Cell Biology

Science Explorer – Cells and Heredity

Powerpoint by J&J Alton

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Cell Lesson Index

Science Explorer
Cells and Heredity

1.1 - DISCOVERING CELLS

1.1 - Discovering Cells - Related Videos

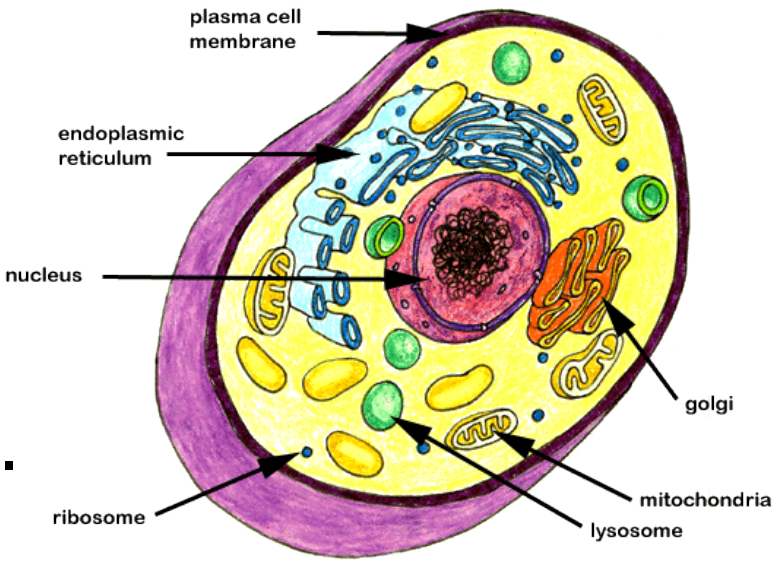
- The Discovery of Cells
- Cell Theory
- Parts of a Compound Microscope
- How to use a Microscope
- Greg Mendel – Meiosis Song

Objectives

1. How did the invention of the microscope contribute to scientists' understanding of living things?
2. What is the cell theory?
3. How does a lens magnify an object?

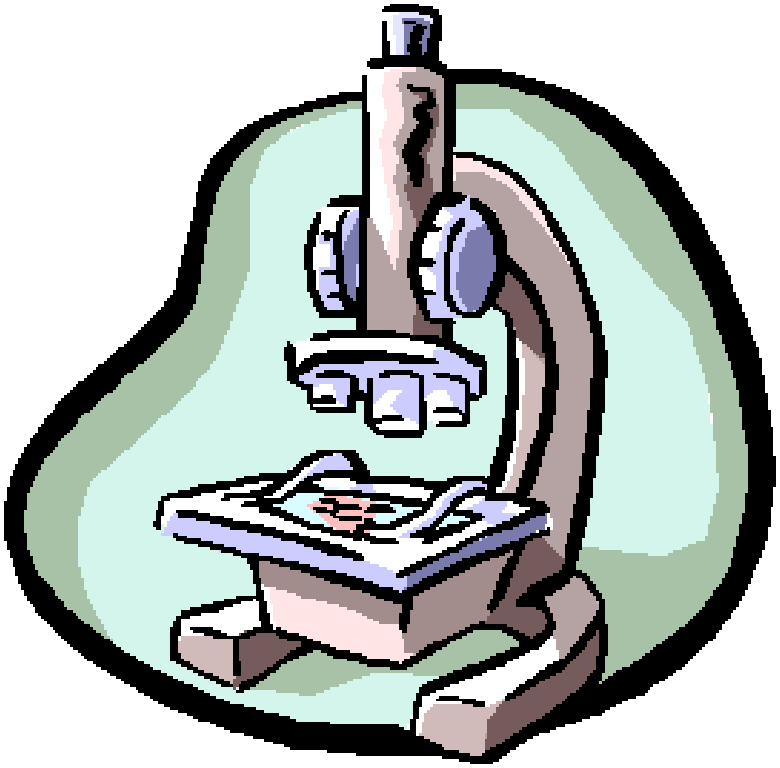
Cells

- Cells are the basic units of structure and function in living things.
- Most cells are too small to be seen with the naked eye.

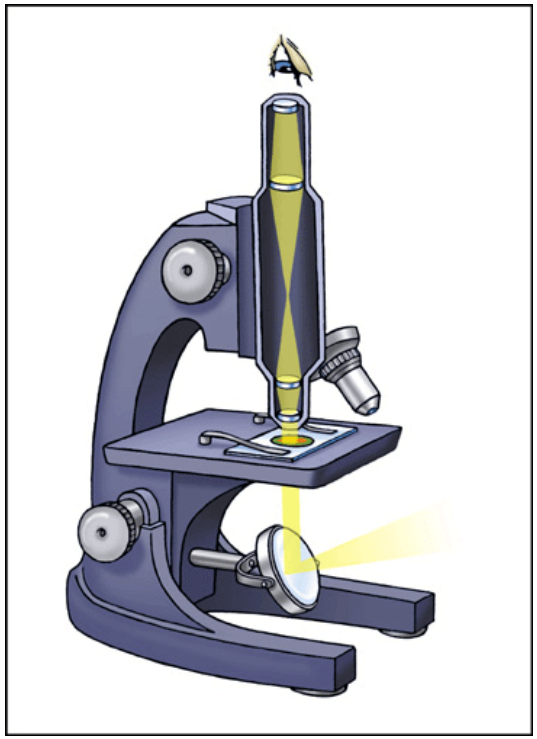


Microscope

- The invention of the microscope made it possible for people to discover and learn about cells.



Microscopes



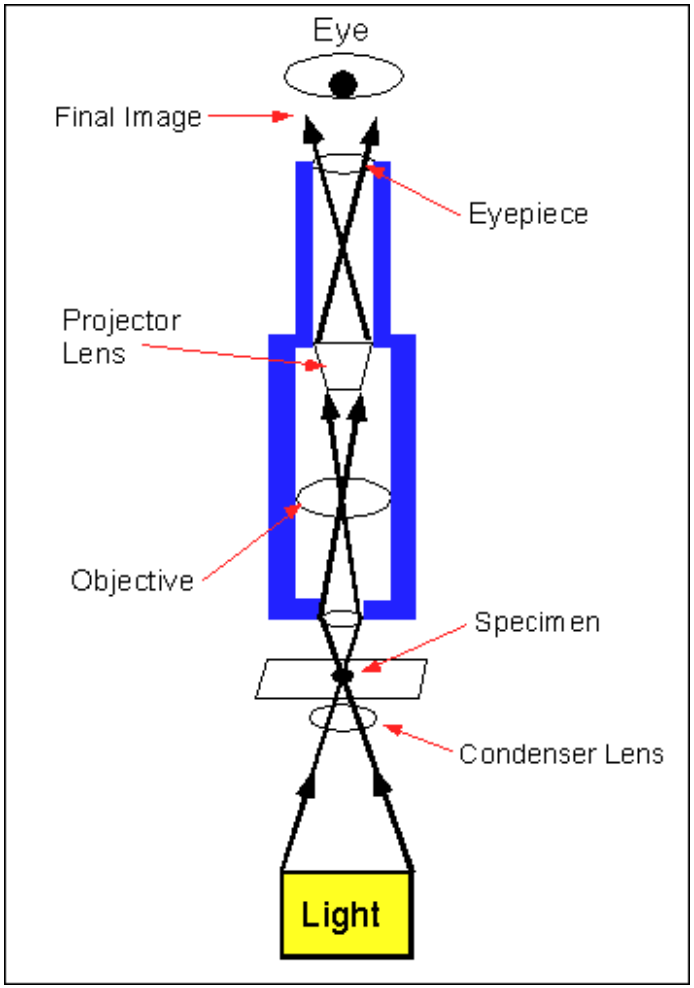
- A **microscope** is an instrument that makes small objects look larger.
- Some microscopes do this by using lenses to focus light.

Simple Microscope

- A simple light microscope contains only one lens.

Compound Microscope

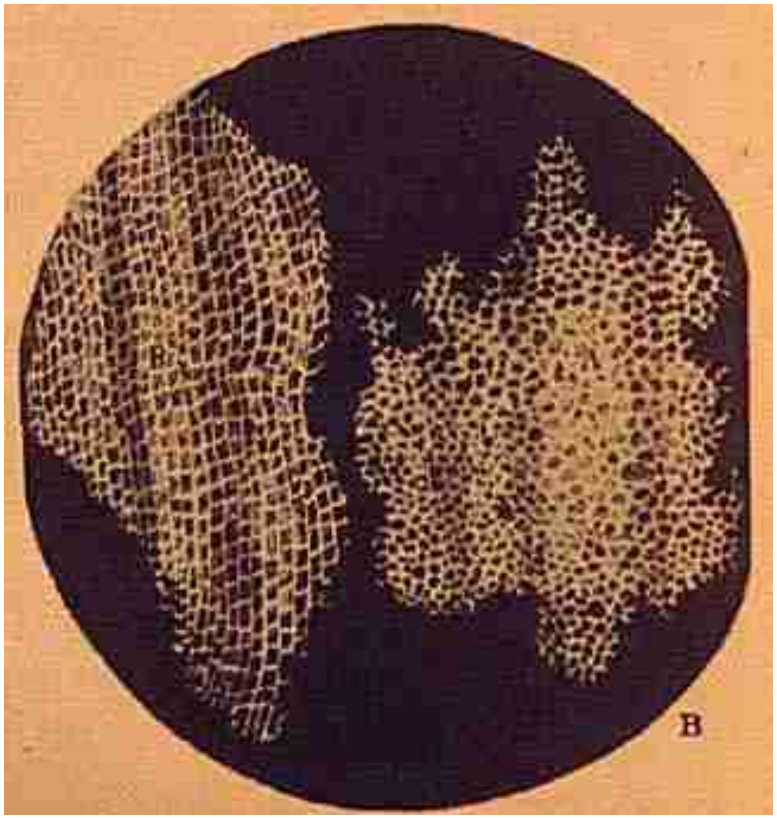
- A light microscope that has more than one lens is called a **compound microscope**.



Cells

- One of the first people to observe cells was Robert Hooke.

Cells



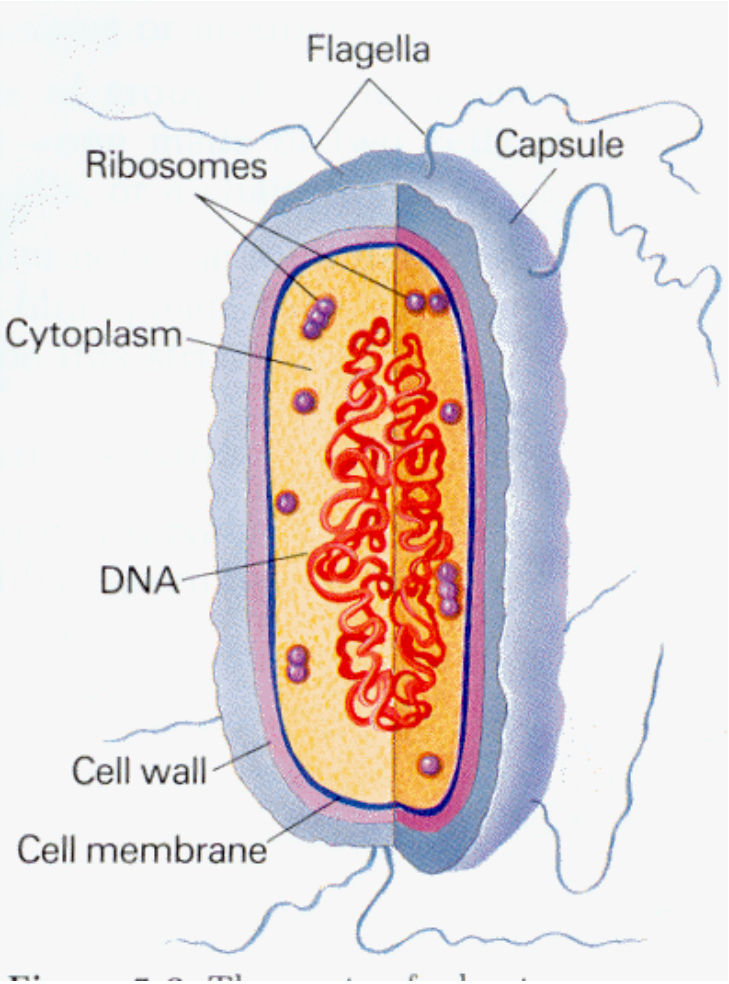
- In 1663, Hooke observed the structure of a thin slice of cork using a compound microscope he had built himself.

Cells

- At about the same time, Anton van Leeuwenhoek began to construct microscopes and use them to observe tiny objects.

Cells

- Leeuwenhoek was the first person to see the single-celled organisms that are now called bacteria.

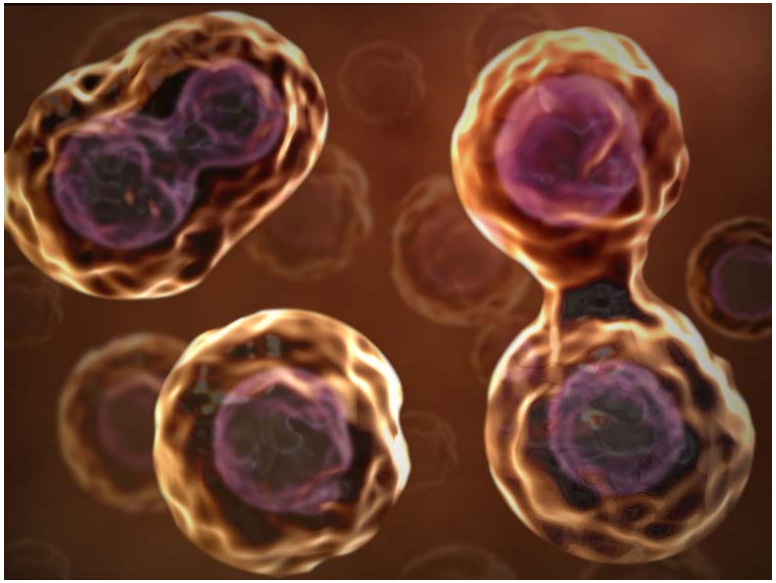


Plant Cells

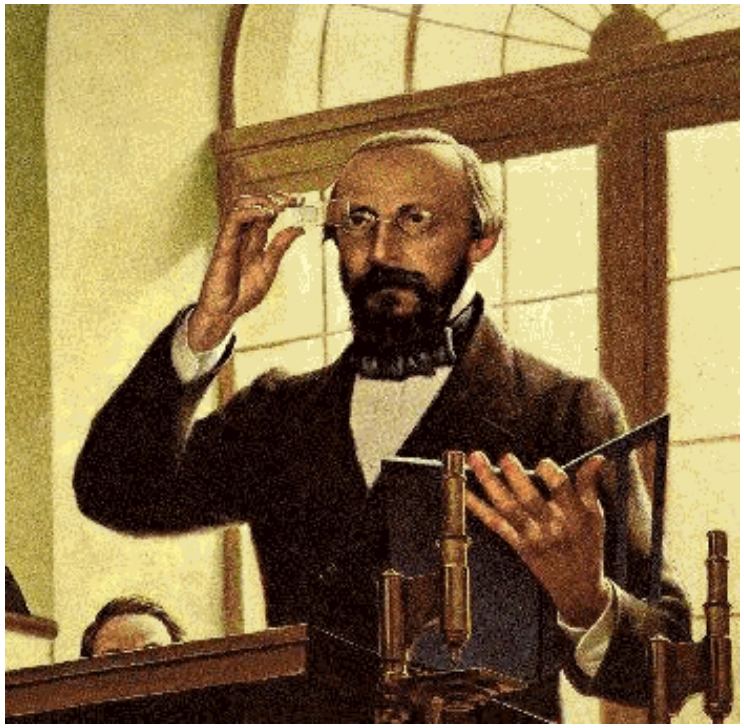
- In 1838 Matthais Schleiden concluded that all plants are made up of cells.

Animal Cells

- The next year, Theodor Schwann concluded that all animals are also made up of cells.



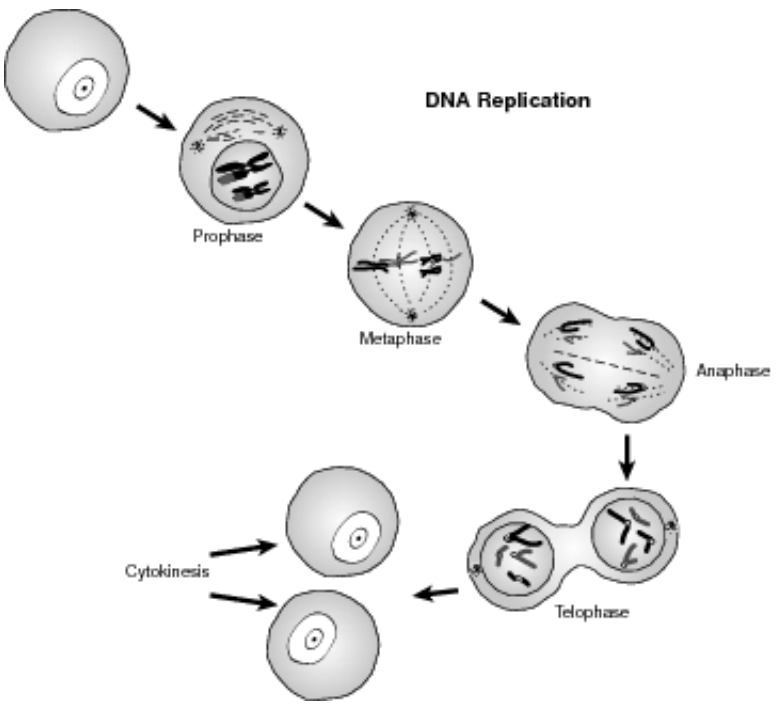
Cell Theory



- In 1855 Rudolf Virchow proposed that new cells are formed only from existing cells.

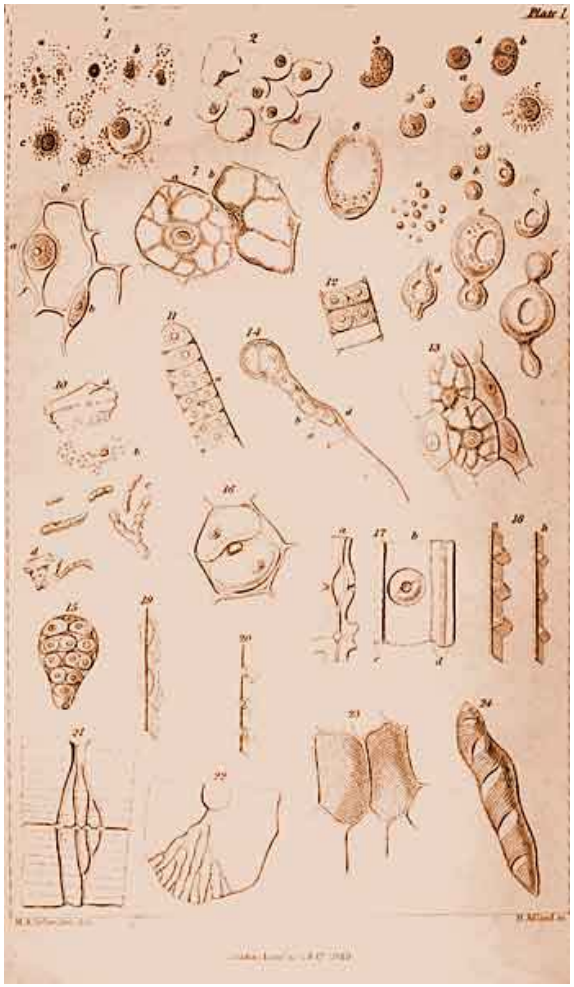
Cell Theory

- The observations and conclusions of Hooke, Leeuwenhoek, Schleiden, Schwann, Virchow, and others led to the development of the **cell theory.**

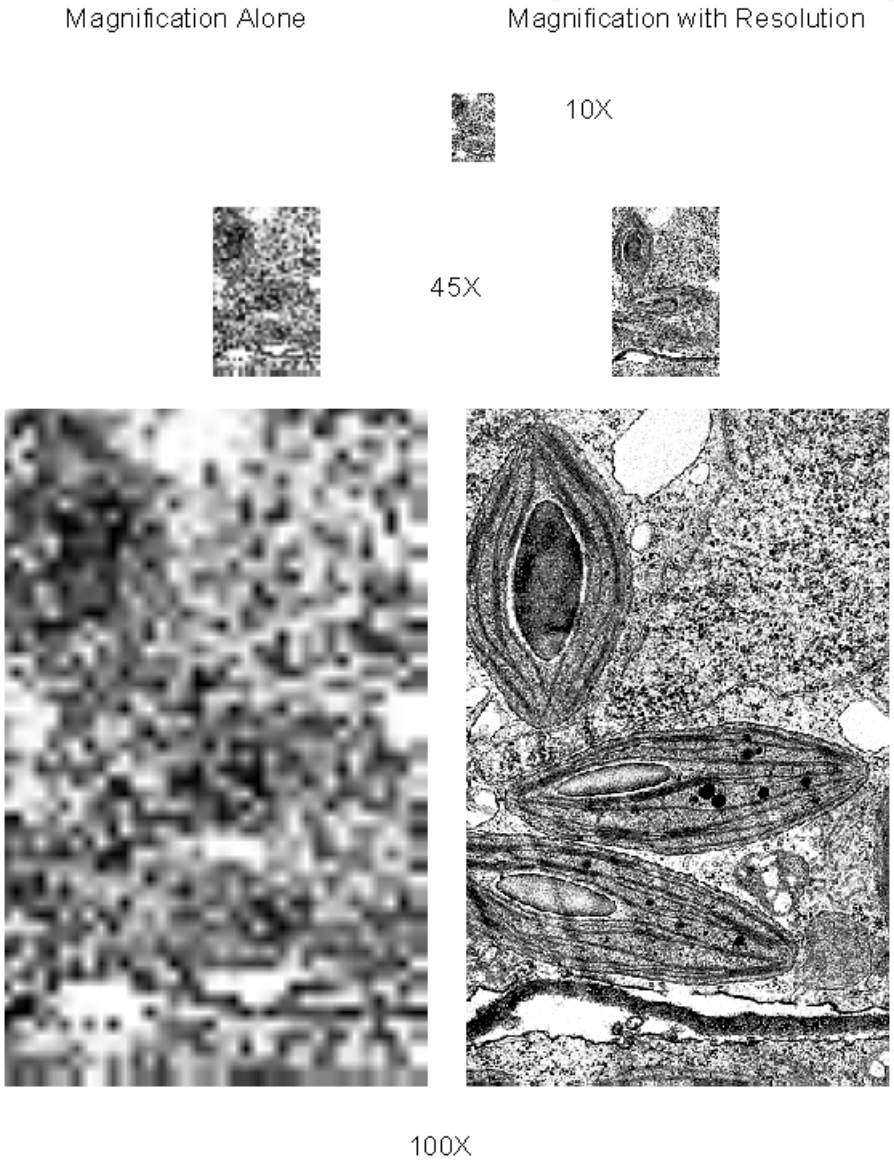


Cell Theory

- The cell theory states;
  - all living things are composed of cells
  - cells are the basic unit of structure and function in living things
  - all cells are produced from other cells.



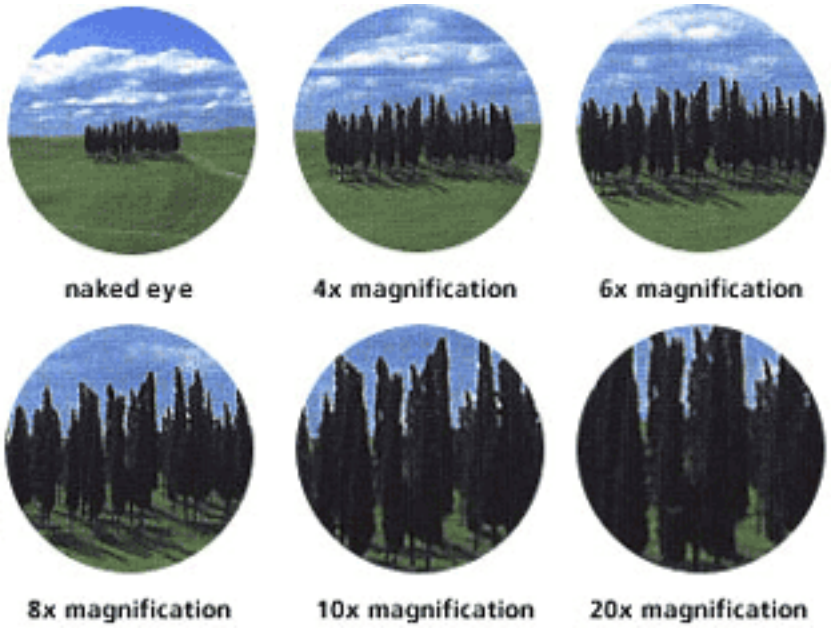
Microscope Properties



- For a microscope to be useful, it must combine two important properties—magnification and resolution.

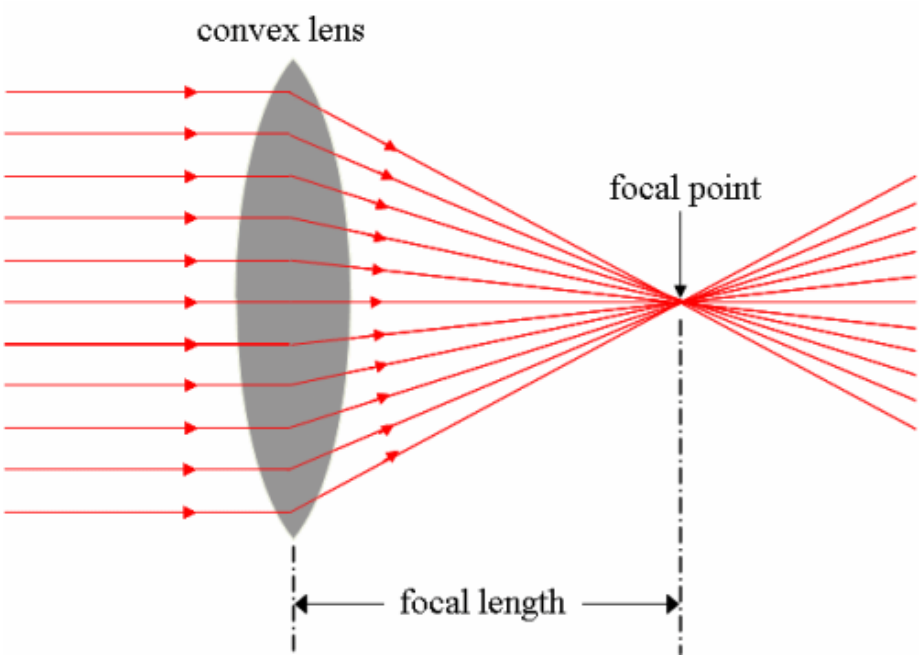
Microscope Magnification

- **Magnification is the ability** to make things look larger than they are.
- The lens or lenses in a light microscope magnify an object by bending the light that passes through them.

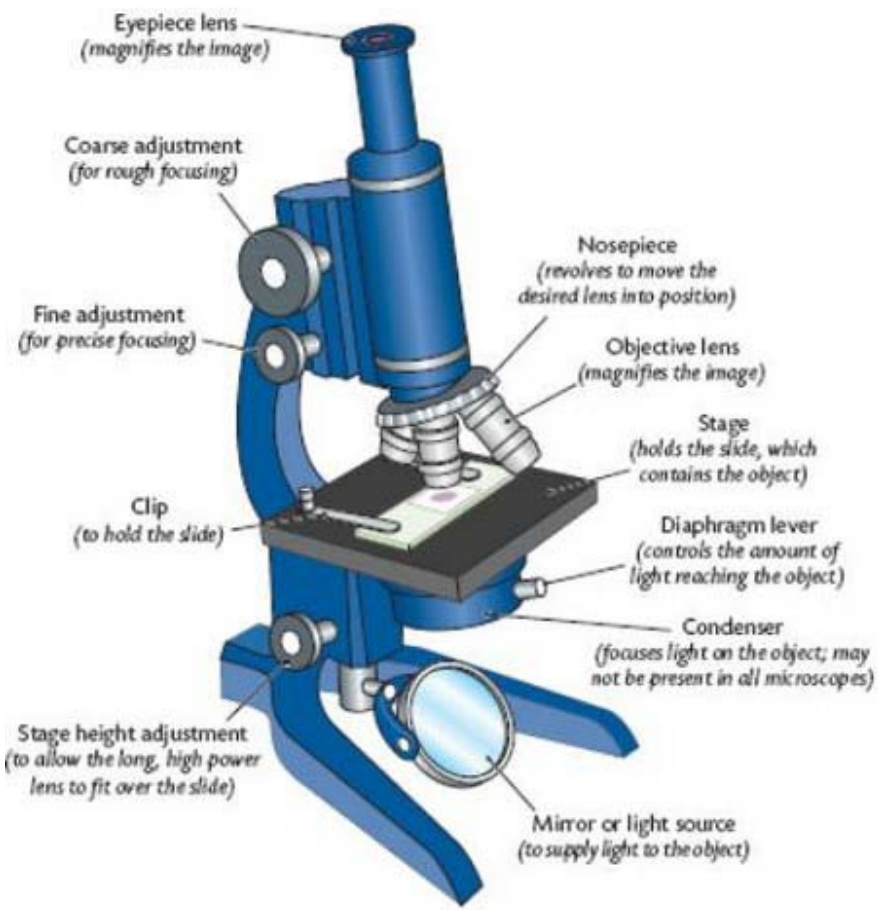


Microscope Magnification

- A lens that magnifies is thicker in the center than at the edges and is called a **convex lens.**



Compound Microscope Magnification



- Because a compound microscope uses more than one lens, it can magnify an object more than a simple microscope.

Compound Microscope Magnification

- The total magnification of a compound microscope is equal to the magnifications of the two lenses multiplied together.

X

=100 x

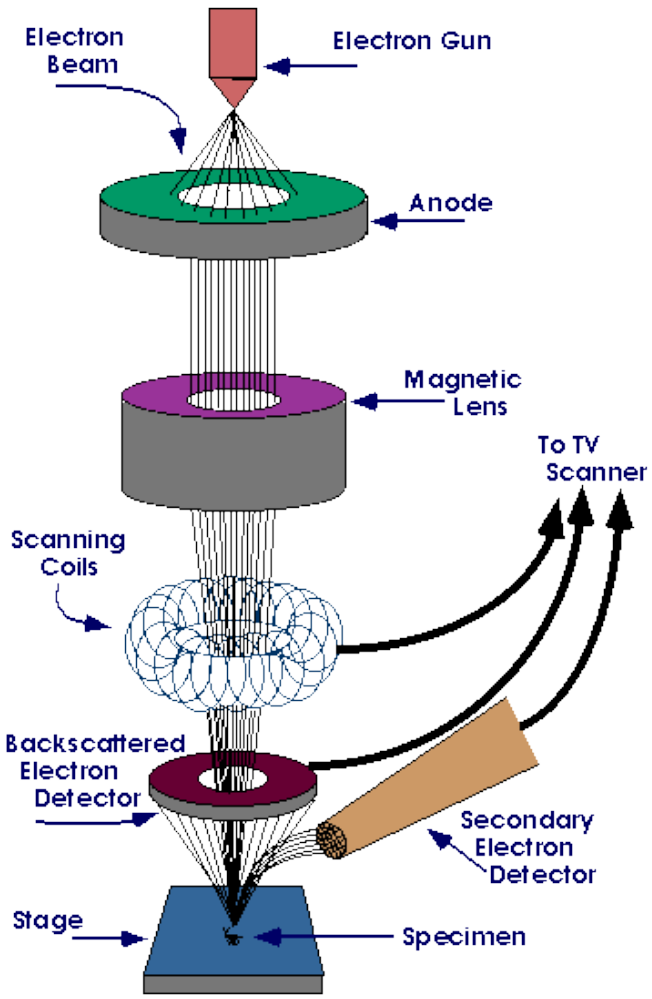
Resolution

- The ability to clearly distinguish the individual parts of an object is called **resolution.**
- Resolution is another term for the sharpness of an image.

300 DPI 8x10 inch Print resolution cropped in

6x7 Fuji 400H rated ISO 200 35mm Kodak 500T rated ISO 800

Electron Microscopes



- Since the 1930s, scientists have developed different types of electron microscopes, which use a beam of electrons instead of light to examine a specimen.

Electron Microscopes

- Because they use tiny electrons to produce images, the resolution of electron microscopes is much better than the resolution of light microscopes.

END – 1.1

Science Explorer
Cells and Heredity

1.2 - LOOKING INSIDE CELLS

1.2 - Looking Inside Cells - Related Videos

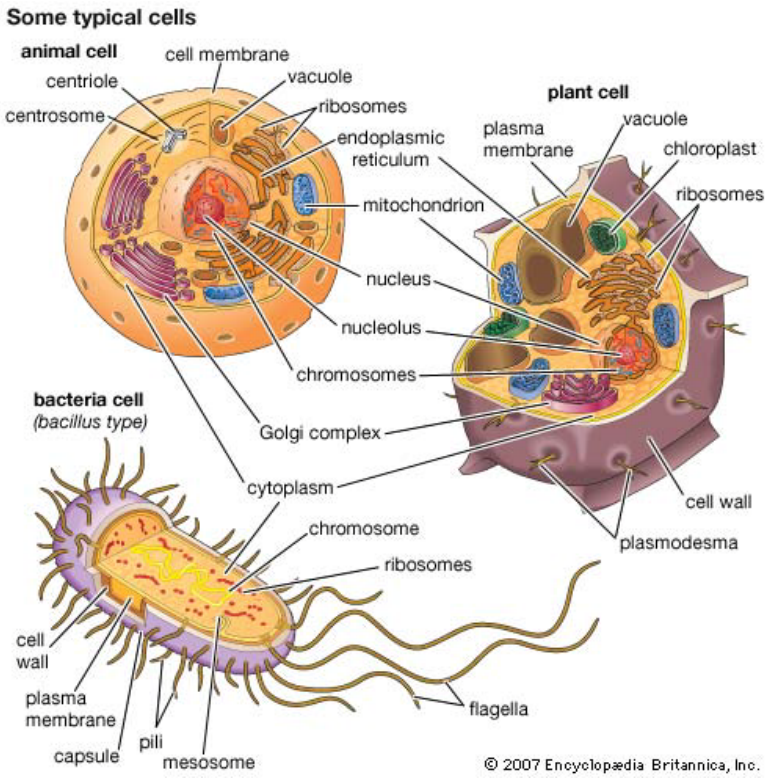
- Cell Membrane – Cell Wall
- Cell Organelles
- Cell Wall
- Cell Wall and Plasma Membrane
- Chloroplasts
- Chromatin
- Cytoskeleton – Cytoplasm
- Endoplasmic Reticulum
- Eukaryotic Cells
- Golgi Apparatus
- Journey Inside the Cell
- Lysosomes
- Mitochondria ATP Synthesis
- Nucleus
- Passive and Active Transport
- Powering the Cell Mitochondria
- Ribosomes
- The Cytoplasm Blues
- The Nucleus
- The Plasma Membrane
- Transport Across the Cell Membrane
- Vacuoles – Vesicles
- Voyage inside the Cell Membrane
- What are Vacuoles?

Objectives

1. What role do the cell membrane and nucleus play in the cell?
2. What functions do other organelles in the cell perform?
3. How do bacterial cells differ from plant and animal cells?

Organelles

- Inside a cell are tiny structures called **organelles**, which carry out specific functions in the cell.
- Organelles include the cell wall, cell membrane, and nucleus.



Cell Wall

- The **cell wall** is a rigid layer of nonliving material that surrounds plant cells. It helps protect and support a cell. Although the cell wall is stiff, many materials can pass through it.

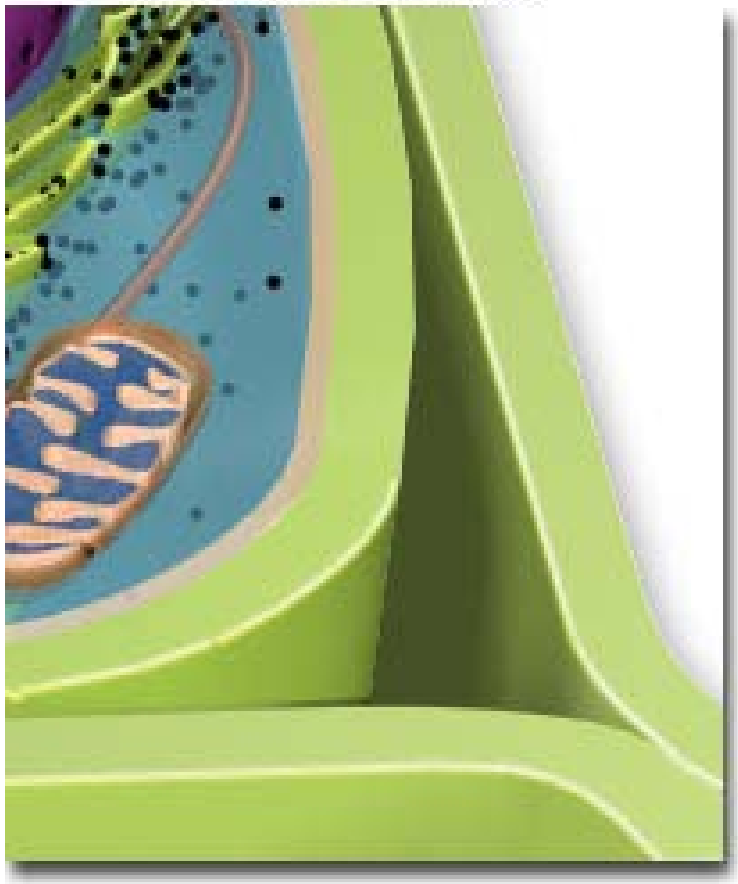
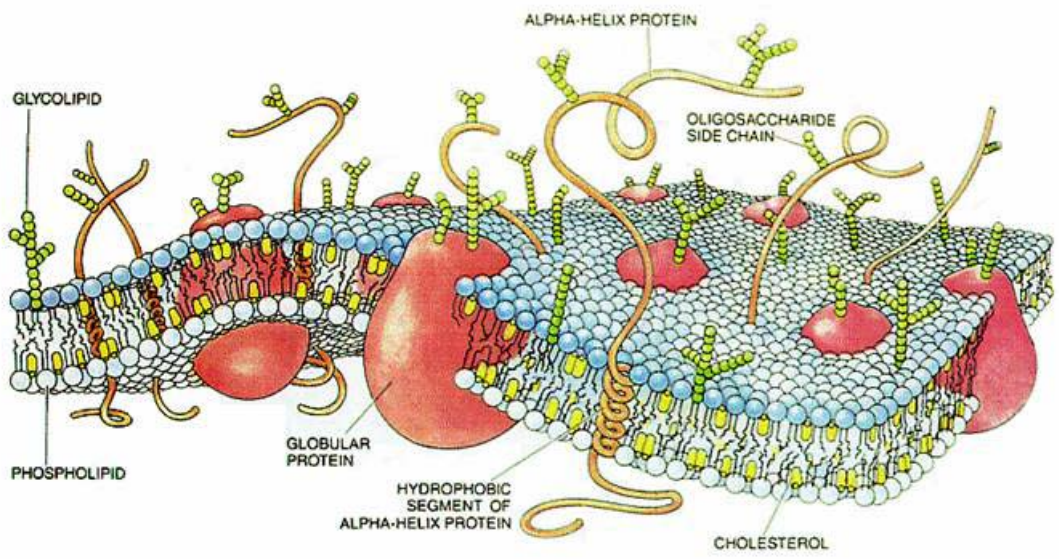


Figure 1

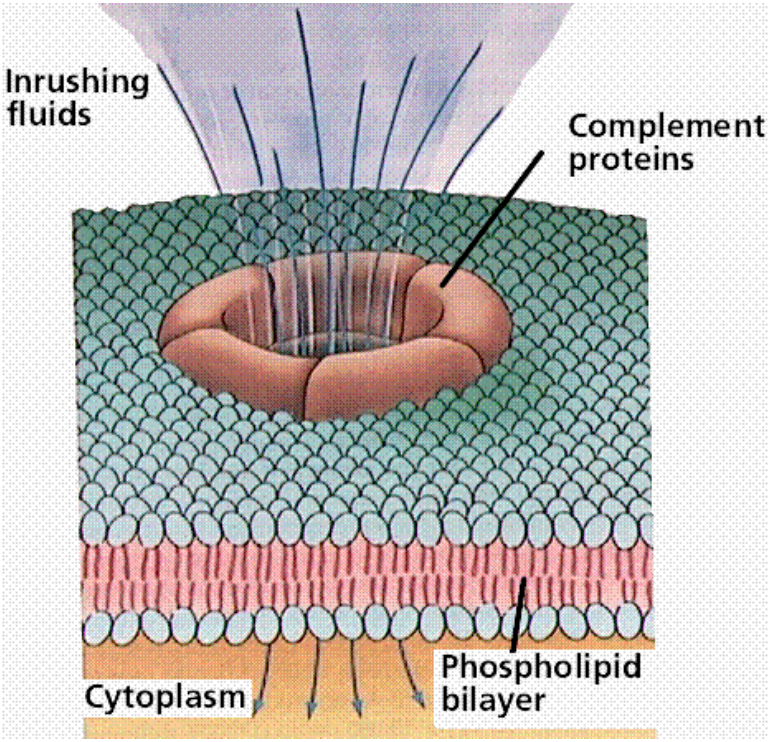
Cell Membrane



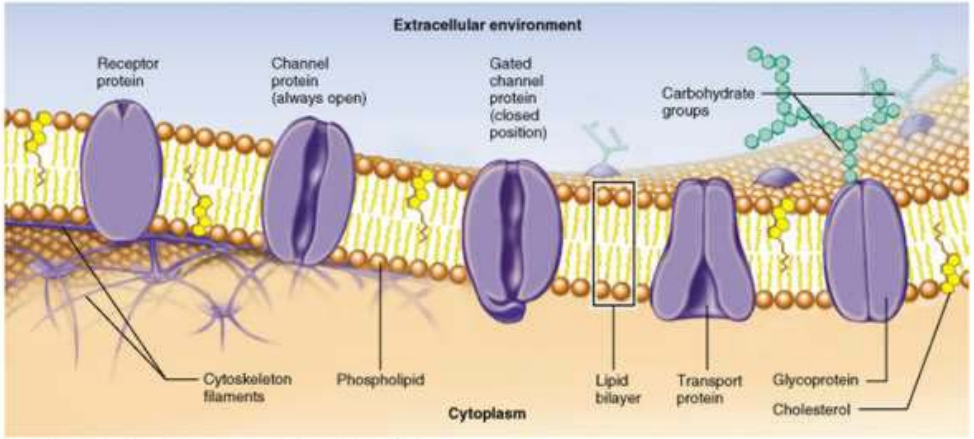
- In cells that do not have cell walls, the **cell membrane** is the outside boundary that separates the cell from its environment.

Cell Membrane

- There are tiny openings, or pores, in the cell membrane through which materials can enter or leave the cell.



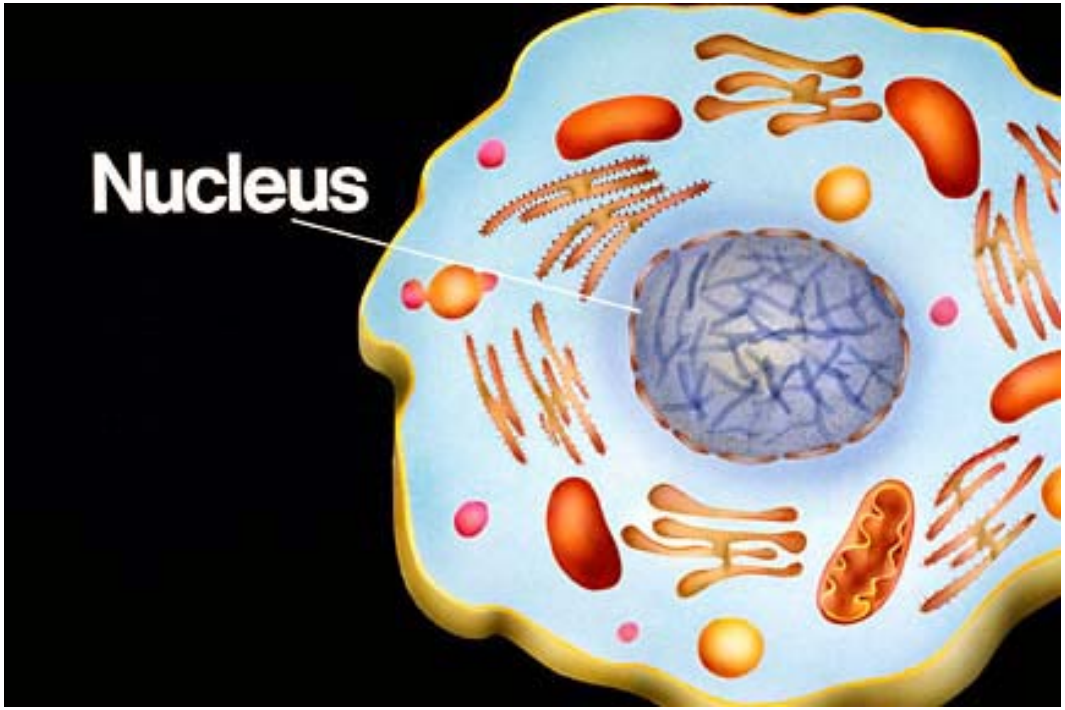
Cell Membrane



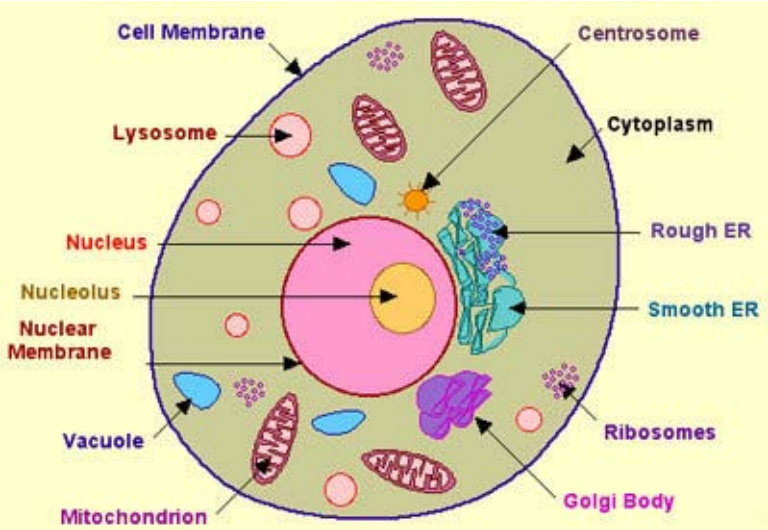
- One of the cell membrane's main functions is to control what substances come into and out of a cell.

Nucleus

- The **nucleus** is a large, oval structure that acts as the "brain" of the cell.



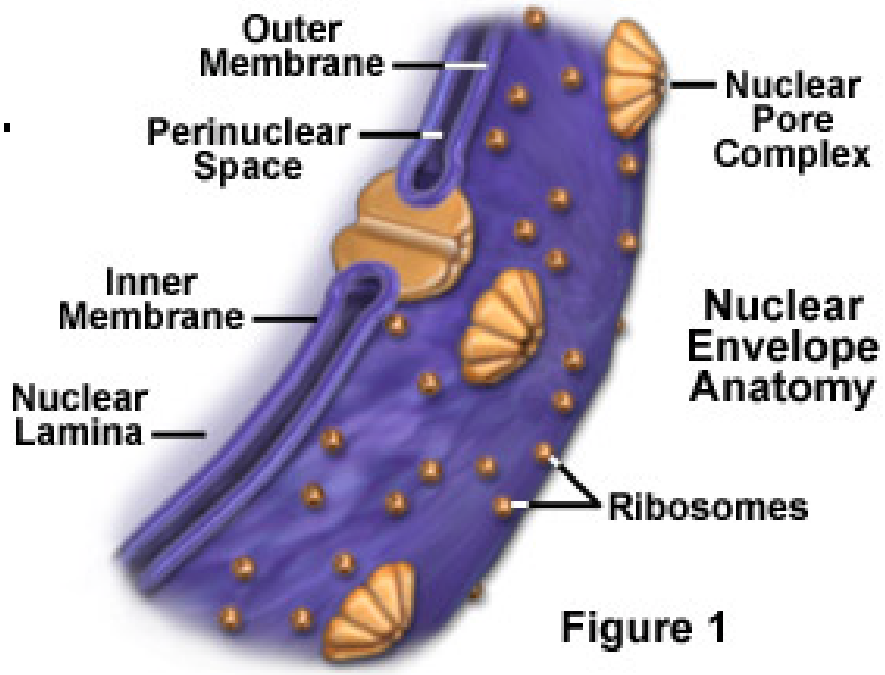
Nucleus



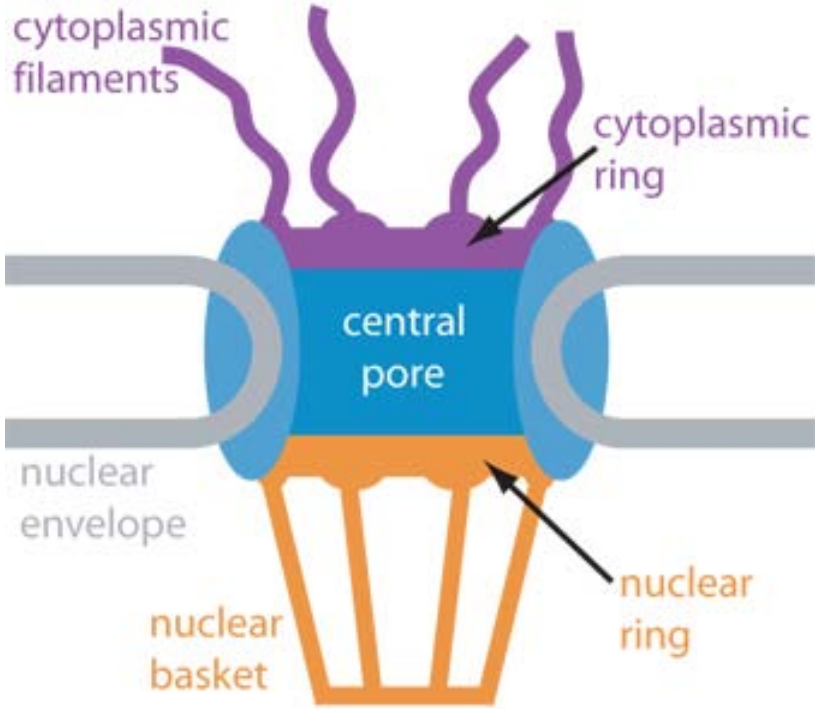
- You can think of the nucleus as the cell's control center, directing all of the cell's activities.

Nuclear Membrane

- The nucleus is surrounded by a nuclear membrane.



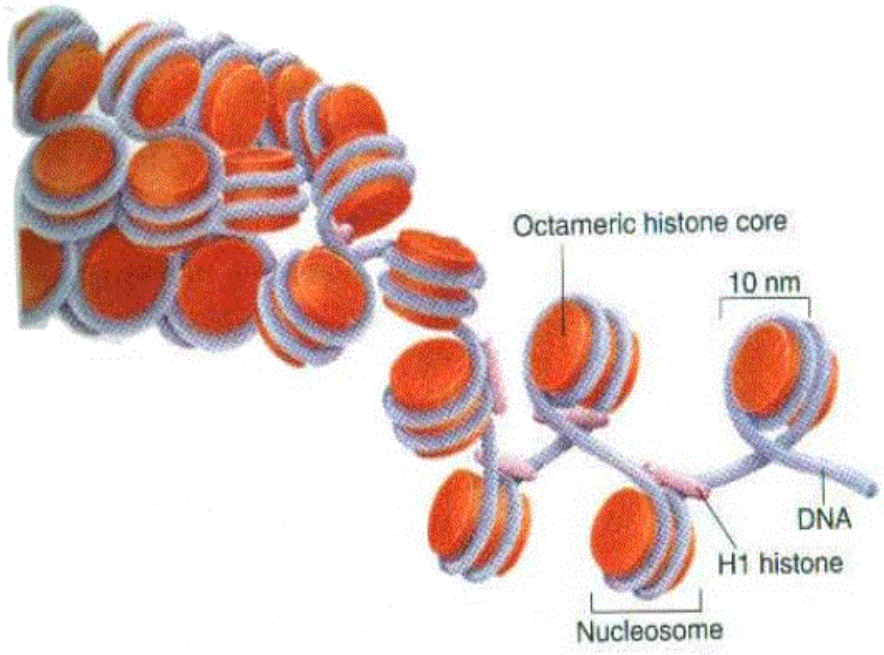
Nuclear Membrane



- Materials pass in and out of the nucleus through small openings, or pores, in the nuclear membrane.

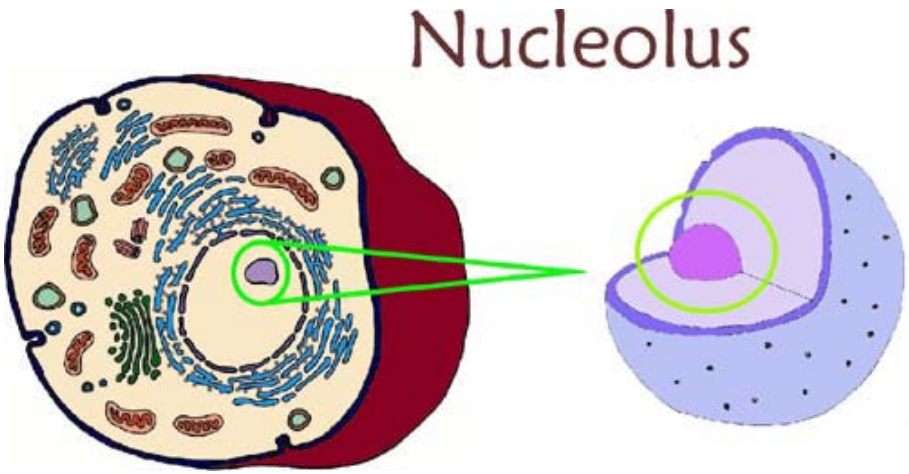
Chromatin

- Floating in the nucleus are thin strands called **chromatin**, which contains the genetic material, or the instructions for cell functions.

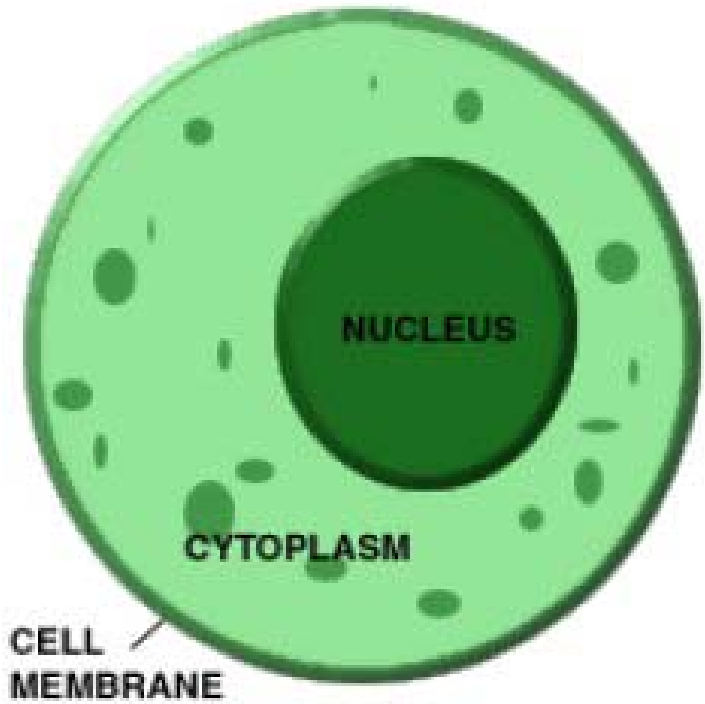


Nucleolus

- The nucleus also contains the nucleolus, a structure where ribosomes are made.



Cytoplasm



- The **cytoplasm** is the region between the cell membrane and the nucleus. Many cell organelles are found in the cytoplasm.

Organelles

- The **organelles** function to produce energy, build and transport needed materials, and store and recycle wastes.

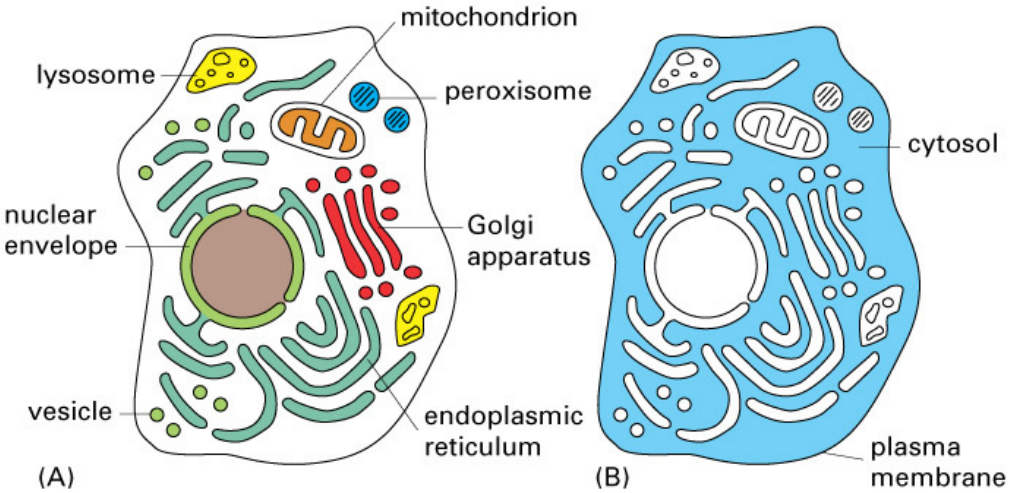
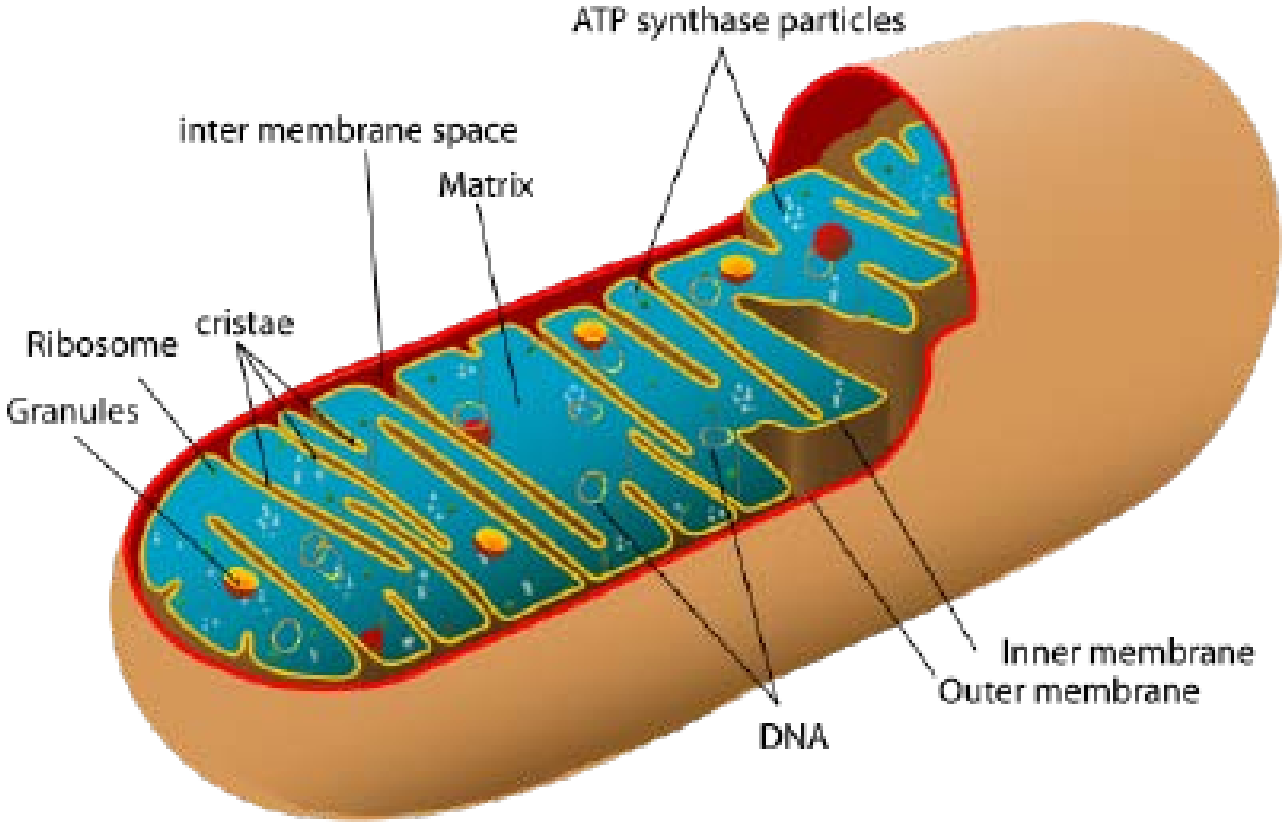


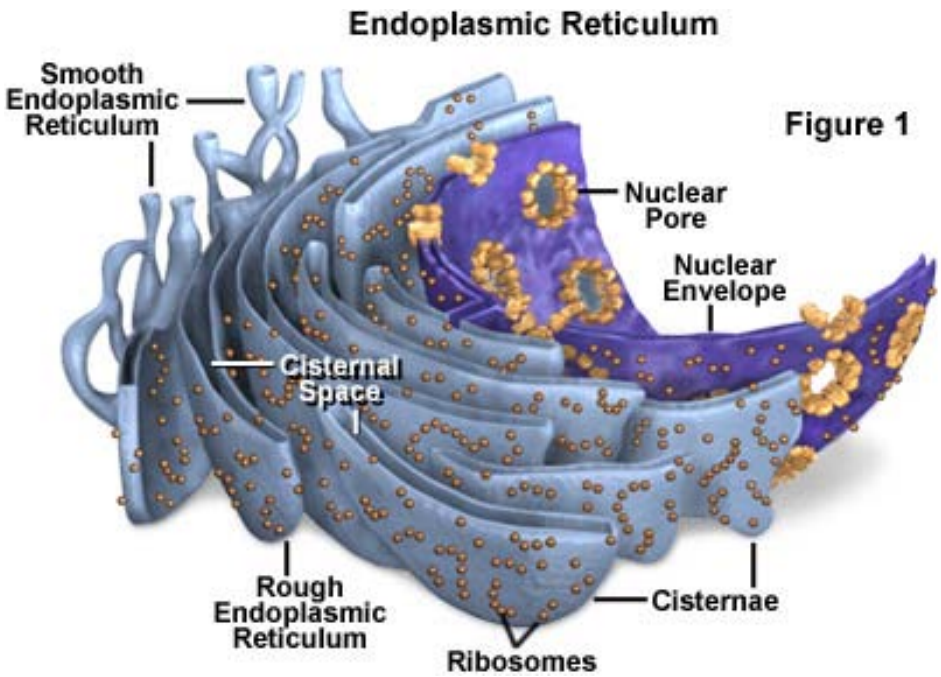
Figure 1-24 Essential Cell Biology, 2/e. (© 2004 Garland Science)

Mitochondria



- Rod-shaped organelles called **mitochondria** produce energy.

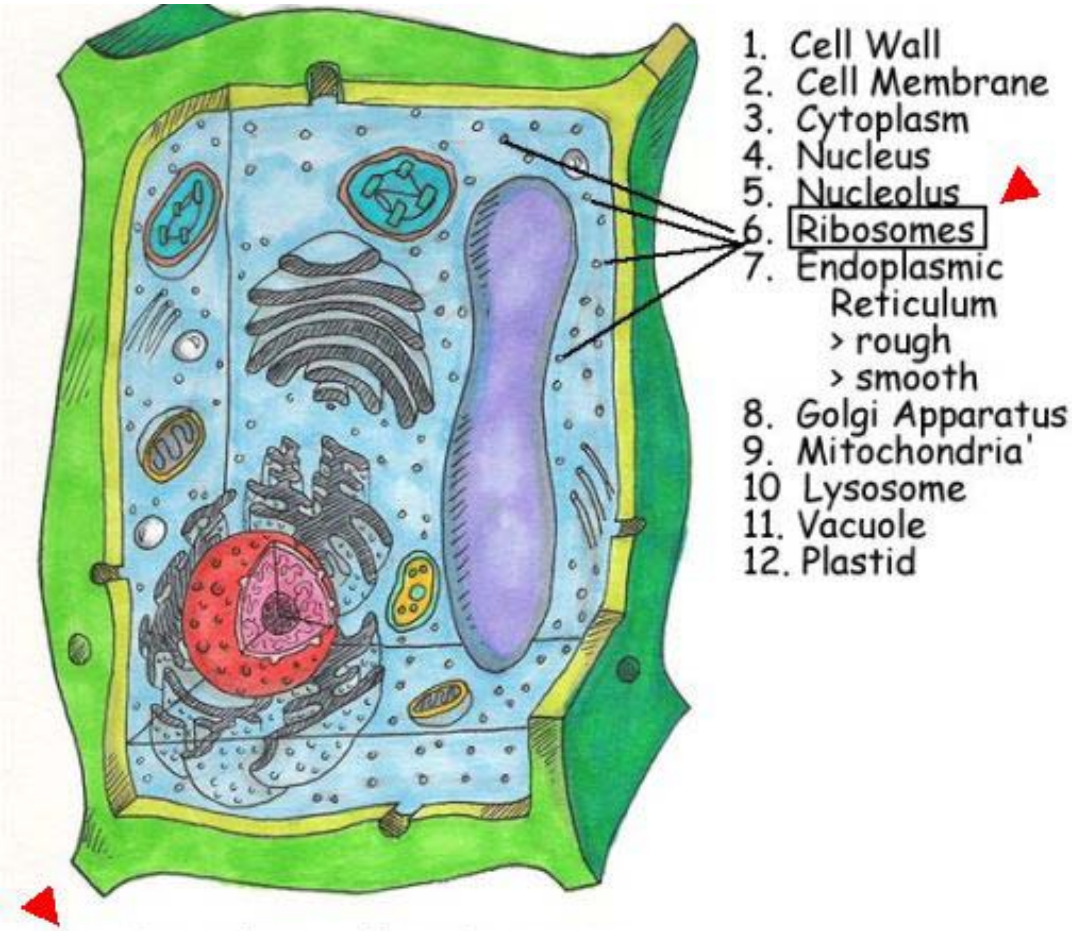
Endoplasmic Reticulum



- A maze of passageways called the **endoplasmic reticulum** carries proteins and other materials from one part of the cell to another.

Ribosomes

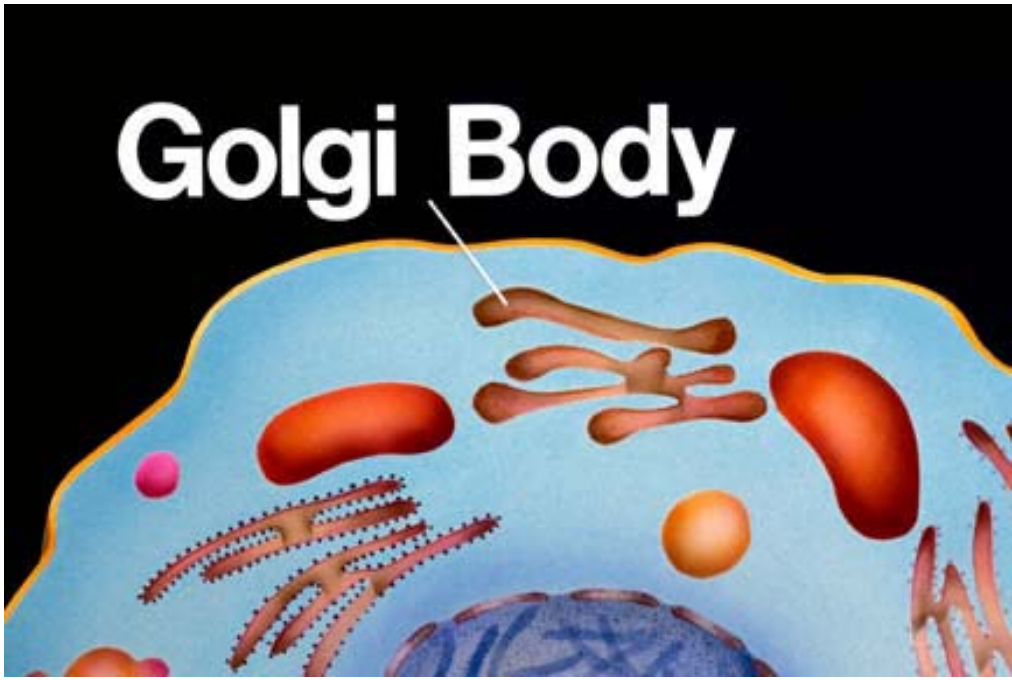
- Small, grainlike bodies called **ribosomes** produce proteins.



The place where cells make protein.
> some protein stays in cells, some exported
> most numerous organelles in cell.

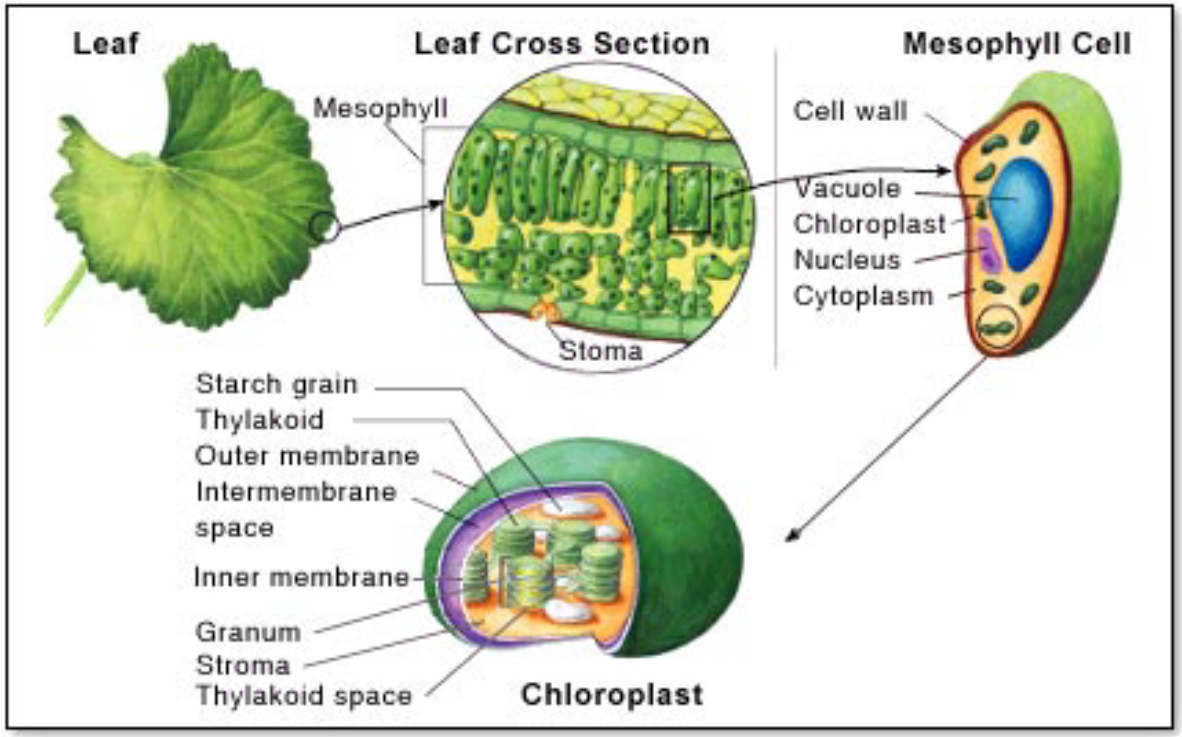
Golgi Bodies

- Collections of sacs and tubes called **Golgi bodies** distribute proteins and other materials throughout the cell.

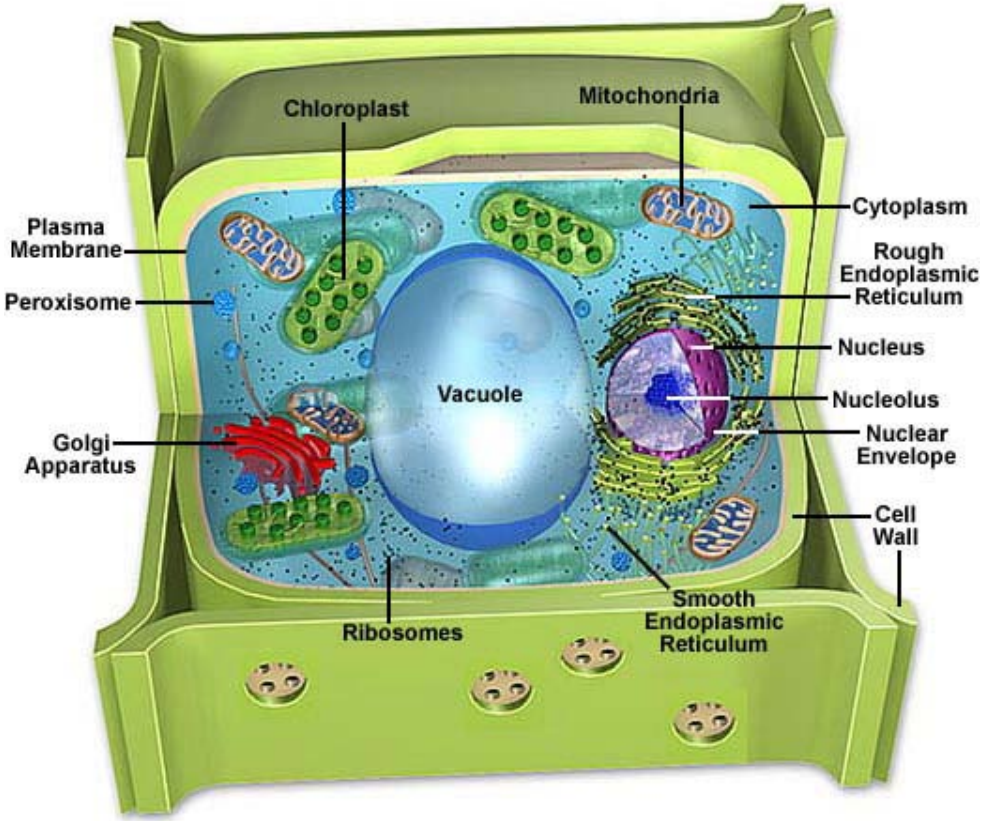


Chloroplasts

- In plants and some other organisms, large, green structures called **chloroplasts** capture energy from sunlight and use it to produce food for the cell.



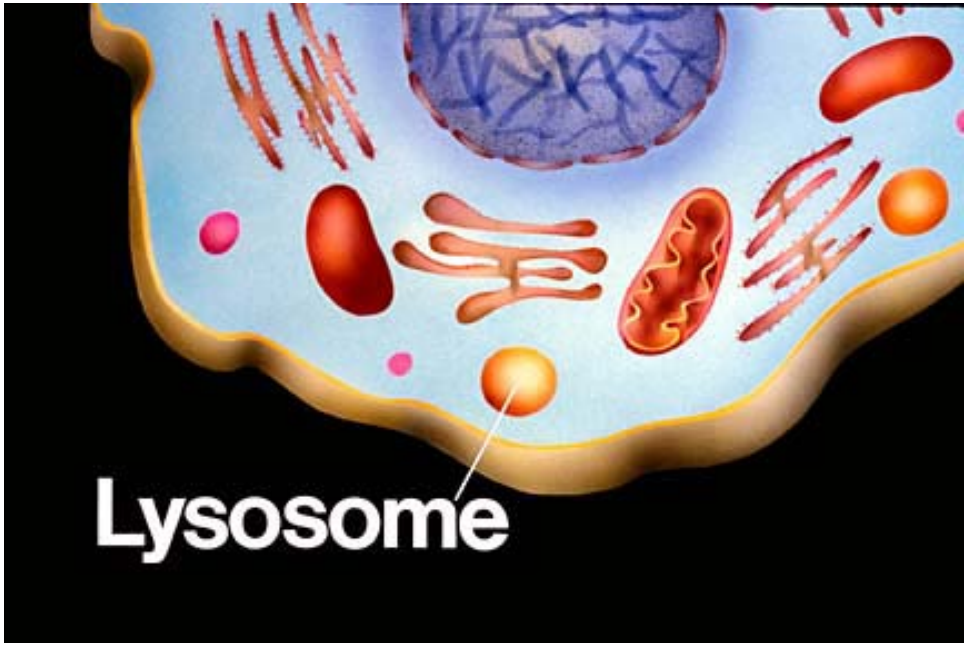
Vacuole



- A large sac called a **vacuole** stores food and other materials in the cell.

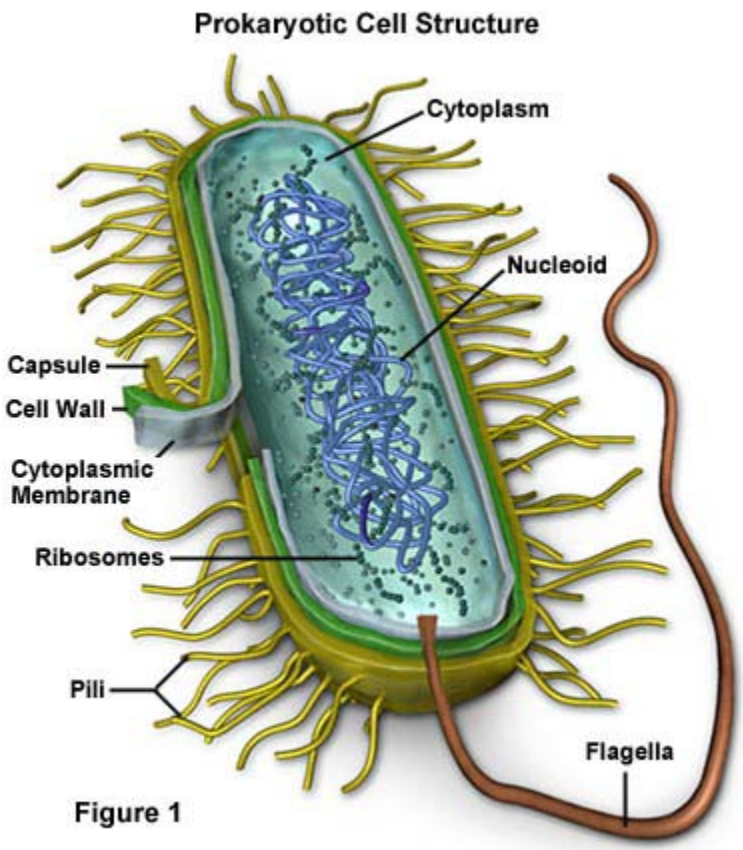
Lysosomes

- Small, round structures called **lysosomes** break down food and recycle old cell parts.

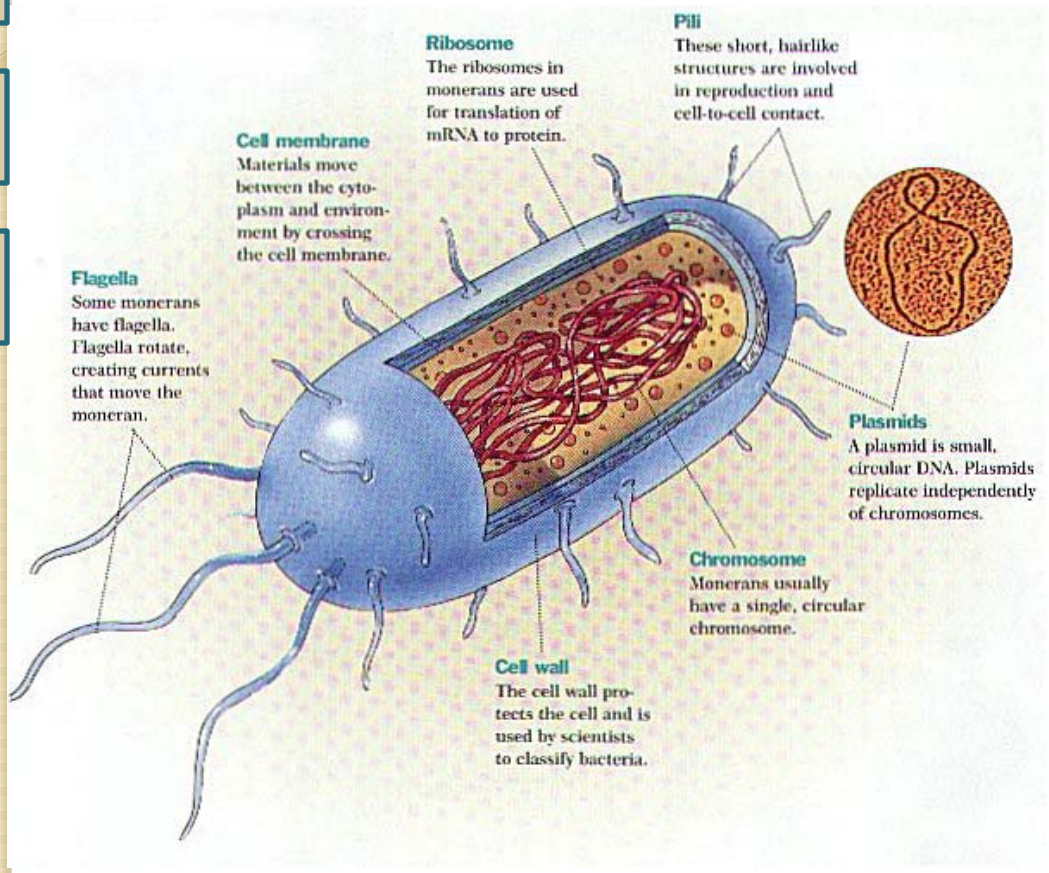


Bacterial Cell

- A bacterial cell is smaller than a plant or animal cell.
- While a bacterial cell does have a cell wall and a cell membrane, it does not contain a nucleus.



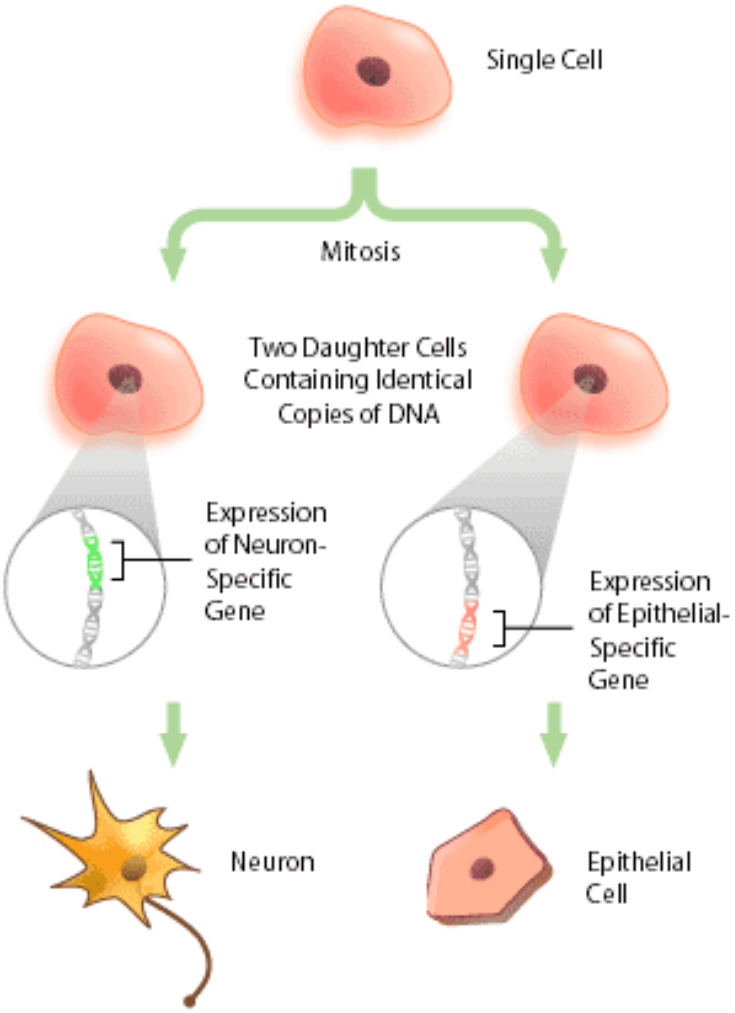
Bacterial Cell



- A bacterial cell also contains ribosomes but none of the other organelles found in plant or animal cells.

Many-celled Organisms

- In many-celled organisms, the cells are often quite different from each other. The structure of each kind of cell is suited to the function it carries out in the organism.



END – 1.2

Science Explorer
Cells and Heredity

1.3 - CHEMICAL COMPOUNDS IN CELLS

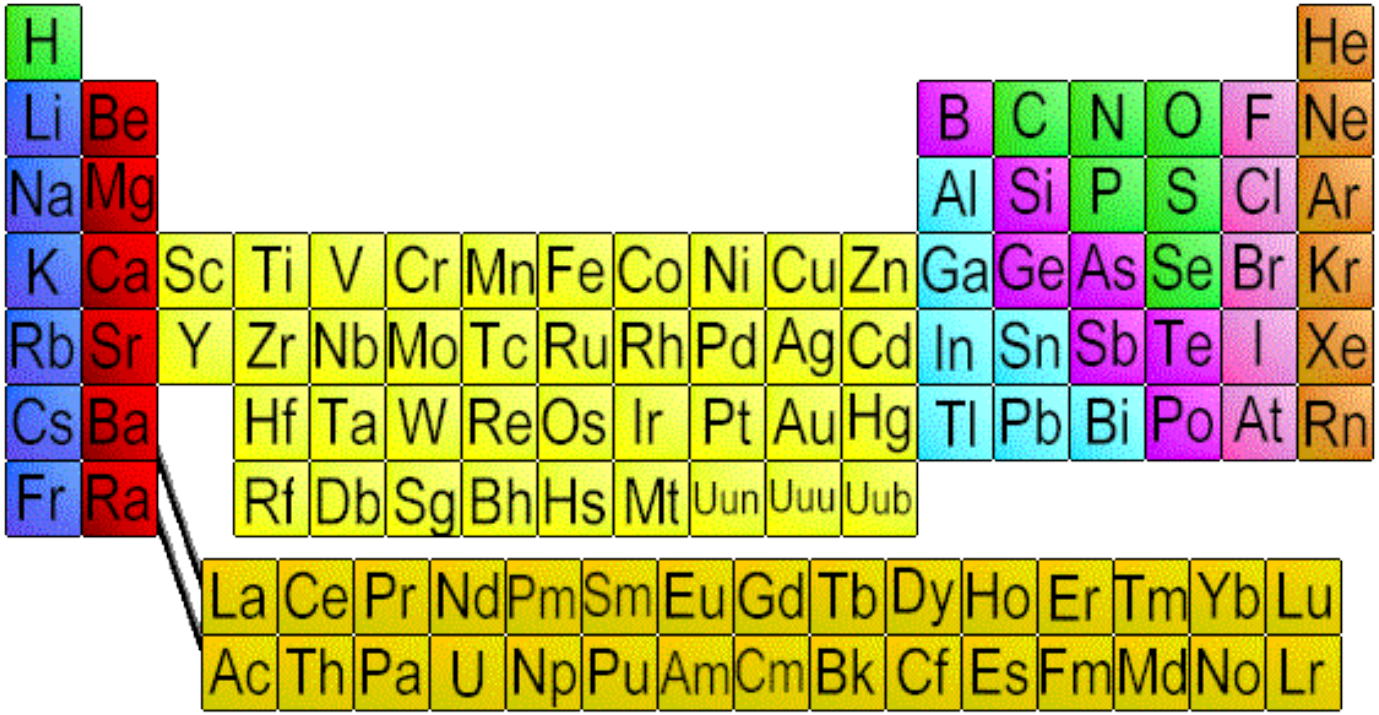
1.3 - Chemical Compounds in Cells – Related Videos

- Atoms and The Periodic Table
- Biology Amino Acids and the R Group
- Biology Proteins Amino Acids
- Enzymes
- From DNA to Protein
- Lipid
- Lipids
- Nova Science Now Amazing Atoms
- Nucleic Acids
- Organic Compounds
- Organic Molecules Carbohydrates
- Protein Structure
- They Might be Giants – Meet the Elements
- What is a Chemical Compound?

Objectives

1. What are the four main kinds of organic molecules in living things?
2. How is water important to the function of cells?

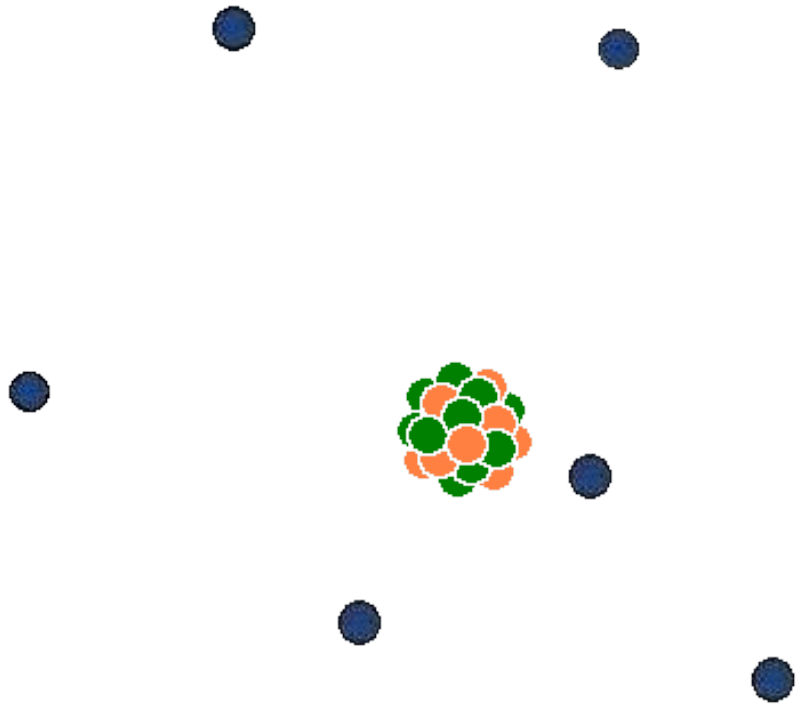
Element



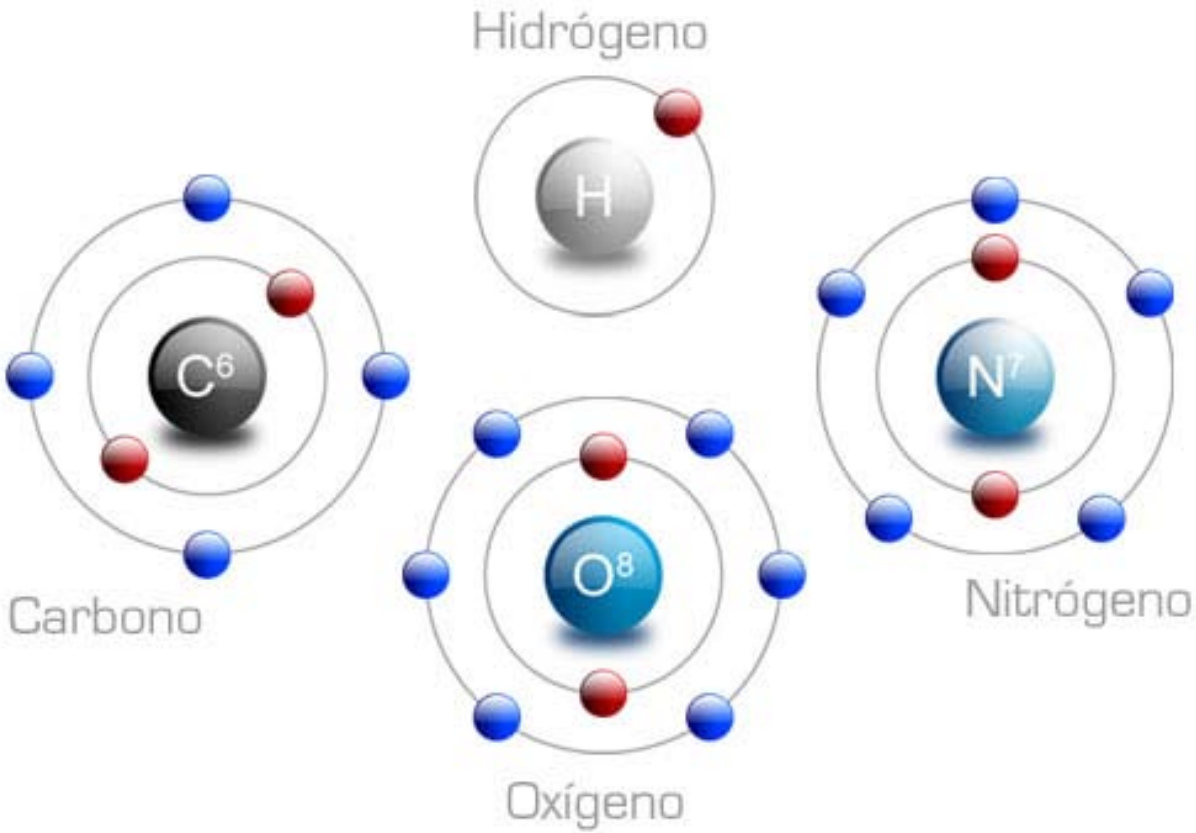
- An **element** is any substance that cannot be broken down into simpler substances.

Atom

- The smallest unit of an element is called an **atom**.



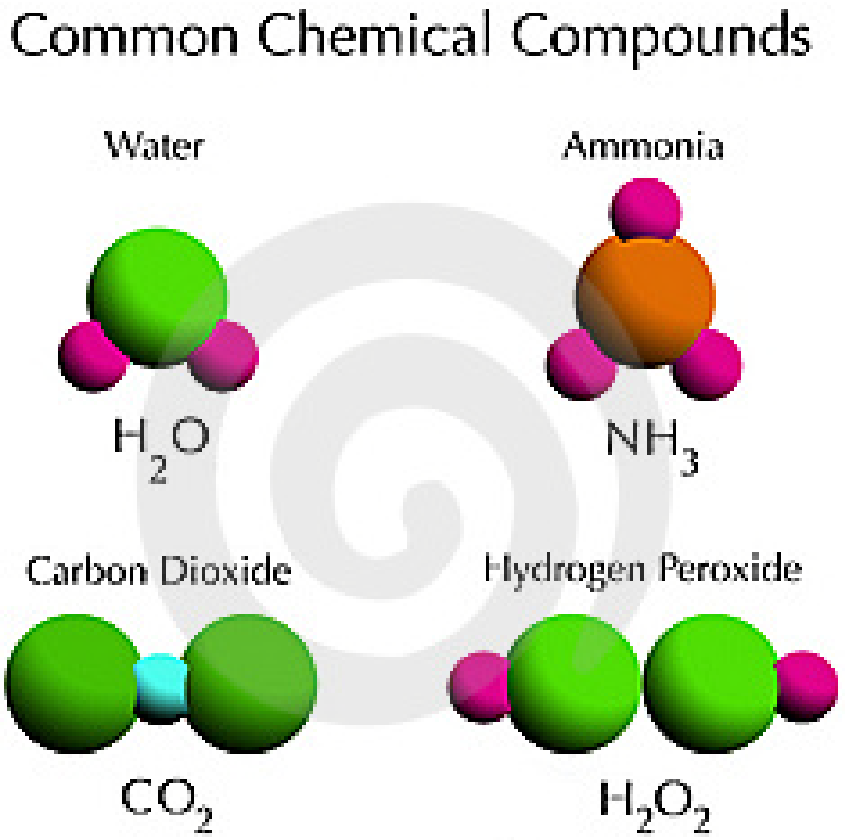
CHON



- The most common elements in living things are carbon, oxygen, hydrogen, and nitrogen

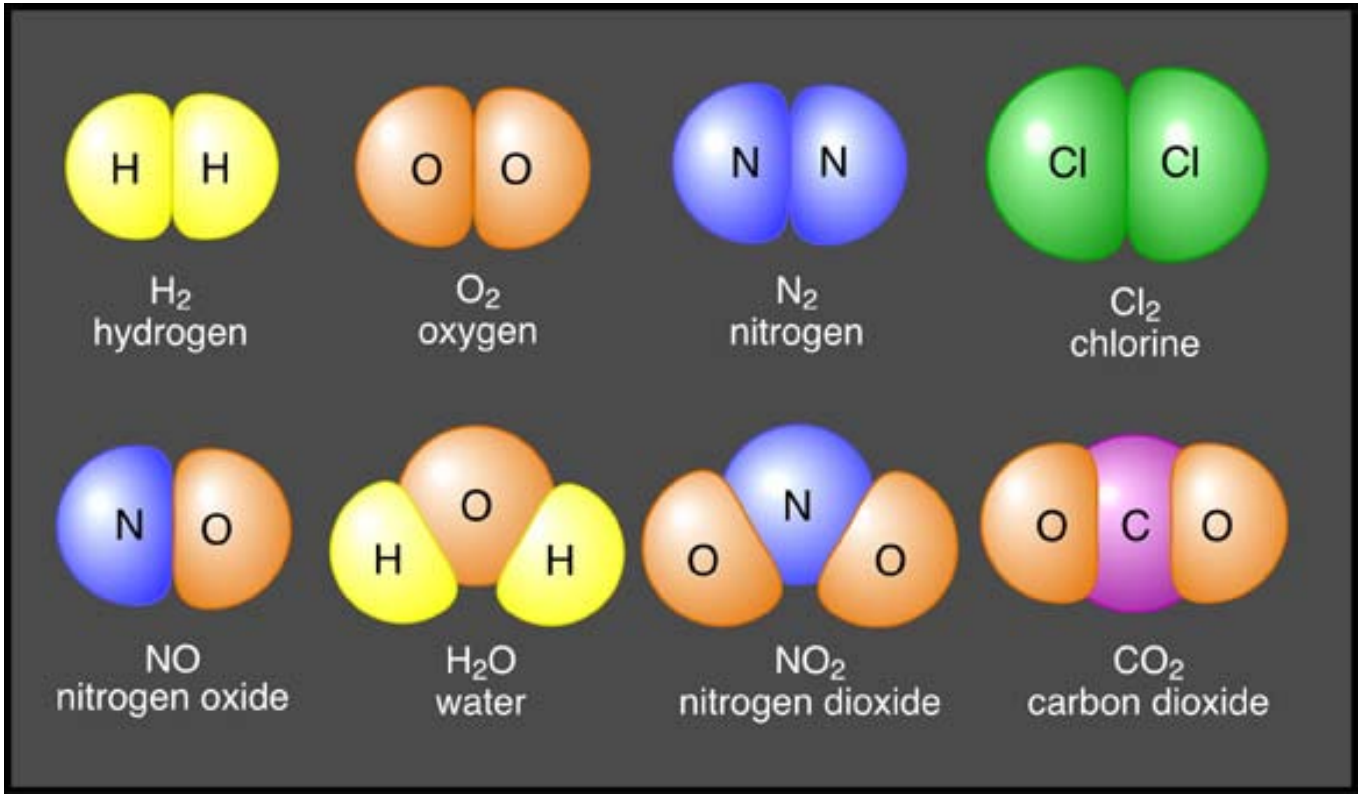
Compound

- When two or more elements combine chemically, they form a **compound.**



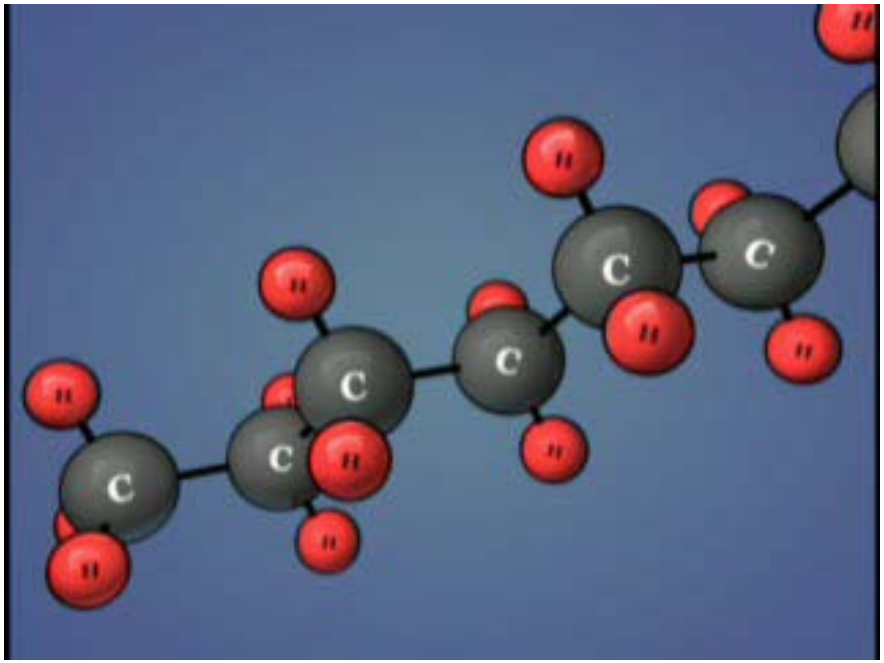
Molecule

- The smallest unit of most compounds is called a **molecule.**

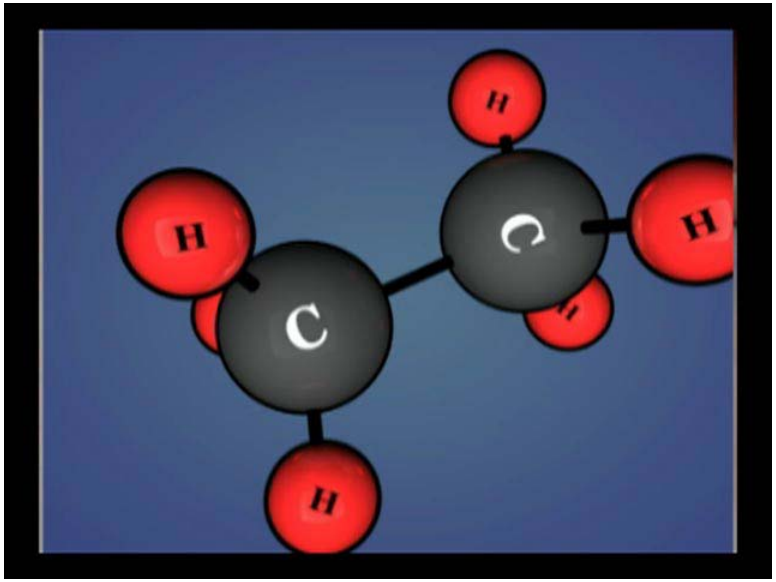


Compounds in Living Things

- Many of the compounds found in living things contain the element carbon, which is usually combined with other elements.



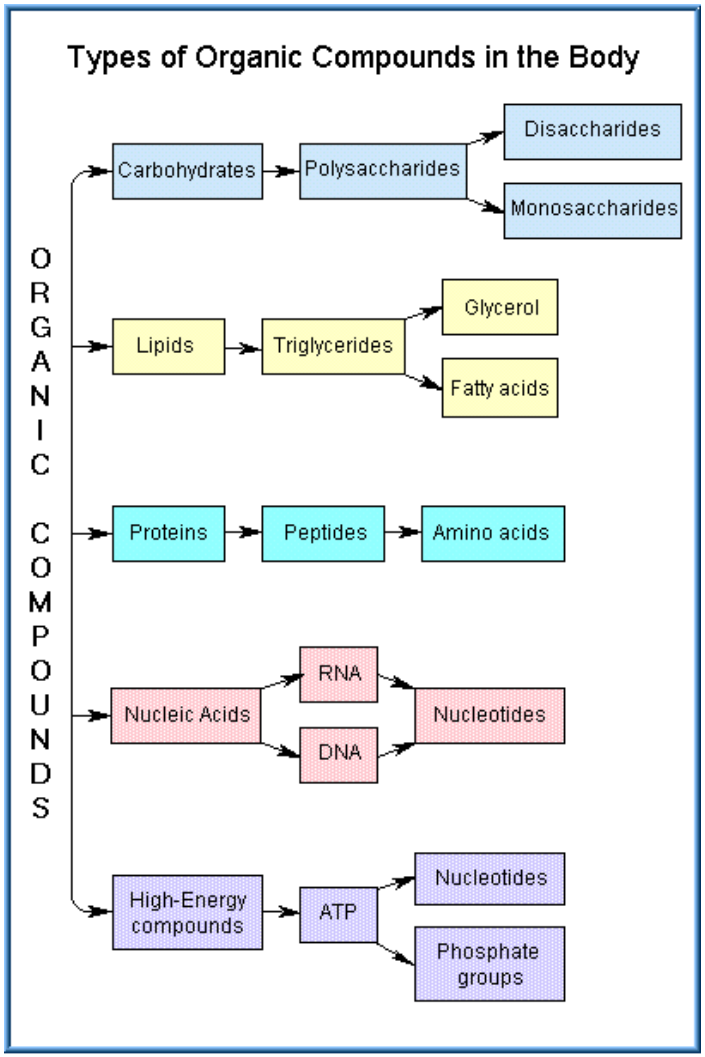
Organic Compounds



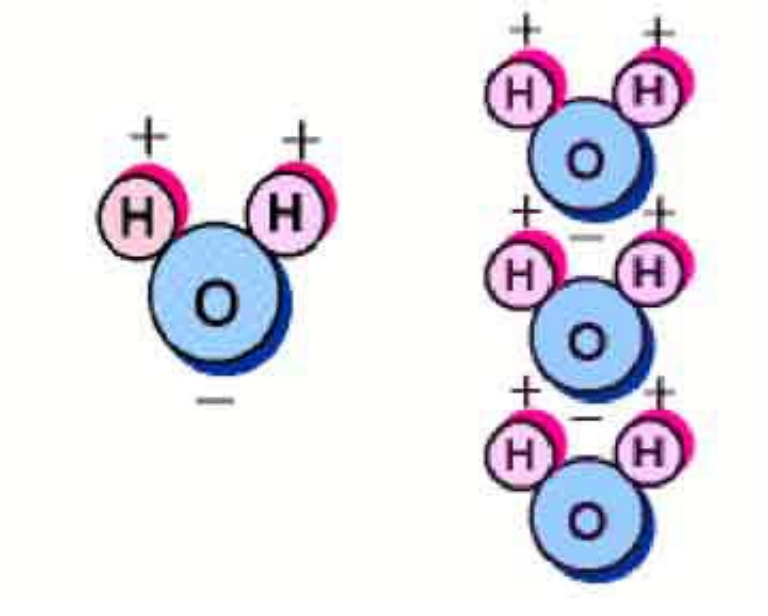
- Most compounds that contain carbon are called **organic compounds**.

Organic Compounds

- The most important groups of organic compounds found in living things are carbohydrates, lipids, proteins, and nucleic acids.



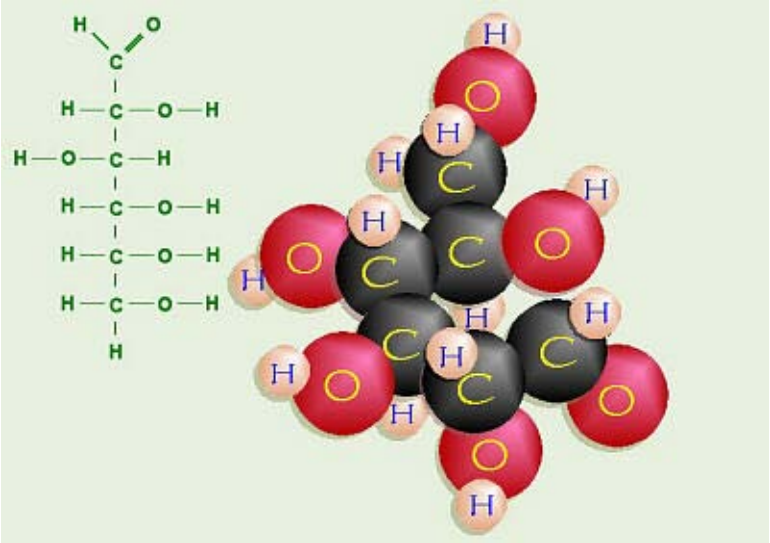
Inorganic Compounds



- Compounds that do not contain the element carbon are called **inorganic compounds.**

Carbohydrates

- A **carbohydrate** is an energy-rich organic compound made of the elements carbon, hydrogen, and oxygen.

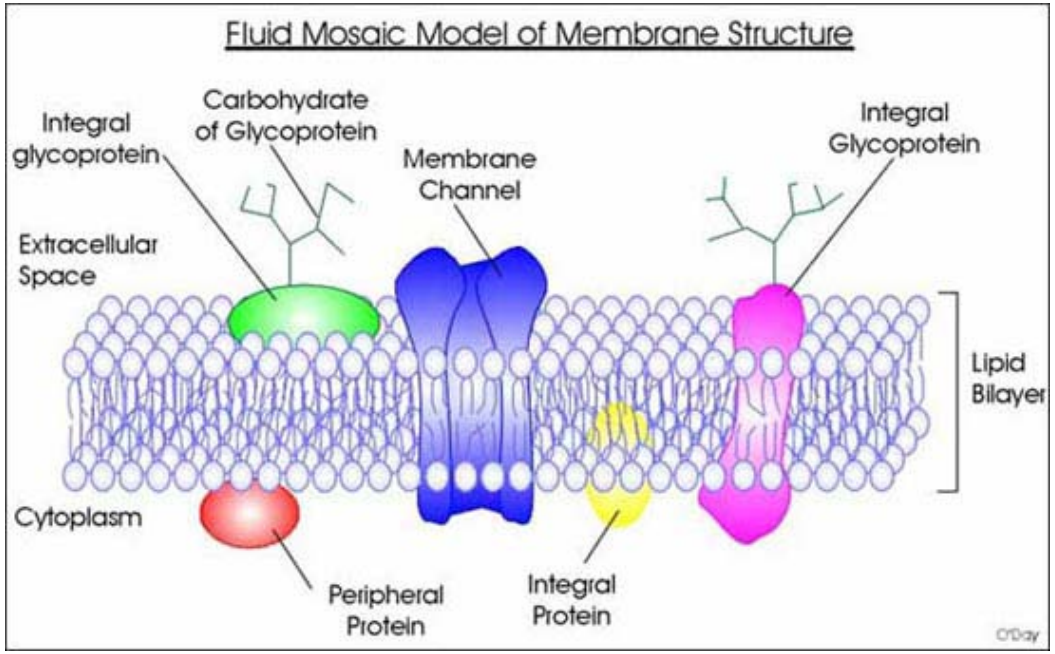


Carbohydrates

- Sugars and starches are examples of carbohydrates.

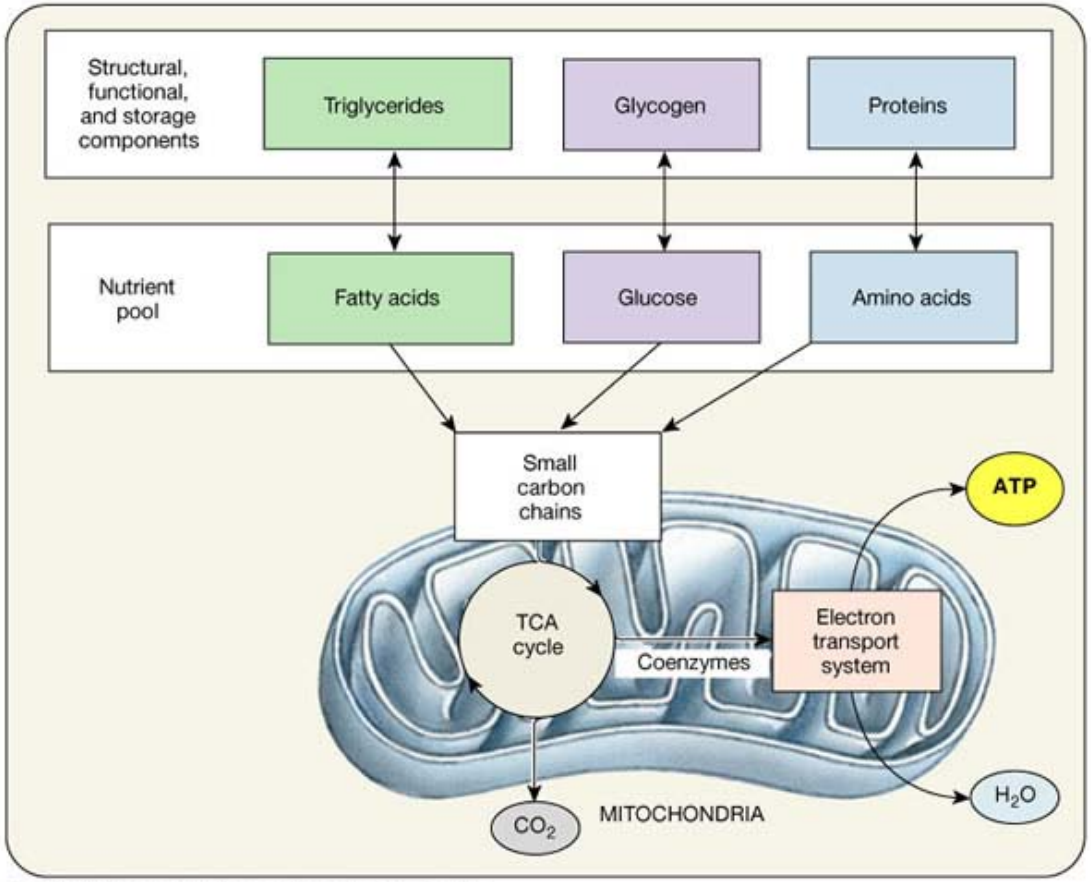
Carbohydrates

- Carbohydrates are important components of some cell parts, including cell walls and cell membranes.



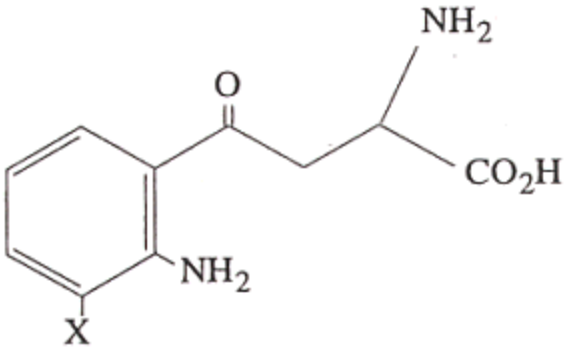
Carbohydrates

- Carbohydrates also provide cells with energy.



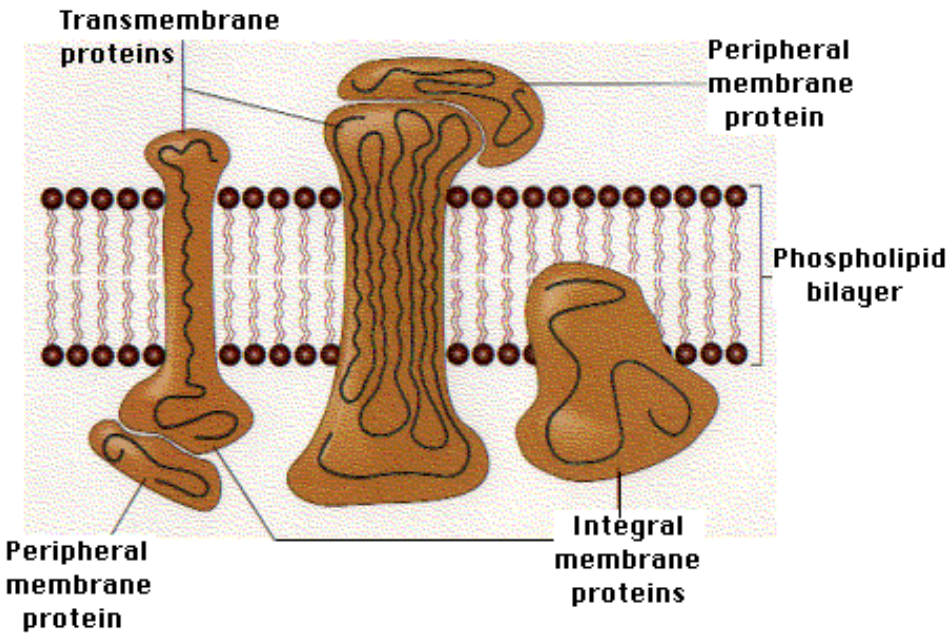
Proteins

- **Proteins** are large organic molecules made of carbon, hydrogen, oxygen, nitrogen, and, in some cases, sulfur.



6–7

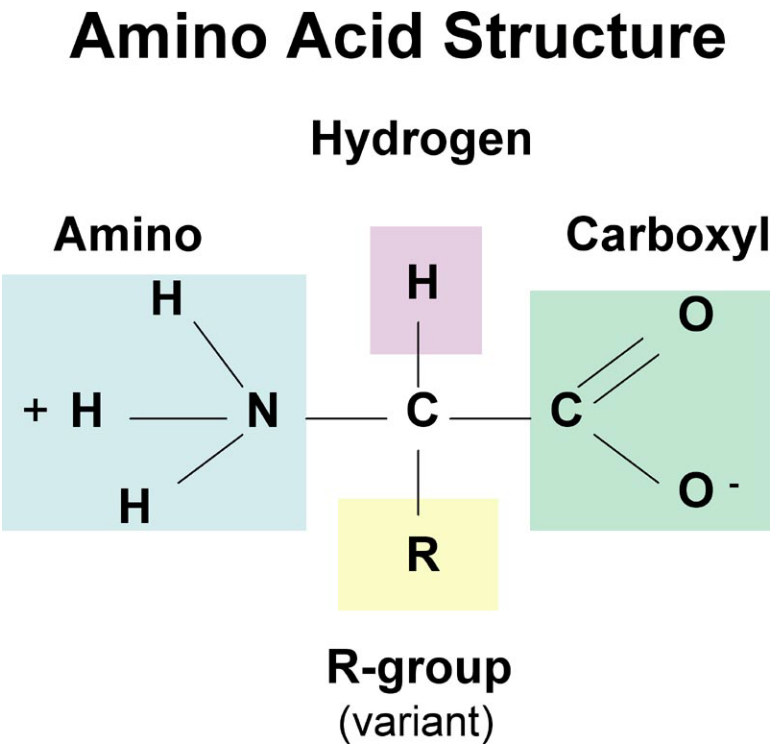
Proteins



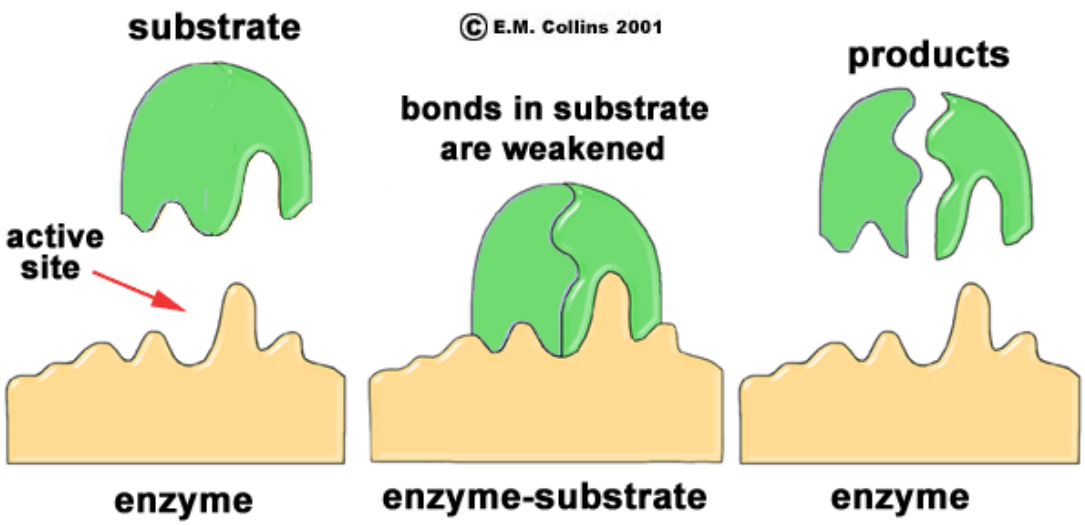
- Cells use proteins for cell membranes and many of the organelles within the cell.

Amino Acids

- Protein molecules are made up of smaller molecules called **amino acids.**



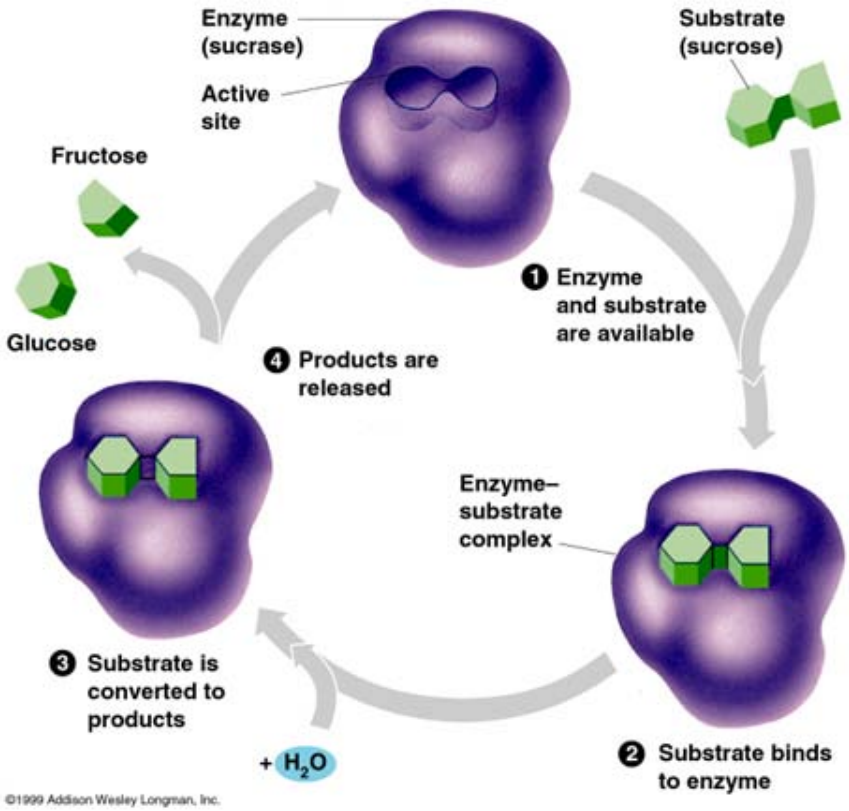
Enzyme



- An **enzyme** is a type of protein that speeds up a chemical reaction in a living thing.

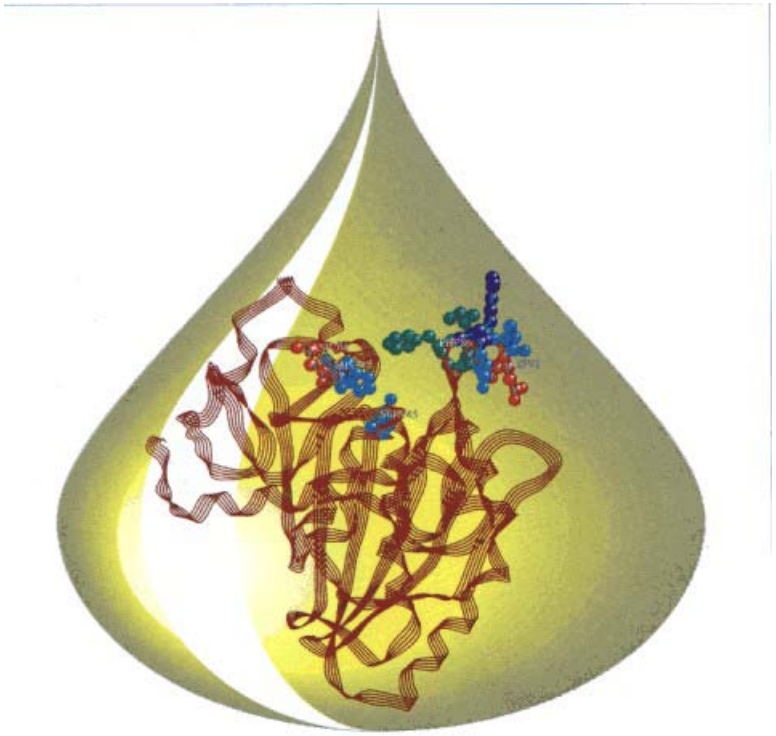
Enzymes

- Without enzymes, many chemical reactions that are necessary for life would either take too long or not occur at all.



Lipids

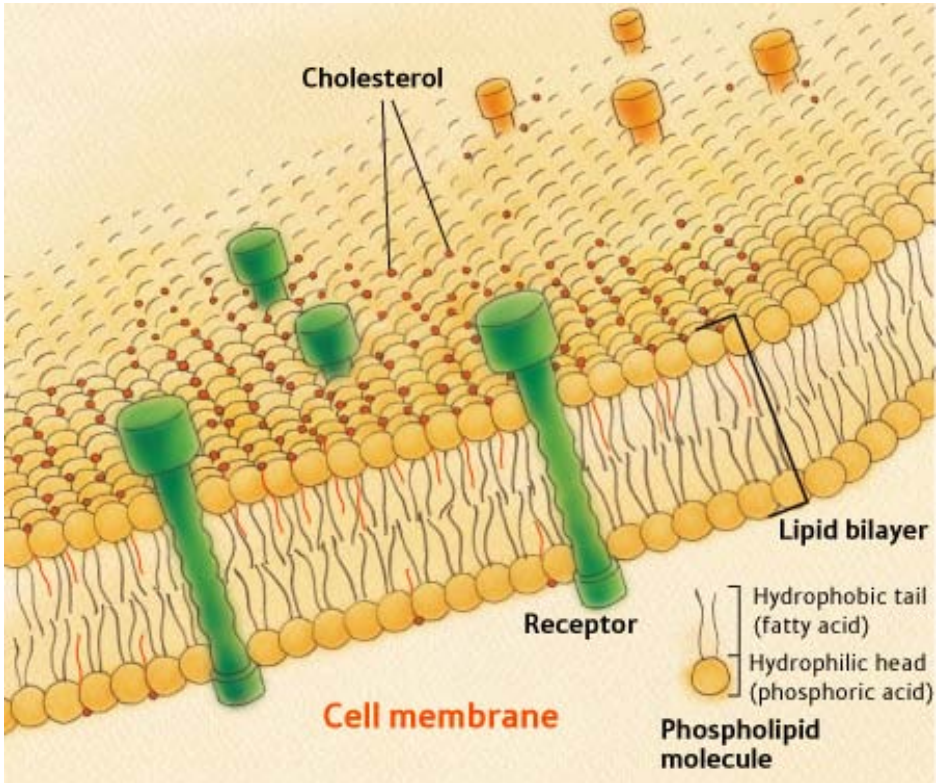
- Fats, oils, and waxes are all **lipids.**
- Lipids are energy-rich organic compounds made of carbon, hydrogen, and oxygen.



The Lipid called Cholesterol

- One type of lipid,

  called cholesterol, is an important component of animal cell membranes.



Cholesterol

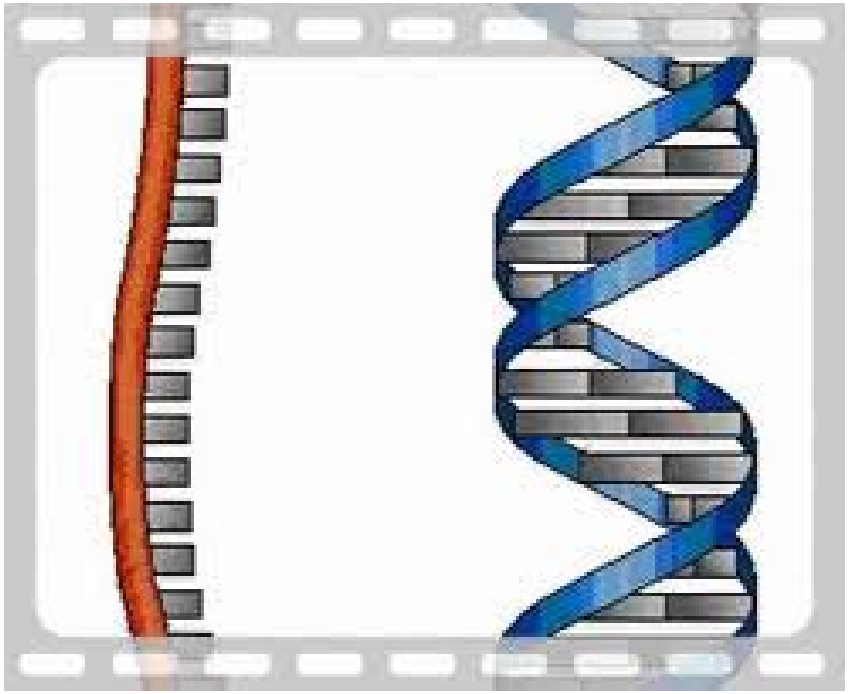
- Your liver normally produces enough cholesterol to meet your body's needs.
- However, many of the foods you eat also contain cholesterol.

Cholesterol

- If your diet contains too much cholesterol, excess amounts of cholesterol can collect along the walls of blood vessels and block the flow of blood.

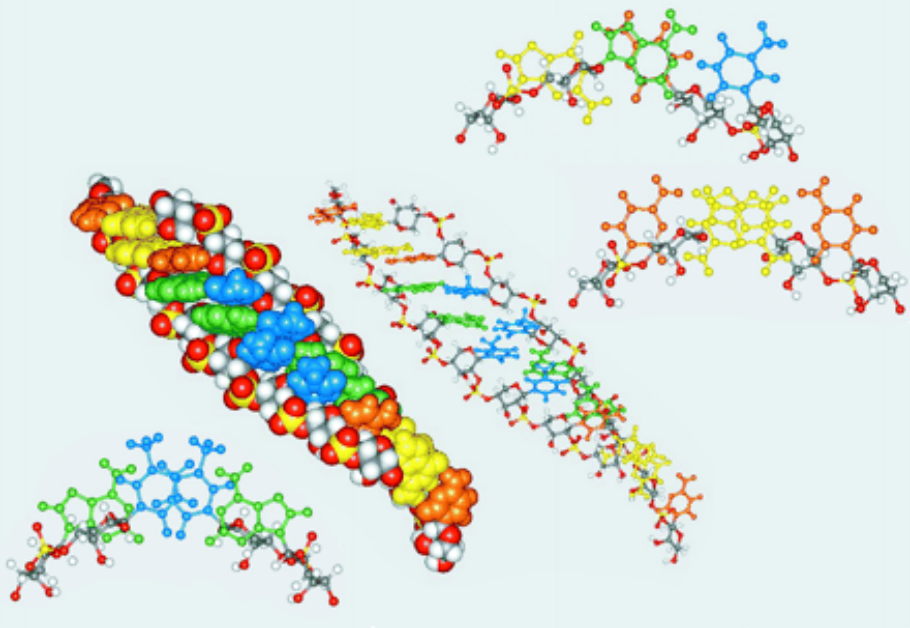
Nucleic Acids

- **Nucleic acids** are very large organic molecules made of carbon, oxygen, hydrogen, nitrogen, and phosphorus.



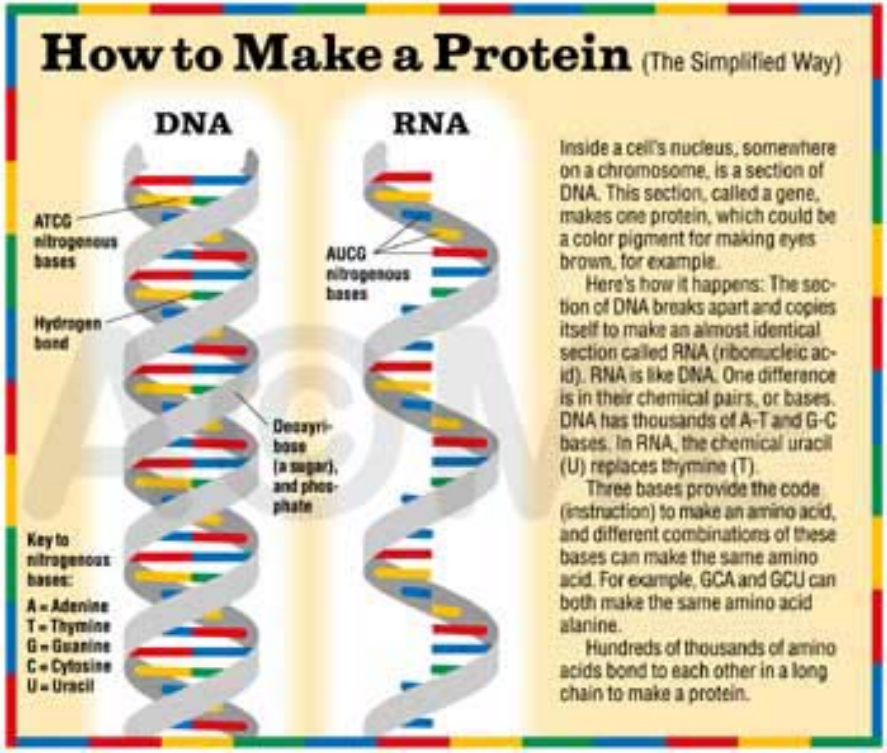
Nucleic Acids

- Nucleic acids contain the instructions that cells need to carry out all the functions of life.



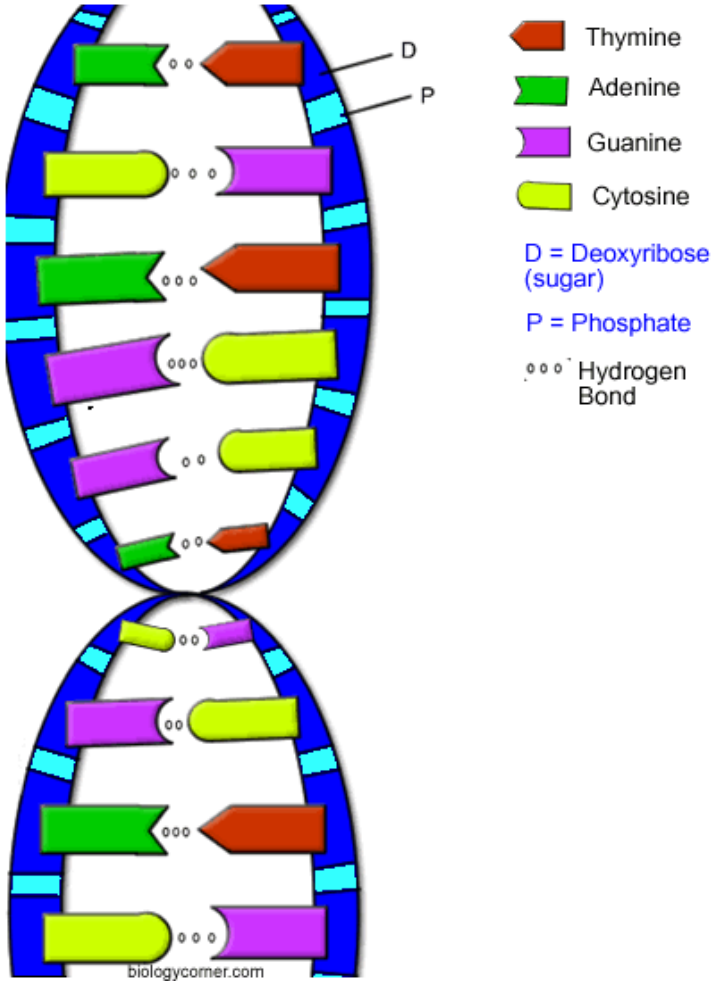
Nucleic Acids

- There are two kinds of nucleic acids: DNA and RNA.



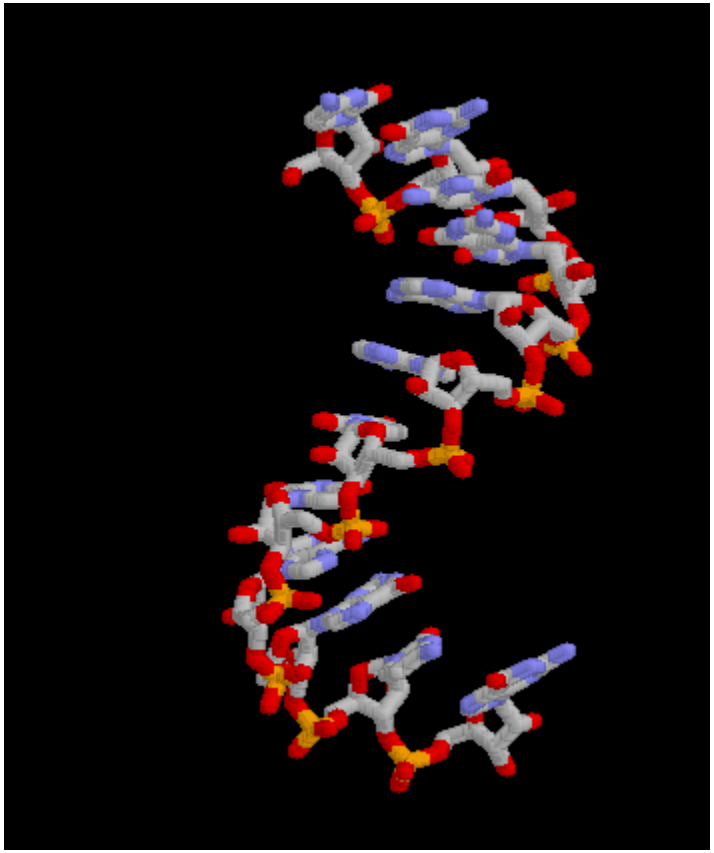
DNA

- Deoxyribonucleic acid, or **DNA**, is passed from parent to offspring and directs all of the cell's functions.



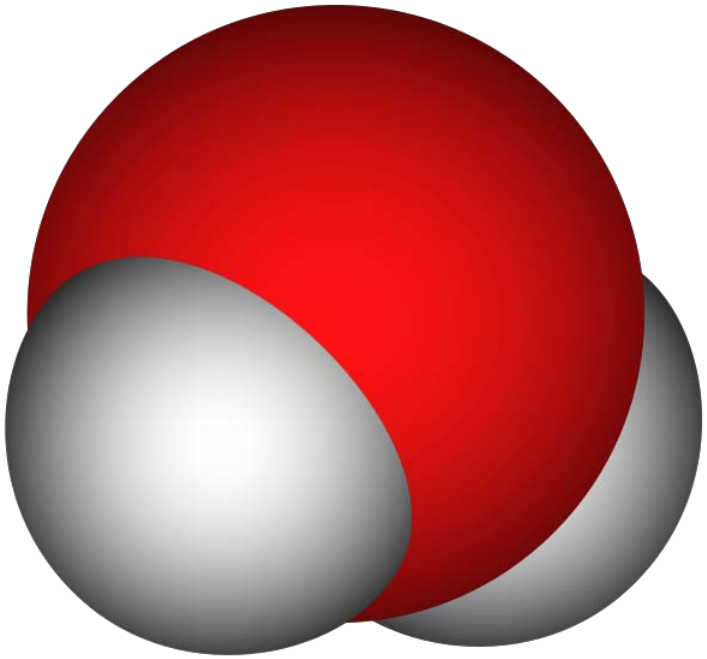
RNA

- Ribonucleic acid, or **RNA**, plays an important role in the production of proteins.



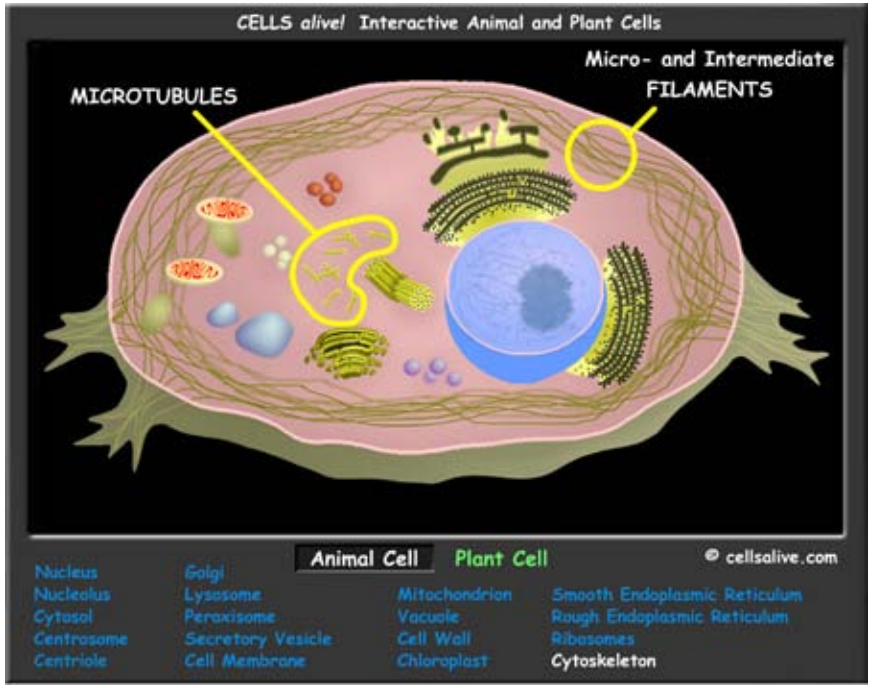
H2O

- Water plays many vital roles in cells. Without water, most chemical reactions within cells could not take place.



H2O

- Water also helps cells keep their size and shape and helps keep the temperature of cells from changing rapidly.



END – 1.3

Science Explorer
Cells and Heredity

1.4 - THE CELL IN ITS ENVIRONMENT

1.4 - The Cell in its Environment – Related Videos

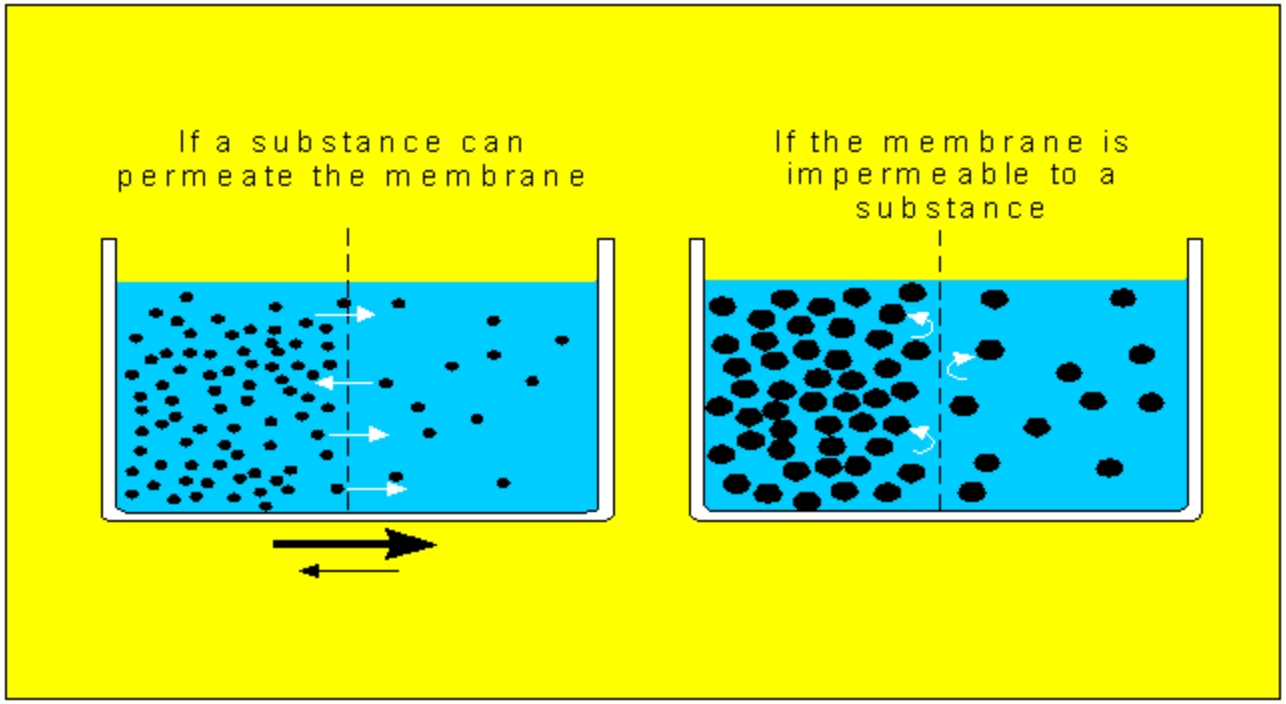
- Active Transport
- Diffusion & Osmosis
- Passive & Active Transport
- Passive Transport

Objectives

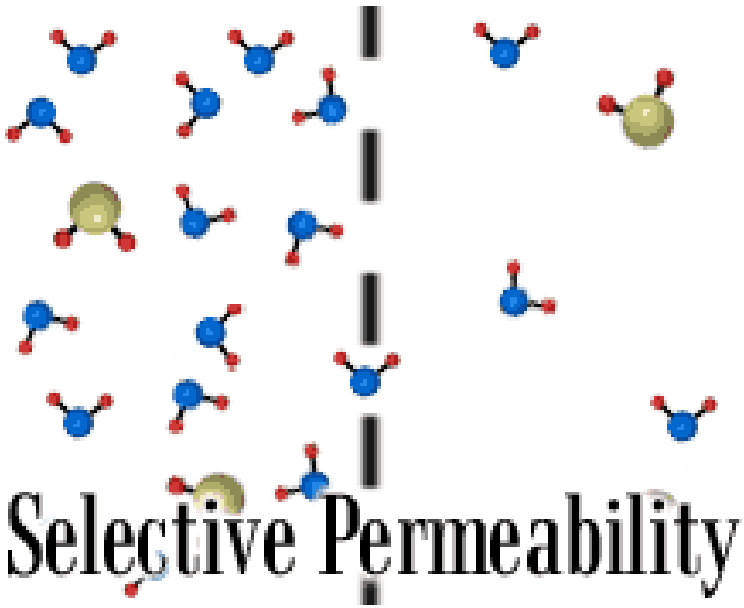
1. By what three methods do materials move into and out of cells?
2. What is the difference between passive transport and active transport?

Cell Membrane

- The cell membrane is **selectively permeable,** which means that some substances can pass through it while others cannot.



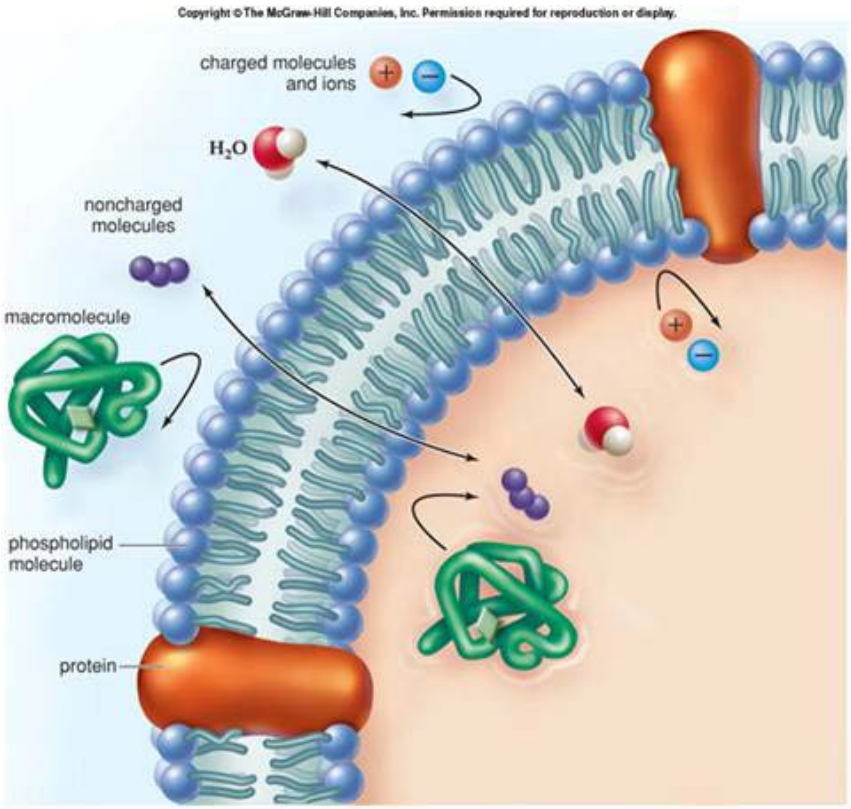
Cell Membrane



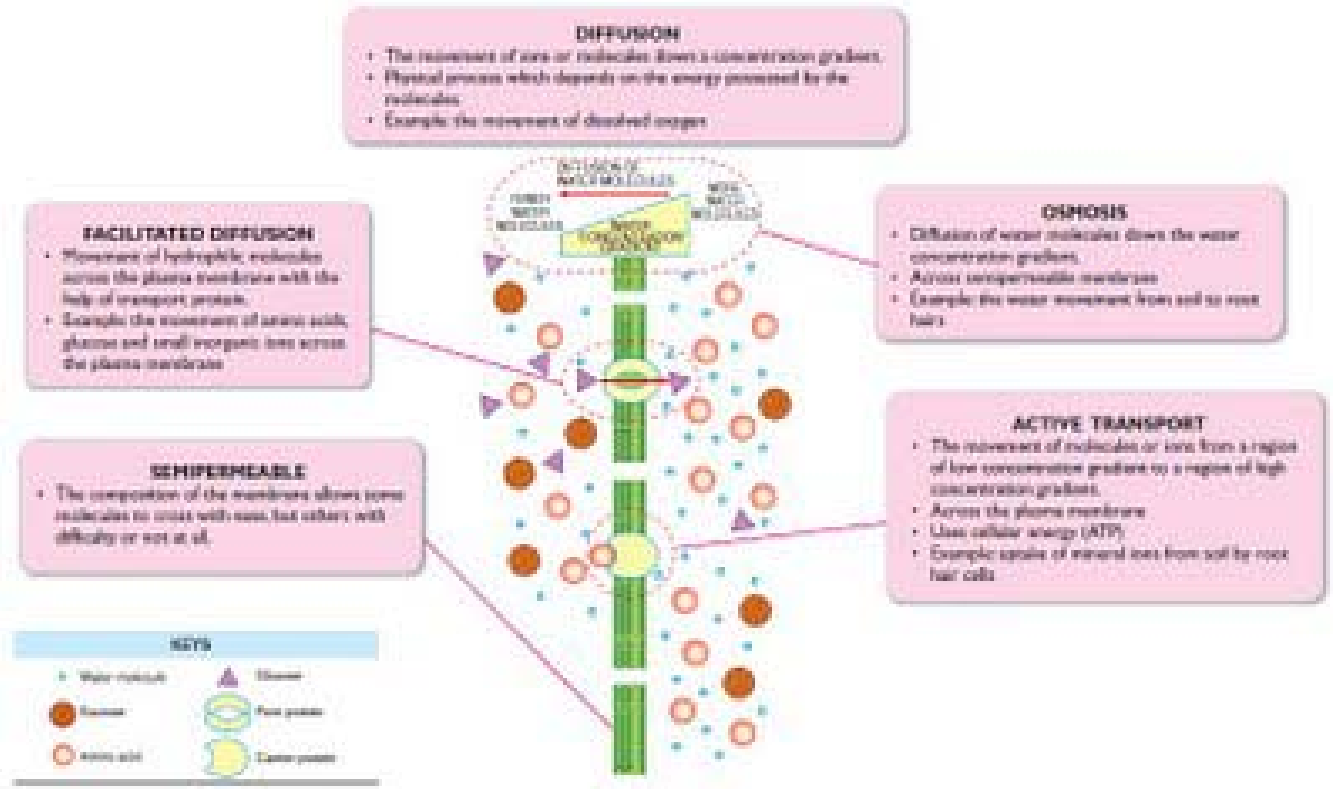
- The cell membrane is usually permeable to substances such as oxygen, water, and carbon dioxide.

Cell Membrane

- On the other hand, the cell membrane is usually not permeable to some large molecules and salts.



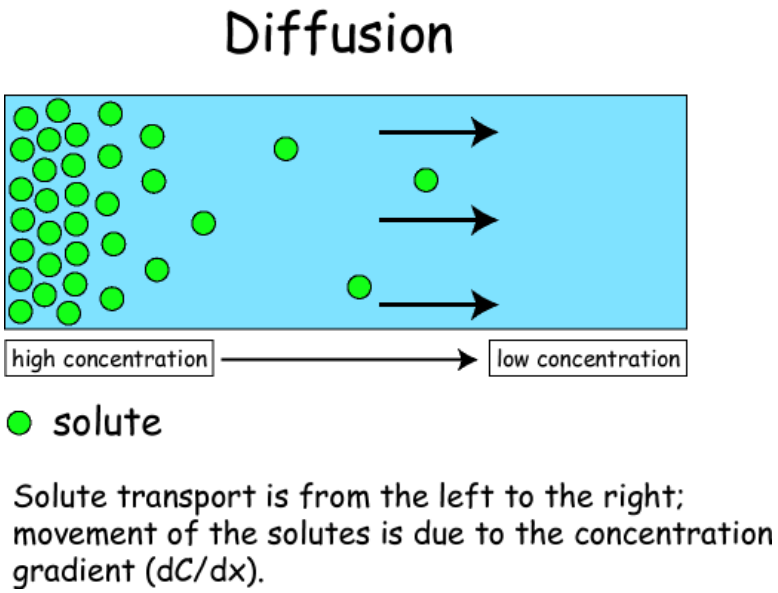
Diffusion, Osmosis, and Active Transport



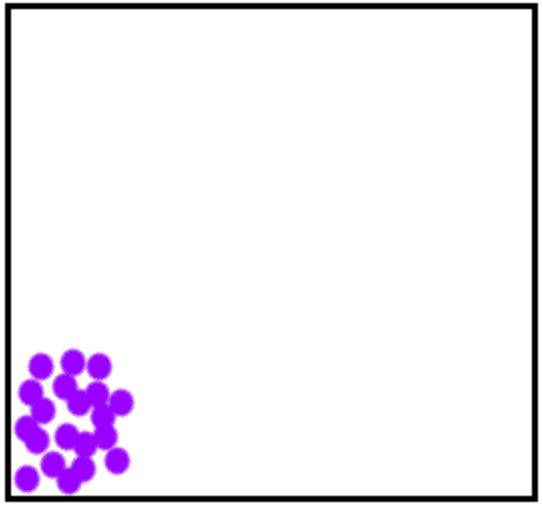
- Substances that can move into and out of a cell do so by one of three methods: diffusion, osmosis, or active transport.

Diffusion

- The main method by which substances move into and out of cells is diffusion.



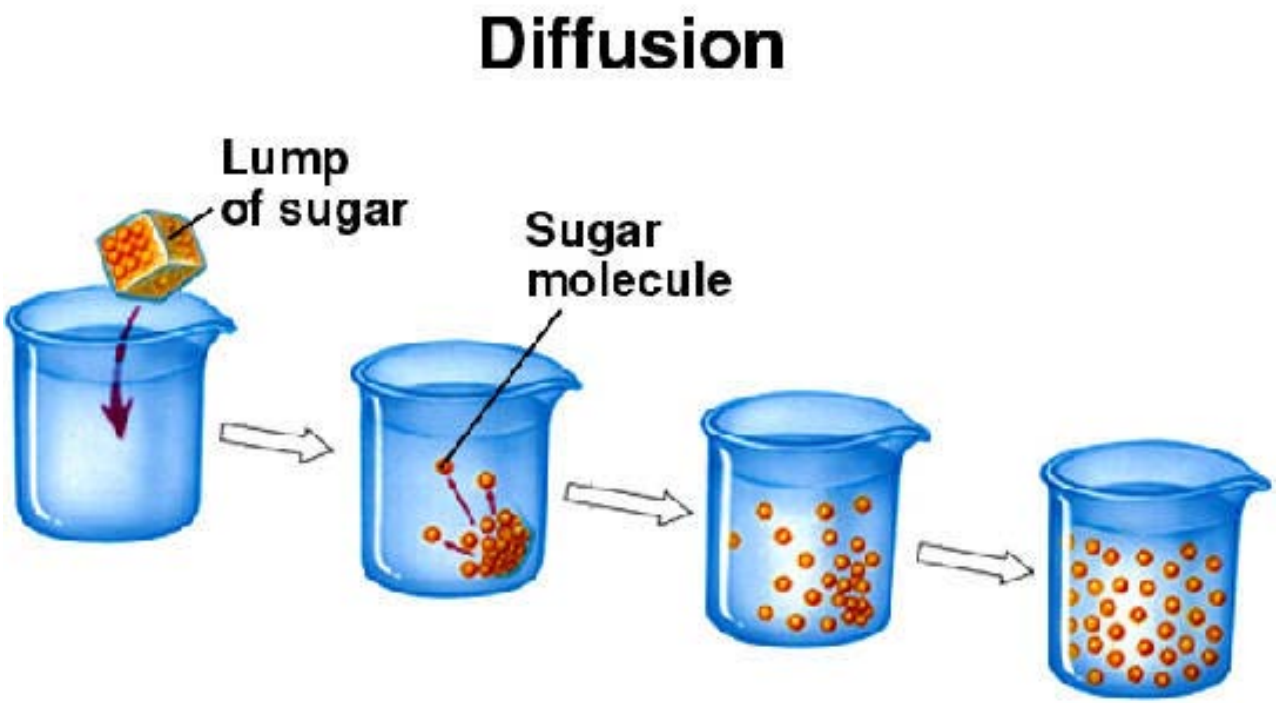
Diffusion



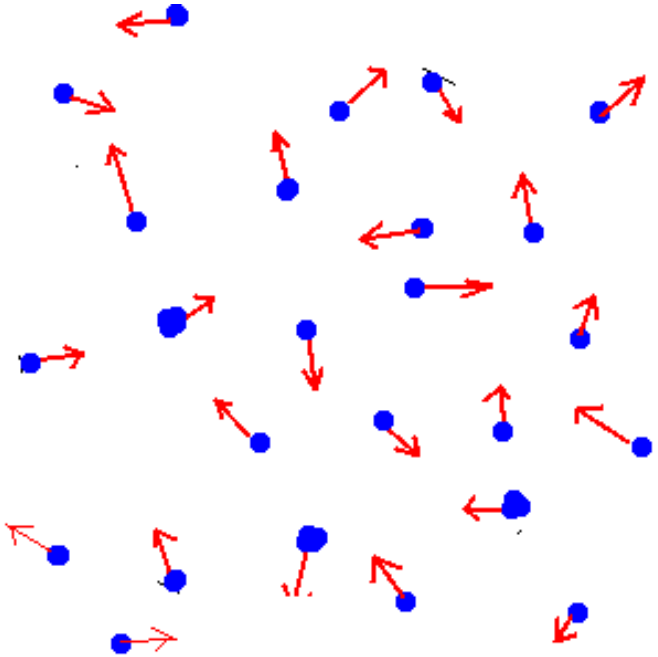
- **Diffusion** is the process by which molecules tend to move from an area of higher concentration to an area of lower concentration.

Diffusion

- The concentration of a substance is the amount of the substance in a given volume.



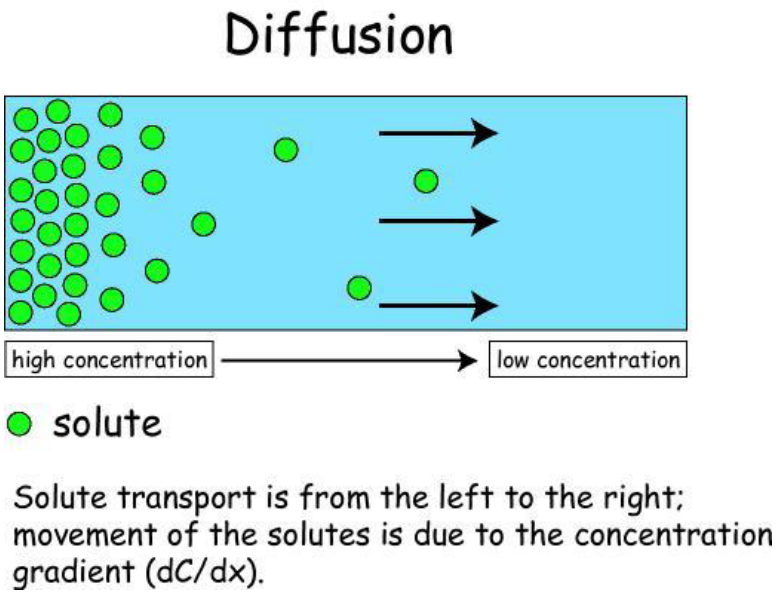
Diffusion



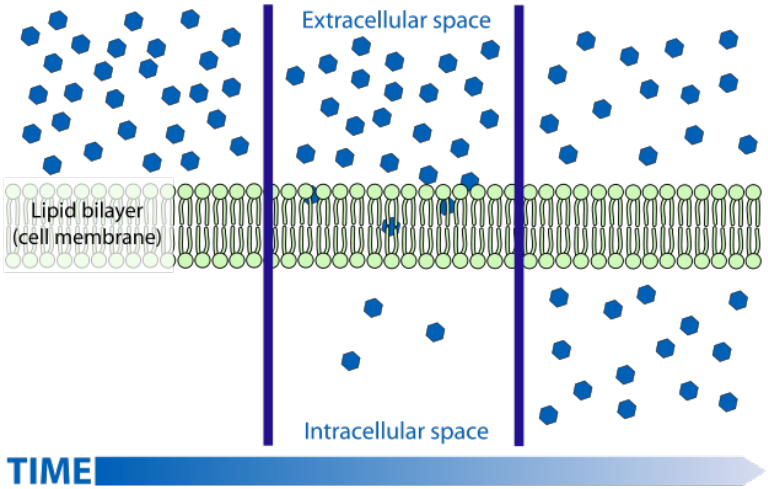
- Diffusion is caused by molecules moving and colliding.

Diffusion

- The collisions cause the molecules to push away from one another and spread out.



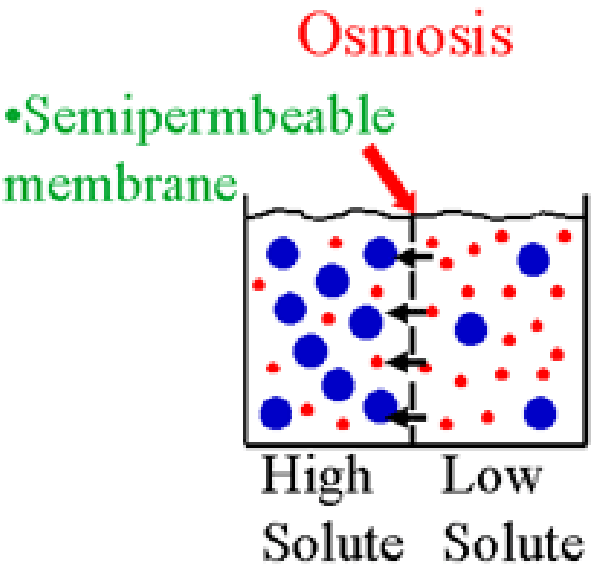
Diffusion



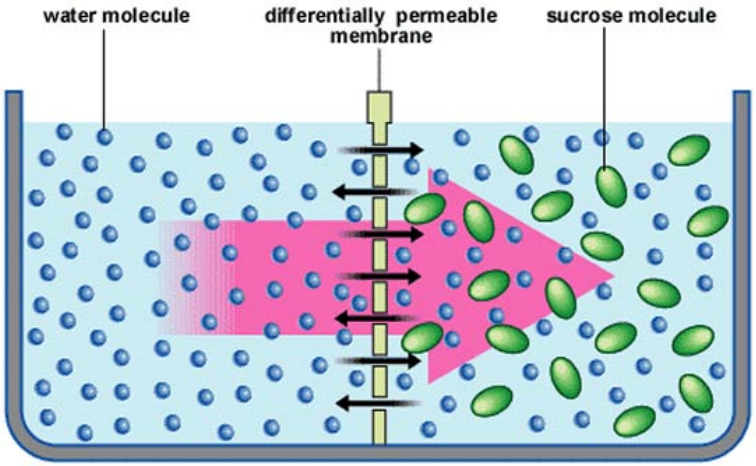
- Molecules diffuse through the cell membrane into a cell when there is a higher concentration of the molecules outside the cell than inside the cell.

Osmosis

- The diffusion of water molecules through a selectively permeable membrane is called **osmosis.**

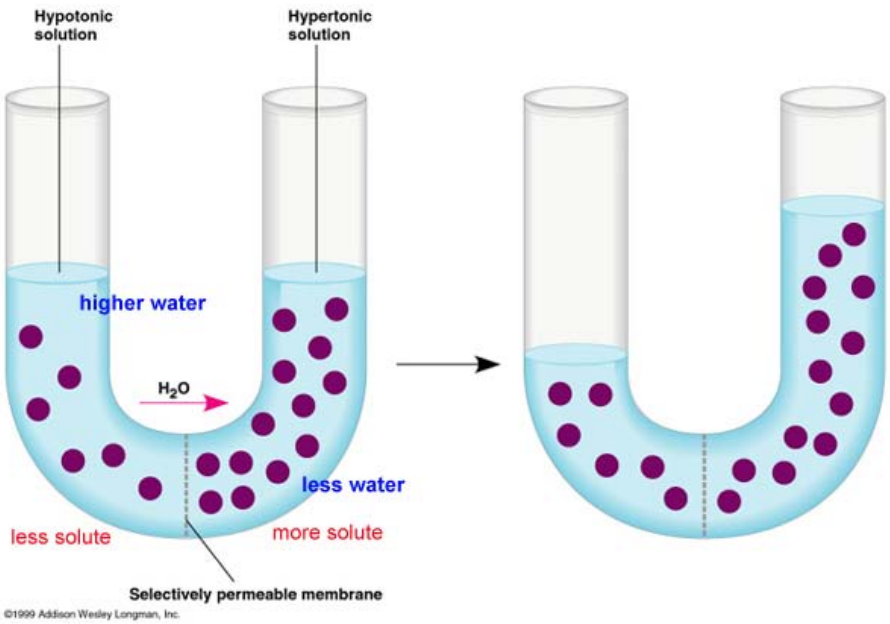


Osmosis

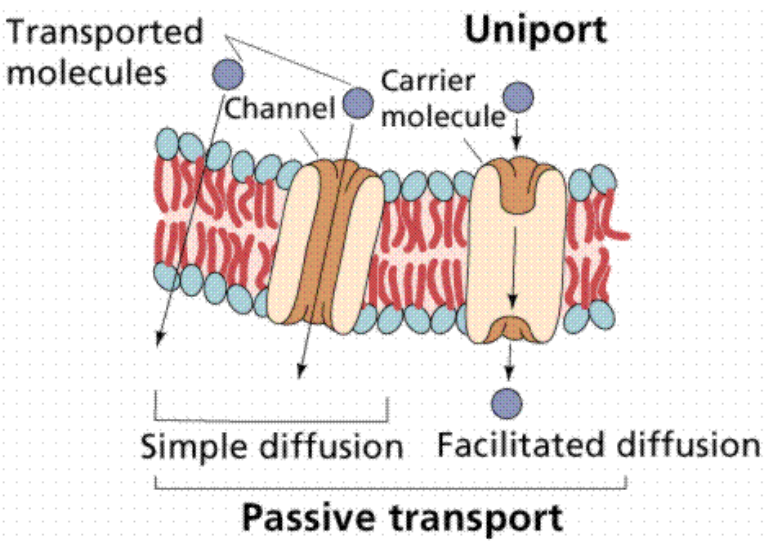


- Osmosis is important to cells because cells cannot function properly without adequate water.

- In osmosis, water molecules move from an area where they are highly concentrated through the cell membrane to an area where they are less concentrated.

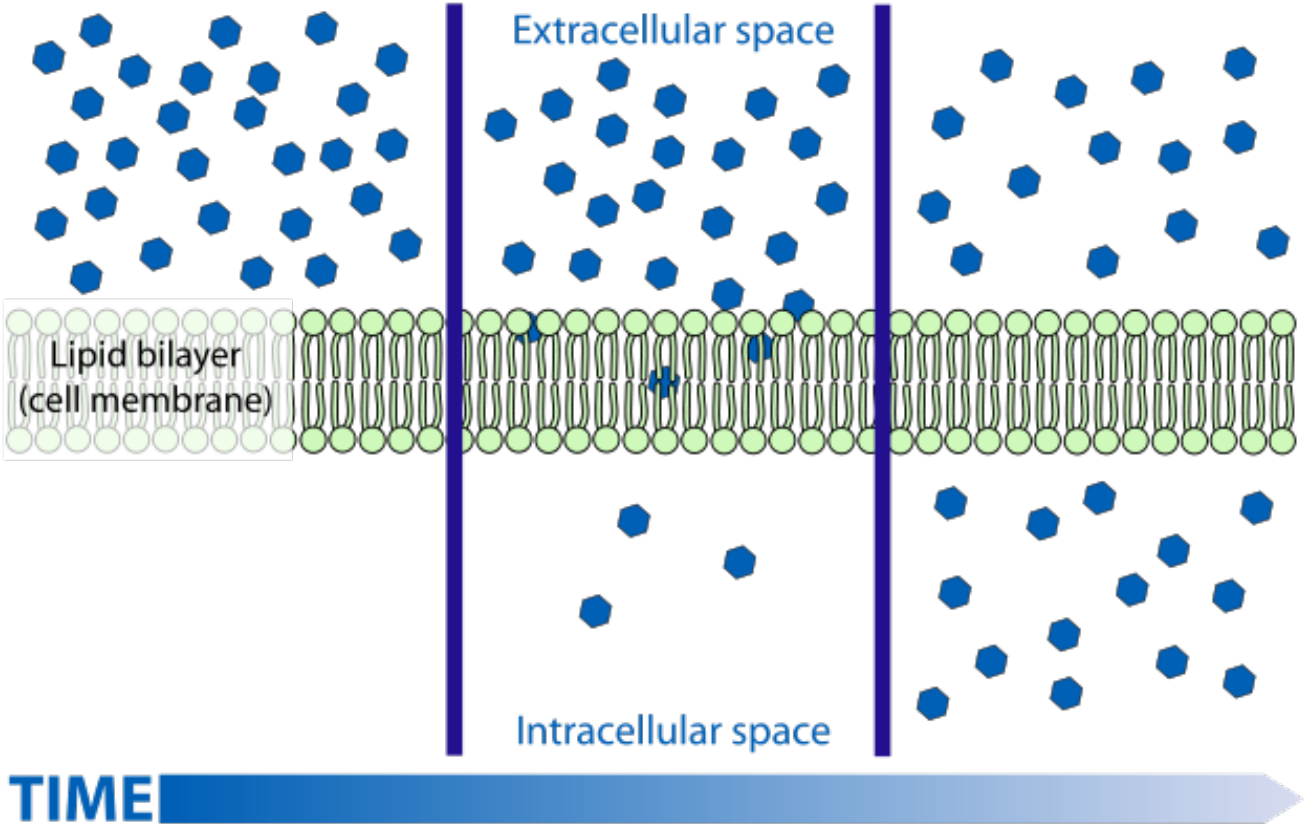


Passive Transport

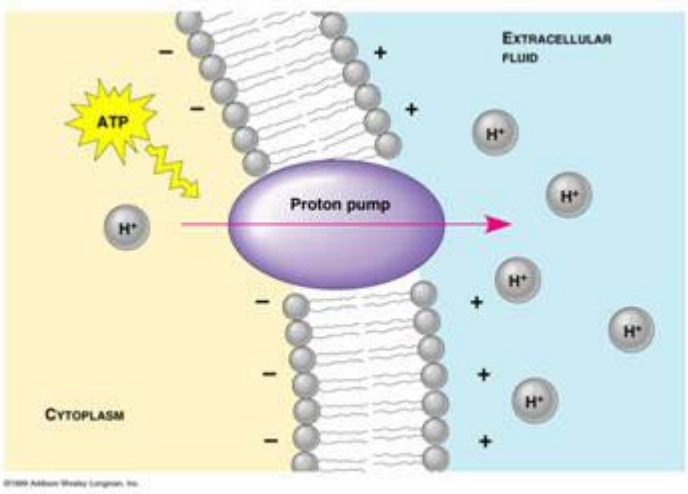


- The movement of materials through a cell membrane without using energy is called **passive transport**.

- Diffusion and osmosis are both types of passive transport.



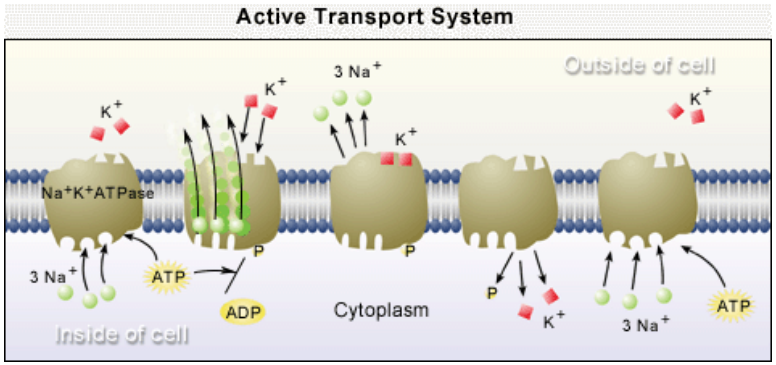
Active Transport



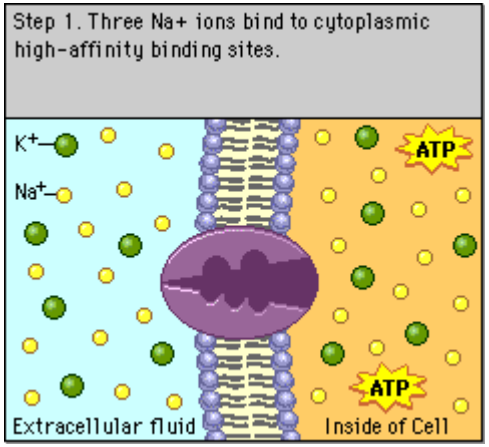
- When a cell needs to take in materials that are in higher concentration inside the cell than outside the cell, the movement of the materials requires energy.

Active Transport

- **Active transport** is the movement of materials through a cell membrane using energy.



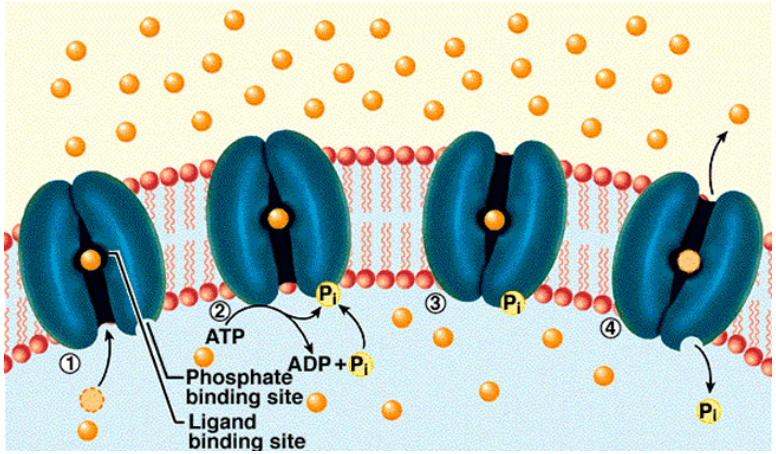
Active Transport



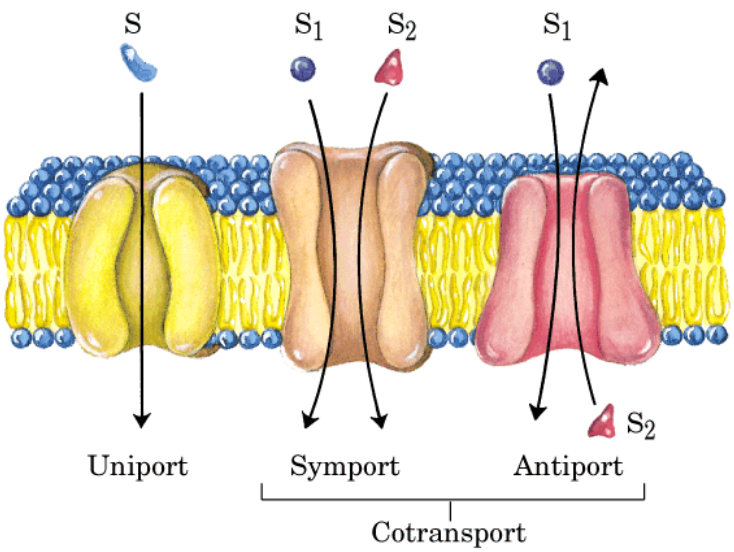
- The main difference between passive transport and active transport is that active transport requires the cell to use energy while passive transport does not.

Active Transport

- A cell has several ways of moving materials by active transport.



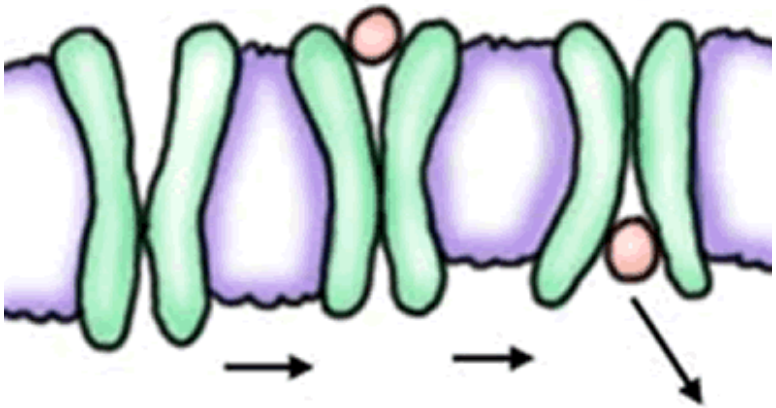
Active Transport



- In one method, transport proteins in the cell membrane “pick up” molecules outside the cell and carry them in, using energy in the process.

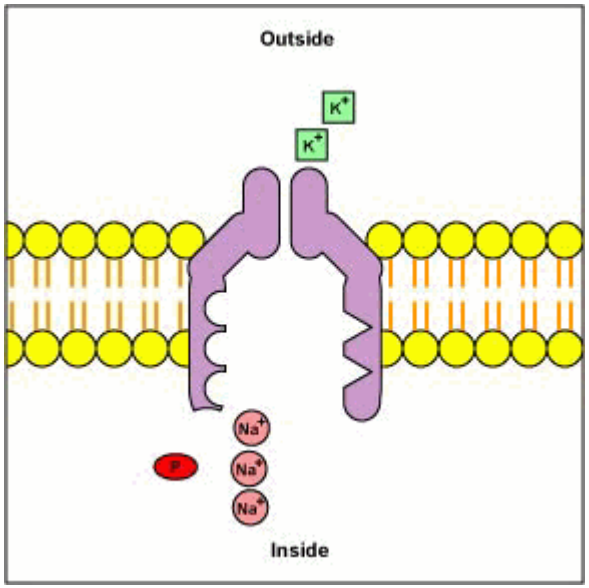
Active Transport

- Another method of active transport is engulfing, in which the cell membrane surrounds, or engulfs, a particle.



ONE METHOD OF TRANSPORT THROUGH THE MEMBRANE

Active Transport

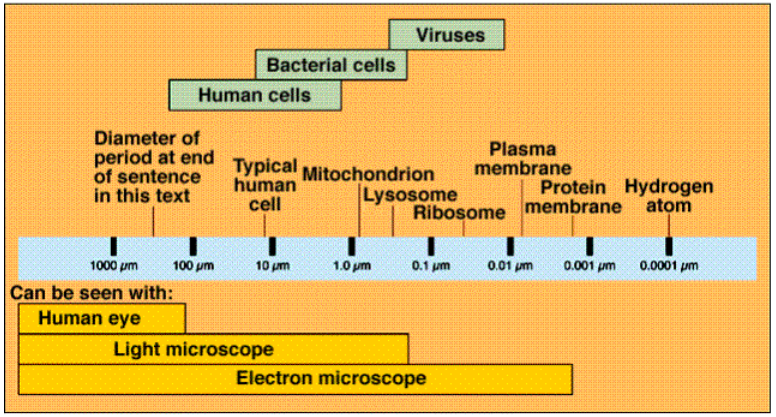


- The cell must use energy in this process as well.

Cell Size

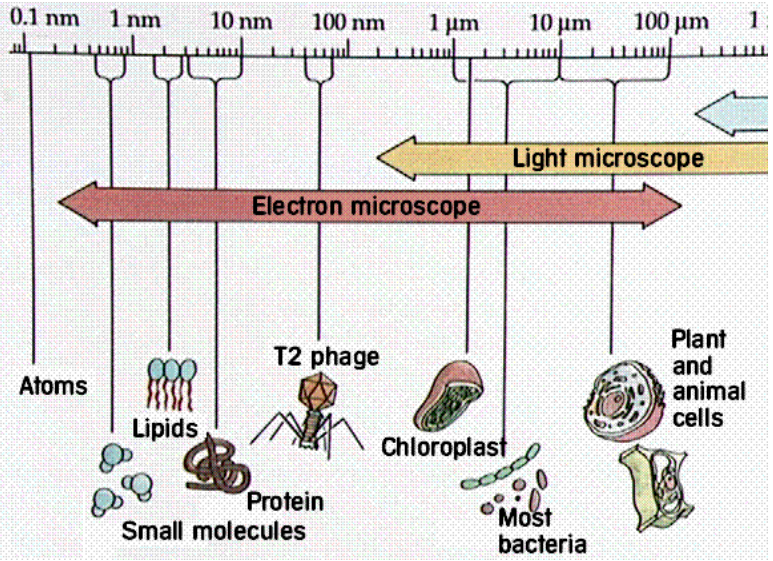
- Most cells are very small.

Size Range of Cells

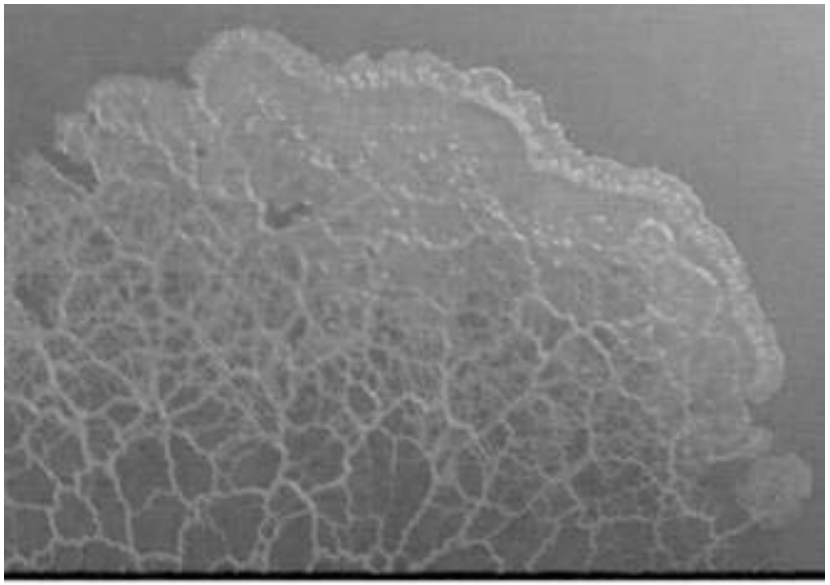


Cell Size

- One reason is related to the fact that all materials move into and out of cells through the cell membrane.



Cell Size



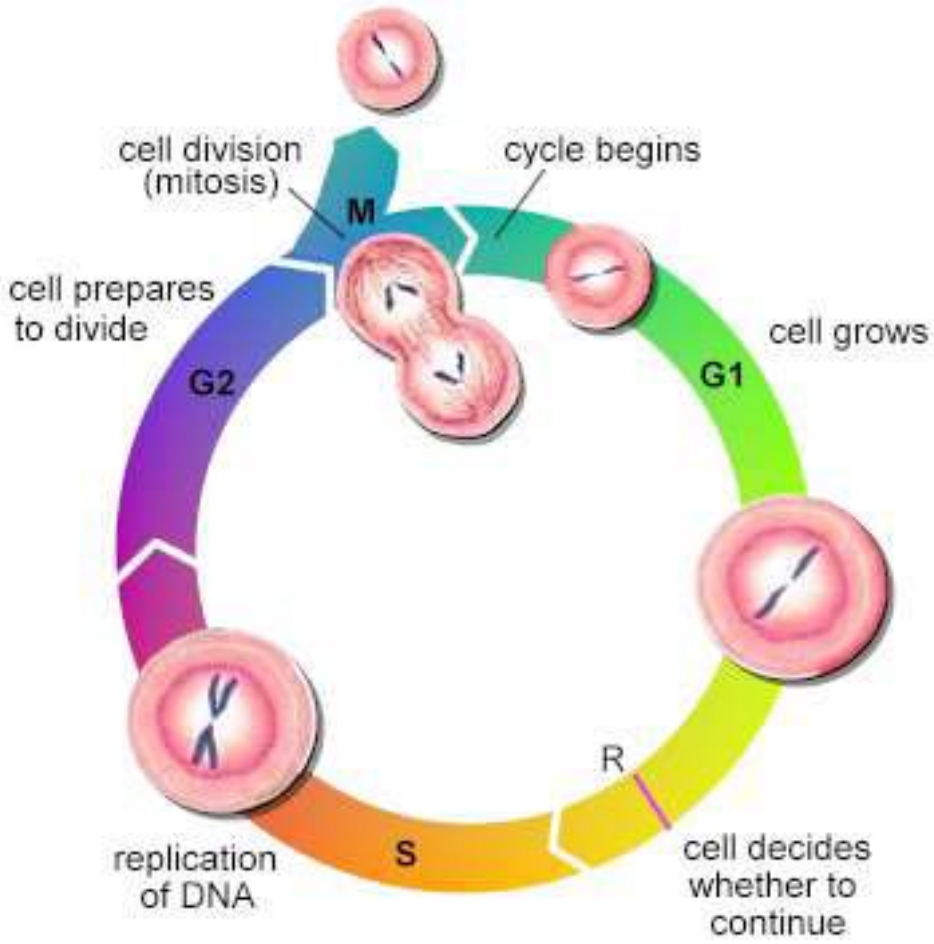
- Once a molecule enters a cell, it is carried to its destination by a stream of moving cytoplasm.

Cell Size

- In a very large cell, streams of cytoplasm must travel farther to carry materials from the cell membrane to all parts of the cell.

Cell Size

- When a cell reaches a certain size, it divides into two new cells.



END – 1.4

Science Explorer
Cells and Heredity

2.1 - PHOTOSYNTHESIS

2.1 - Photosynthesis - Related Video

- Calvin Cycle
- Photosynthesis

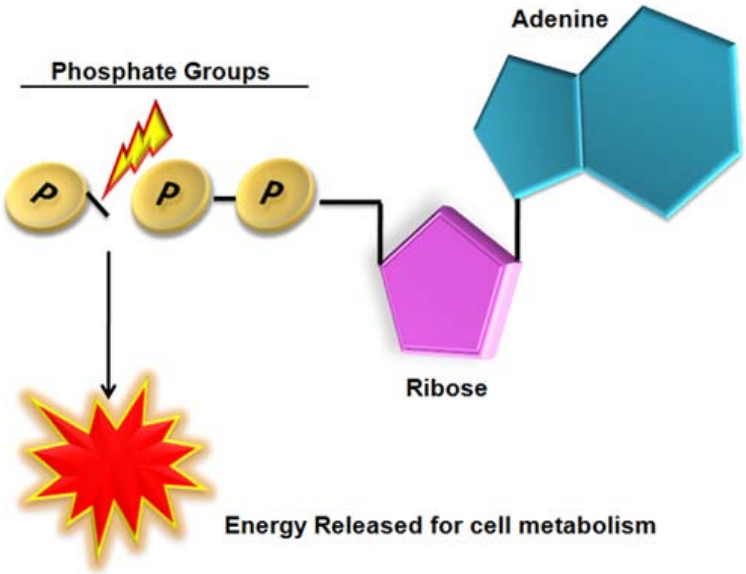
Objectives

1. What happens during the process of photosynthesis?
2. How does the sun supply living things with the energy they need?

Photosynthesis

- The sun provides almost all the energy used by living things on Earth.

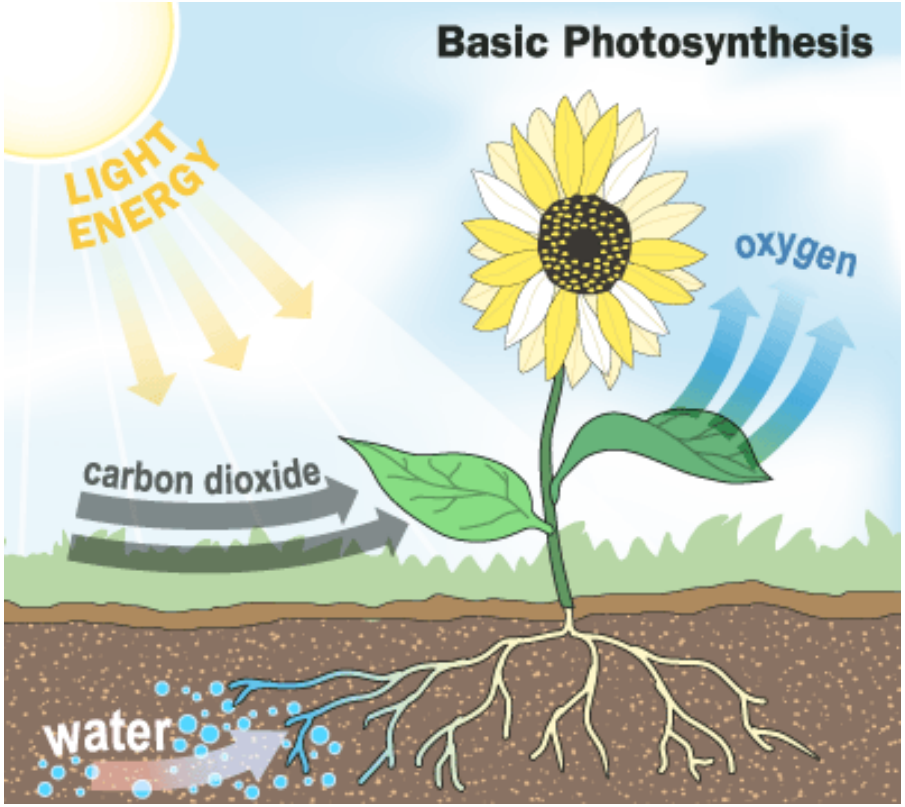
Photosynthesis



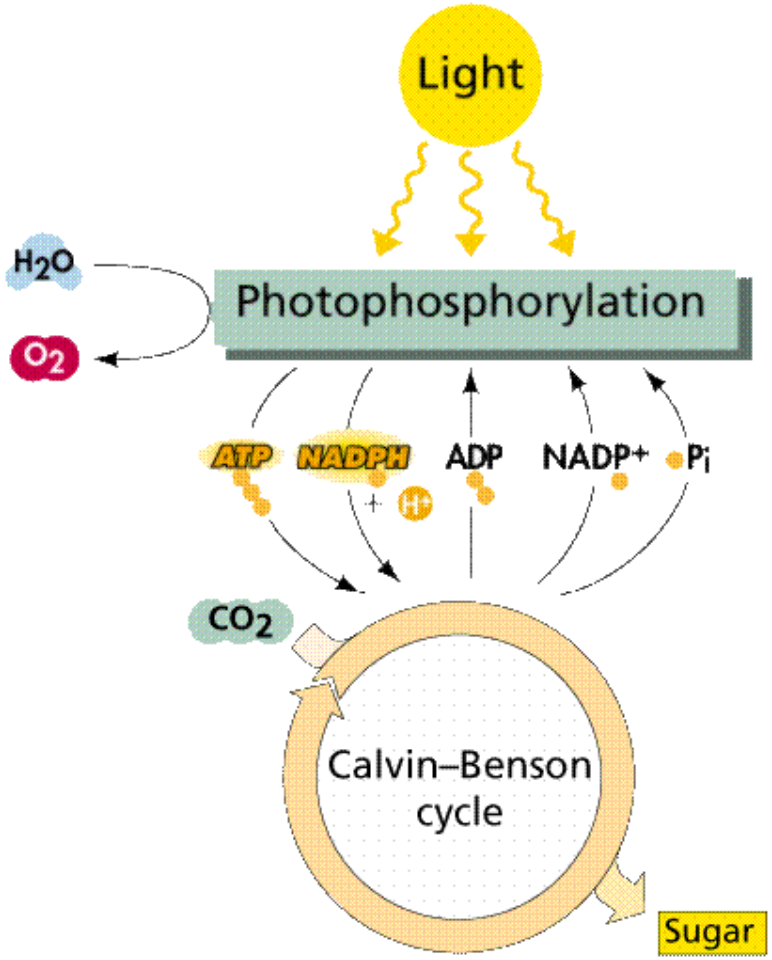
- All cells need energy to carry out their functions.

Photosynthesis

- The process by which a cell captures the energy in sunlight and uses it to make food is called **photosynthesis**.



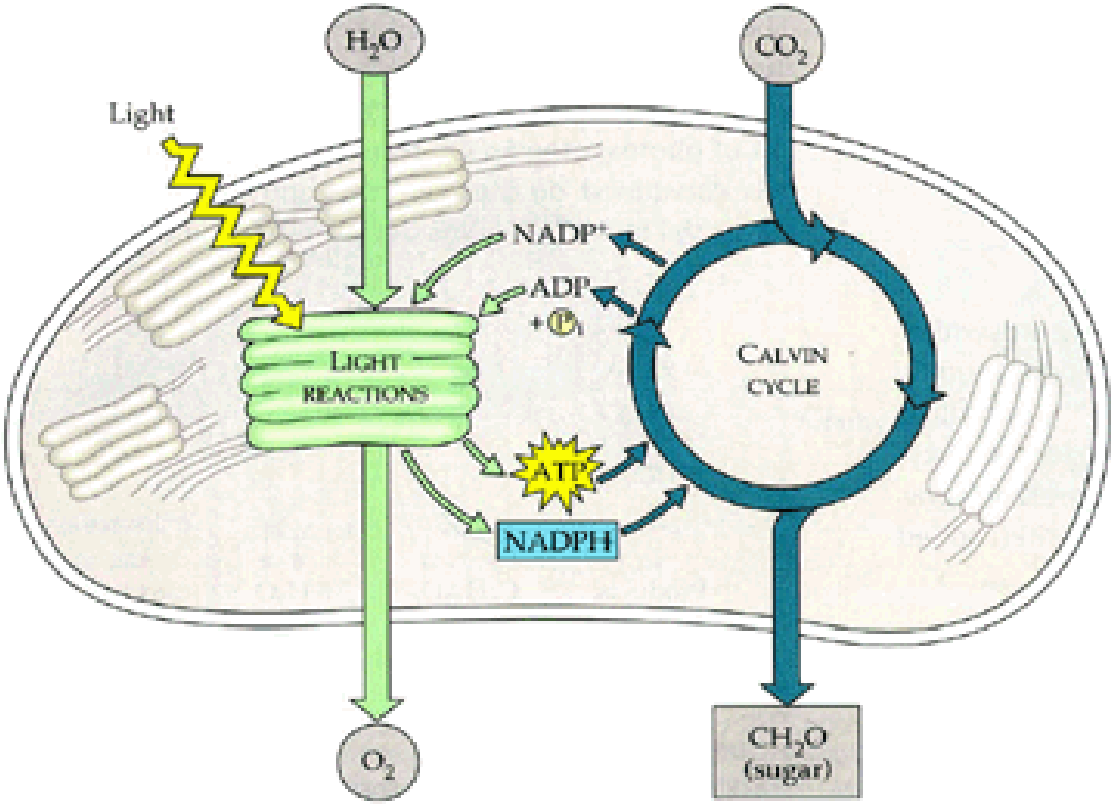
Photosynthesis



- During photosynthesis, plants and some other organisms use energy from the sun to convert carbon dioxide and water into oxygen and sugars, including glucose.

Photosynthesis

- You can think of photosynthesis as taking place in two stages.



Photosynthesis – 1st Stage

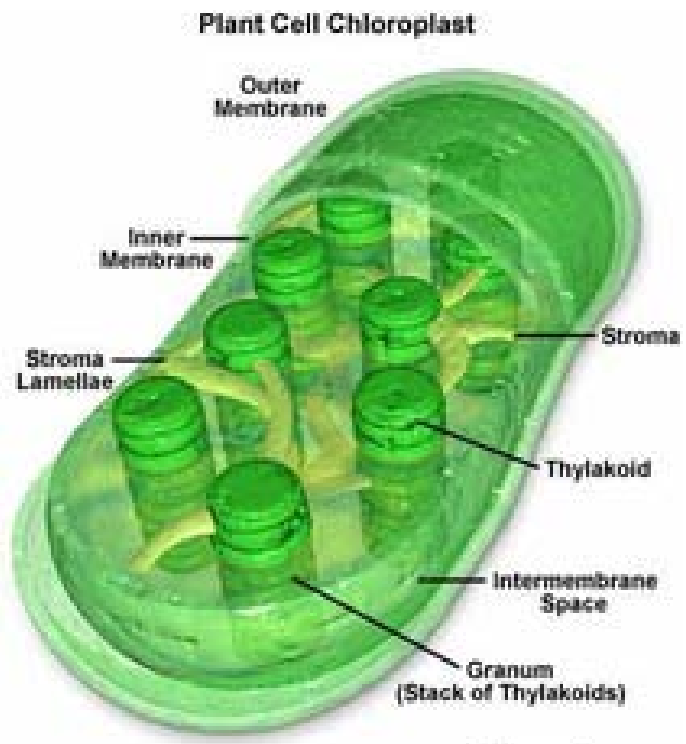


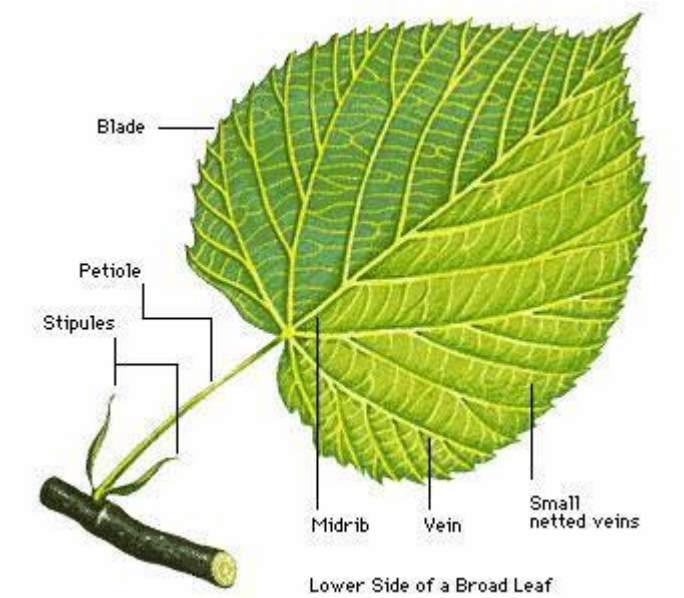
Figure 1

- The first stage of photosynthesis involves capturing the energy in sunlight.

Photosynthesis – 1st Stage

- In plants, this energy-capturing process occurs in the leaves and other green parts of the plant.

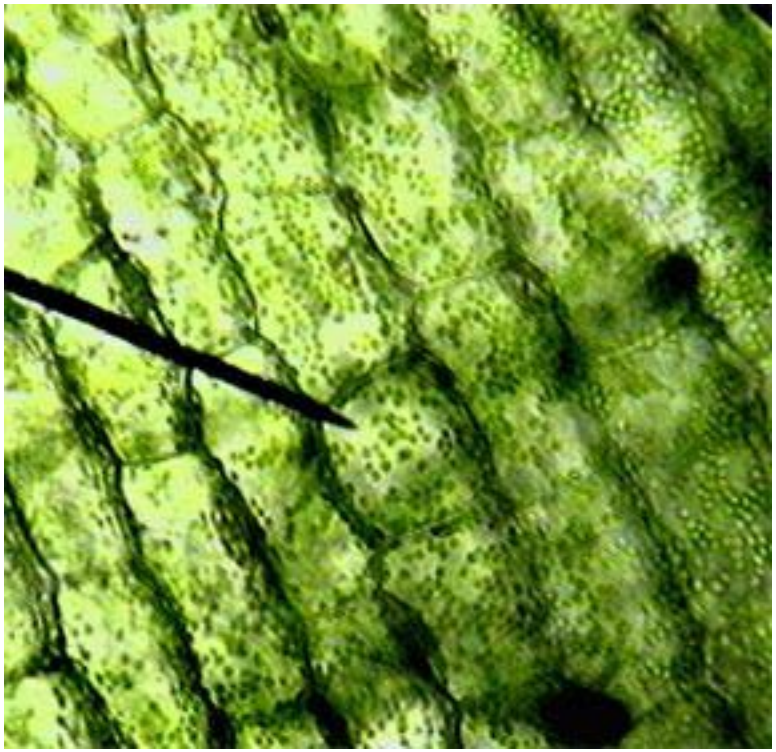
Pigments

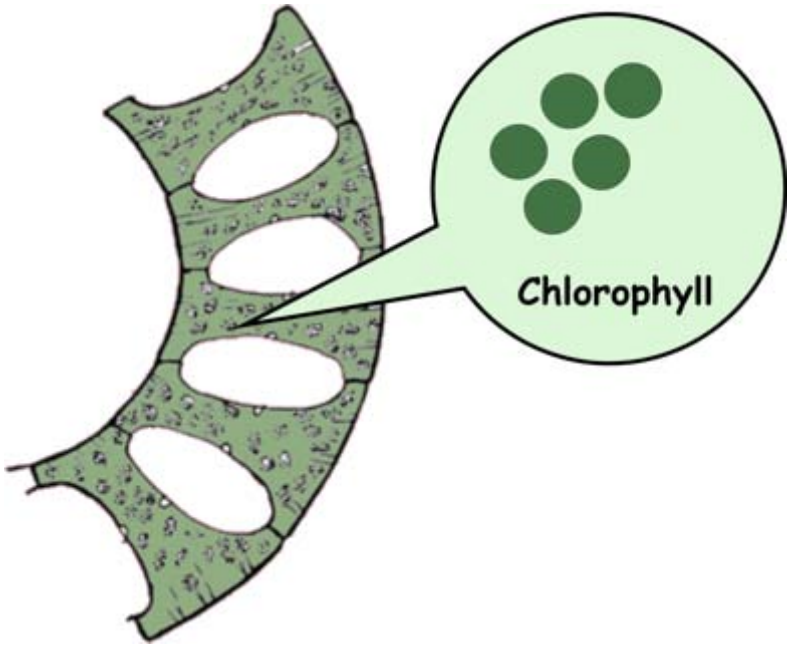


- The chloroplasts in plant cells give plants their green color. The green color comes from **pigments,** colored chemical compounds that absorb light.

Chlorophyll

- The main pigment found in the chloroplasts of plants is **chlorophyll.**

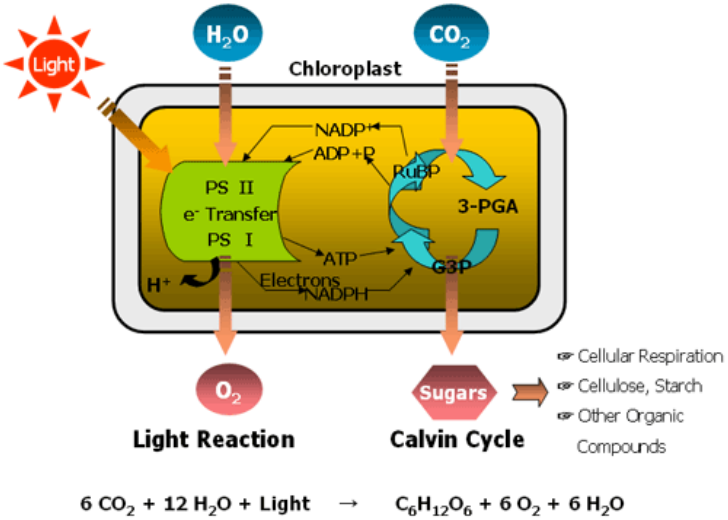




- The pigments capture light energy and use it to power the second stage of photosynthesis.

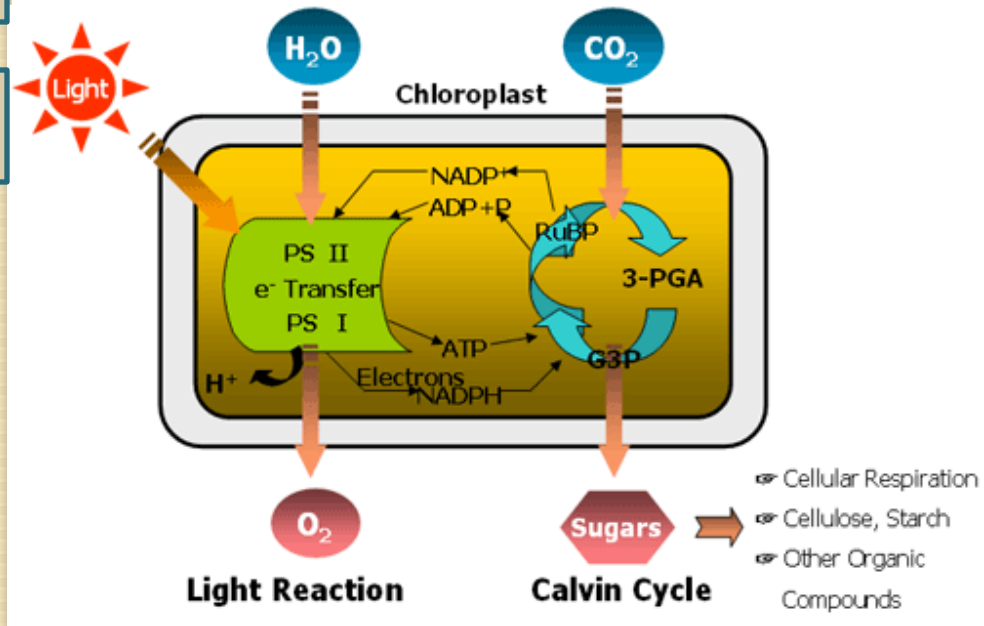
Photosynthesis – 2nd Stage

- In the **second stage** of photosynthesis, the cell uses the captured energy to produce sugars.



$6\ CO_2 + 12\ H_2O + \text{Light} \rightarrow C_6H_{12}O_6 + 6\ O_2 + 6\ H_2O$

Photosynthesis – 2nd Stage

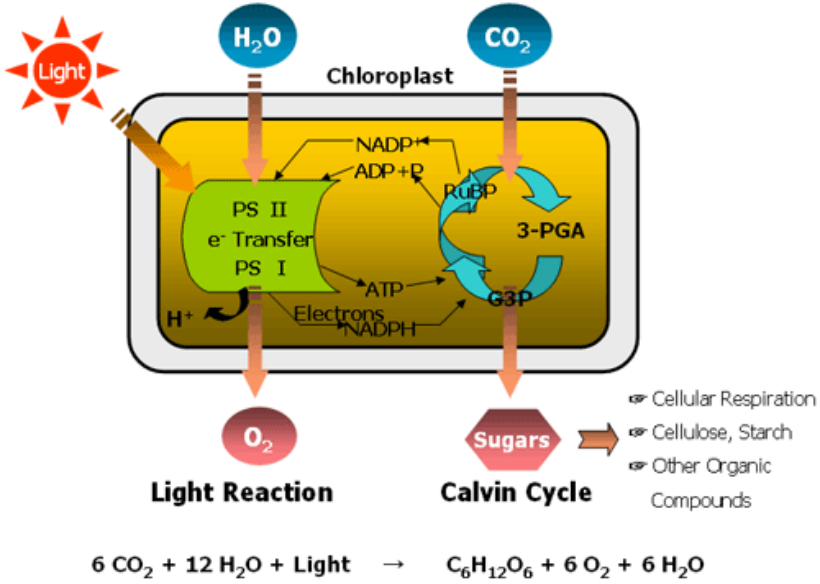


$$6\ CO_2 + 12\ H_2O + \text{Light} \rightarrow C_6H_{12}O_6 + 6\ O_2 + 6\ H_2O$$

- The cell needs two raw materials for this stage: water (H2O) and carbon dioxide (CO2).

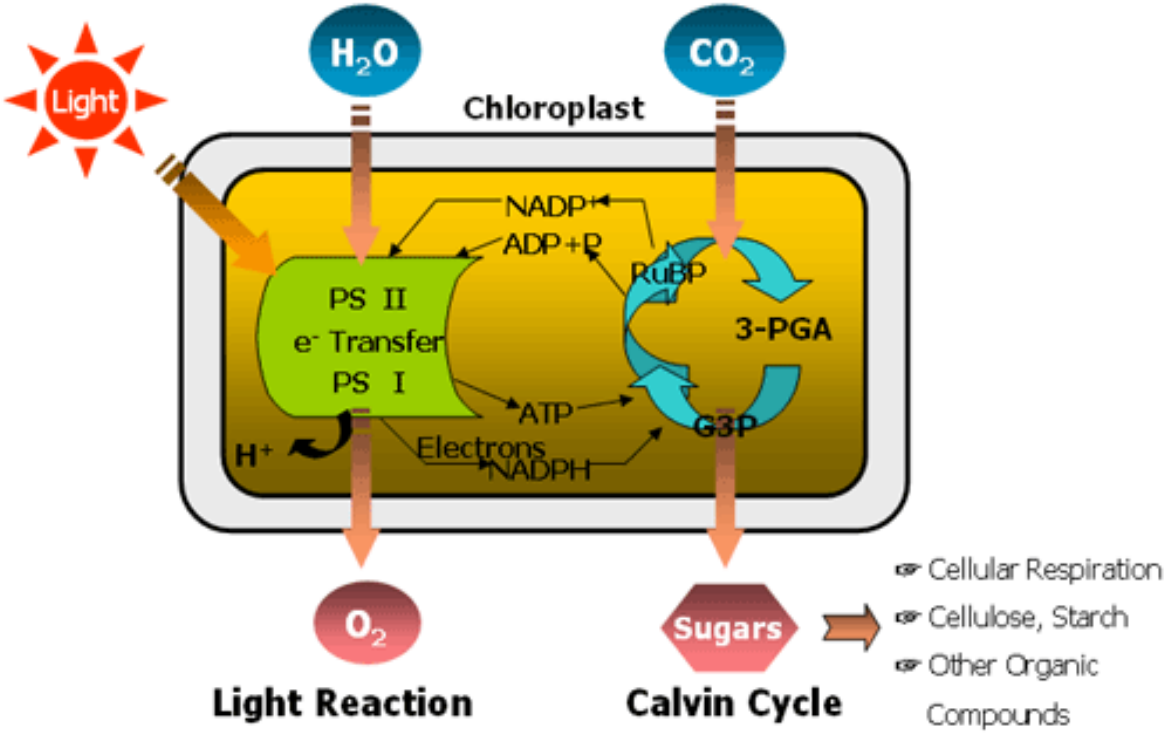
Photosynthesis – 2nd Stage

- In plants, the roots absorb water from the soil.
- Carbon dioxide enters the plant through small openings on the undersides of the leaves called **stomata.**



Photosynthesis – 2nd Stage

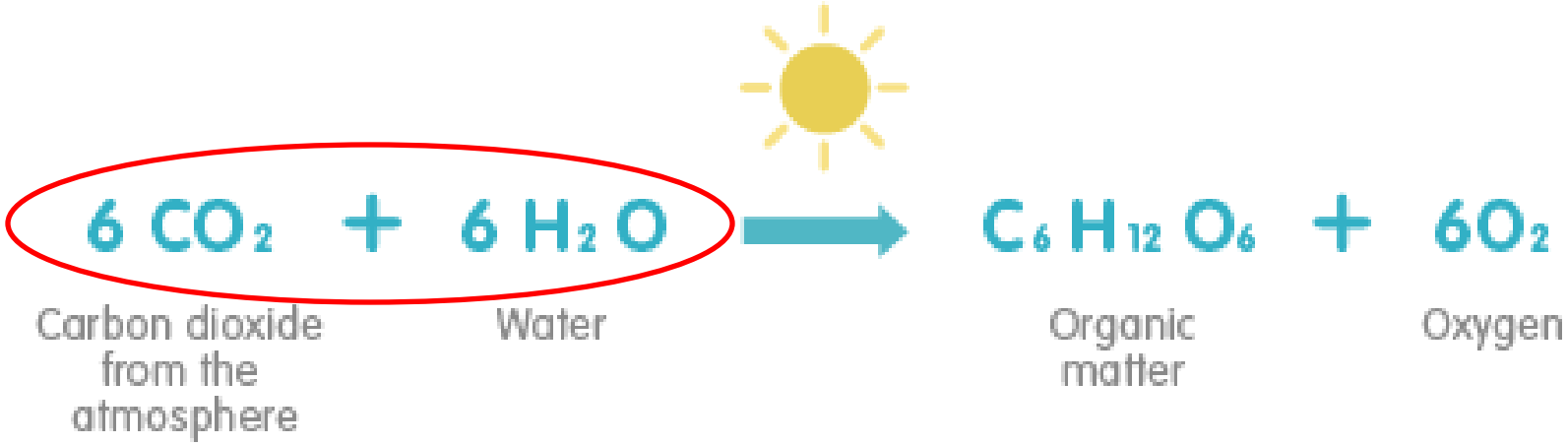
- The events of photosynthesis can be summed up in a chemical equation.



$$6\ CO_2 + 12\ H_2O + \text{Light} \rightarrow C_6H_{12}O_6 + 6\ O_2 + 6\ H_2O$$

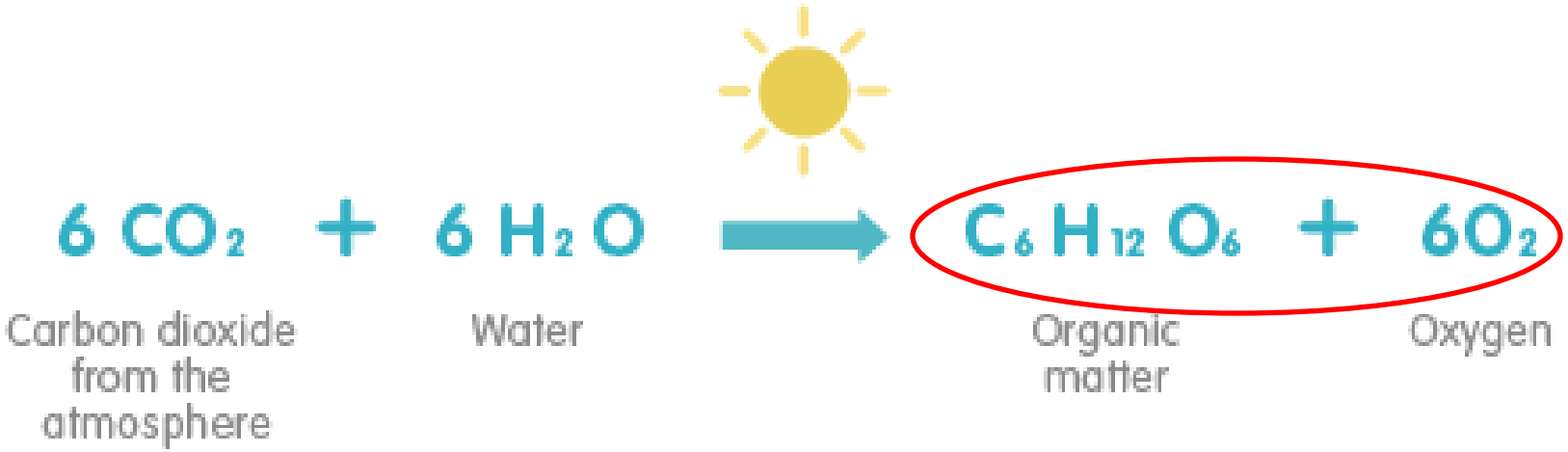
Photosynthesis – 2nd Stage

- The raw materials—six molecules of carbon dioxide and six molecules of water—are on the left side of the equation.



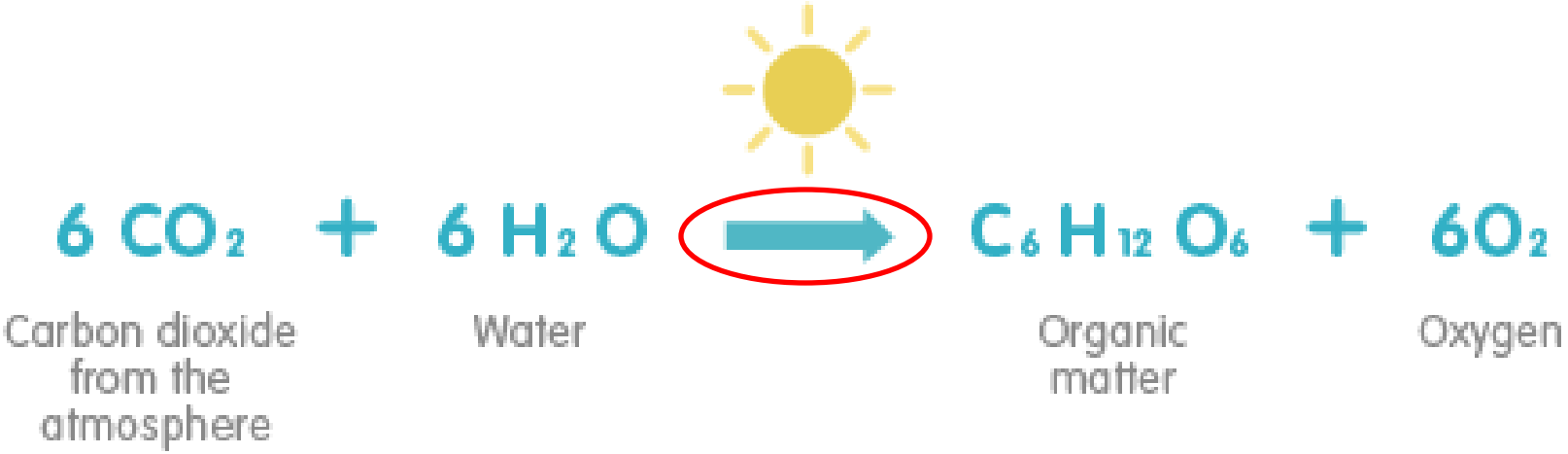
Photosynthesis – 2nd Stage

- The products— one molecule of glucose and six molecules of oxygen—are on the right side of the equation.



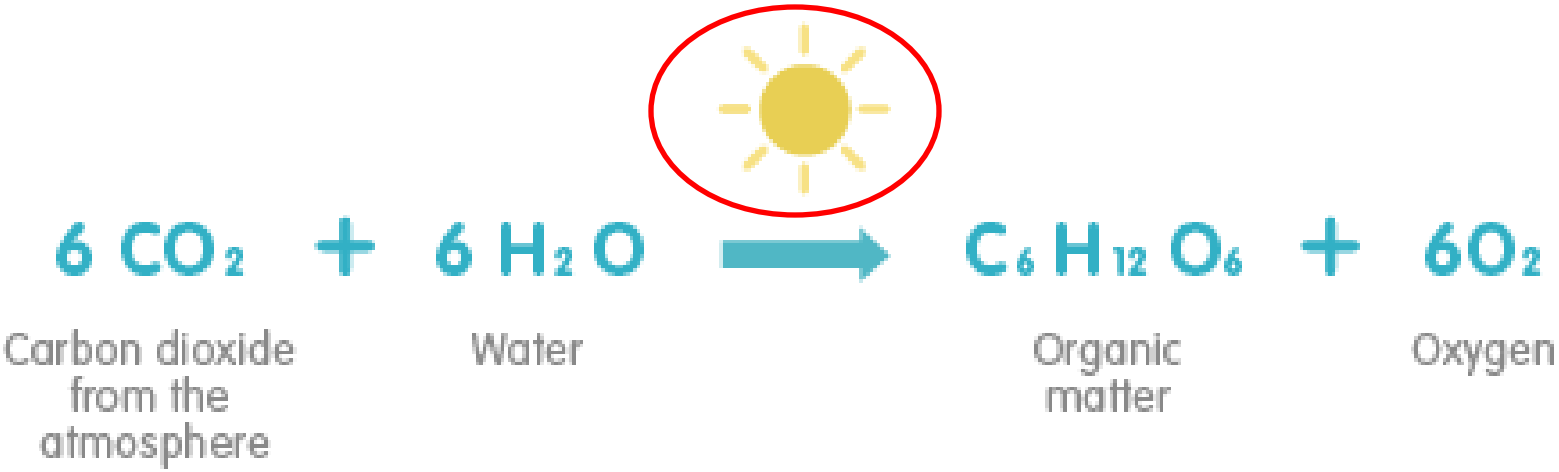
Photosynthesis – 2nd Stage

- An arrow connects the raw materials to the products.



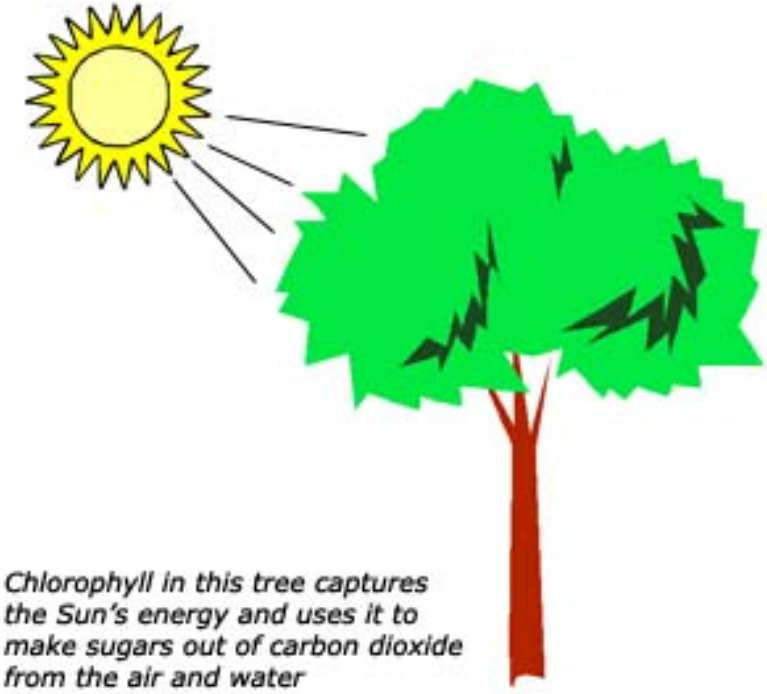
Photosynthesis – 2nd Stage

- Light energy, which is necessary for the chemical reaction to occur, is written above the arrow.



Autotrophs

- A plant is an **autotroph,** an organism that makes its own food.



- The plant’s leaves contain sugars made during photosynthesis.

Heterotroph

- A caterpillar is a **heterotroph**, an organism that cannot make its own food.

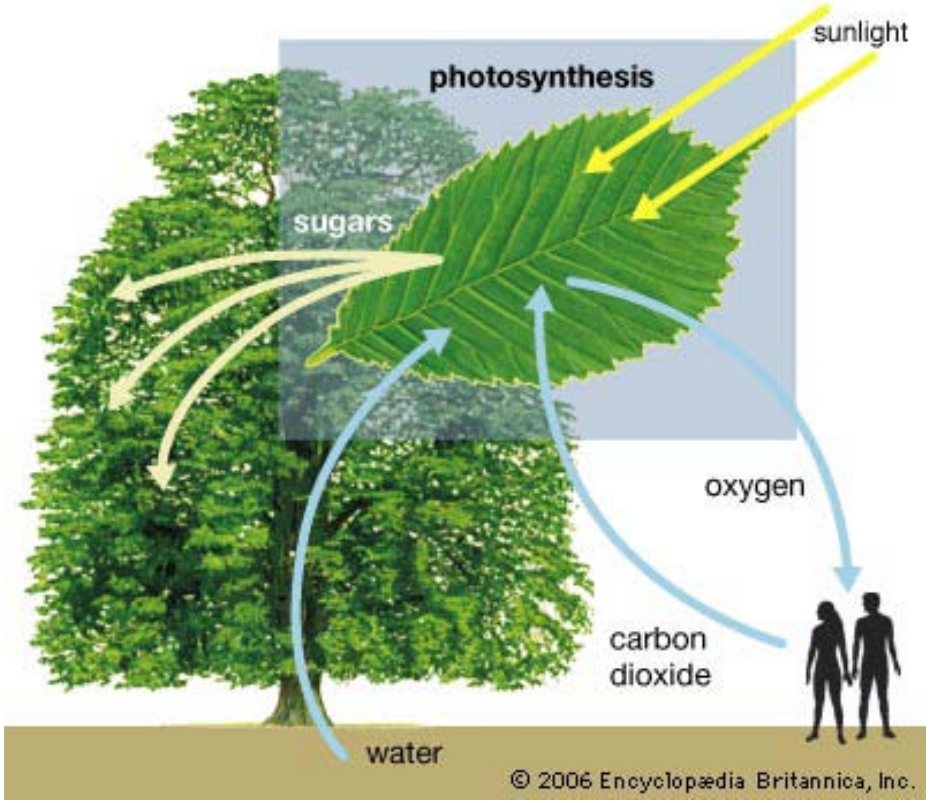
- To live, grow, and perform other functions, the caterpillar needs the energy in plant sugars.

- By eating plants, heterotrophs get energy from the sun in an indirect way.

- Nearly all living things obtain energy either directly or indirectly from the energy of sunlight captured during photosynthesis.

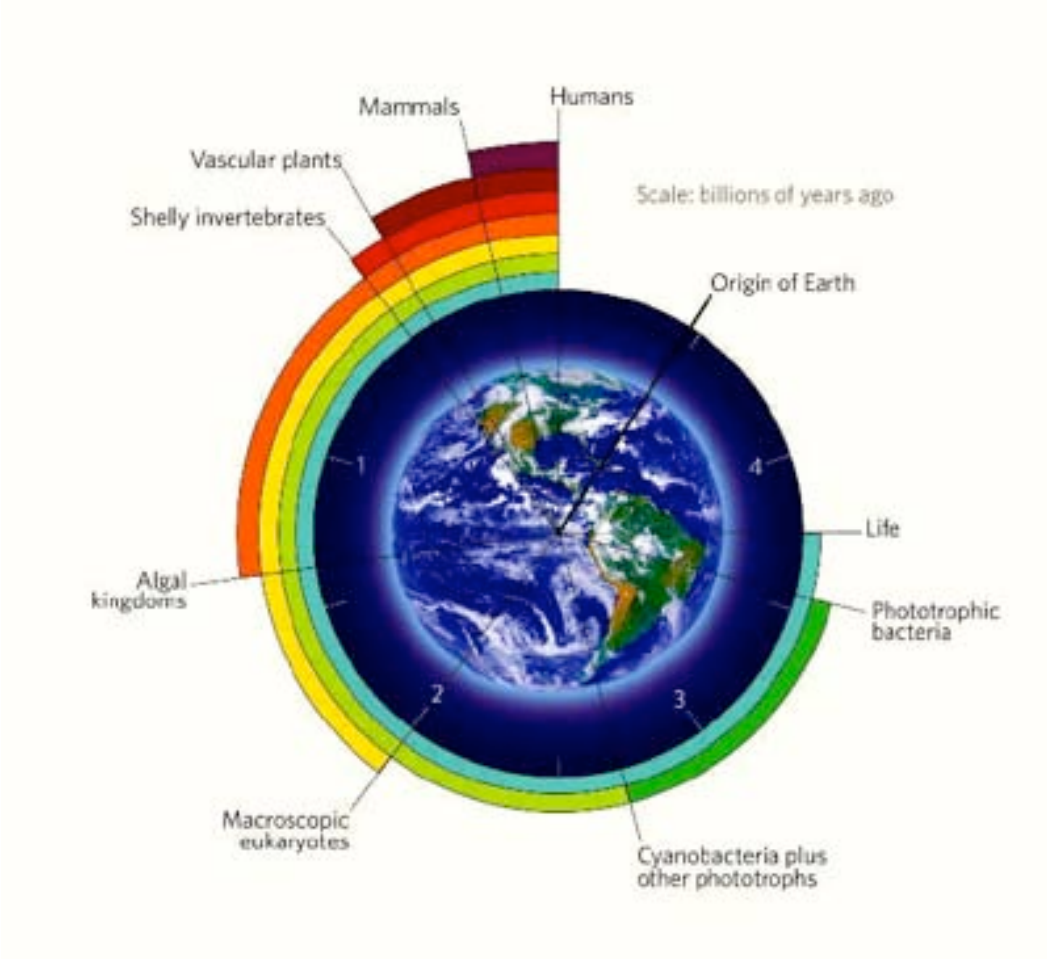
Oxygen in the Atmosphere

- Photosynthesis also is essential for the air you breathe.



Oxygen in the Atmosphere

- Almost all the oxygen in Earth's atmosphere was produced by living things through the process of photosynthesis.



END – 2.1

Science Explorer
Cells and Heredity

2.2 - RESPIRATION

2.2 - Respiration – Related Video

- Anaerobic Respiration Review
- Cellular Respiration Electron Transport Chain
- Cellular Respiration Song
- Electron Transport System
- Fermentation
- Krebs Cycle
- Krebs Cycle Mitochondria
- Respiration and Fermentation

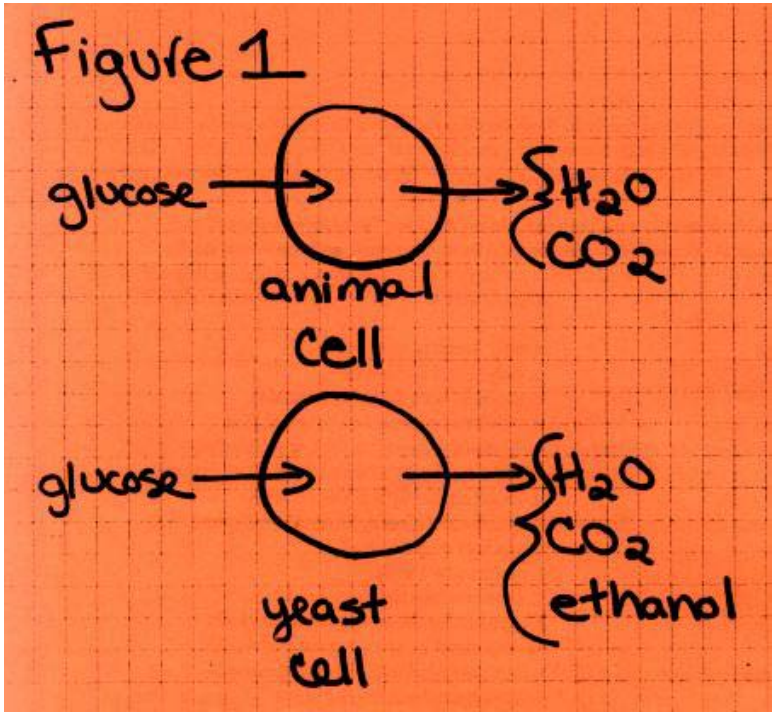
Objectives

1. What events occur during respiration?
2. How are photosynthesis and respiration related?
3. What is fermentation?

- Cells store and use energy in a way that is similar to the way you deposit and withdraw money from a savings account.

- When you eat a meal, you add to your body’s energy savings account.

- When your cells need energy, they make a withdrawal and break down the glucose in food to release energy.



Respiration

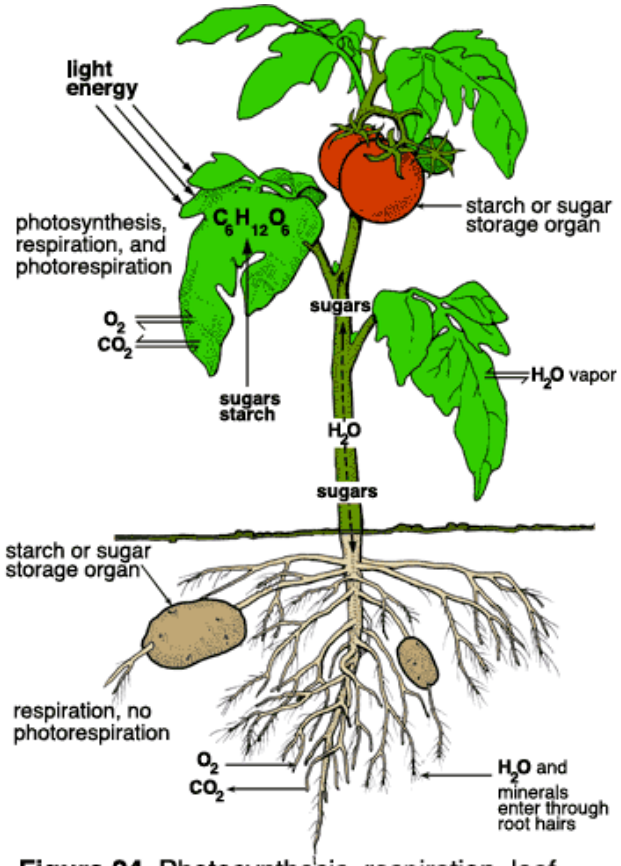
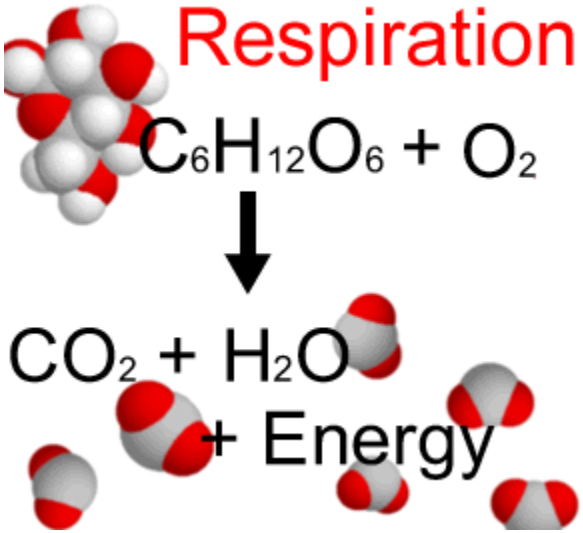
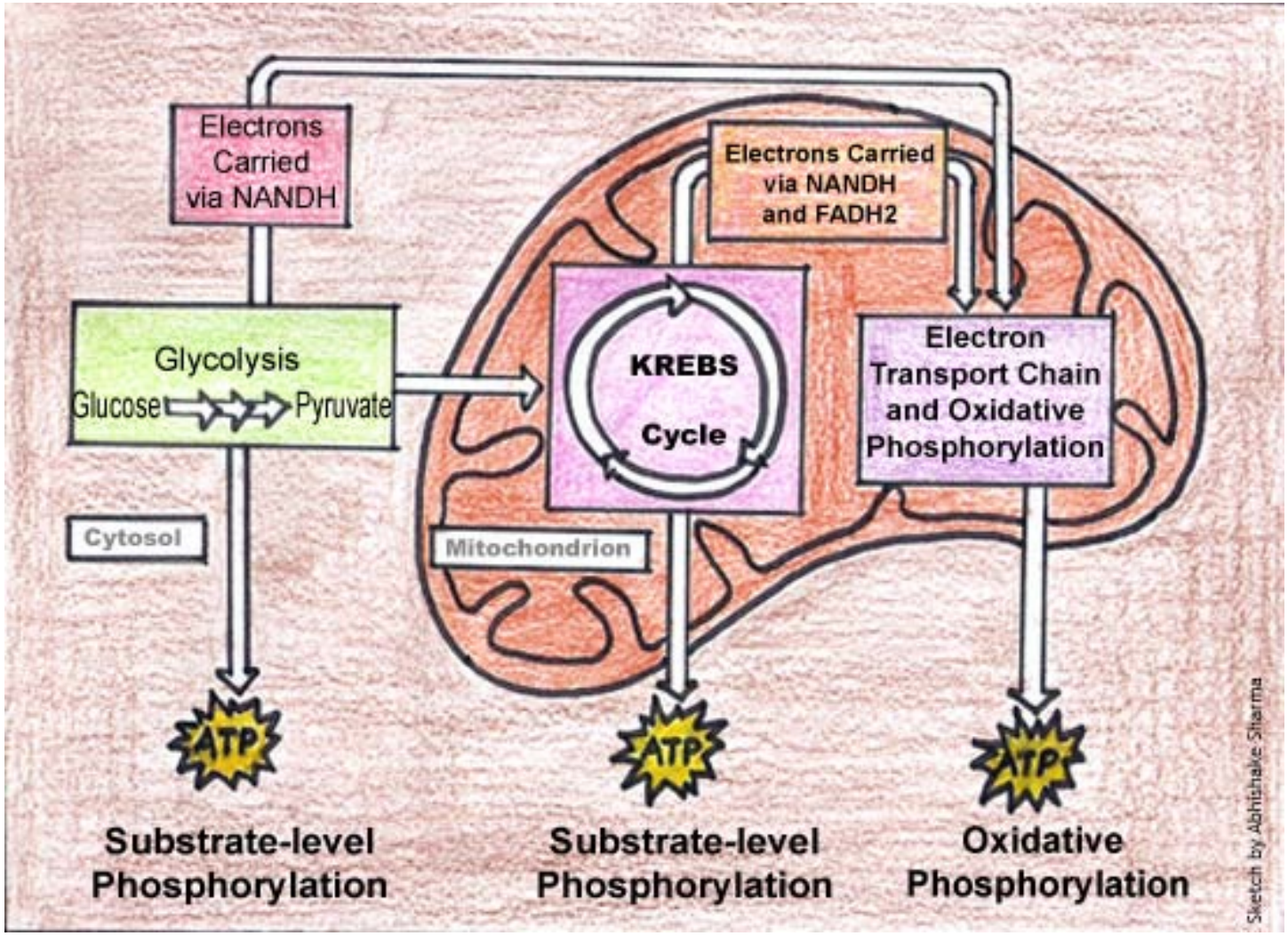


Figure 24. Photosynthesis, respiration, leaf water exchange, and translocation of sugar (photosynthate) in a plant.

- The process by which cells "withdraw" energy from glucose is called **respiration.**

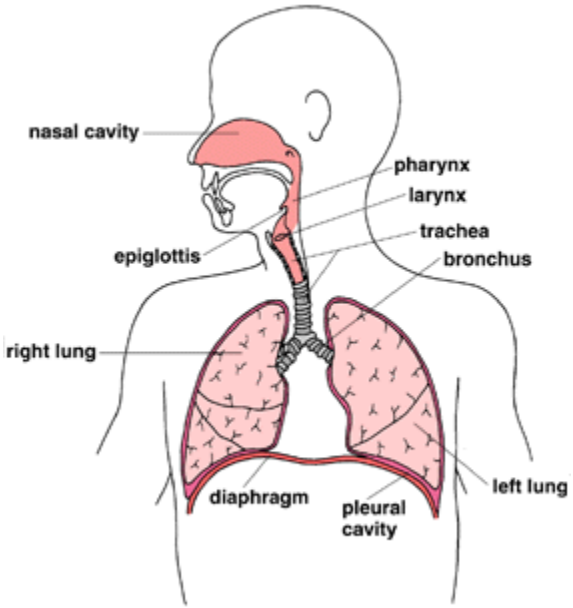
- During respiration, cells break down simple food molecules such as glucose and release the energy they contain.



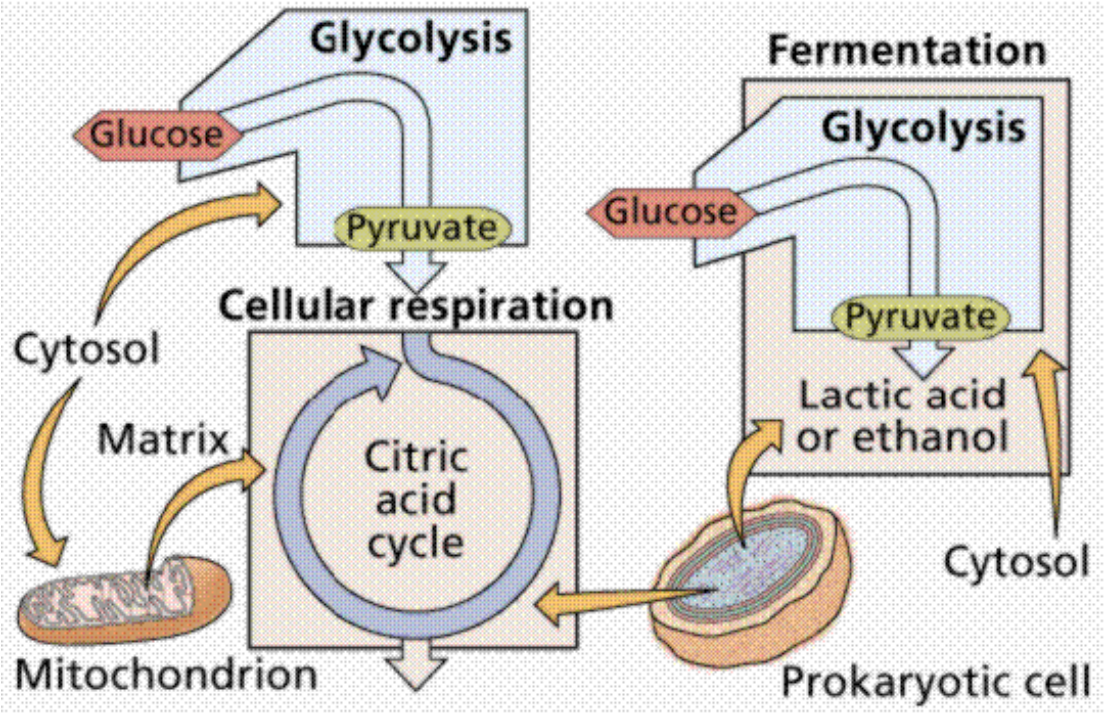


- Because living things need a continuous supply of energy, the cells of all living things carry out respiration continuously.

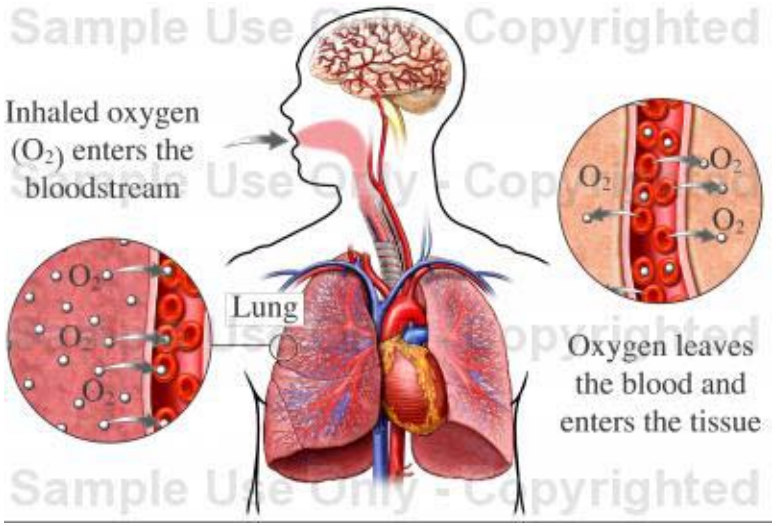
- The term *respiration* also is used to mean breathing, that is, moving air in and out of your lungs.



- To avoid confusion, the respiration process that takes place inside cells sometimes is called cellular respiration.



- The two kinds of respiration are related.
- Breathing brings oxygen into your lungs, and oxygen is necessary for cellular respiration to occur in most cells.

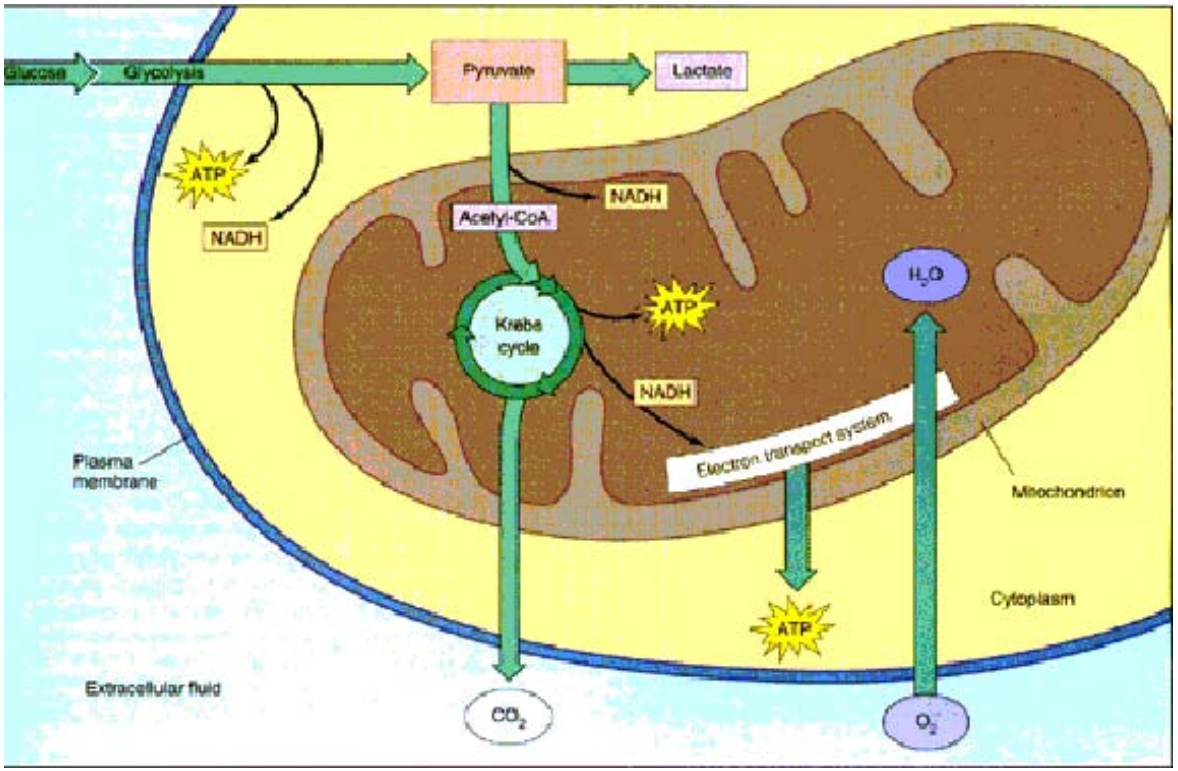


- The overall process of respiration can be summarized in a simple chemical equation.

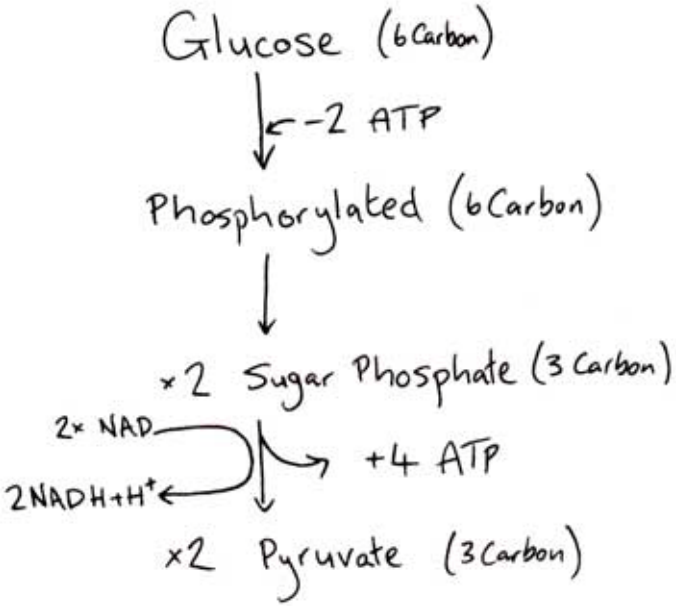
$$C_6H_{12}O_6 + 6O_2 \rightarrow 6H_20 + 6CO_2 + \textbf{energy}$$

(glucose + oxygen → water + carbon dioxide + energy)

- However, respiration is a complex, two-stage process.

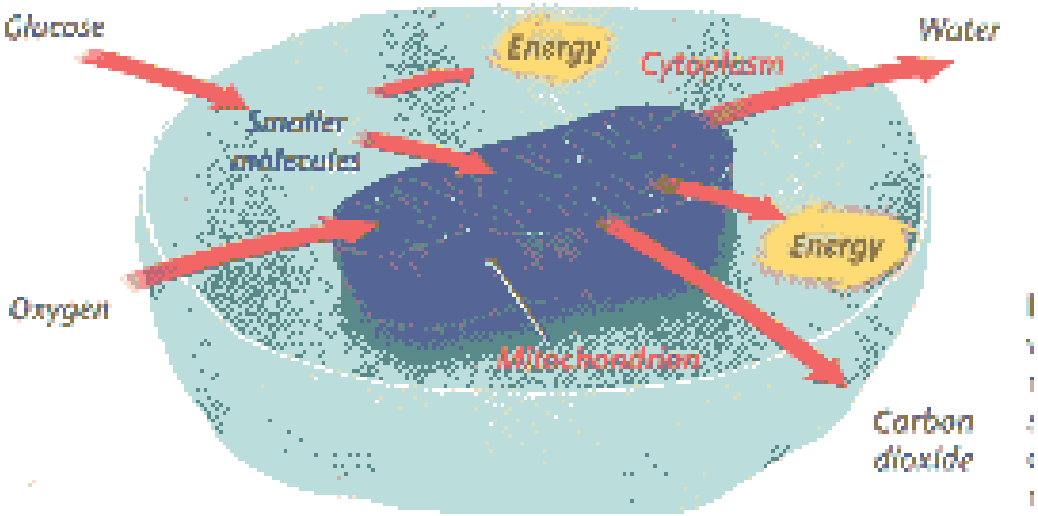


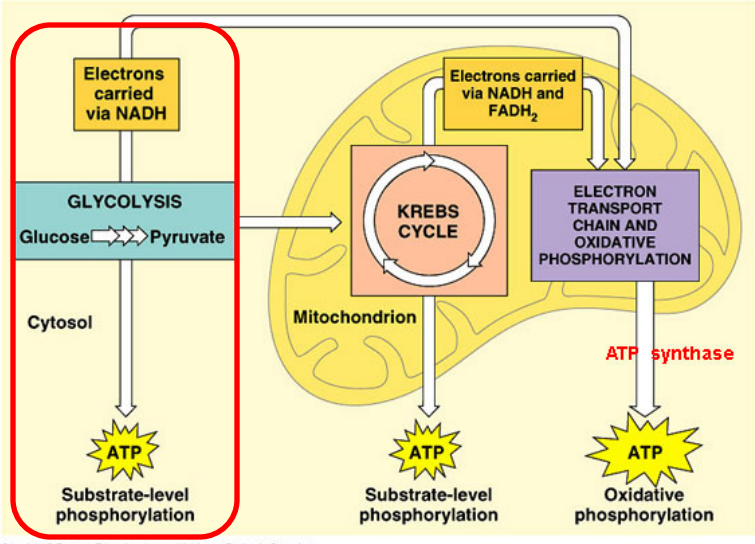
First Stage of Respiration



- The first stage takes place in the cytoplasm of the organism's cells.

- There, glucose molecules are broken down into smaller molecules.

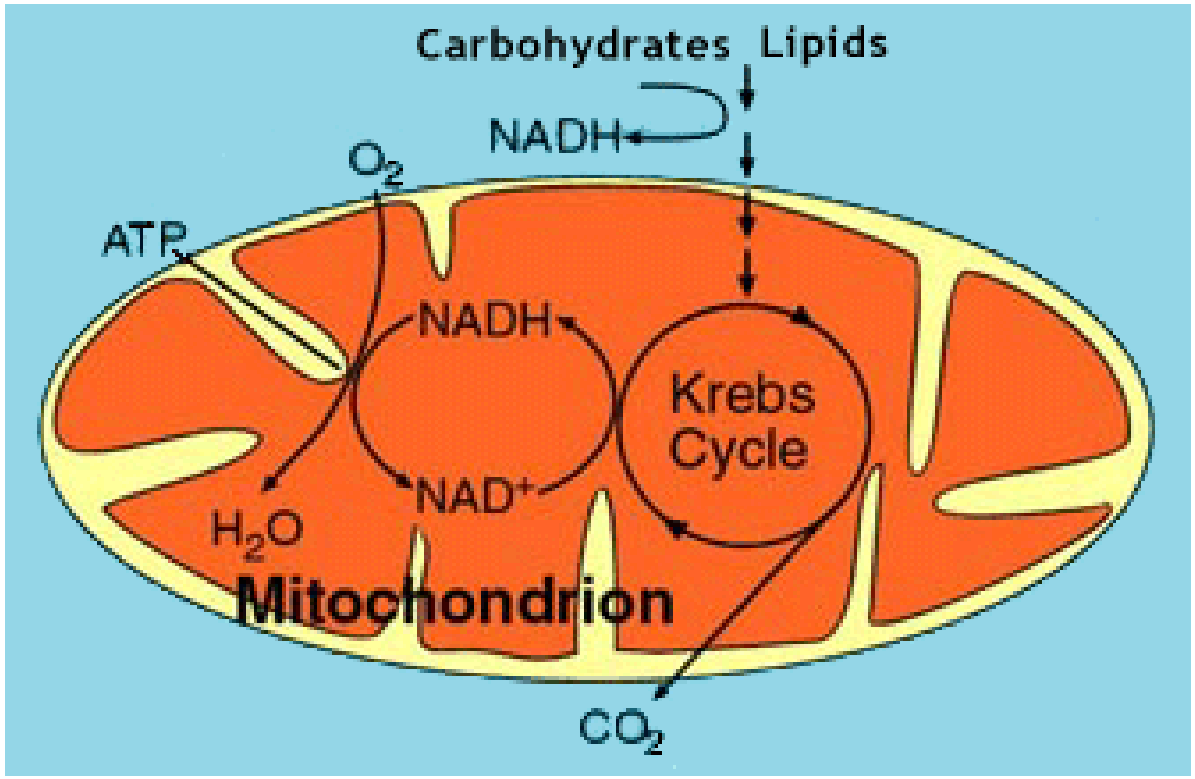


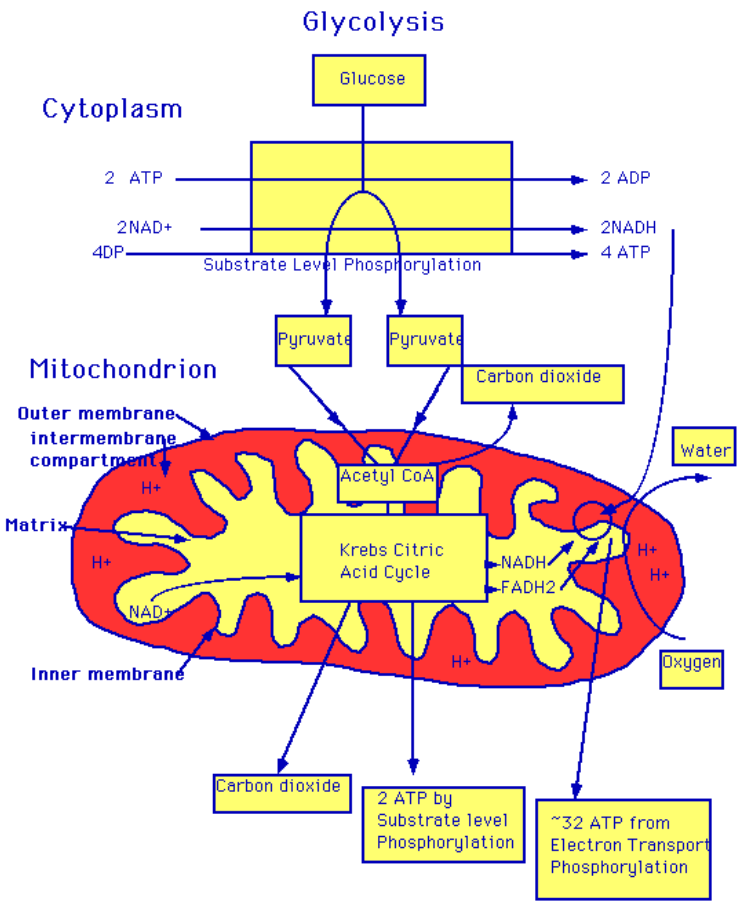


- Oxygen is not involved in this stage of respiration, and only a small amount of energy is released.

Second Stage of Respiration

- The second stage of respiration takes place in the mitochondria.

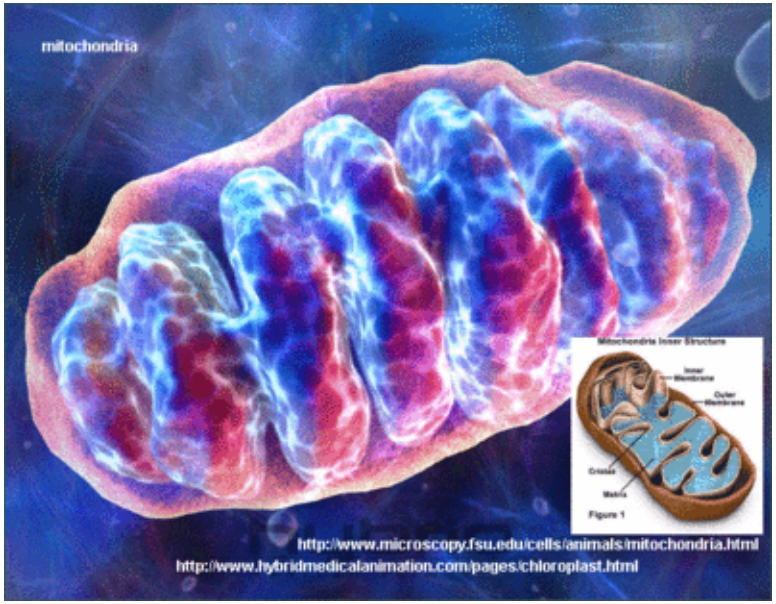


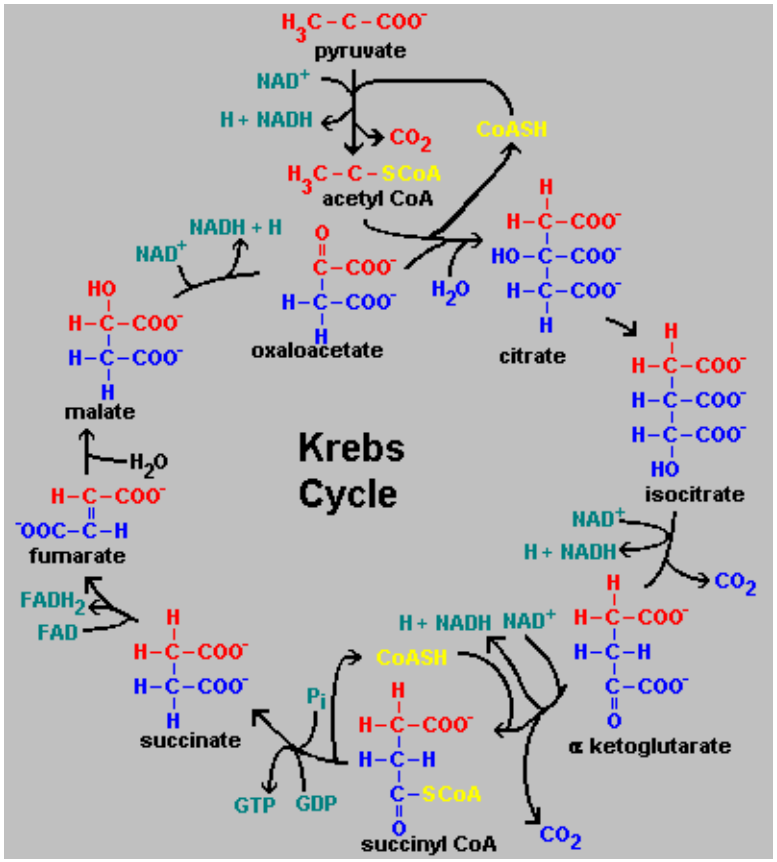


- There, the small molecules are broken down into even smaller molecules.

  (Krebs Cycle)

- These chemical reactions require oxygen, and a great deal of energy is released.





- Two other products of respiration are carbon dioxide and water.

- Photosynthesis and respiration can be thought of as opposite Processes.

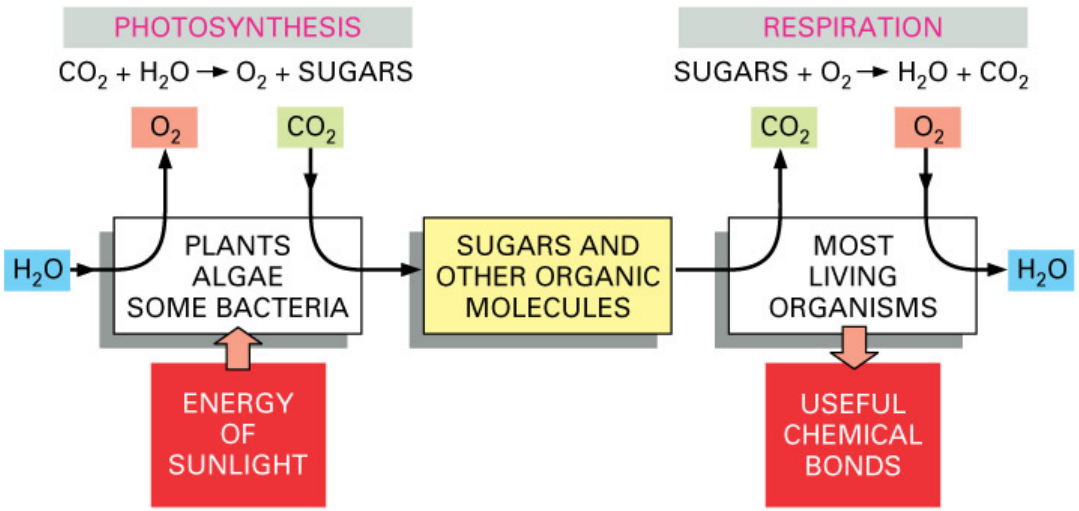
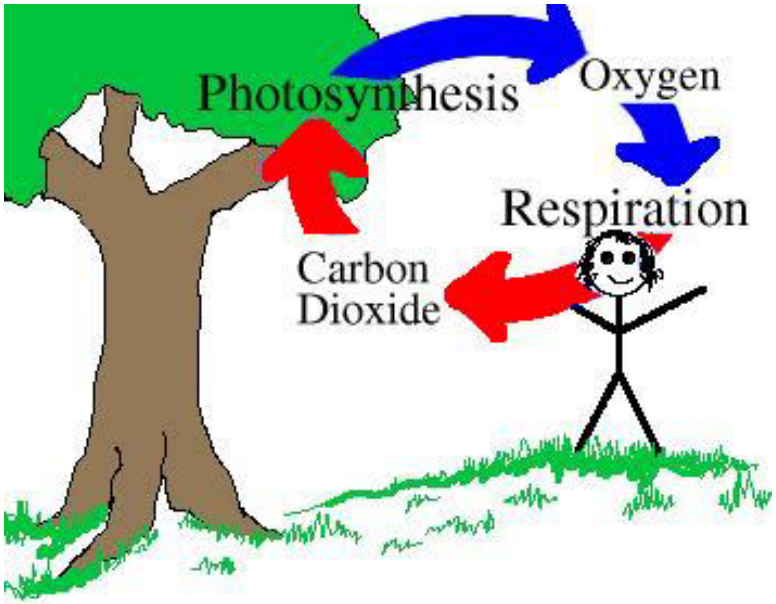


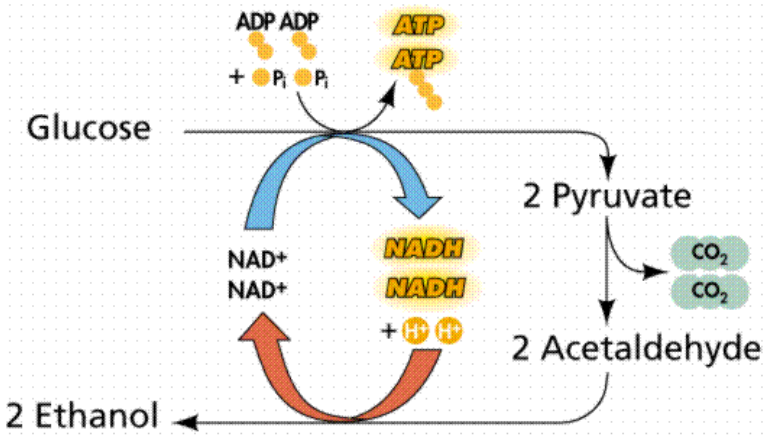
Figure 3-10 Essential Cell Biology, 2/e. (© 2004 Garland Science)

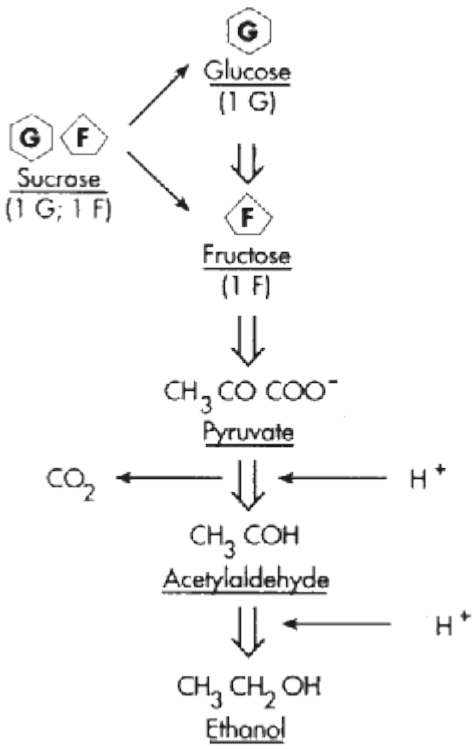


- Together, these two processes form a cycle that keeps the levels of oxygen and carbon dioxide fairly constant in the atmosphere.

Fermentation

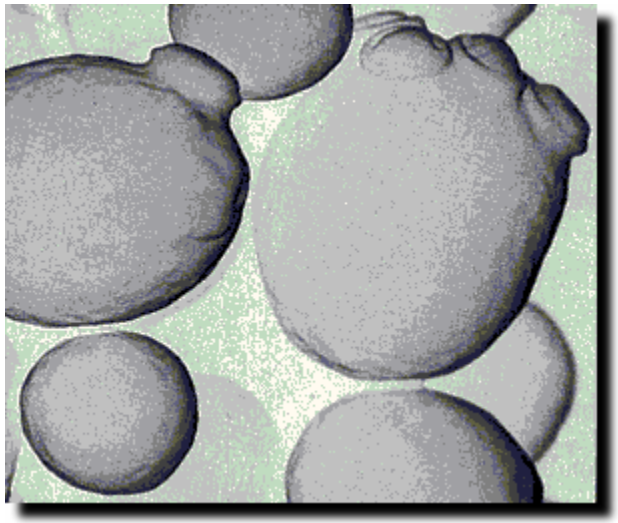
- Some cells obtain their energy through **fermentation**, an energy releasing process that does not require oxygen.

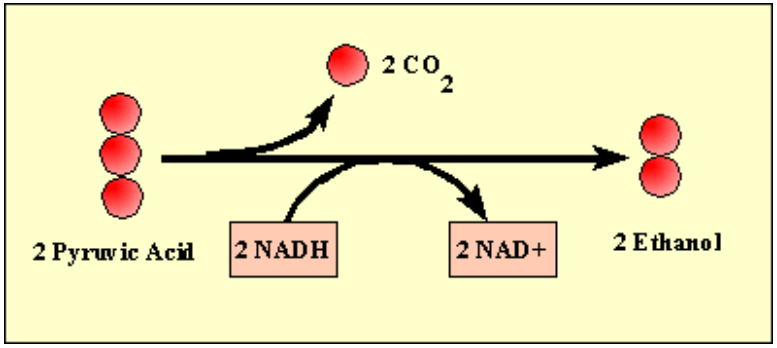




- Fermentation provides energy for cells without using oxygen.

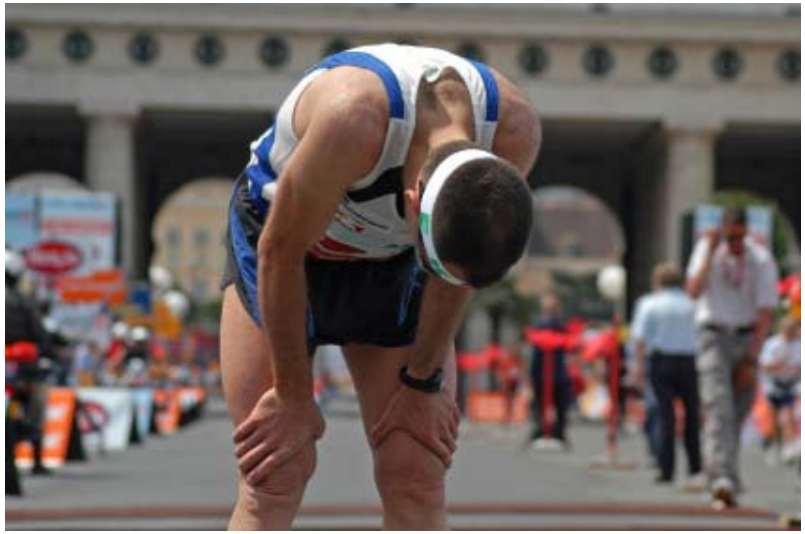
- One type of fermentation occurs in yeast and some other single-celled organisms.



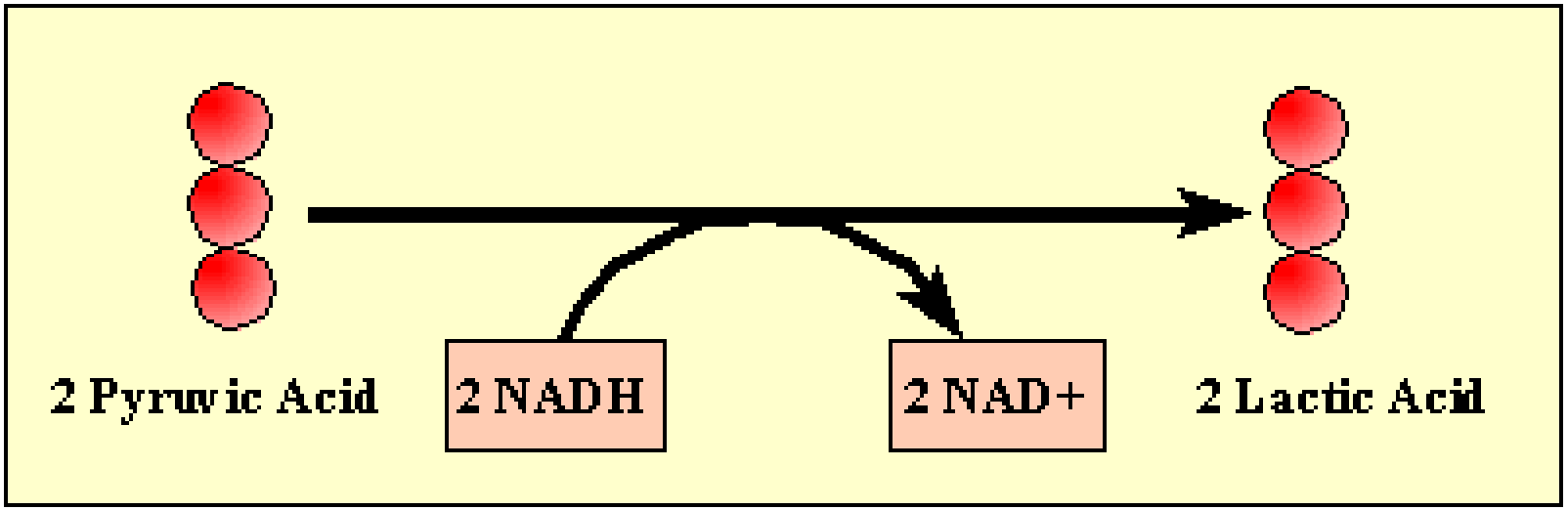


- This process is sometimes called alcoholic fermentation because alcohol is one of the products made when these organisms break down sugars.

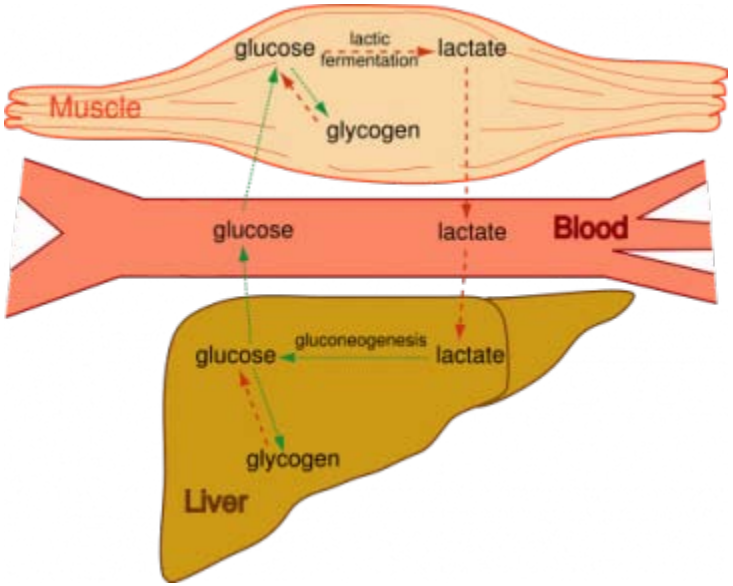
- Another type of fermentation takes place at times in your body, for example, when you've run as fast as you could for as long as you could.



- One product of this type of fermentation is an acid known as lactic acid.



- When lactic acid builds up, your muscles feel weak and sore.



END – 2.2

Science Explorer
Cells and Heredity

2.3 - CELL DIVISION

2.3 - Cell Division – Related Video

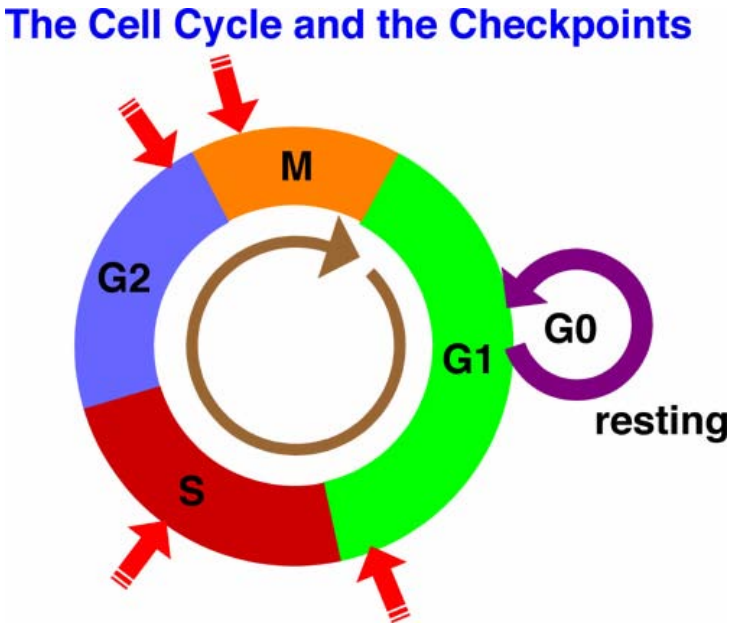
- Cell Cycle
- Cell Division
- Cells From Other Cells
- In Cell Division – The Mitosis Song

Objectives

1. What events take place during the three stages of the cell cycle?
2. What is the role of DNA replication?

Cell Cycle

- The regular sequence of growth and division that cells undergo is known as the **cell cycle**.
- The cell cycle is divided into three main stages.

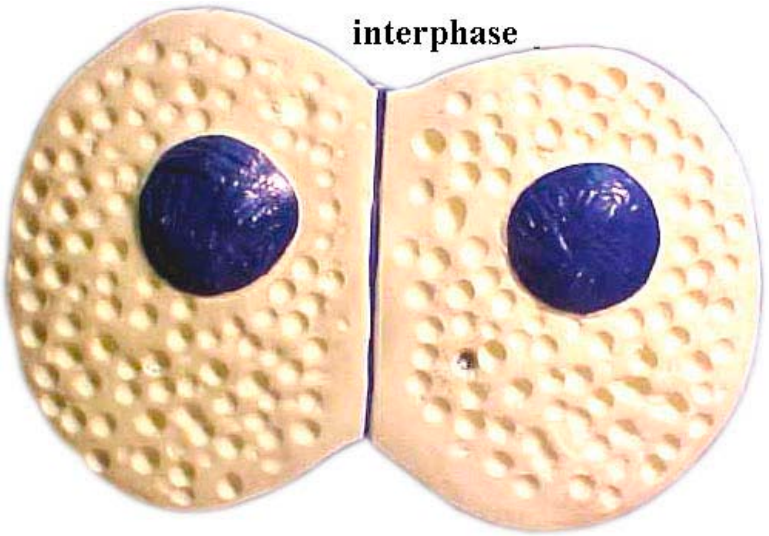


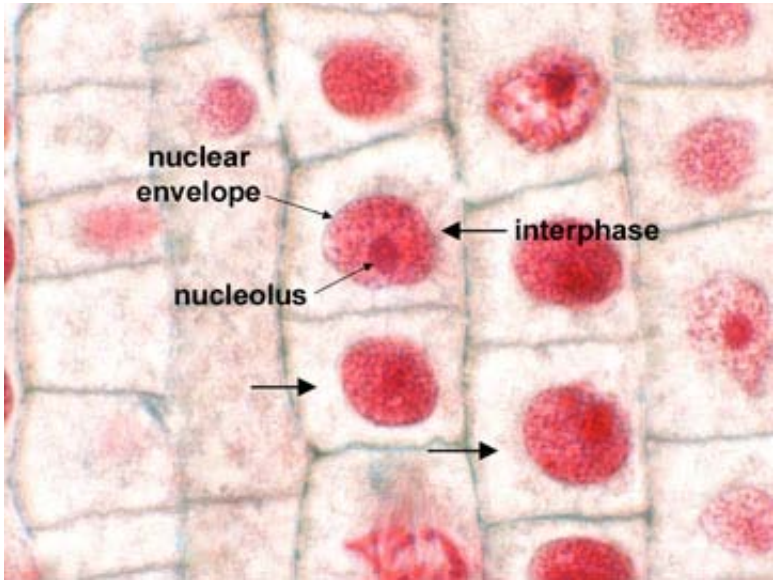
1st Stage - Interphase

- The first stage of the cell cycle is called **interphase.**

Interphase

- During interphase, the cell grows to its mature size,makes a copy of its DNA, and prepares to divide into two cells.

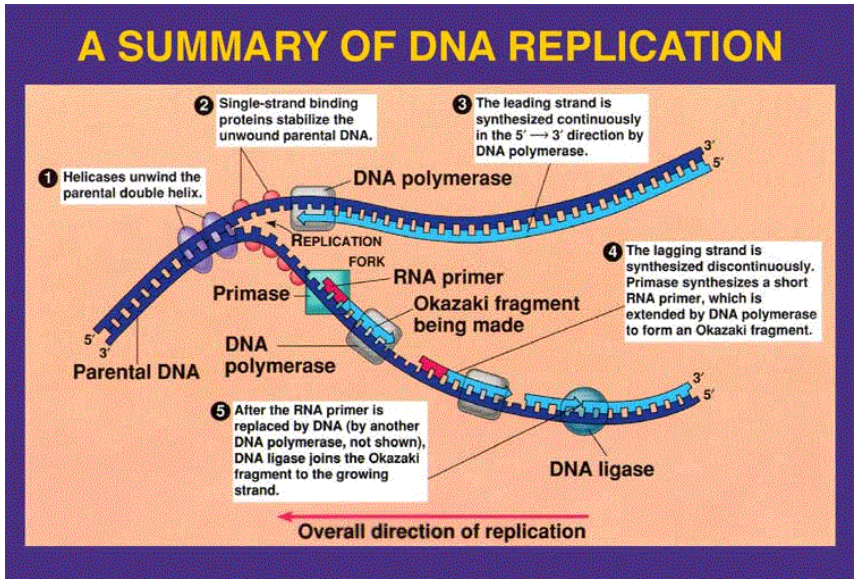


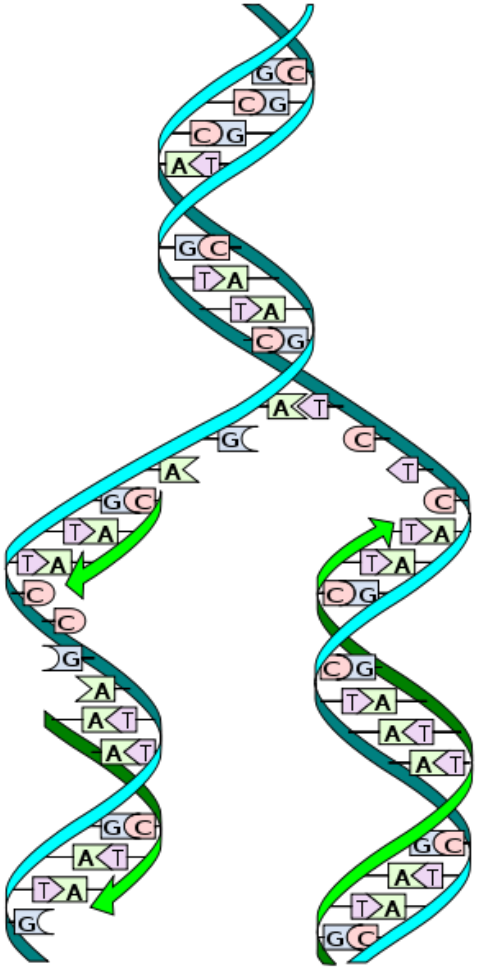


- During the first part of interphase, the cell doubles in size and produces all the structures needed to carry out its functions.

Replication

- After a cell has grown to its mature size, the cell makes a copy of the DNA in its nucleus in a process called **replication.**

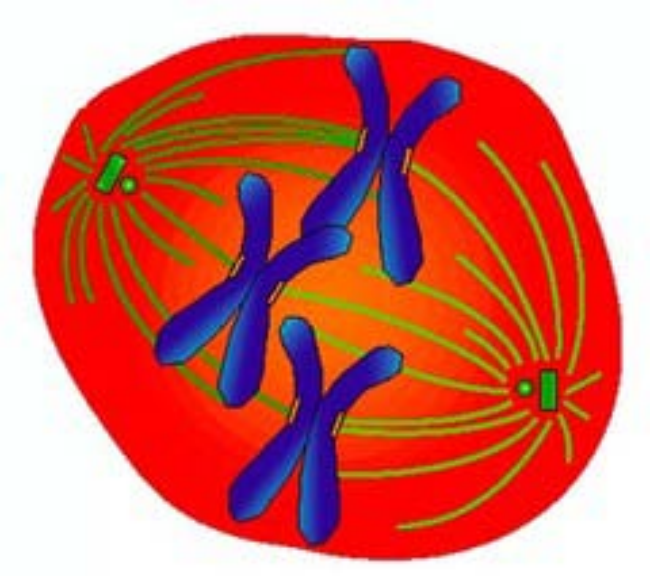


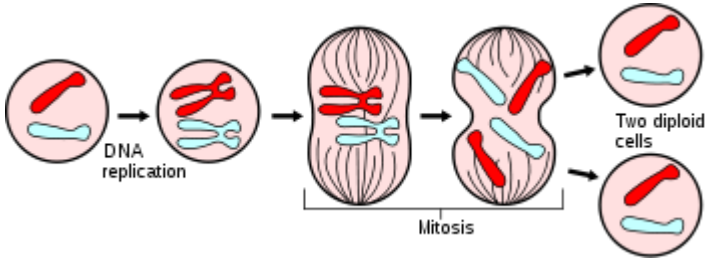


- At the end of DNA replication, the cell contains two identical sets of DNA.

2nd Stage - Mitosis

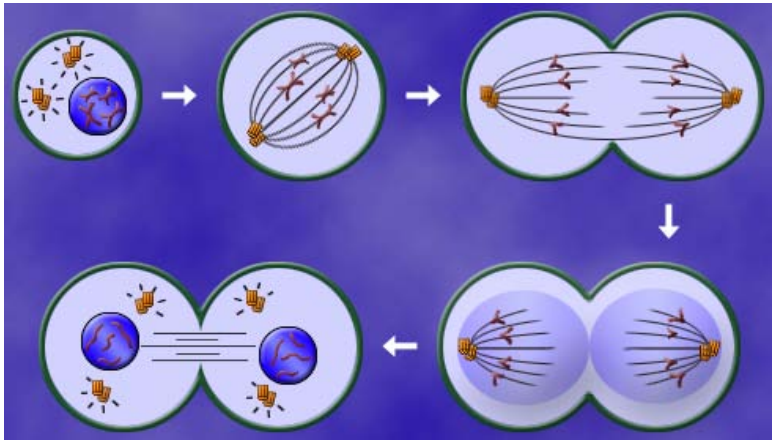
- Once interphase is complete, the second stage of the cell cycle begins.



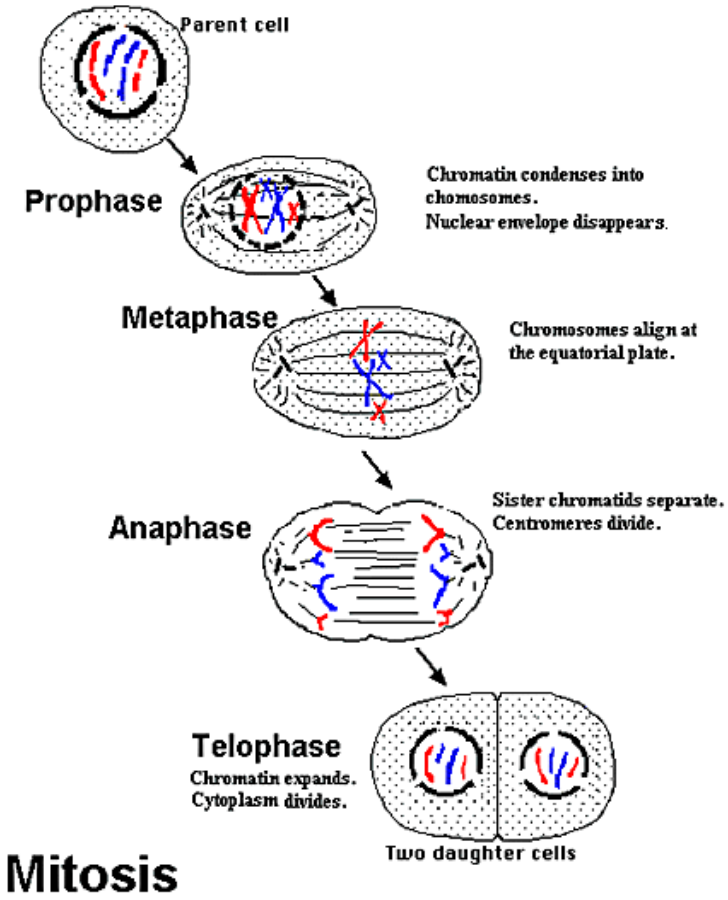


- **Mitosis** is the stage during which the cell's nucleus divides into two new nuclei.

- During **mitosis**, one copy of the **DNA** is distributed into each of the two daughter cells.



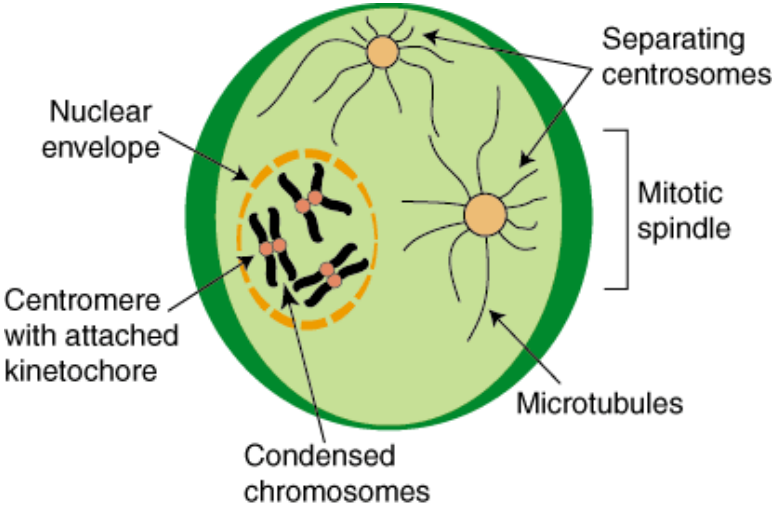
Mitosis Phases



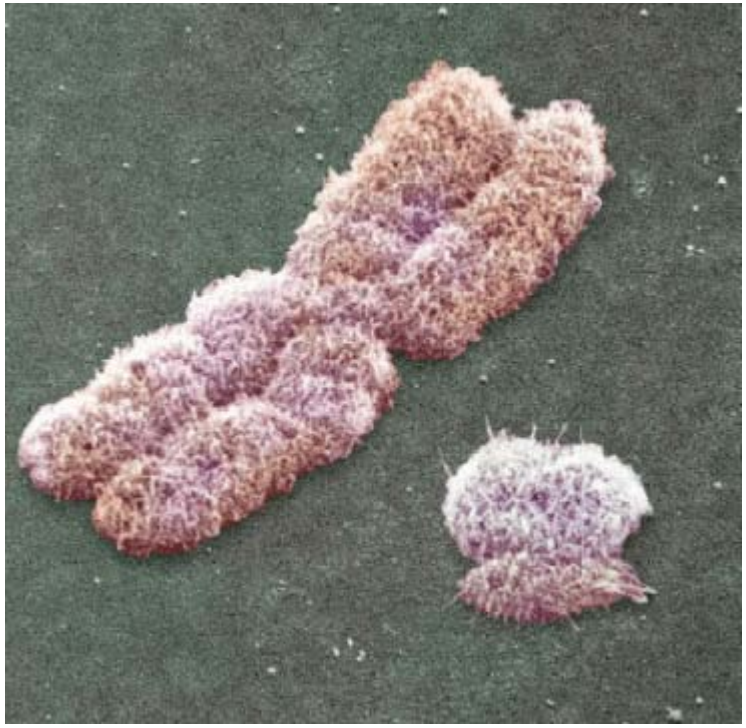
- Scientists divide mitosis into four parts, or phases: prophase, metaphase, anaphase, and telophase.

Prophase

- During prophase, the threadlike chromatin in the cell's nucleus begins to condense into tiny rods.



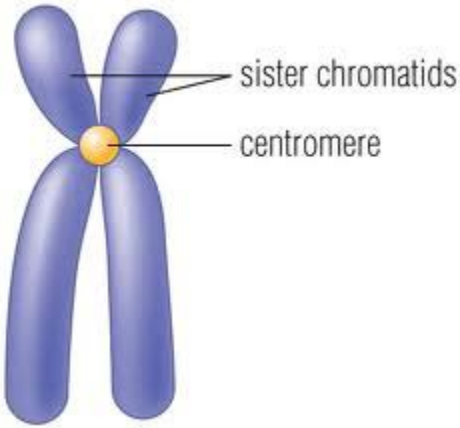
Chromosome



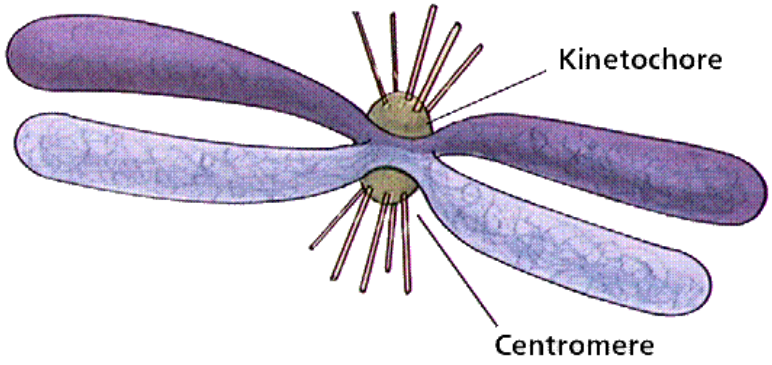
- Scientists call each doubled rod of condensed chromatin a **chromosome.**

Chromatid

- Each identical rod, or strand, of the chromosome is called a **chromatid**

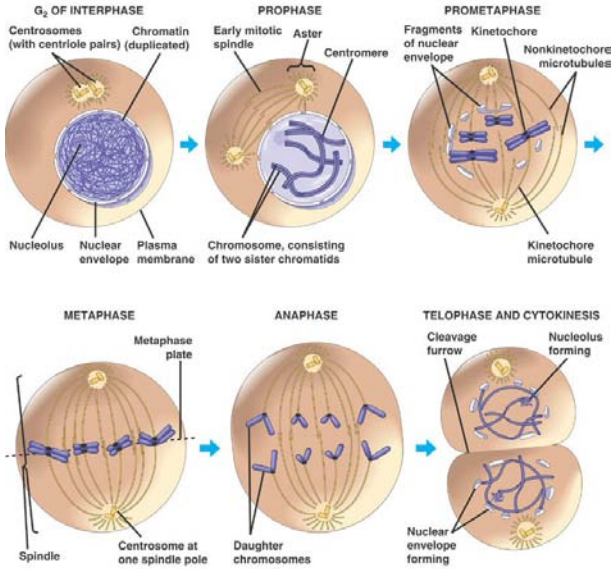


Centromere

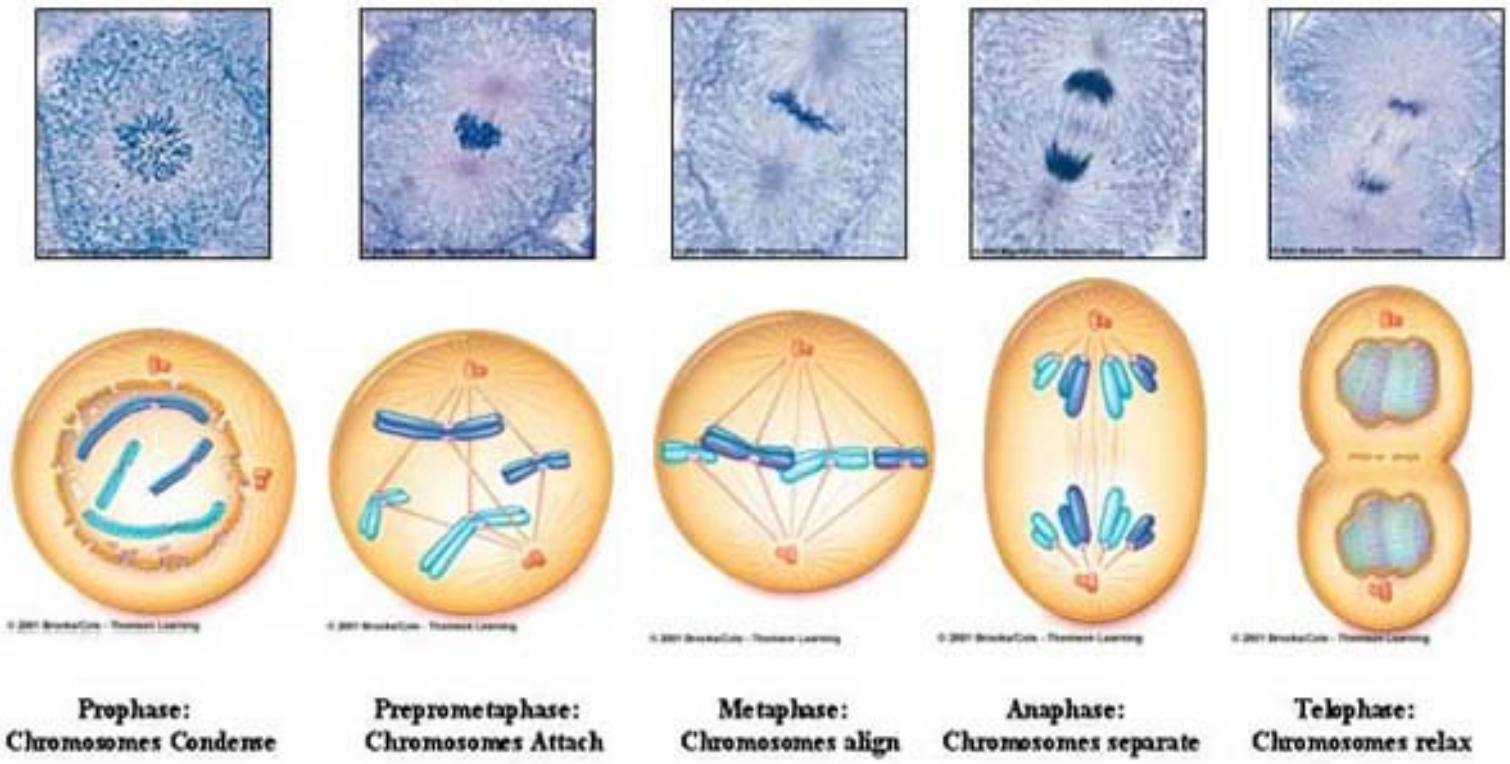


- The two strands are held together by a structure called a centromere.

- As the cell progresses through metaphase, anaphase, and telophase, the chromatids separate from each other and move to opposite ends of the cell.

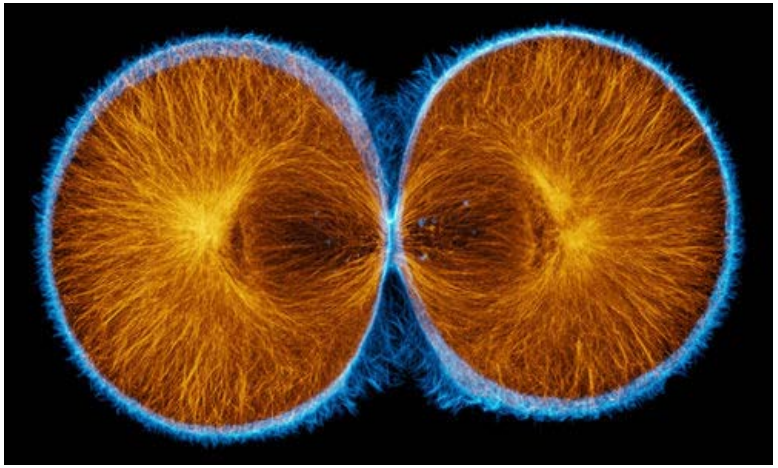


- Then two nuclei form around the chromatids at the two ends of the cell.

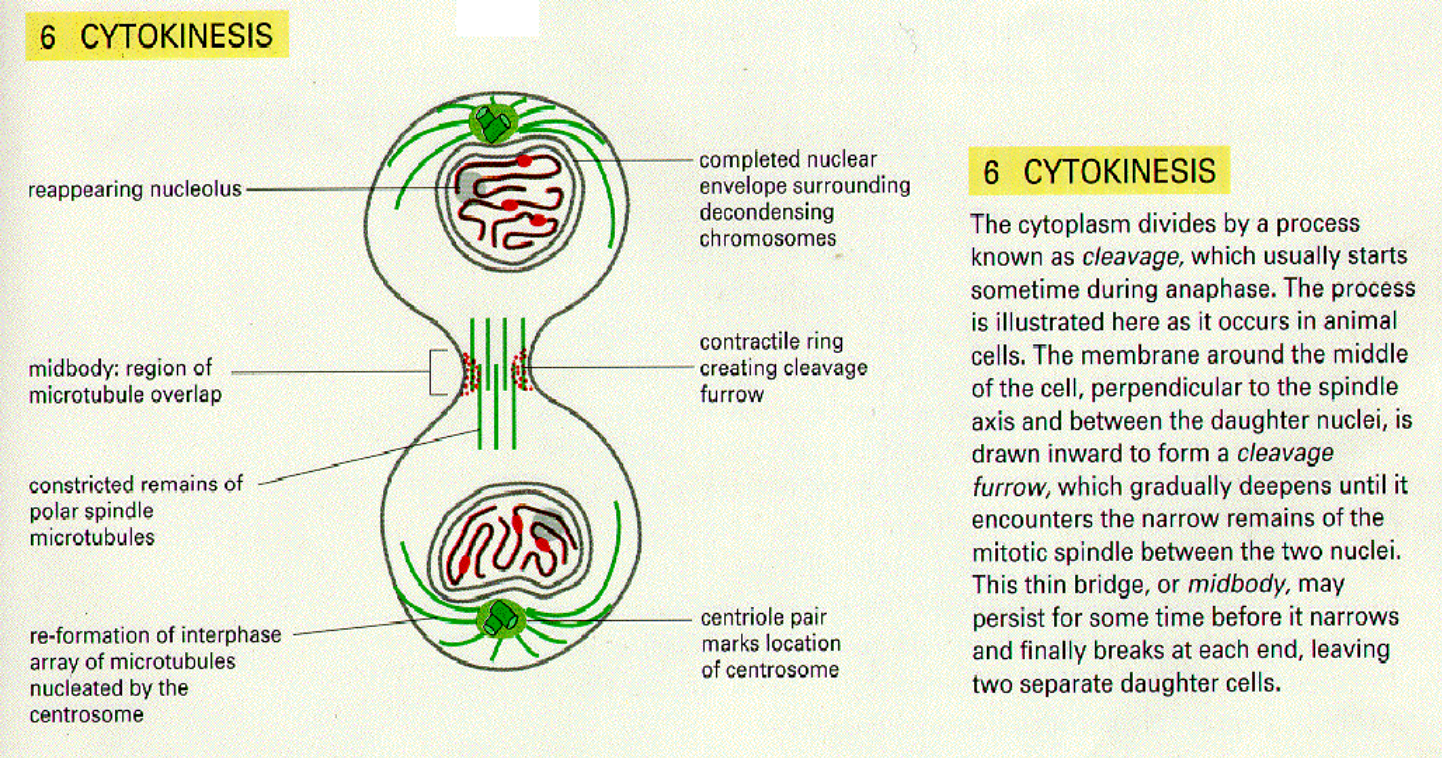


3rd Stage - Cytokinesis

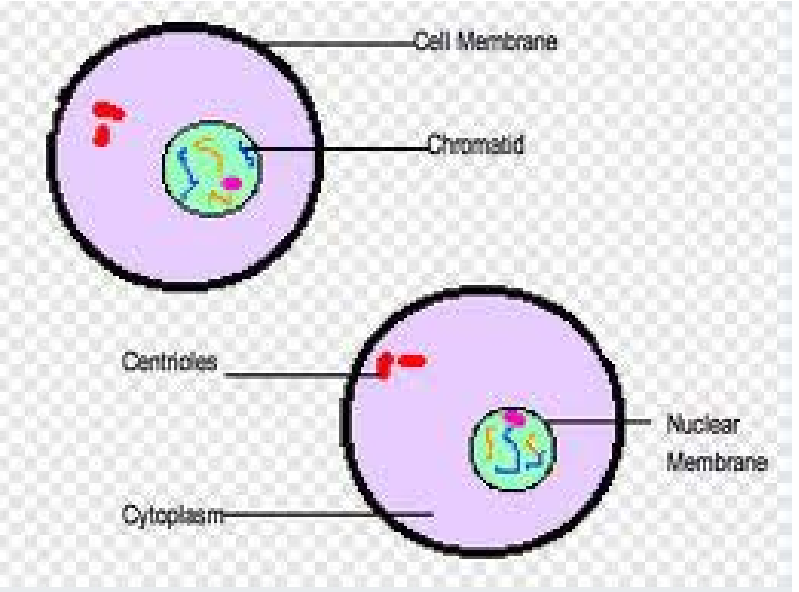
- After mitosis, the final stage of the cell cycle, called **cytokinesis,** completes the process of cell division.

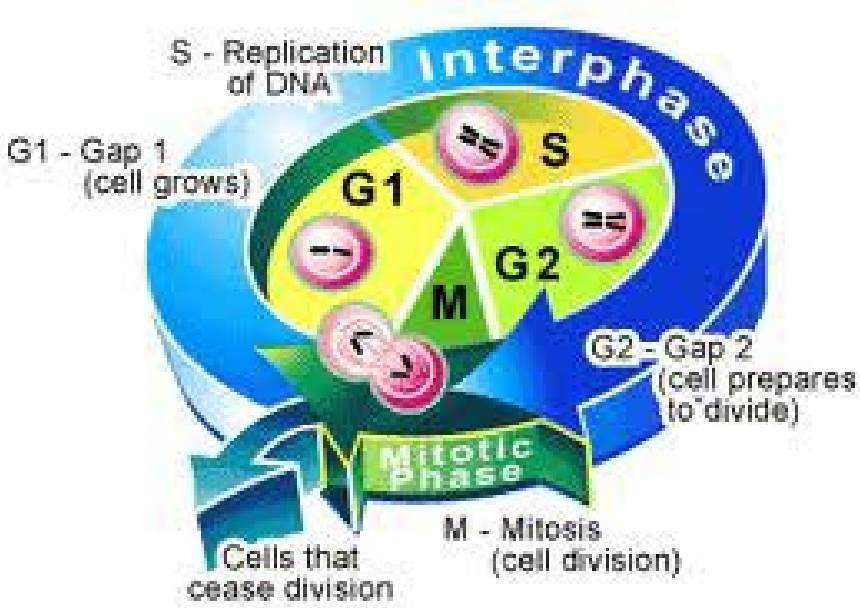


- During cytokinesis, the cytoplasm divides, distributing the organelles into each of the two new cells.



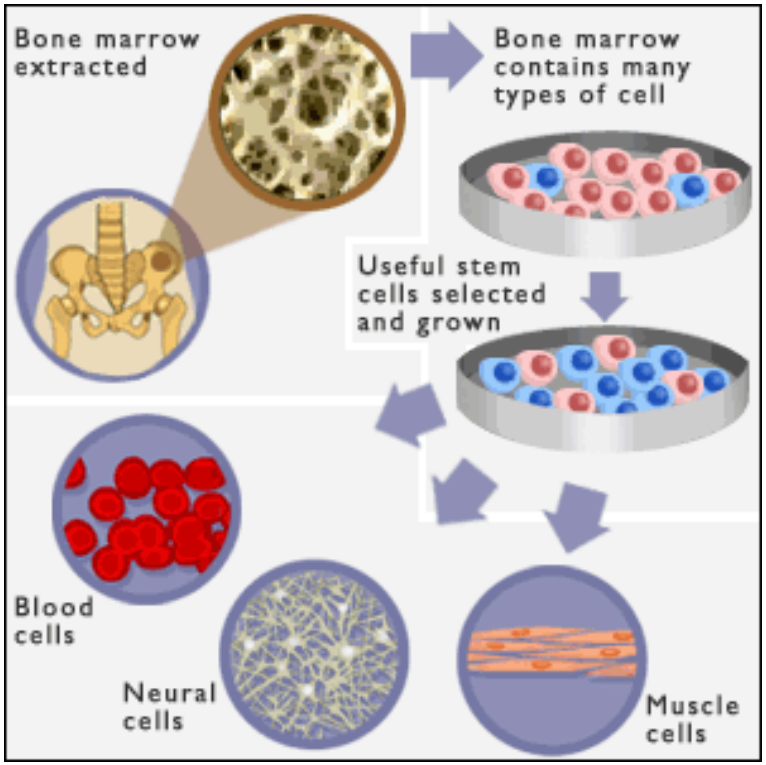
- Each daughter cell has the same number of chromosomes as the original parent cell.

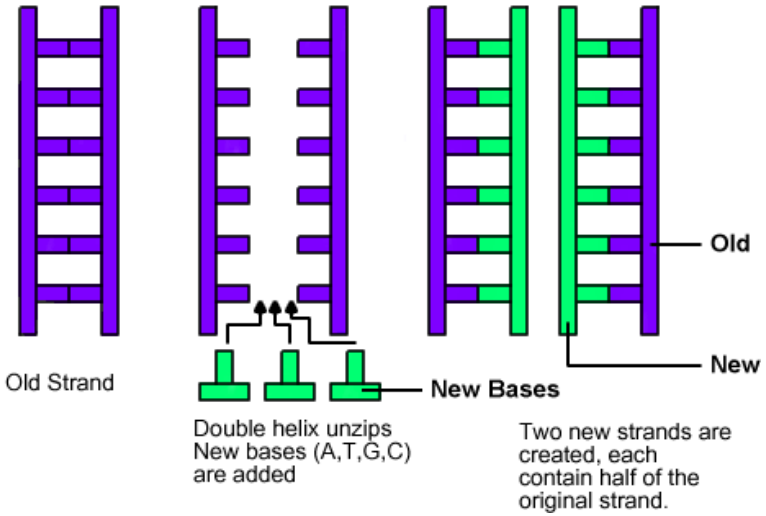




- At the end of cytokinesis, each cell enters interphase, and the cycle begins again.

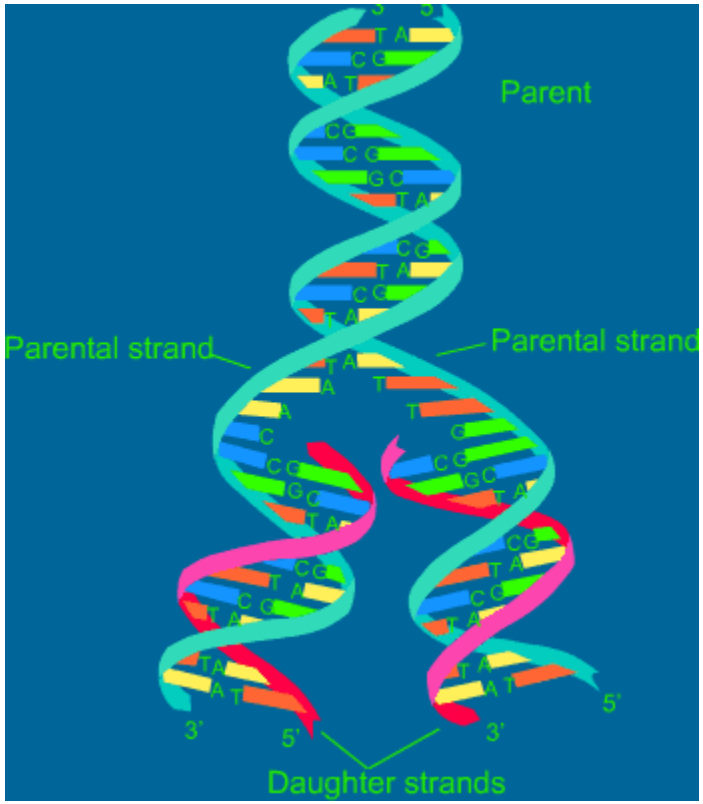
- How long it takes a cell to go through one cell cycle depends on the type of cell. The length of each stage in the cell cycle also varies.

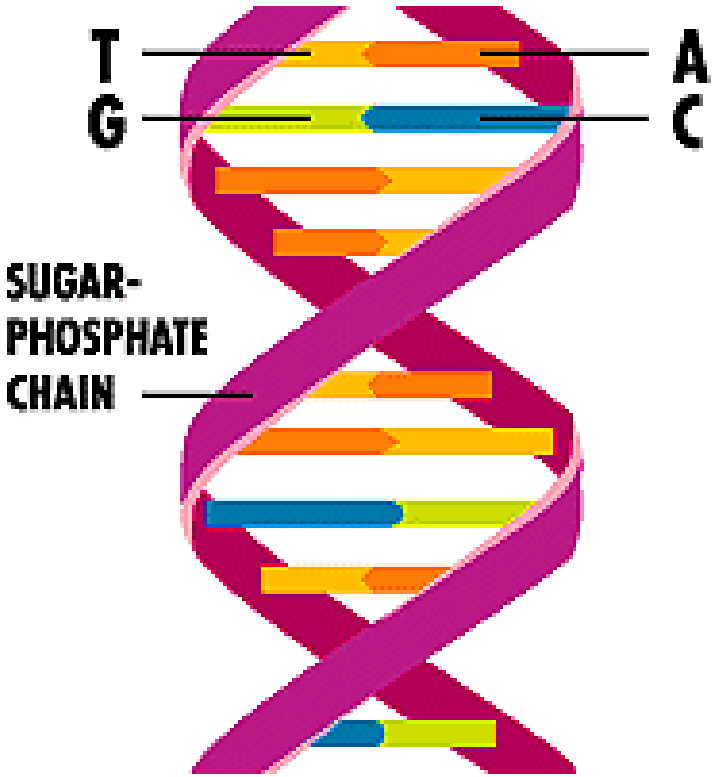




- A cell makes a copy of its DNA before mitosis occurs.

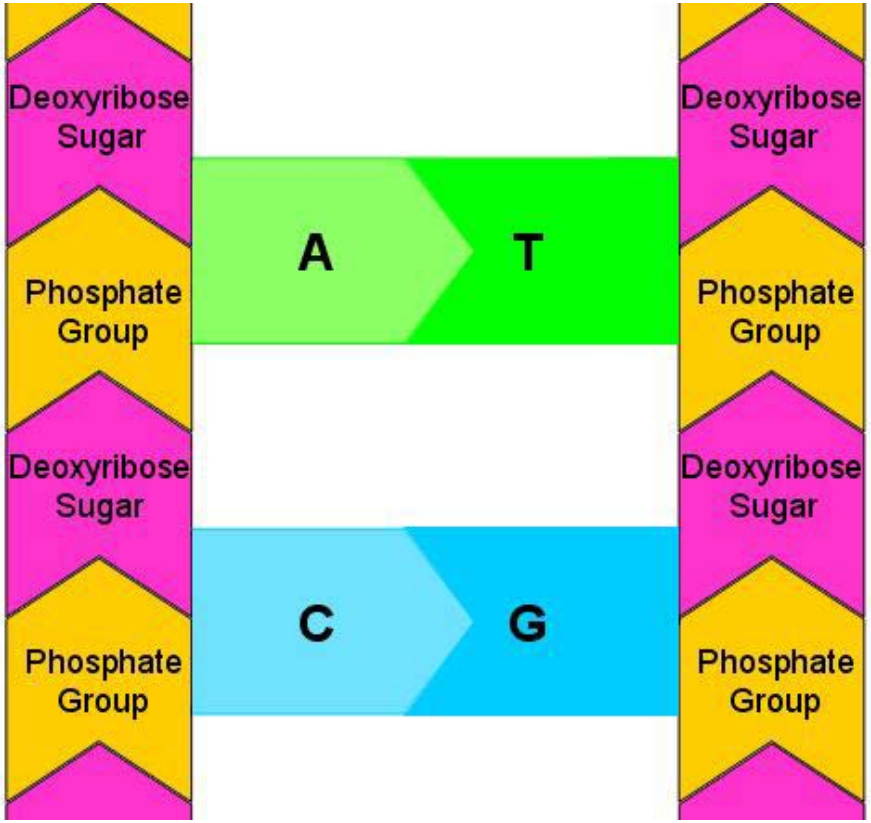
- DNA replication ensures that each daughter cell will have all of the genetic information it needs to carry out its activities.



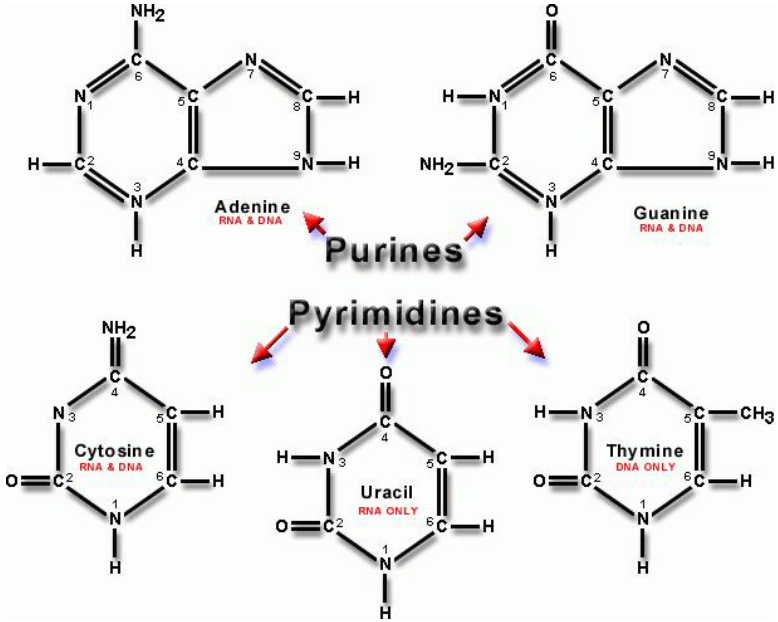


- The two sides of the DNA ladder are made up of alternating sugar and phosphate molecules.

- Each rung of the DNA ladder is made up of a pair of molecules called nitrogen bases.

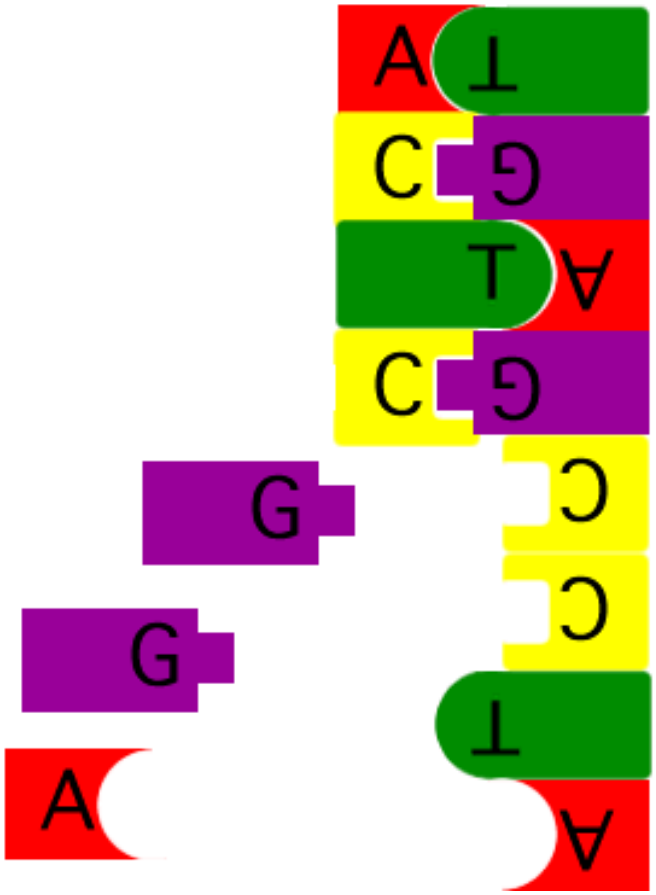


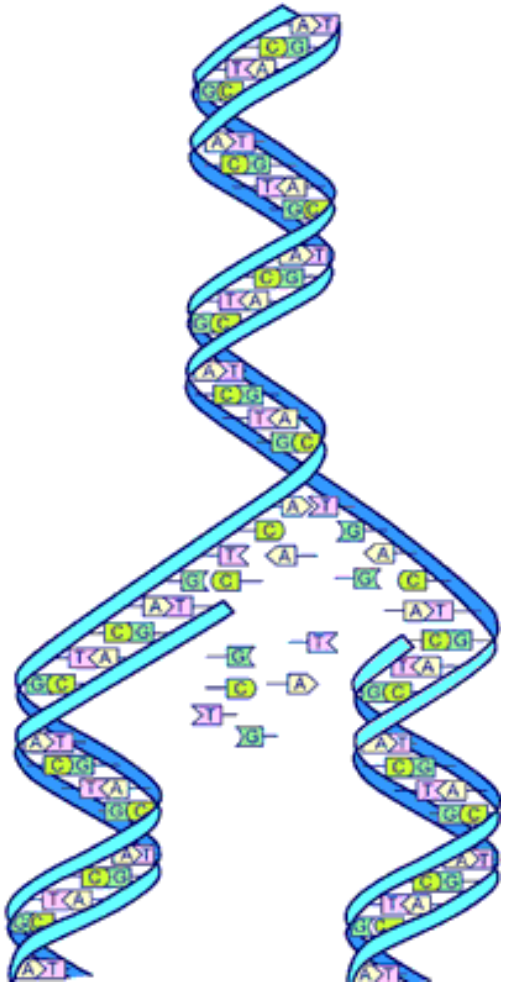
Nitrogen Bases - ATGC



- There are four kinds of nitrogen bases: adenine, thymine, guanine, and cytosine.

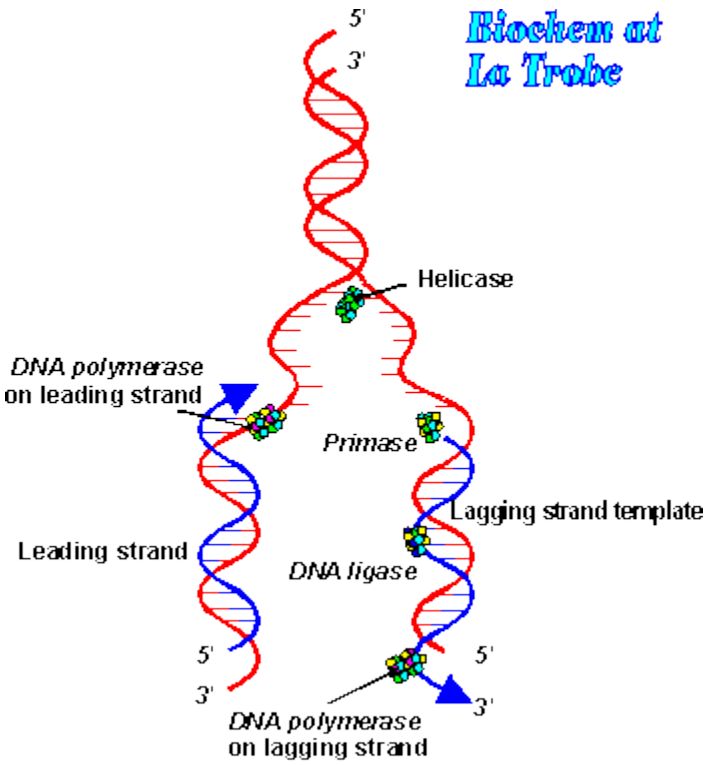
- Adenine only pairs with thymine, and guanine only pairs with cytosine.

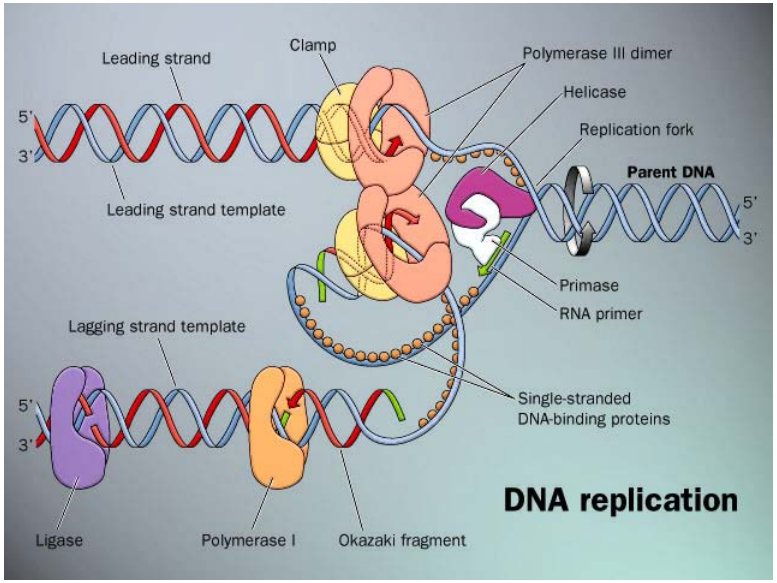




- DNA replication begins when the two sides of the DNA molecule unwind and separate.

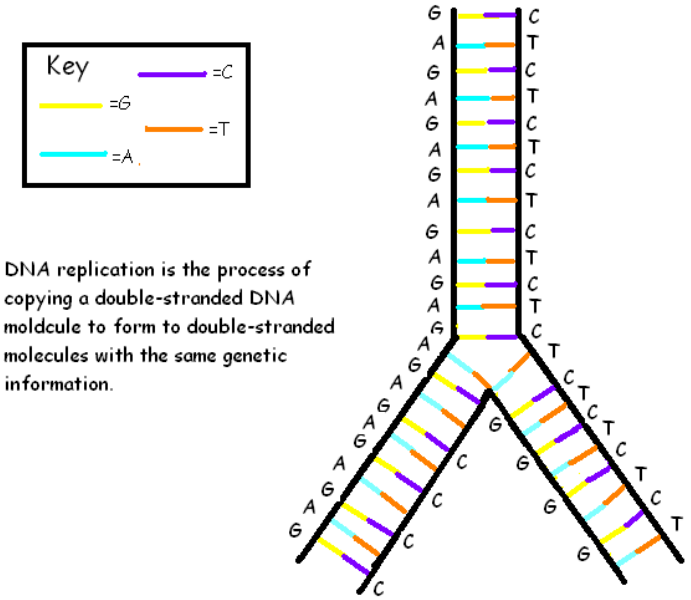
- Next, nitrogen bases in the nucleus pair up with the bases on each half of the DNA molecule.





- Once the new bases are attached, two new DNA molecules are formed.

- The order of the bases in each new DNA molecule will exactly match the order in the original DNA molecule.



DNA replication is the process of copying a double-stranded DNA moldcule to form to double-stranded molecules with the same genetic information.

END 2.3

Science Explorer
Cells and Heredity

2.4 - CANCER

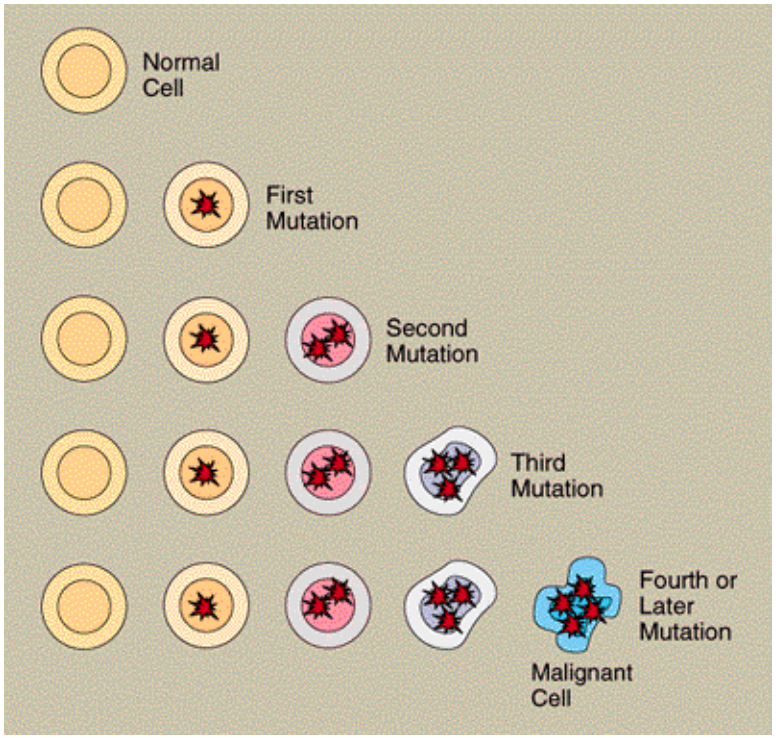
2.4 - Cancer - Related Video

- 3D Medical Animation – What is Cancer?
- Cancer Cells vs Healthy Cells
- Cancer Growth Animation
- DNA Mutation
- Gene Mutation
- Mitosis in Cancer

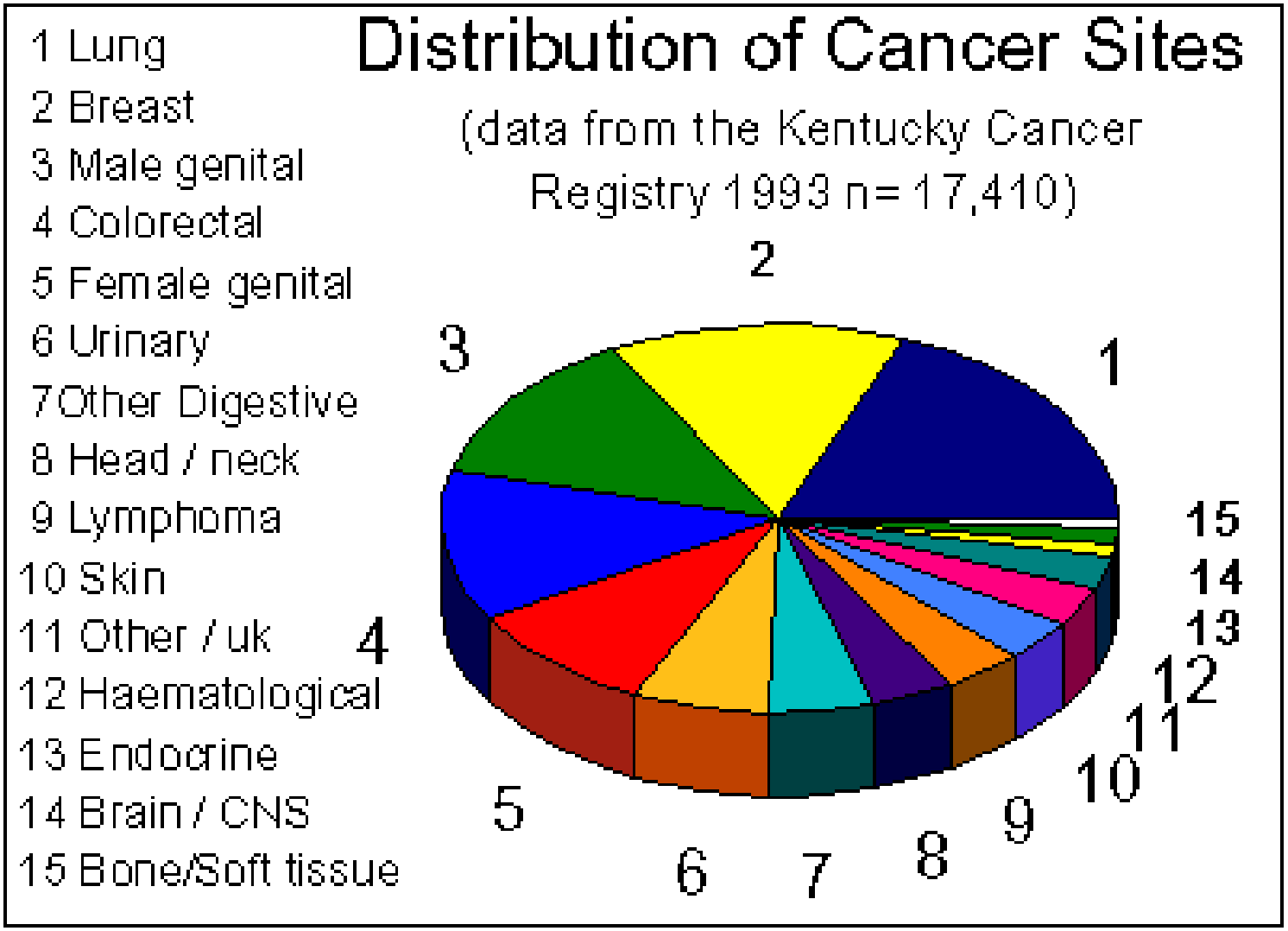
Objectives

1. How is cancer related to the cell cycle?
2. What are some ways that cancer can be treated?

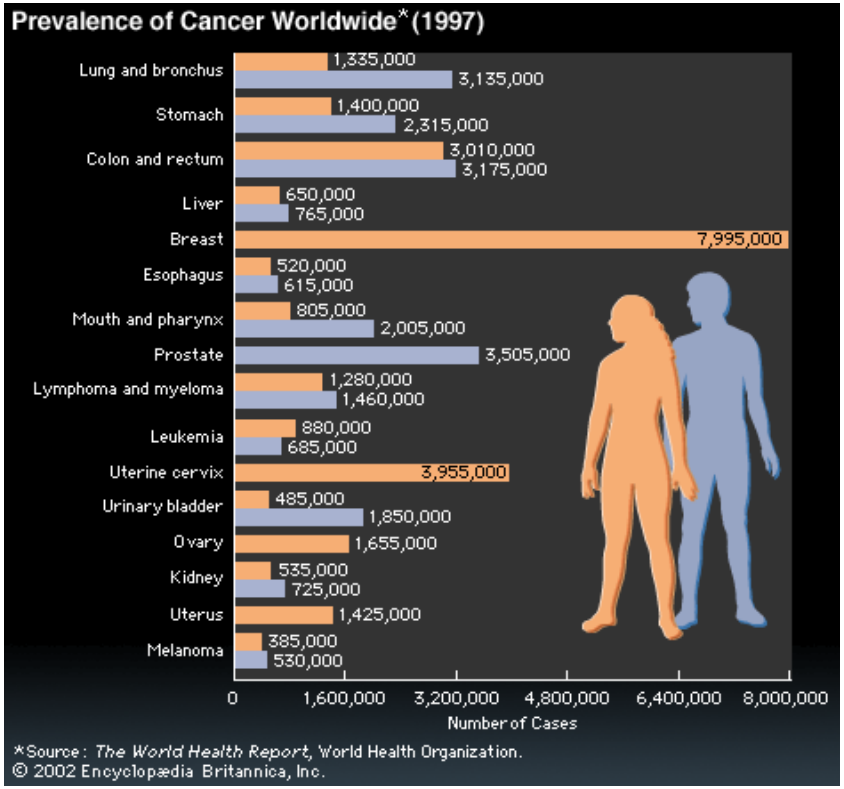
- Cancer is a disease in which cells grow and divide uncontrollably, damaging the parts of the body around them.

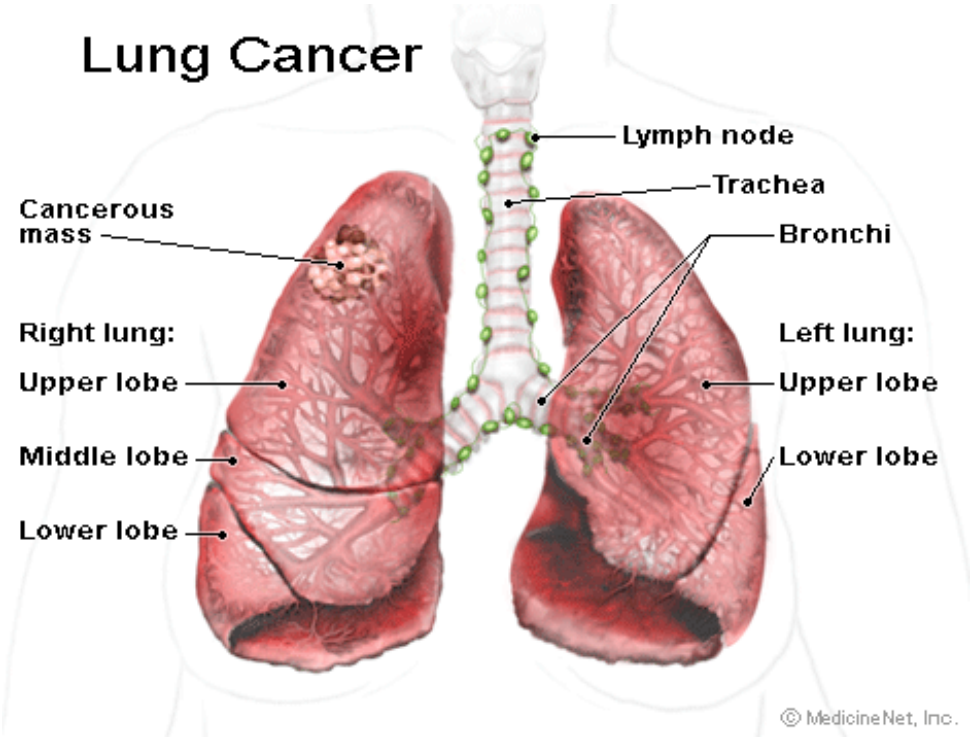


- There are more than 100 types of cancer.



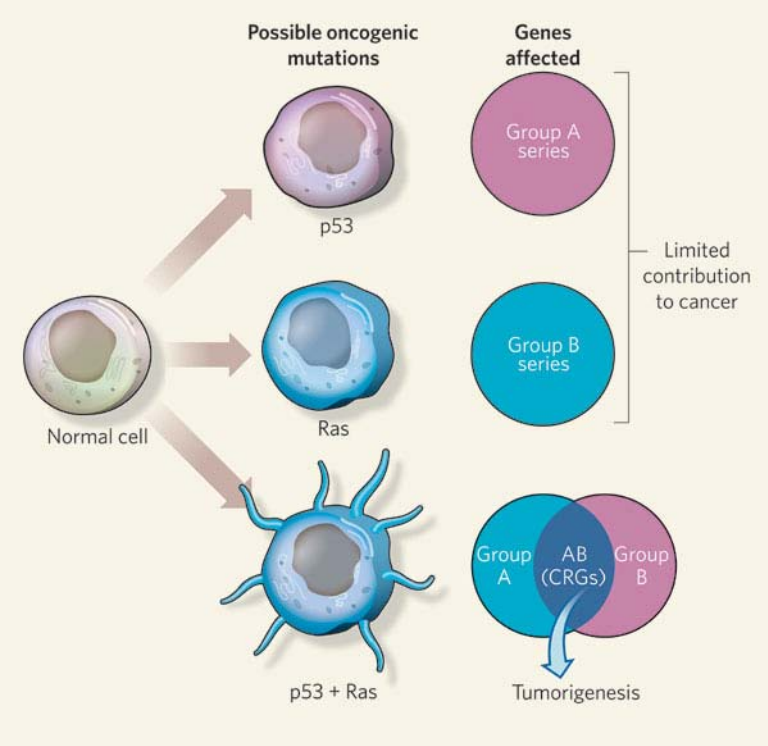
- Cancer can occur in almost any part of the body.
- Cancers are often named by the place in the body where they begin.





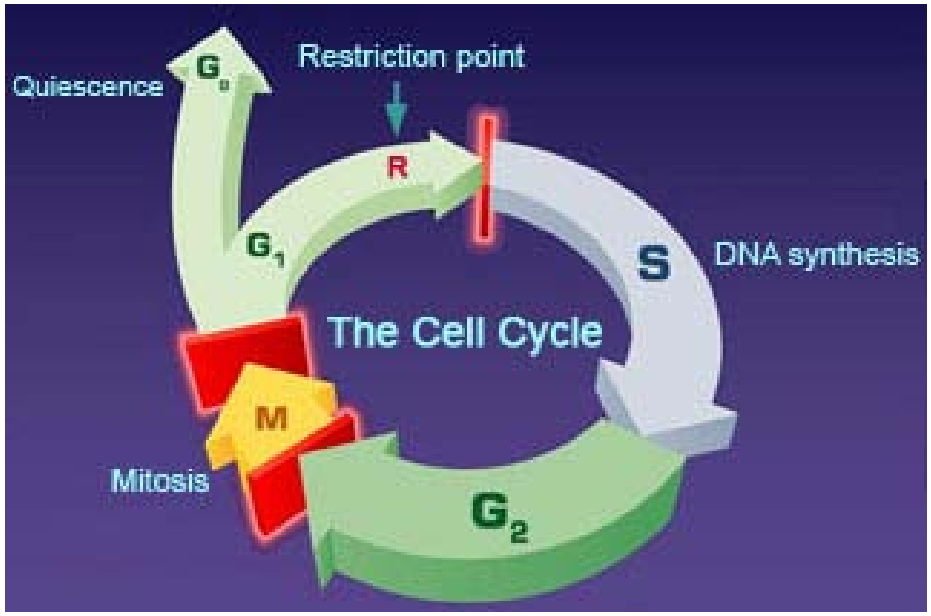
- In the United States today, lung cancer is the leading cause of cancer deaths among both men and women.

- Scientists think that cancer begins when something damages a portion of the DNA in a chromosome.

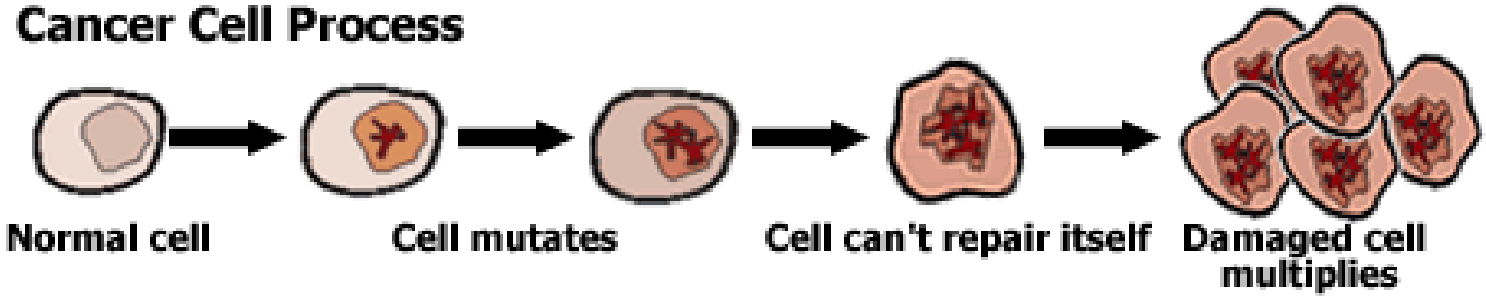


- The damage causes a change in the DNA called a **mutation**. Cancer begins when mutations disrupt the normal cell cycle, causing cells to divide in an uncontrolled way.

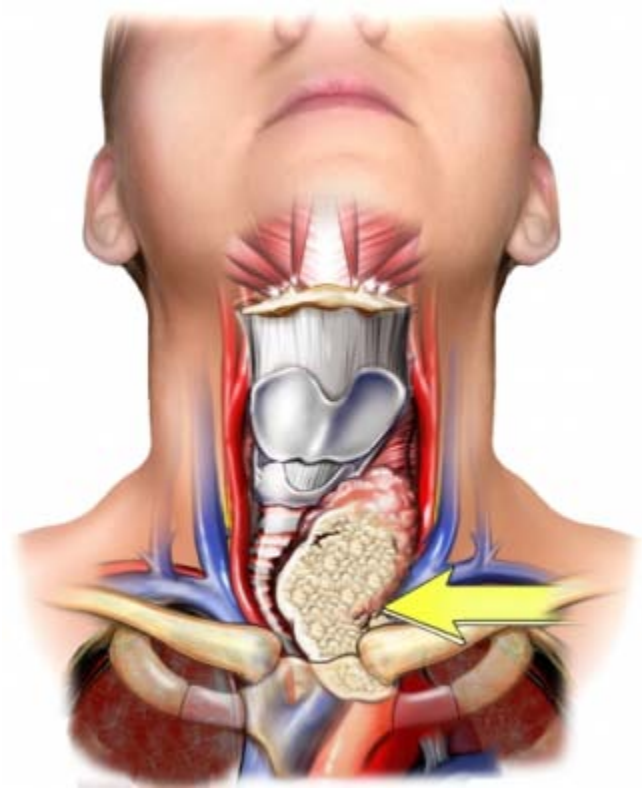
- Without the normal controls on the cell cycle, the cells grow too large and divide too often.

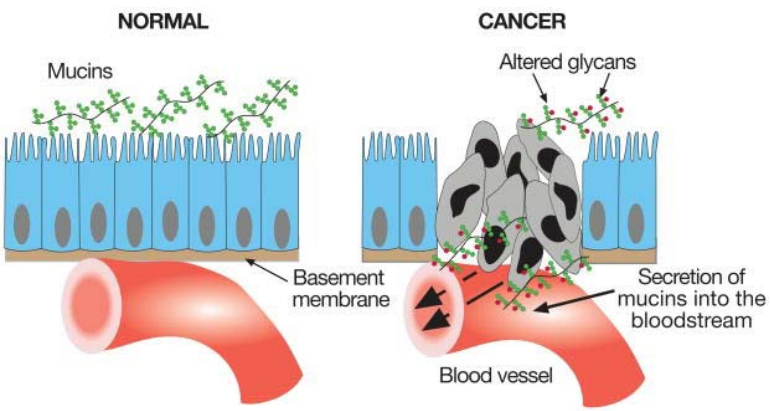


- As the cell divides, more and more abnormal cells like it grow near it.



- In time, these cells form a tumor.
- A **tumor** is a mass of abnormal cells that develops when cancerous cells divide and grow uncontrollably.

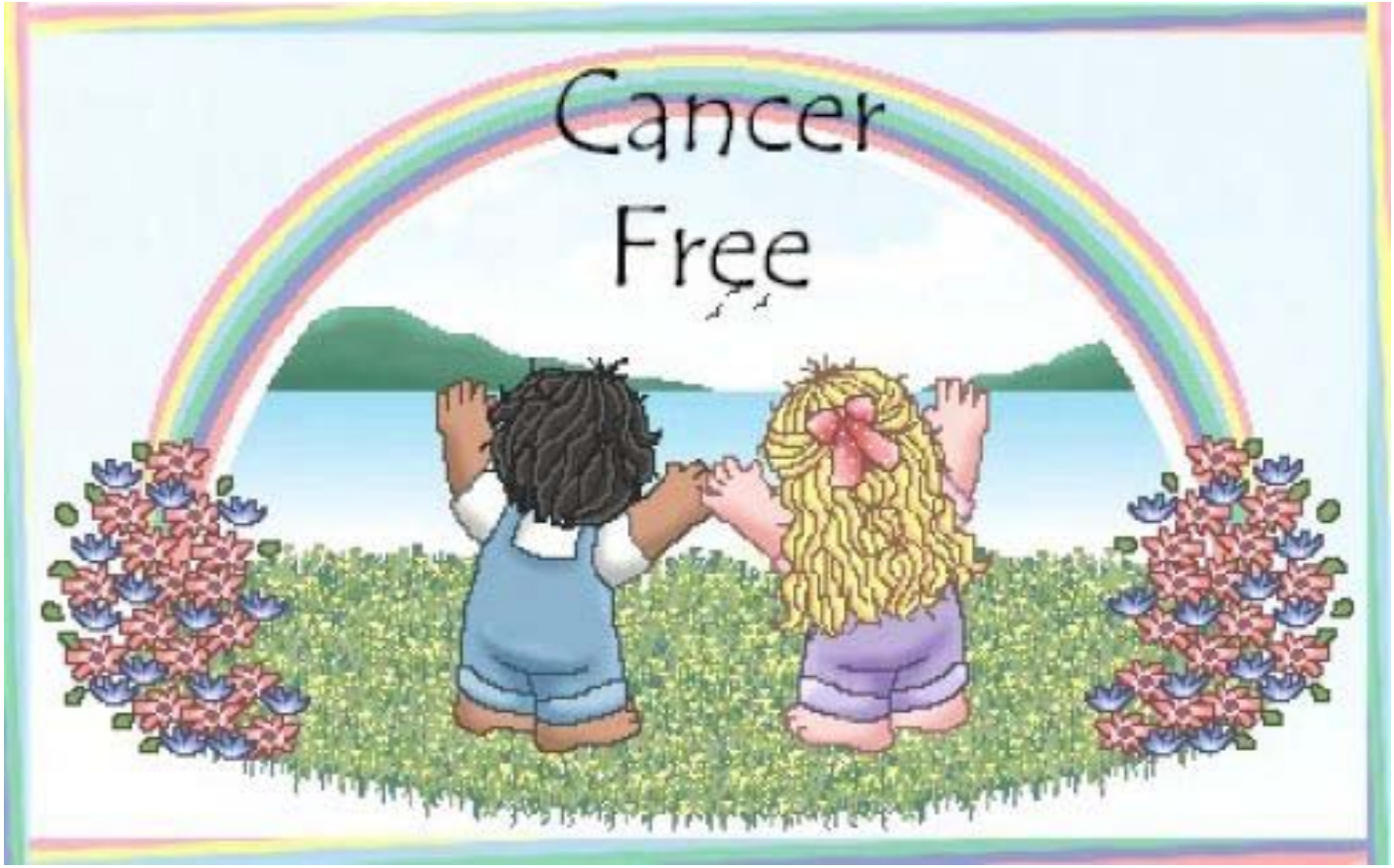




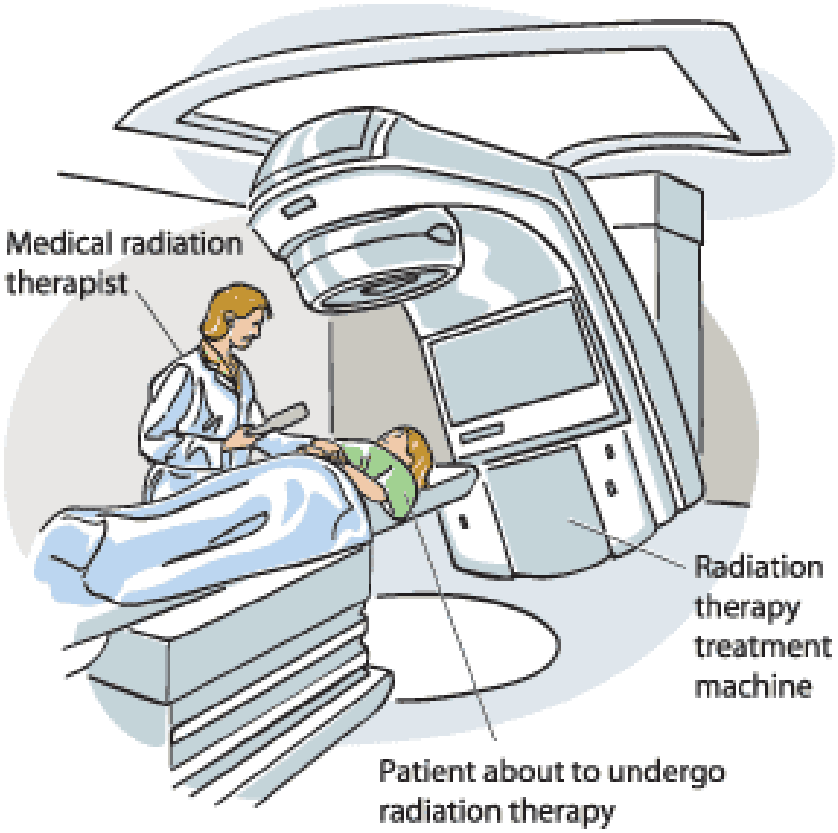
- Some of the cancerous cells may break off the tumor and enter the bloodstream.
- In this way, the cancer can spread to other areas of the body.

- Doctors usually treat cancer in one or more of three ways: surgery, radiation, or drugs that destroy the cancer cells.

- When a cancer is detected before it has spread to other parts of the body, surgery is usually the best treatment.

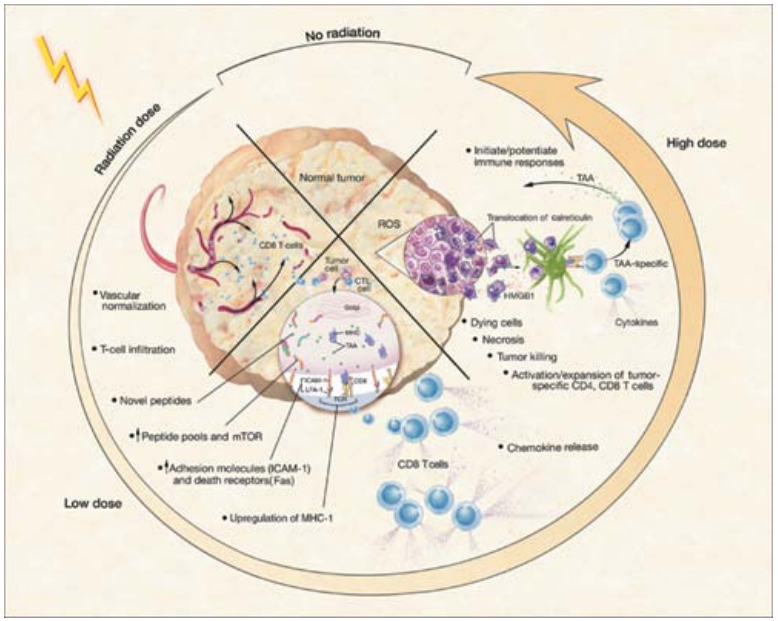


- If doctors can completely remove the cancerous tumor, a person may be cured of the disease.



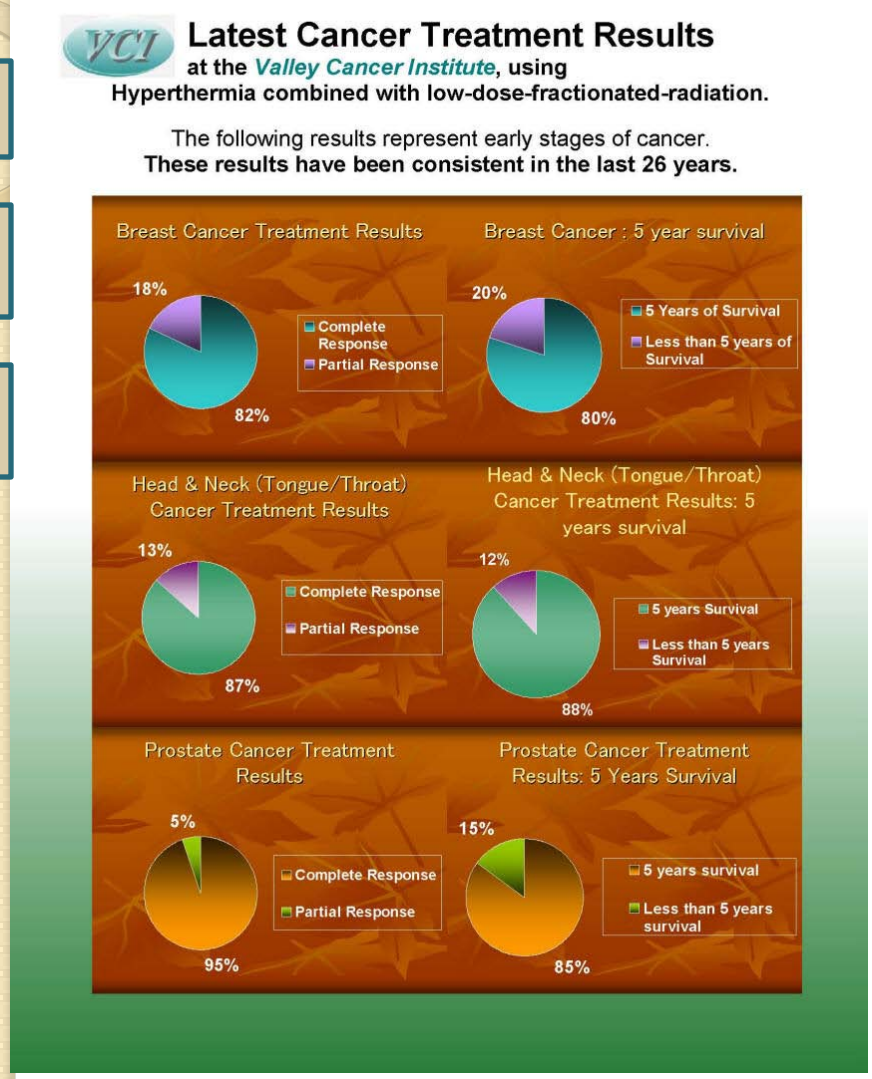
- If, however, the cancer has spread or the tumor cannot be removed, doctors may use radiation.

- Fast growing cancer cells are more likely than normal cells to be destroyed by radiation.



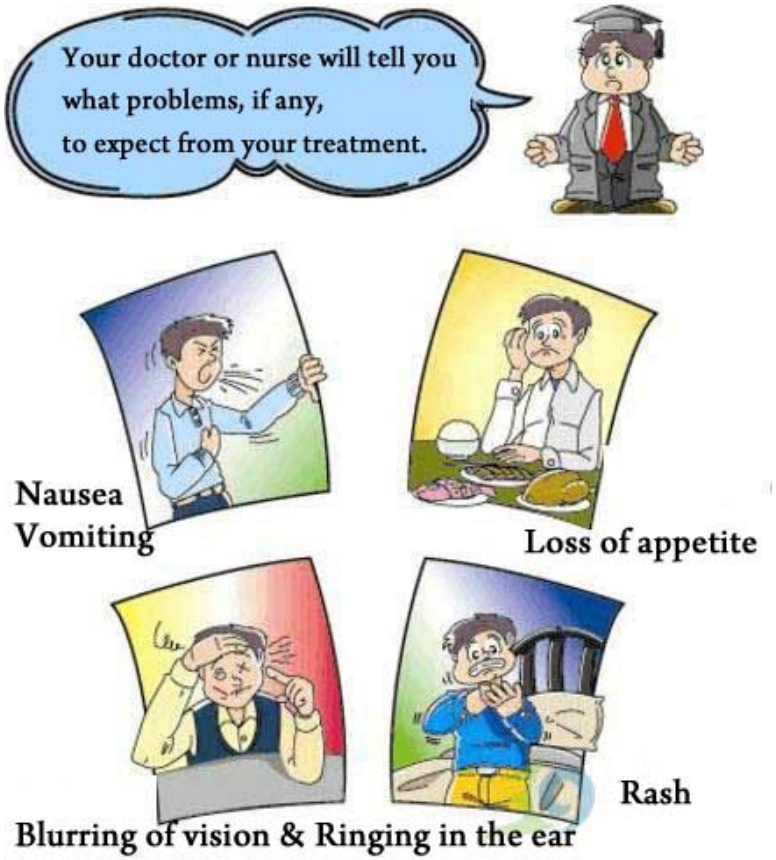
- **Chemotherapy** is the use of drugs to kill cancer cells.

- It is effective because the drugs spread throughout the body, killing cancer cells or slowing their growth.



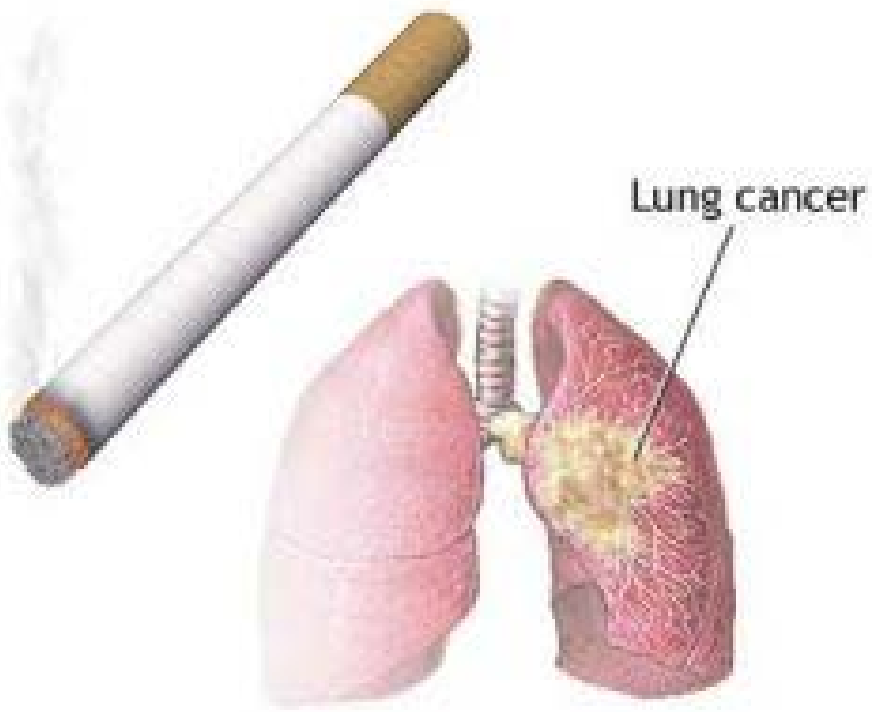
- Unfortunately, none of these cancer treatments is perfect.

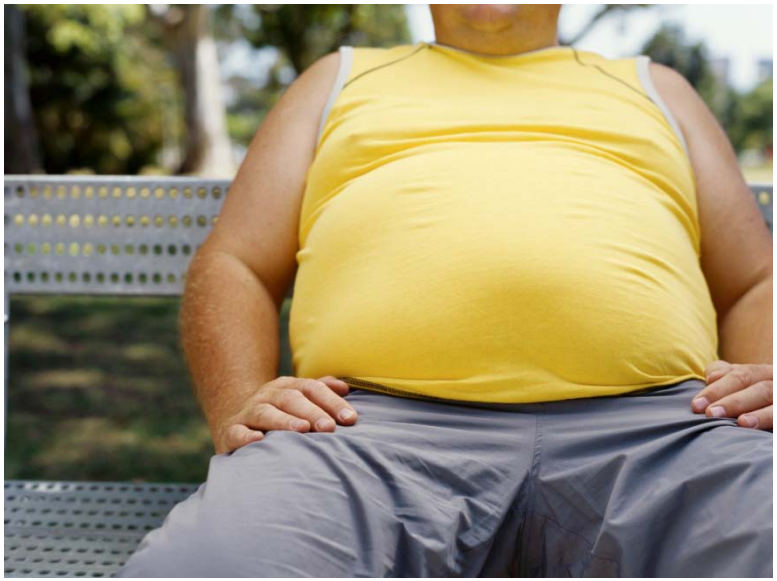
- Most have unpleasant, or even dangerous, side effects.
- Scientists continue to look for new ways to treat cancer.



- Scientists estimate that almost two thirds of all cancer deaths are caused either by tobacco use or unhealthful diets.

- Smoking is the main cause of lung cancer.





- Unhealthful diets may lead to almost as many cancer deaths as does tobacco.

- A diet that is low in fat and includes a lot of fruits, vegetables, and grain products can help lower a person’s risk of some types of cancer.

END 2.4