

# EOC Biology Study Guide

## Scientific Method

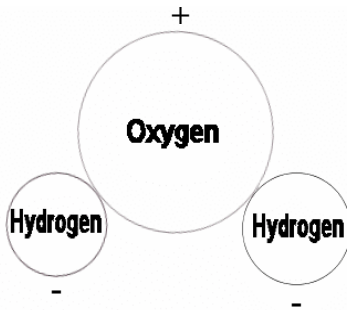
The student will demonstrate the ability to use scientific skills and processes and major biological concepts to explain the uniqueness and interdependence of living organisms, their interactions with the environment, and the continuation of life on earth.

## Goal: 1

The student will be able to explain the correlation between the structure and function of biologically important molecules and their relationship to the cell

## Water

- **Polar** molecule that dissolves many substances
- Made up of 2 hydrogen atoms and one oxygen atom covalently bonded



[www.666man.net/Revelation\\_17\\_The\\_Beast\\_Formul...](http://www.666man.net/Revelation_17_The_Beast_Formul...)

## Organic Compounds

Molecule	Shape	Function
Carbohydrate	Ring	Quick energy, produced during cellular respiration
Monosaccharide	C - C C	
Lipid	Straight Chain	Used as stored energy. Also a major component of the cell membrane
Fatty Acid	H H - C - H H - C - H H - C - H H - C - H H - C - H H - C - H H	
Protein	Branched with functional group	Building blocks of cell components; Produced from DNA material
Amino Acid		
Nucleic Acids	Phosphate, sugar and a nitrogen base	DNA and RNA material
Nucleotide		

## Lipids: One of The Raw Materials for Vitamins

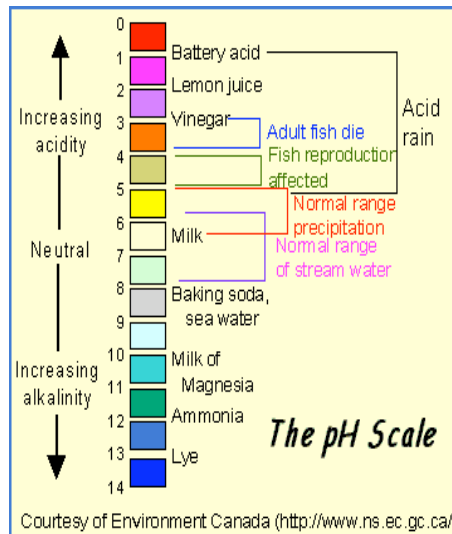
Vitamin	Found in...	Used for...
C	Citrus fruits, berries, tomatoes, broccoli, and spinach	Helps make collagen – a tissue needed for healthy bones, teeth, gums and blood vessels
D	Dairy products and breakfast cereals which are fortified with vitamin D	Critical for bone building
K	Green leafy vegetables	Needed for blood clotting

## Osmosis

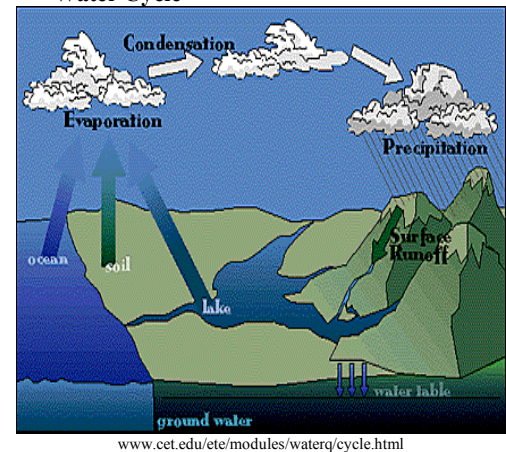
- Form of passive transport
  - Allows water molecules to move from an area of higher concentration to an area of lower concentration to create equilibrium
1. **Hypertonic solution** – molecule concentration of the solution is more than the cell and water moves out of the cell creating plasmolysis (cell shrinking)
  2. **Hypotonic solution** – molecule concentration of the solution is less than the cell and water moves in eventually creating cytolysis (cell bursting)
  3. **Isotonic solution** – molecule concentration in equal inside and outside of the cell, water moves back and forth to continue equilibrium

## pH Scale

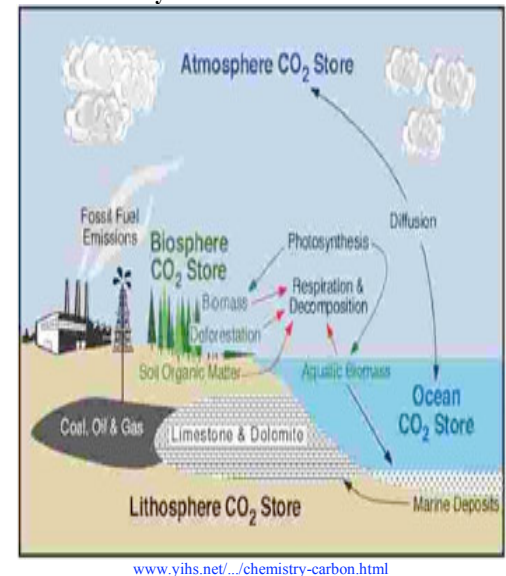
- Used to compare level of acidity or alkalinity in solutions
- Scale is 0-14



## Water Cycle

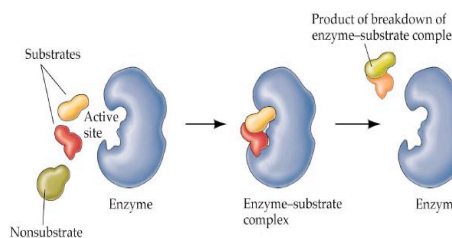


## Carbon Cycle



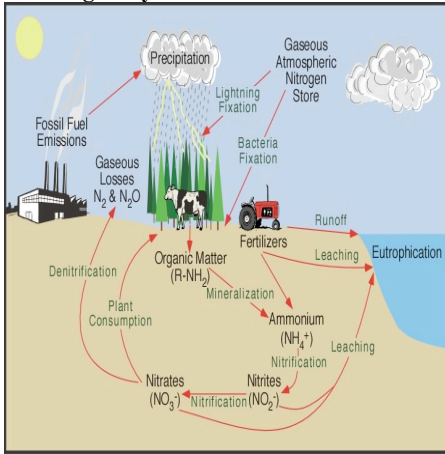
## Enzymes

- Biological molecules made of protein that help catalyze reactions
- Specific to each reaction
- Affected by temperature and pH
- Lock and key model



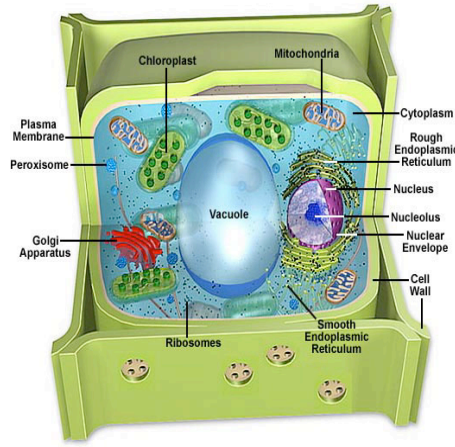
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## Nitrogen Cycle



[www.physicalgeography.net/fundamentals/9s.html](http://www.physicalgeography.net/fundamentals/9s.html)

## Plant Cell



[micro.magnet.fsu.edu/cells/plants/plantmodel.html](http://micro.magnet.fsu.edu/cells/plants/plantmodel.html)

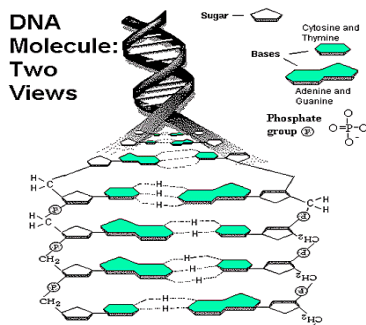
## Major Cell Parts and Functions PLANT AND ANIMAL CELLS

1. Mitochondria – cell energy; respiration center
2. Golgi Apparatus – process, package and release proteins from the cell
3. Nucleus – control center of cell
4. Nucleolus – contains DNA material
5. Centrioles – direct chromosomes during cell division
6. Microtubules – cytoskeleton, structure and support
7. Cytoplasm – jelly-like fluid that protects organelles
8. Ribosomes – protein production
9. Cell membrane - structure and support; selectively permeable
10. Endoplasmic Reticulum (smooth & rough) – intercellular transport
11. Vesicle – used to transport molecules in and out of the cell
12. Lysosome – digestive organelle
13. Cell Wall – support and structure
14. Plastid – photosynthesizing organelle
15. Central Vacuole – storage and digestive organelle

## Goal: 3

The student will analyze how traits are inherited and passed on from one generation to another

## DNA Molecule: Two Views



[www.accessexcellence.org/AB/GG/dna\\_molecule.html](http://www.accessexcellence.org/AB/GG/dna_molecule.html)

Di-nucleotide molecule with 3 distinct parts

- Nitrogenous bases (A-T, C-G)
- Five carbon sugar
- Phosphate group

## RNA Structure

Differences between DNA and RNA

- Sugar in RNA = ribose
- Sugar in DNA = deoxyribose
- In RNA – Uracil replaces Thymine
- DNA is a di-nucleotide molecule while RNA is a mono-nucleotide molecule

## Types of RNA

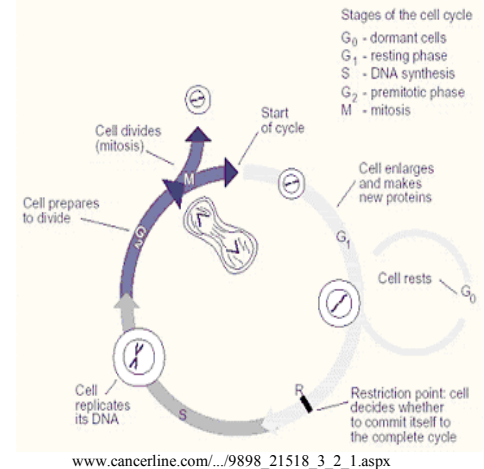
1. mRNA – produced during **Transcription**; eventually will bind to ribosomes and become the driving force of protein synthesis
2. tRNA – has the anti-codons of the mRNA; associated with specific amino acids
3. rRNA – genetic information used the production of ribosomes



[www.immediart.com/catalog/popup\\_image.php?PID...](http://www.immediart.com/catalog/popup_image.php?PID...)

Watson & Crick discovered 3-D model of DNA in 1953. They won the Nobel Prize in 1962.

## The Cell Cycle

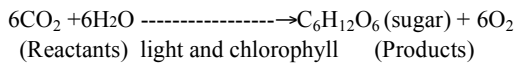


[www.cancerline.com/.../9898\\_21518\\_3\\_2\\_1.aspx](http://www.cancerline.com/.../9898_21518_3_2_1.aspx)

1. G<sub>1</sub> Phase – Growth and development
2. S Phase – Chromosomal replication
3. G<sub>2</sub> Phase – Continued growth and development; final preparation for cell division
4. M Phase – Cell division (mitosis) and cytokinesis

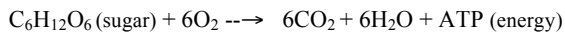
## Photosynthesis

- Biological pathway that plant cells use to create organic molecules (food)



## Cellular Respiration

- Process **all** cells use to convert organic molecules (food) into energy molecules (ATP)
- Aerobic = with oxygen
- Anaerobic = without oxygen (fermentation) leads to lactic acid in muscles



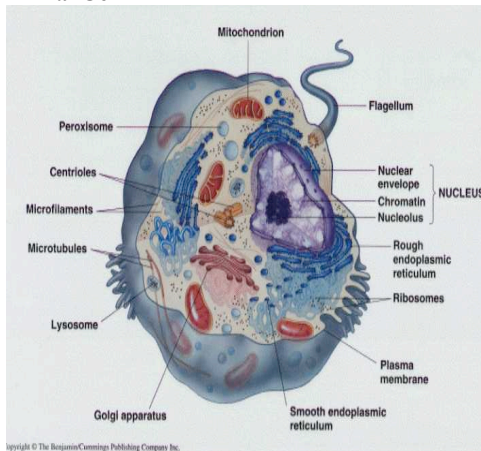
## Chemosynthesis

- Energy production done with organic molecules when both light and oxygen are not present
- Used in thermal sea vents

## Goal: 2

The student will demonstrate an understanding that all organisms are composed of cells, which can function independently or as part of multicellular organisms

## Animal Cell

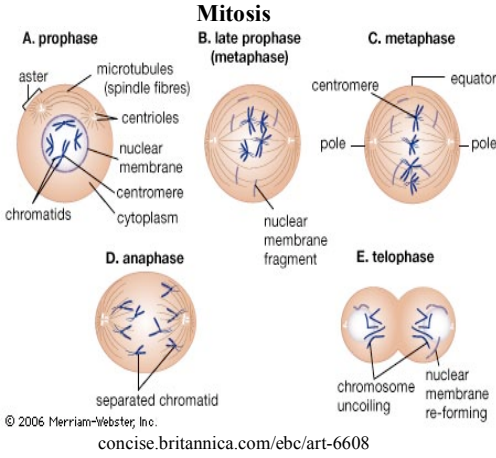


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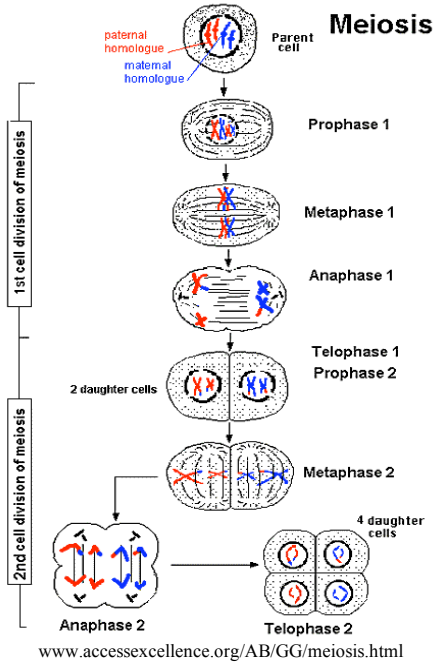
[websitesiteforteachers.org/.../animalcell.html](http://websitesiteforteachers.org/.../animalcell.html)

## Chromosomes

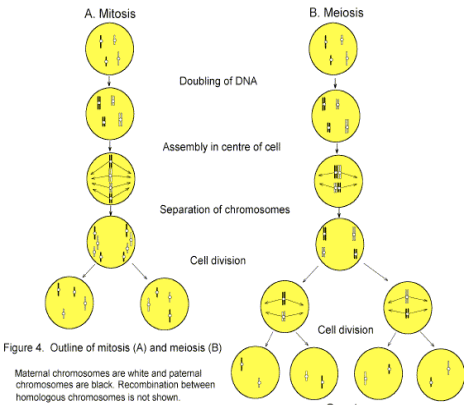
- Humans have 46 chromosomes (23 pairs)
- Pairs 1 – 22 are autosomes
- Pair 23 are the sex chromosomes



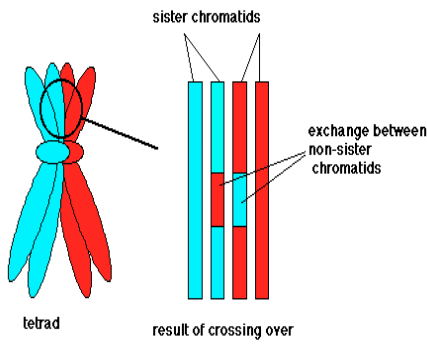
Mitosis occurs in all cells except for gametes



## Mitosis v. Meiosis



## Recombination



wappingersschools.org/.../visualvocab/page7.html

## Punnett Square Monohybrid Cross

	B	b
B	BB	Bb
b	Bb	bb

- Allele – alternate form of a gene
- Phenotype – the expressed trait
- Genotype – actual combination of genes
- Dominant
- Recessive
- Heterozygous
- Homozygous

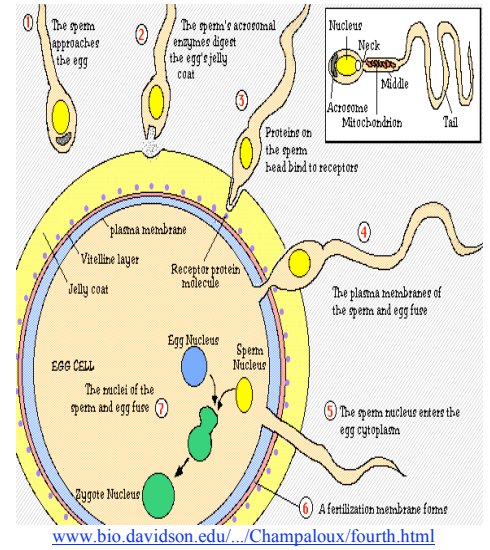
## Sex-Linked Traits

	X	X <sup>d</sup>
X	girl (unaffected) XX 25%	girl (carrier) XX <sup>d</sup> 25%
Y	boy (unaffected) XY 25%	boy (with defect) X <sup>d</sup> Y 25%

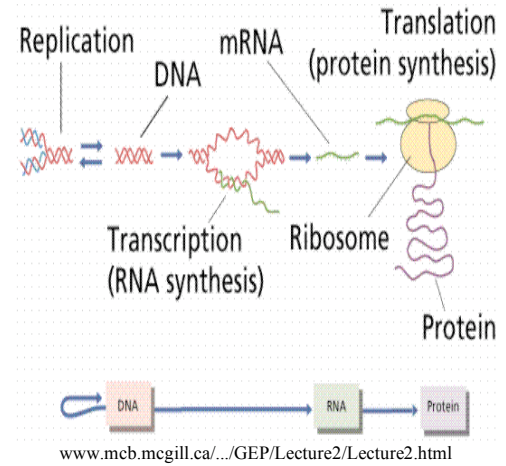
www.nlm.nih.gov

- Traits are carried on the sex chromosomes (X or Y)
- Males cannot be a carrier for an X-linked trait

## Fertilization



## Gene Expression (Central Dogma of Molecular Biology)



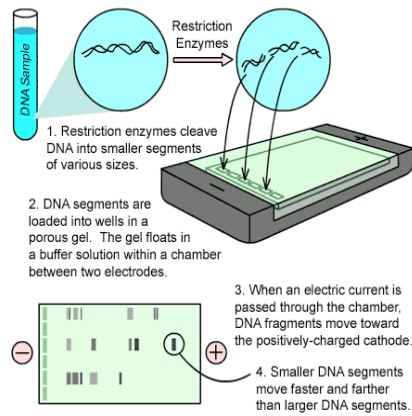
- **Replication** – DNA → DNA (Takes place in the nucleus)
- **Transcription** - DNA → RNA (Takes place in nucleus; following this process the mRNA exits the nucleus)
- **Translation** - RNA → Polypeptide\*\* (Takes place in intracellular matrix)

\*\*Polypeptides are composed of amino acids and are responsible for the expression of traits

Stem Cells are undifferentiated cells that have the potential to become specialized in structure or function. Primarily found in embryos although they are also found all over the adult human body.

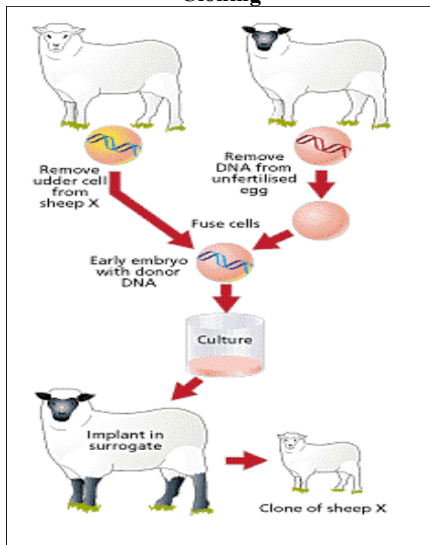
## DNA Technology

Figure S-2: Gel Electrophoresis



[www.stanford.edu/./diagnosis/gentest/s7.html](http://www.stanford.edu/./diagnosis/gentest/s7.html)

## Cloning

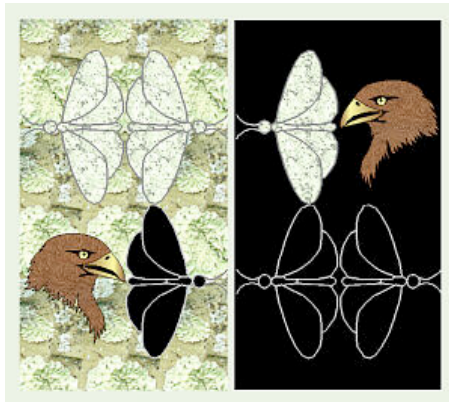


[www.clonesafety.org](http://www.clonesafety.org)

## Goal: 4

The student will explain the mechanism of evolutionary change

## Natural Selection



[biology.clc.uc.edu/courses/bio106/nat-sel.htm](http://biology.clc.uc.edu/courses/bio106/nat-sel.htm)

Ex: Moths (*Biston betularia*) that are camouflaged more effectively will have a lower chance of being prey for local predators

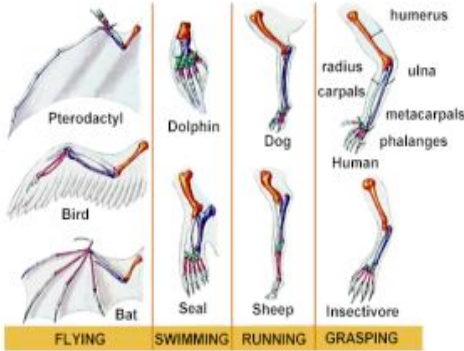
## Natural Selection

Organisms best adapted to their environment will survive to reproduce more efficiently than those that are not.

## Evolution

Evolution is defined as change over time.

## Homologous Structures



[www.iss.k12.nc.us/./shs/jmccartney/natsel.html](http://www.iss.k12.nc.us/./shs/jmccartney/natsel.html)

## Goal: 5

The student will investigate the interdependence of diverse living organisms and their interactions with the components of the biosphere.

## Symbiosis

The relationship between two or more organisms

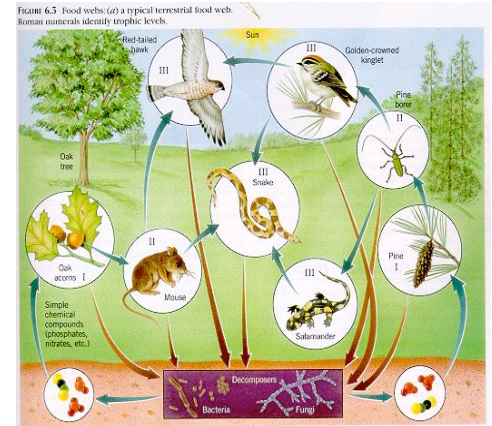
Relationship	Definition	Example
Parasitism	One species benefits, the other is harmed	Tick Tape worm
Commensalism	One species benefits, the other is unaffected	Cattle egrets
Mutualism	Both species benefit	Flowers and bees (pollination)

## Succession

Succession is the process of re-growth. Succession and stability are linked because an ecosystem must constantly change to remain stable. An ecosystem can become more stable with an increase in biodiversity (the number of different species in that ecosystem)

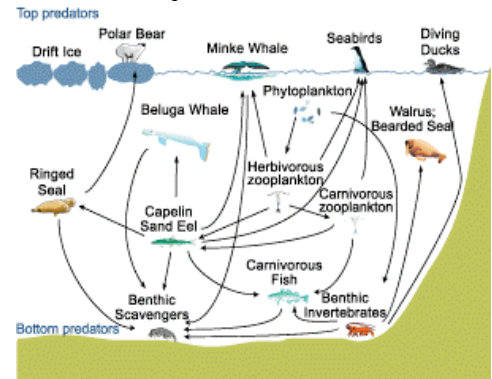
- **Primary** – starts with rock (e.g., volcanic eruption)
- **Secondary** – starts with soil already present
- **Pioneer species** – first species to inhabit an area or ecosystem
- **Climax community** – the end community with complex relationships established

## Terrestrial Food Web

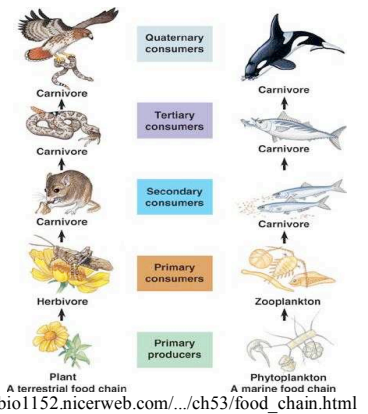


[weedeco.msu.montana.edu/./lecture\\_20.htm](http://weedeco.msu.montana.edu/./lecture_20.htm)

## Aquatic Food Web



[www.environment.no/././thepage\\_2796.aspx](http://www.environment.no/././thepage_2796.aspx)



**Producer** – produces energy (food), autotroph

**Consumer** – consumes energy, heterotroph

**Herbivore** – consumer that eats plant material

**Carnivore** – consumer that eats other consumers

**Omnivore** – consumer that eats plant material and other consumers

**Decomposer** – consumer that eats dead or decaying material; recycles nutrients into the soil for producers

## Human Impact

Human can have a negative or positive impact on the earth. Destruction of habitat and pollution are two major disturbances that can create a shift in stability. Humans can have a positive impact by participating in species recovery programs, creating legislation to protect animals and conservation methods.