**Study Guide For EOC Part 2!!**

**Biochemistry**

* A **Macromolecule or polymer** is a large molecule. A molecule made from carbon and hydrogen is **Organic**.
* There are four main macromolecules that are important to biology:

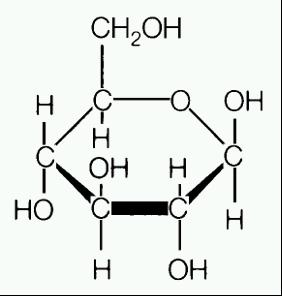
**carbohydrates, lipids, proteins, and nucleic acids**

**Carbohydrates**- these are **sugars** used for **quick energy**. Remember many sugars **end in –ose.**

Their building blocks or monomers are **monosaccharides**.

Types:

**Monosaccharides**---- one sugar----examples **Glucose** which is made in photosynthesis



**Fructose** which is in honey and fruit

Glucose

**Disaccharides**--2 sugars or 2 monosaccharides connected

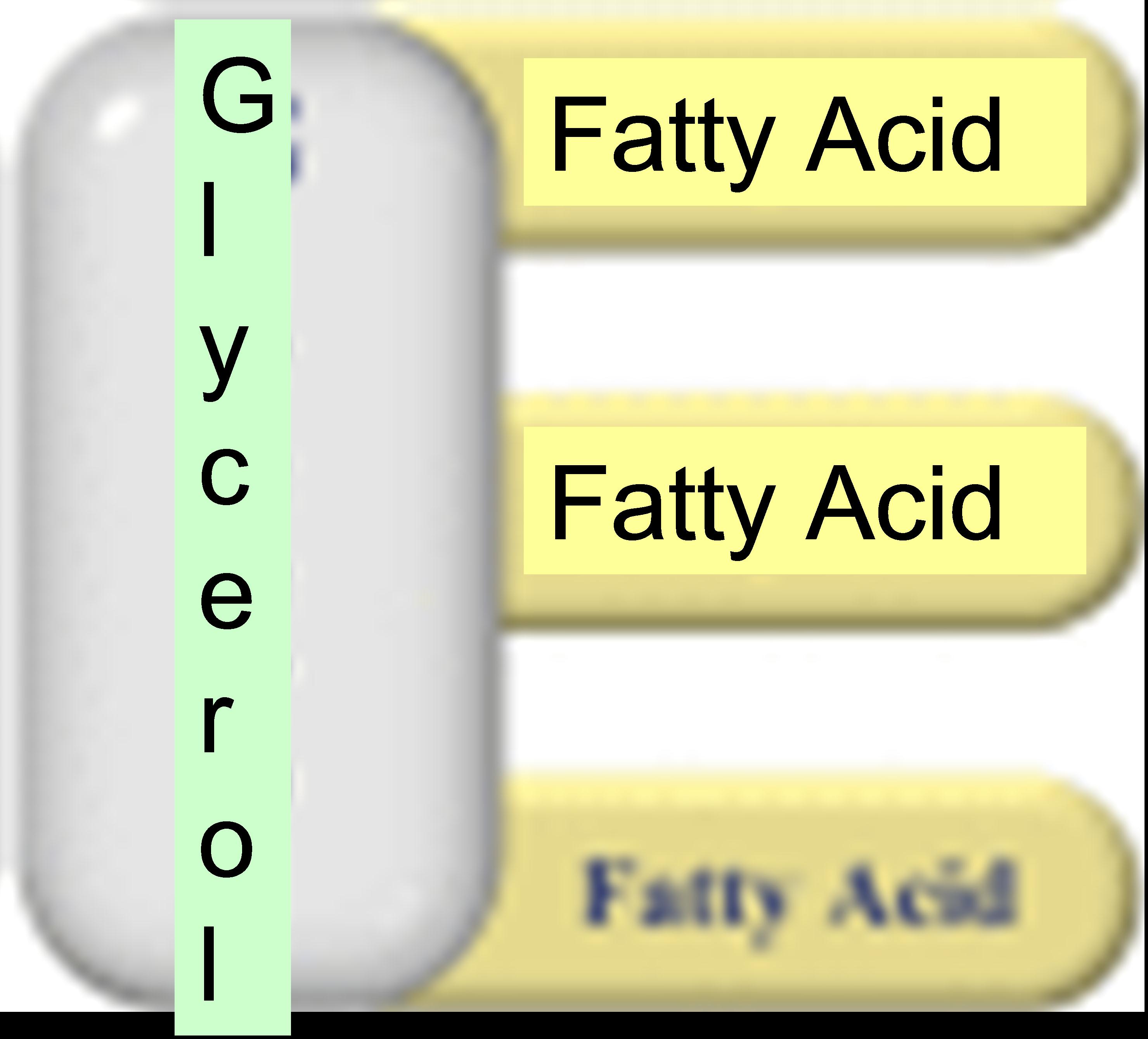
**Polysaccharides**---many sugars- examples **Cellulose** which is in cell walls

**Starch** which is used for plant energy storage

**Glycogen** which is used for animal energy storage in the liver

**Lipids**- these are fats, waxes and oils. They are used for **long term energy storage** and for **the cell membrane**. Also used for **insulation** to protect animals from the cold.

**Subunits**- a fat is made of a **glycerol** backbone and three **fatty acid chains**.



**Phospholipids**: fats that make up the cell membrane

**Steroids**: fats which are in rings instead of chains like cholesterol used to make hormones like testosterone.

Examples of lipids:

**Proteins**- Made from (subunits) **amino acids** which are held together by **peptide bonds**. There are 20 amino acids. They are made in the **ribosome**. Proteins fold in a 3D shape and this shape determines their function**.**

Important Proteins:

**Enzymes** (see enzymes in this packet)

**Hemoglobin**- a protein in a blood cell that helps carry oxygen in the blood.

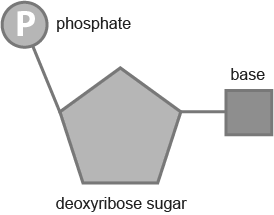
**Insulin-** a protein in the body which helps maintain proper blood sugar levels. If there are problems making insulin than a person could have diabetes.

**Nucleic Acids**:

These molecules are our **inherited genetic information** and **instructions for proteins**.

The two main examples are **RNA and DNA**

They are made of **Nucleotides**. Nucleotides are made of a **phosphate, sugar, and base**.

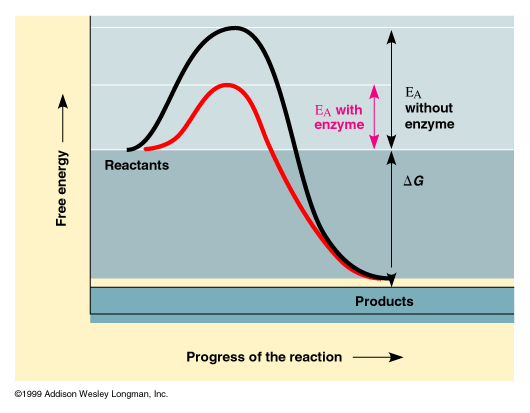


## Enzymes

* **Enzymes** can also be called **Catalysts**. Several enzymes end with –**ase**.

Ex. Lactase, Maltase. They can be used over and over again.

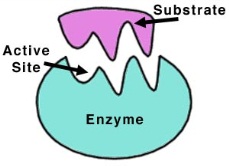
* These are proteins that **help speed up reactions**. Without them most of the reactions that happen in our body would happen so slowly that we would die. They are **reusable**.
* People who lack the **enzyme Lactase are Lactose intolerant**. Meaning they cannot break down the sugar, lactose, in dairy products. So if they were to drink milk they would have an upset stomach.
* Every reaction needs a certain amount of energy to start (**activation energy**). **Enzymes lower the amount of reaction energy needed**. So since the reaction doesn’t need as much energy it can go faster.



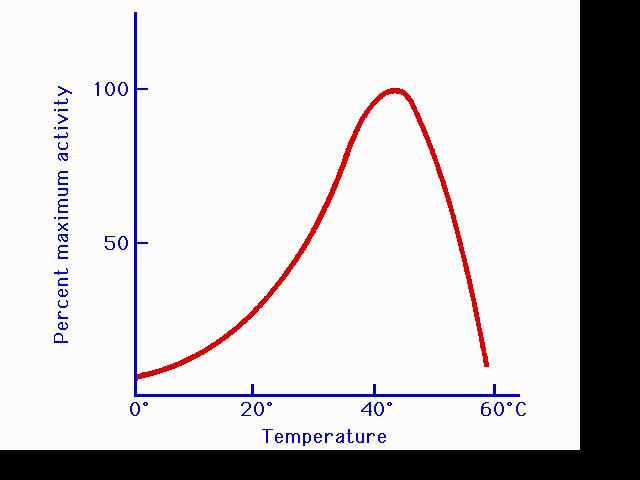
The taller slope is without an enzyme because it required more energy.

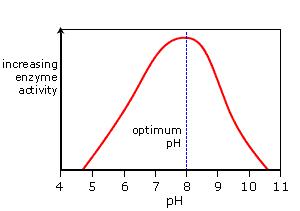
The lower slope is with and enzyme because it required less energy.

* Enzymes fit together with **substrates**. Substrates are whatever chemical the enzyme is working on. They fit like **a lock and key**. Enzymes only fit their specific substrate.
* The place where the substrate fits into the enzyme is called the **active site**.



* If you change the shape of the enzyme it won’t work anymore. You can do this by changes in temperature or pH level. Its called **denaturation**.





\*Remember the words **optimum and optimal** mean best or highest!

basic

acidic

Remember that **Acids are 1-6**, **Neutral is 7** and **Bases are 8-14**. The lower the number the stronger the acid. The higher the number the stronger the base.

# 

**Cells**

* Cells are the smallest living things. Cells make tissues, tissues make organs, and organs make an organism (living thing).

Cells Tissue Organ Organism

Muscle Cell Muscle Tissue Heart Human

* To see a cell you must use a microscope. To determine the magnification: **Lens x Eyepiece= magnification**. Example. **Lens= 10x and Eyepiece = 40x so 10 X 40= 400x magnification**.

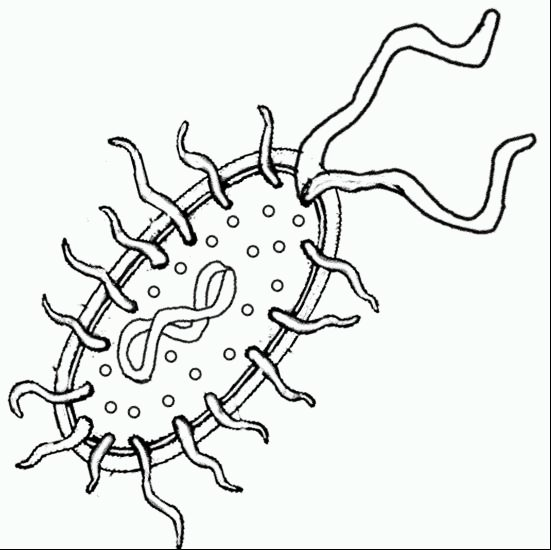
There are two main types of cells: Prokaryotes and Eukaryotes

* **Prokaryotes** do **NOT have a nucleus or any other organelles**.

They **do have ribosomes, cytoplasm and DNA**. Their DNA can be a **plasmid (circular DNA)**.

They are small, microscopic and unicellular.

Take the “p” and turn it upside down for a “b”= **Bacteria!**



Ribosomes (the dots)

Flagella

DNA or **Plasmid**

**A plasmid is circular DNA**.

Cell Membrane

Cilia

Cell wall

* **Eukaryotes** **DO have a nucleus and all organelles**.

Animals, plants, protists and fungi are all eukaryotes.

Can be multi or unicellular and are larger.

P=Plant, A=Animal, B=Bacteria/Prok

**Important Organelles**:

P and A

**A. Nucleus**- “the brain of the cell” Controls all cell functions. DNA is inside.

P, A and B

**B. Cell/plasma membrane**- controls what enters and leaves the cell. Homeostasis

P, A and B

**C. Ribosomes**- these make the proteins in the cell

P and A

**D. Mitochondria**- “powerhouse” of the cell. Provides energy by Cellular respiration.

P and B

**E. Cell wall**- this is not in animals. Provides protection and support for the cell

P

**F. Chloroplast**- this is only in plants and protists. This is where photosynthesis happens. It contains a pigment called **chlorophyll** which keeps the plant green and captures light energy.

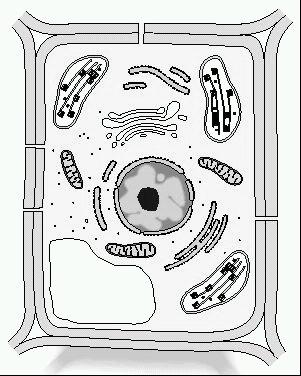
P, A

**G. Vacuole**- Large vacuole in plants and small ones in animal. It stores food, water, enzyme, and waste.

C. Ribosomes are dots

**Animal Cell**

**Plant Cell**



B



B

E

C. Ribosomes are dots

AA

AA

D

F

G

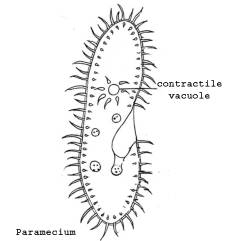
D



Linear DNA

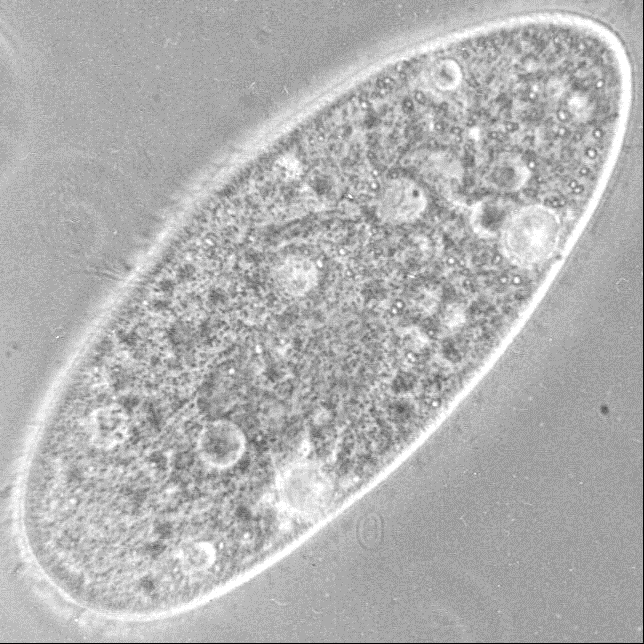
**Protists:** They **are Eukaryotes** because they have a nucleus and organelles

Most protists live in water. Many of them have **contractile vacuoles.** An organelle that helps cells **maintain water balance (homeostasis**). Excess water is temporarily stored in the vacuole. Then the vacuole contracts to pump the excess water out of the cell.

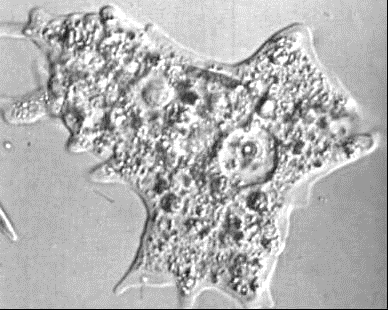


(Looks like a star)

The Animal like protists-



**Paramecium**

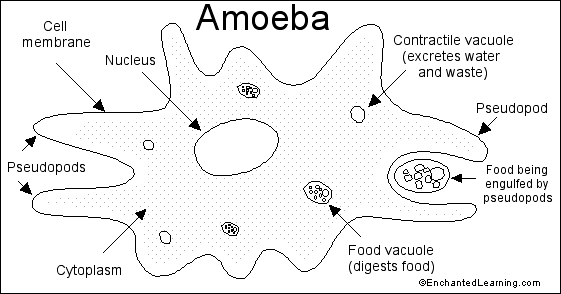


**Amoeba**

Heterotrophs (eat) - absorb their food through membrane

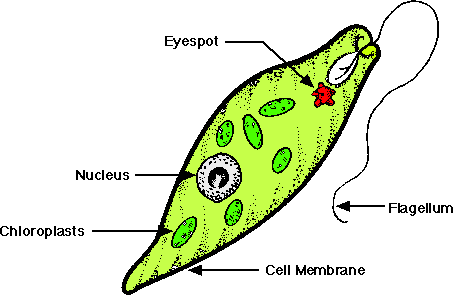
-**Pseudopods-** “false feet” Parts of the cell membrane used to engulf food.





Autotrophs (plant like protists) – do photosynthesis using chloroplast, but can also catch prey

**Euglena**

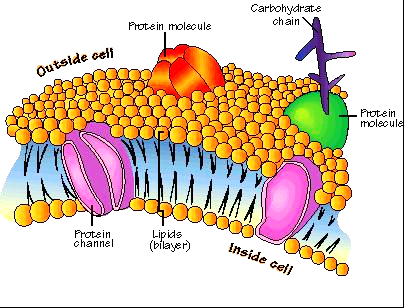


Euglena have **eyespots** which are organelles sensitive to light. The eyespot lets Euglena know where to move so they will have light for photosynthesis.

**Transport in the Cell**

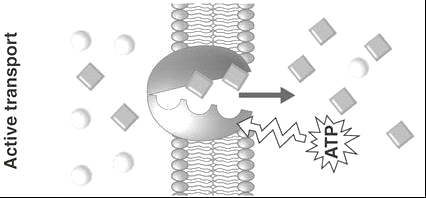
* The **plasma membrane** controls what enters and leaves the cell. It maintains a balance on the outside of the cell and on the inside = **homeostasis or equilibrium**. It is important for your body to maintain homeostasis or balance to stay alive.
* Another name for the plasma membrane is the **Phospholipid bilayer**= 2 layers of fat.

Protein



Phospholipids

* Plasma membrane is **semi or selectively permeable**. Means it only lets some things through.
* **Solutes**- anything dissolved in water like salt or sugar. It cannot move through the membrane without energy.
* There are two types of transport= **Passive** and **Active**
* **Active transport** **requires energy (ATP).** It moves materials from **low to high concentration** and requires the help of **carrier proteins**. It goes **against** the concentration gradient. It usually moves **big molecules** like carbohydrates.



High

**Low**

* **Passive transport** **does not require any energy**. Moves **small molecules**.

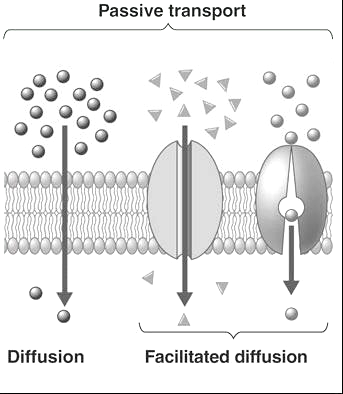
It moves **with** the concentration gradient.

Types of passive transport:

**Diffusion** is a type of passive transport and move materials from a high to low concentration. Can move oxygen, water, carbon dioxide.

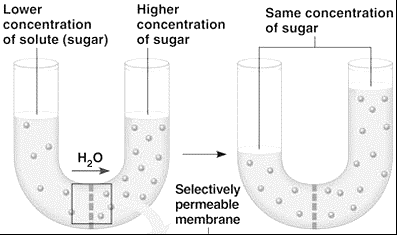
**Osmosis**- the movement of **water** from an area of high to low concentration **across a membrane**. Osmosis is a type of diffusion.

Passive Transport

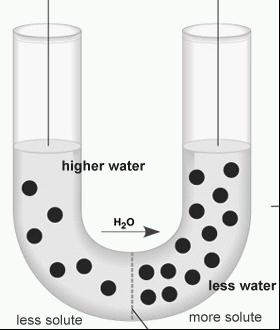


Osmosis

High



Low



45% water

60% solutes

70%

water

10% solutes

Water would move from high to low and leave the cell

This means there is 40% inside and 90% water outside. So water will move in.

There is high water on left and low on right. So water will move towards the right. Making the right side higher.

**Homeostasis** is maintained in other ways in the body.

* **Temperature:** when you are too hot you sweat to reduce your body temperature and when you are too cold you shiver to raise your body temperature.
* Your cells need to maintain a neutral pH (7) so there are **buffers** in the blood that helps to keep your blood from getting to acidic or too basic.
* Your body works to keep your **blood glucose** (sugar) levels balanced. **Insulin** helps keep this balance and an imbalance can cause **Diabetes.**
* Homeostasis will be any situation where your body adjusts to keep things balanced or in a normal range.

**Animal Behavior**

* There are two types of behaviors:

a. **learned**- behaviors we will not know until we learn them

b. **innate or instinct**- behaviors that we are born with and no one has to teach us

* There are several innate behaviors:

**Suckling instinct**- this is when a baby automatically knows how to suckle or drink milk from the mother’s breast

**Courtship** – this is mating behavior

**Territorial defense**- protection of an animal’s area, food, or mate

**Estivation**- this is like hibernation in the summer time. Frogs do this in the desert to protect themselves from the summer heat of the desert

**Hibernation**- deep sleep in the winter time

**Migration**- when birds or other animals leave the north and move to the south for the winter and then come back in the summer

**Taxes (taxis)-** this movement. Positive taxes is moving towards and negative taxes is moving away. Ex. Euglena have a positive phototaxis…meaning they move towards the light.

All of these innate behaviors help an organism survive and reproduce…..Natural Selection.

* Ways we learn behavior:

**Imprinting**- this happens in birds. The first animal or object that the new born bird sees, the bird forever sees as its mother.

**Habituation**- becoming so used to something that you cease to be bothered by it or notice it.

Ex. not noticing your ceiling fan anymore or a train that passes by your house

**Classical conditioning**- learning to relate, connect, or associate unrelated things. Pavlov rang a bell every time he fed his dogs. So then the dogs learned to associate bell ringing with food even if no food as around. Ex. can opener with your cat or dog

**Trial and error**- trying something over and over again and learning from your mistakes.

**Energy**

**Photosynthesis**= putting together with light

* This is the process where **producers/autotrophs** make their own food (glucose). The energy for this reaction is from the sun. Sun energy is called **radiant energy**.
* Plants turn **radiant energy** (sun) into **chemical energy** (glucose).
* **Reactants** (ingredients) = water, carbon dioxide, and light

(remember plants are opposite of us...we breathe in oxygen they breath in CO2)

**Products** (what you get) = glucose and oxygen

* You must know the formula:

Light



* Photosynthesis happens in the **chloroplast** of the cell. Since animals do not have chloroplasts they cannot perform photosynthesis. The **chlorophyll** is pigment in the chloroplast that absorbs the sunlight and makes the plant green.
* The Carbon dioxide enters the leaf and the oxygen leaves the leaf through an opening called the stomata or stoma. The **stomata** are surrounded by guard cells.

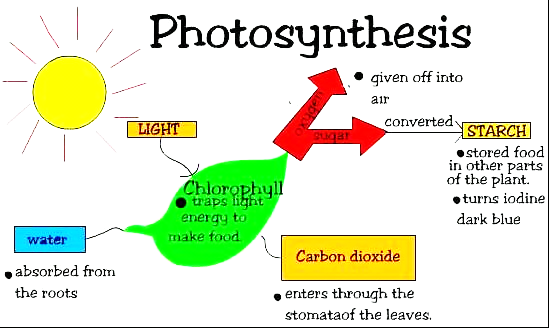


The stoma or stomata

Oxygen out

Carbon Dioxide in

Guard cells



Gives off oxygen

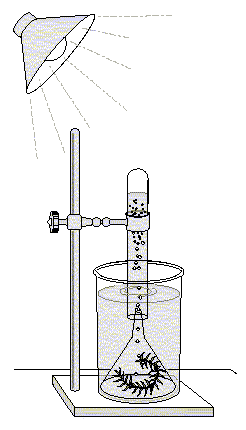
Glucose= a Carbohydrate or sugar

**Chloroplast**

This is an **elodea plant** which is a water plant. When **exposed to light** **little bubbles** appear in the water. What are the bubbles? **Oxygen**...the plant makes it when it is doing photosynthesis from the light.

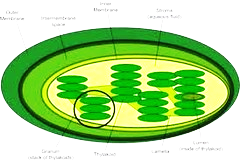
The more light the more bubbles. The more CO2...the more bubbles.

Because more ingredients more oxygen (product)



* Plants have **vascular tissue**: the veins in the leaf. There are two kinds: **Xylem** carries water up from the roots to the leaves and **Phloem** carries sugar down from the leaves to the roots.

The **chloroplast**. Remember it has stacks on the inside that look like pancakes = sugar!



**Cellular Respiration** – this is how **cells break down the glucose** made in photosynthesis to **release energy.** All living things do respiration all of the time.

* Respiration happens in the **mitochondria** of the cell. This is why we call the mitochondria the power house of the cell because it is releasing energy.

The **mitochondria**. Remember it looks like a bean with a river in it.



* Respiration is the **opposite** of photosynthesis.
* **Reactants** (ingredients) = glucose and oxygen

**Products** (what you get) =water, carbon dioxide and energy (ATP)

(ATP)



* There are two types of respiration-

**Aerobic**- respiration that **uses oxygen**. Makes more energy or **36 ATP**.

**Anaerobic**- **does not use oxygen** (“An” means not). Makes less energy only **2 ATP**.

* Another name for Anaerobic respiration is **Fermentation**.

There are two types of anaerobic respiration or Fermentation:

**Lactic Acid Fermentation**- this **makes lactic acid**. This is the type of respiration our **muscles** do when they run out of oxygen. It is why our muscles get sore. **Bacteria** also make lactic acid.

**Alcohol Fermentation**- fermentation done by **yeast.** It **makes alcohol** and can make it from apple juice.



If we put apple juice or glucose and yeast into a test tube, the yeast will make alcohol. But it will also make some bubbles. What are the **bubbles**? **Carbon Dioxide** which is made as the yeast does alcohol fermentation or anaerobic respiration.

|  |  |
| --- | --- |
| **Photosynthesis** | **Respiration** |
| Uses water, light and CO2 | Uses Oxygen and Glucose |
| Makes Oxygen and glucose | Makes water, CO2 and energy (ATP) |
| Happens in chloroplast | Happens in mitochondria |
| Happens in producers | Happens in all living things all the time |
|  | Has two types: aerobic and anaerobic |

**ATP**- is the **energy** molecule that is made in respiration. It is how our bodies temporarily store the energy made in respiration. The energy is in the bonds of the molecule. **ATP is energy made during respiration used for active transport and other life functions.**

**Ecology**

* **Food chains**: show the **flow of energy** in the ecosystem. Every food chain **MUST start with a producer** because they store energy from the sun (radiant energy) as chemical energy to pass to other organisms.

**Producer or Autotroph**- an organism that makes its own food like a plant

**Consumer or Heterotroph**- an organism that has to eat

* Types of Consumers:

**Herbivore**- eats only plants ex. rabbit

**Carnivore**- eats only meat ex. lion

**Omnivore**- eats both plants and meat ex. human

**Decomposer**- breaks down dead material. Ex. bacteria, fungi, worms

**Scavenger**-eats already dead organisms Ex. road kill

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Worm%252012

Heterotroph

Decomposer

Tertiary Consumer

Heterotroph

Carnivore

Secondary Consumer

Heterotroph

Omnivore

Primary Consumer

Heterotroph

Herbivore

Producer

Autotroph

\*The **arrows show the direction of the energy flow** so they go the opposite way you would think.

They go towards the organisms eating because they are getting the energy

\***only 10% of the energy passes from one organism to another**. Energy is lost as **heat**.

5.4 Least Energy

**Energy Pyramid**

54

Carnivore/tiger

Tertiary Consumer

Decomposer/ worm

Secondary Consumer

540

Omnivore/human

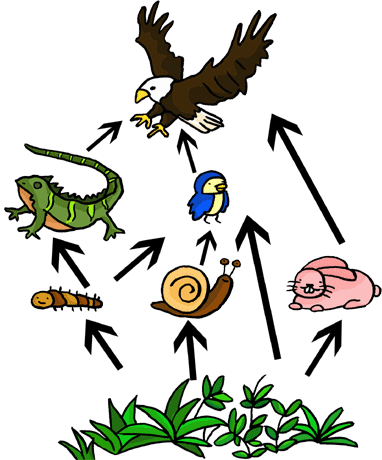
Primary Consumer

Most energy ex. 54000

5400

Autotroph/Producer/tree

Herbivore/rabbit



\*The bird is a primary AND secondary consumer because he eats the plant and the snail.

\*The Eagle is a secondary and tertiary consumer because he eats the rabbit and the lizard.

\*The eagle gets the least energy and the producer has the most.

\*If you were to remove the bird. The eagle population would decrease. The snail and caterpillar populations would increase so then the plant population would decrease.

**Relationships**

* All living things are in a relationship and when it is a close relationship it is called

a **Symbiosis.**

* There are three main Symbiotic relationships:

**Mutualism**- ☺ ☺ Both organisms benefit

Example: the sea anemone provides a home for the clown fish and the

clown fish protects the sea anemone from predators

**Commensalism**- ☺ one organism benefits and the other doesn’t care (not

hurt or helped)

Example: a cow walking in a field stirs up insects for the cow bird to eat

**Parasitism**- ☺ ☹ One organism benefits while the other one is harmed

Example- a tic on a dog

* Two other non-symbiotic relationships:

**Predator/Prey and Competition**

\***Competition** is when organisms want the same limited resources and competition limits the growth of a population

\*The difference between **predator/prey and parasitism**: Predator/prey is an organism HUNTING for food. Parasitism live off of each other in a negative way which could but not always result in death.

**Population growth**

Populations will grow unchecked until they are limited by limiting factors. **Limiting factors** are resources like water, space, food, etc that a population can run out of.

**Carrying Capacity**- the number of organisms an ecosystem can support

**J-curve**. This population grows extremely fast (**exponential growth**). **At first there are unlimited resources. However, the population uses up all the resources and will crash and all die out.** **The highest point is its Carrying Capacity**.

Carrying Capacity



**S-curve**. This population grows until it reaches it carrying capacity. **Then it will stabilize over the carrying capacity.** Carrying Capacity **not** highest point! **There is a limited amount of resources that the population balances with**.

Carrying Capacity



**Predator/Prey curve**

Predator and prey population growth are opposite of each other. When the predator is up the prey is down and vice versa. **They help keep each other’s populations in check and from growing out of control**



**Environmental problems**

Humans are responsible for almost all modern day environmental issues.

* **Habitat Destruction**- destroying the home of an organism.

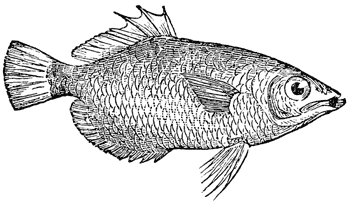
This could happen because of **deforestation** (cutting down trees), or because of invasive species or melting glaciers, etc.

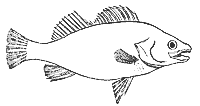
* **Pollution:** We are polluting the habitat of many organisms. The **runoff** from our developed or Urban (City) populations is polluting rivers and lakes. Our **hog lagoons** are flooding and polluting water sources.
* **Bioaccumulation or Biomagnification**- when poisons build up in the food chain. The higher up you go in the food chain the more poison there is.

Ex. The USA used to spray **DDT** which is a pesticide on our crops. It ended up in our rivers and lakes. Small fish would then have this DDT in their system. The big fish would eat the small fish and get even more DDT. Eagles would eat the big fish. Eagles ended up with tons of DDT in their system which caused them to crush their eggs. Rachel Carson discovered the connection between the DDT and the eagles.

Ex 2. There is **mercury in our fish**. The fish higher up the food chain have more mercury and can be dangerous to humans.







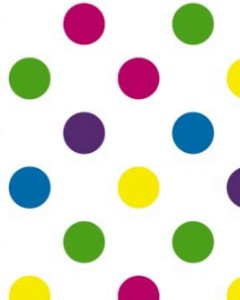
10g of DDT

10,000g of DDT

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1000g of DDT

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* **Nonnative or invasive species**- these are organisms which are from another country. They **do not have any natural predators** so they **take over** their new environment pushing out other native species.

Ex. Boa Constrictor has been put into the everglades. It has no natural predators and

is taking over. This is not good for other animal species in the area.

Ex2. **Kudzu** from Asia is a fast growing vine which takes over an area.

Ozone Depletion: The ozone layer is a layer of gas which surround the earth and protects from radiation. Without the ozone layer we would all die or have skin cancer. Chlorofluorocarbons or CFCs were depleting or destroying the ozone layer. These CFCs were in spray cans and refrigerators.

* **Acid Rain**- this is rain that has a pH of less than 7. It can kill off whole forests and kill fish in lakes and rivers. It is caused by air pollution like **burning fossil fuels**. The pH scale helps determine if something is a Base or an Acid. Cells and organisms like to be at a neutral pH.

**Basic**

**Neutral**

**Acidic**

1 2 3 4 5 6 7 8 9 10 11 12 13 14

* **Ozone Layer**- Ozone is a layer of gases which filters out the harmful **UV radiation** from the sun. Without the ozone humans would be exposed to radiation and have more cases of skin cancer. **Chlorofluorocarbons (CFC’s)** which are made from refrigerators and spray cans destroy the ozone layer.
* **Stewardship, Conservation and Sustainable practices**: when humans work to protect their environment

Ex. recycling, replanting trees, cleaning streams and rivers

**Carbon Cycle**

Carbon is an element that is in all living things on earth. It cycles the earth mainly in the form of Carbon Dioxide and Glucose.

* Five ways Carbon Dioxide gets into the atmosphere:

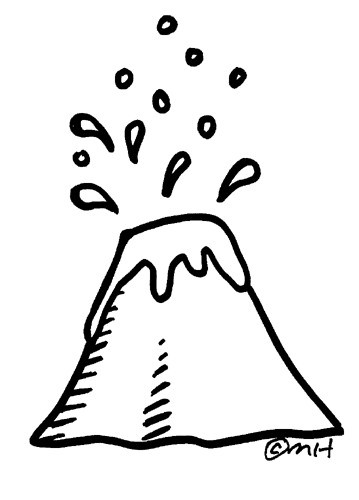
**respiration, burning fossil fuels, open burning, decomposition, and volcanoes**

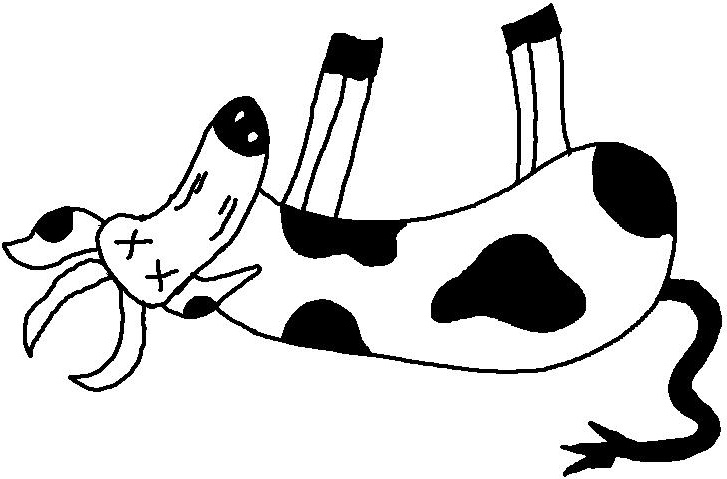
* The main way Carbon is removed from the atmosphere is: **Photosynthesis**



**Volcanoes**

**Decomposition**





* Unfortunately due to the **burning of fossil fuels humans** are releasing way too much carbon dioxide into the atmosphere. **Autotrophs/Plants are trying to remove the carbon dioxide but they can’t keep up.**
* Too much carbon dioxide (a **greenhouse gas**) is causing the **Sun’s radiation to be trapped** on the earth which is causing the earth’s temperature to rise. We call this the **greenhouse effect** which causes **global warming or climate change**. This causes the glaciers to melt and the oceans to

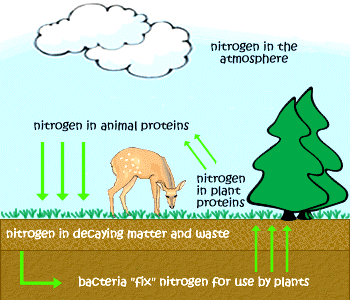
Radiation from sun trapped by CO2 (**greenhouse effect**)

Too much CO2 in Atmosphere

Earth’s temperatures rise = **global warming** or **Climate Change**

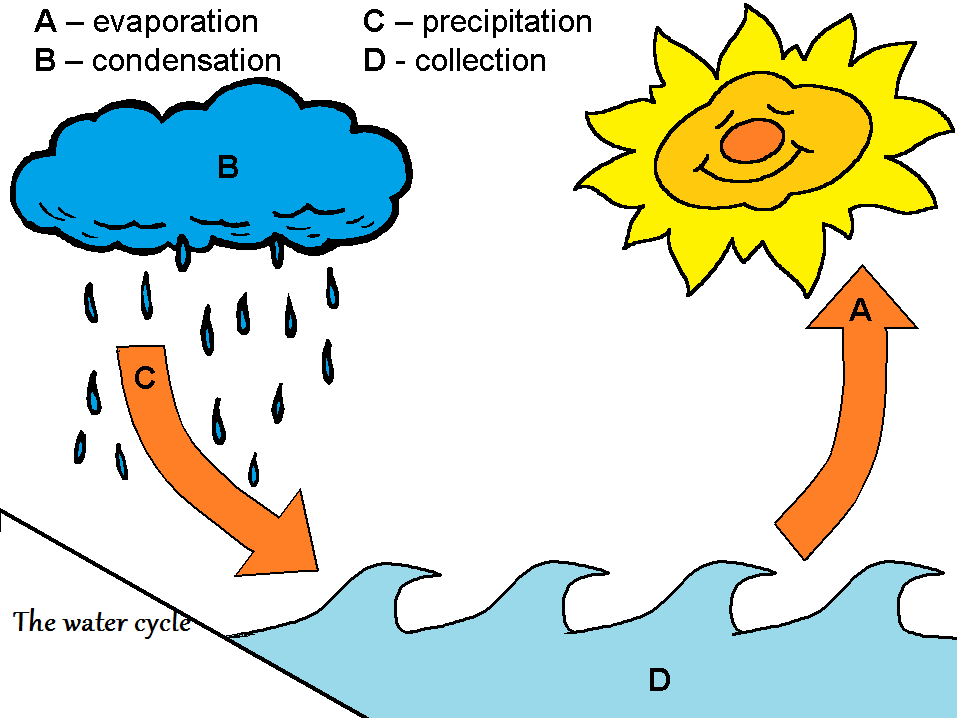
Burning fossil fuels

**Nitrogen Cycle**



* Nitrogen is another important element that cycles in the ecosystem. We **need nitrogen to make DNA, RNA, and Proteins.**
* Animals get nitrogen through the food we eat and we put it back into the environment through our waste and when we die.
* Plants get nitrogen through **Nitrogen Fixation**. Bacteria that live on the roots of some plants fix the nitrogen so plants can use it. In return the bacteria get food from the plant. This is a **mutualistic r**elationship.

**Water Cycle**



Water goes up into the atmosphere through **Evaporation**: Water turning to steam

**Transpiration:** water evaporating from plants (plant sweat)

Water then turns into clouds through **condensation**.

When it comes back to the earth as rain, snow, or sleet it is called **precipitation**

It can then **run off** back into a body of water like a lake or it can soak into the ground and become our **ground water**.

**E.** Transpiration

