes-make proteins
- Located free floating in the cytoplasm or attached to endoplasmic reticulum (ER)

- Endoplasmic Reticulum (ER)-  
system of internal membranes  
that move proteins and other  
substances through the cell
- Rough ER-embedded with  
ribosomes

- When a protein is made, it passes into the ER by way of a vesicle (membrane bound sac used for transporting substances)
- Smooth ER-lacks ribosomes, used for making lipids and breaking down toxins

- Golgi Apparatus-flattened, membrane-bound sacs that package and distribute things in the cell

# 5 Step Process to Packaging and Distribution of Proteins

- Ribosomes make proteins on RER. Then packaged into vesicles.

- Vesicles transport the new proteins from RER to golgi apparatus

- In the golgi apparatus, proteins are processed and then packaged into new vesicles

- Many of the vesicles move to the membrane and release contents outside the cell

- Other vesicles like lysosomes remain inside cell

- Lysosome-small spherical organelles that contain digestive enzymes used for breaking down proteins, carbs, and nucleic acids

# ATP Production

- Mitochondria-rod shaped organelles used for making ATP, combine oxygen with food molecules
- Have their own distinct DNA, transferred from the mother

# Plant Cells

- Cell Wall-nonliving barrier outside the cell membrane
- Supports and protects the cell
- Made of cellulose (polysaccharide)

- Chloroplasts-use light energy to make carbohydrates for the plant

- Central Vacuole-large storage vacuole for holding stores of water and other substances
- When full, push against the cell wall
- When shrunken, release pressure against the cell wall (plant wilts)

- <http://www.tvdsb.on.ca/westmin/science/sbi3a1/Cells/cells.htm>

- [http://www.mhhe.com/biosci/esp/2001\\_gbio/default.htm#ok](http://www.mhhe.com/biosci/esp/2001_gbio/default.htm#ok)
- <http://www.johnkyrk.com/>