

Biology EOC Highlight Review



Courtesy of Mr. S. Russillo

Organic Compounds

- All living things are made of organic compounds.
- Contain the element Carbon
- Carbohydrates, Proteins, Lipids, Nucleic Acids



Carbohydrates

- Monomer- monosaccharide
- Function- energy source and structure
- Tests: glucose-Benedict's
starch- Iodine
- Ex. Cellulose, glycogen, starch

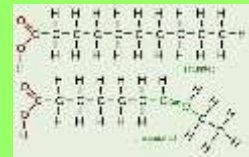


Lipids

- Made of fatty acids and glycerol
- Function- energy storage and insulation
- Tests: brown paper test
- Examples: fats and steroids



Lipid vs. water



Nucleic Acids

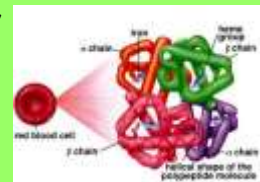


- Monomer- nucleotide
- Function- carry genetic information
- Ex. DNA and RNA



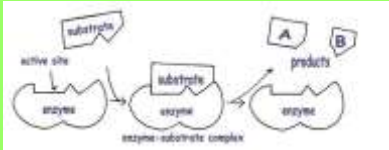
Proteins

- Monomer- amino acids
- Function- building and repairing cells, communication, transport, and regulation
- Tests- Biurets
- Examples: enzymes, hemoglobin



Enzymes

- Catalysts in living things
- Specific to a particular substrate
- Reusable
- Affected by temperature and pH



Cells

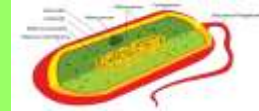
Prokaryotes

- Simple, no membrane bound organelles
- Bacteria only
- One circular chromosome
- Includes: chromosome, ribosomes, and plasma membrane
- Circular DNA: Plasmids



Eukaryotes

- Membrane bound organelles
- Plants and Animals
- True nucleus containing chromosomes



Nucleus

- "Control Center"
- Contains chromosomes



Mitochondria

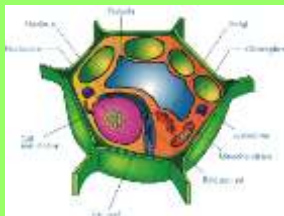
Singular: Mitochondrion



- "Powerhouse" of the cell
- Produces energy in the form of ATP
- Site of Aerobic respiration

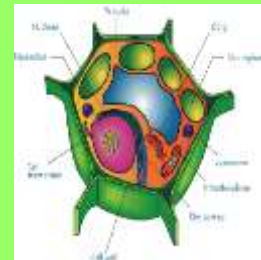
Chloroplast

- Site of photosynthesis
- Plant cells ONLY
- Contains the pigment chlorophyll



Vacuole

- Storage of excess materials
- Water, sugars, and waste
- Plant cells usually contain one large vacuole



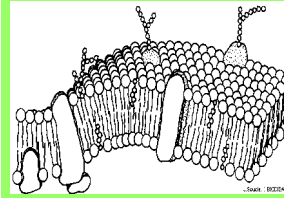
Ribosomes

- Proteins are synthesized
- Found in both prokaryotes and eukaryotes



Plasma Membrane

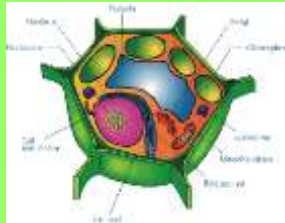
aka: Cell Membrane



- Surrounds the cell
- Regulates what enters/leaves the cell
- Helps maintain homeostasis
- Made of phospholipids with embedded proteins

Cell Wall

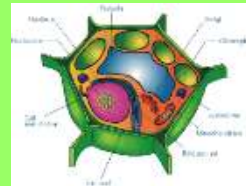
- Plant cells ONLY
- Surrounds cell and provides support and protection.
- Made of cellulose



Eukaryotes

Plant

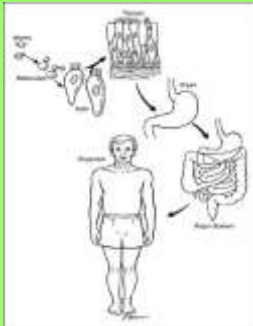
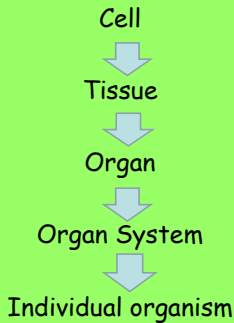
- Cell wall
- Chloroplast
- Large central vacuole



Animal

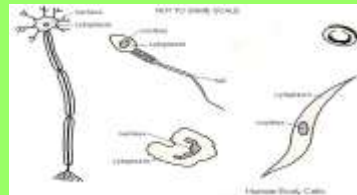


Cell Organization



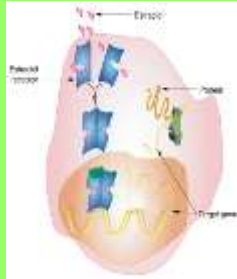
Cell Specialization

- Process: differentiation
- cells develop to perform different functions
- Regulated by genes



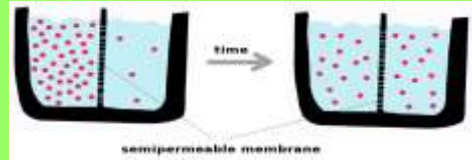
Cell to Cell Communication

- Chemical Signals (hormones) can be sent from one cell to another
- Receptor proteins on the plasma membrane receive the signal



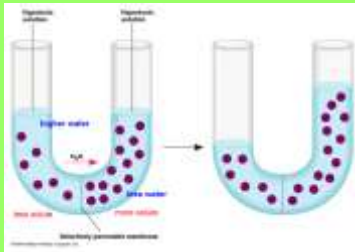
Diffusion

- Form of passive transport (NO ENERGY NEEDED) across a membrane
- Solutes move from high concentration to low concentration



Osmosis

- Diffusion of water (also passive transport)

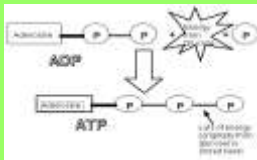


Active Transport

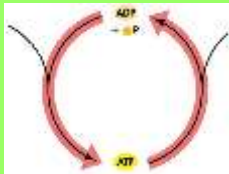
- Particles moving against the concentration gradient which REQUIRES ENERGY (ATP)
- Low concentration to high concentration



ATP



- Energy storing molecule
- Can be used for quick energy by the cell
- Energy is stored in the phosphate bonds



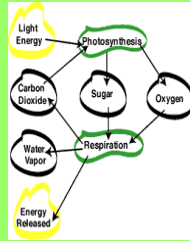
Photosynthesis

- SUNLIGHT, Water and Carbon Dioxide used to produce Glucose and Oxygen
- $6\text{H}_2\text{O} + 6\text{CO}_2 \rightarrow \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2$
- Occurs in the chloroplast



Aerobic Respiration

- Used to release energy (ATP) for cellular use
- $C_6H_{12}O_6 + 6O_2 \rightarrow 6H_2O + 6CO_2 + ATP$
- Occurs in the mitochondria



Anaerobic Respiration

aka Fermentation

- Does not require Oxygen
- also used to release energy, but not as efficient as aerobic respiration (less ATP)
- Products include CO_2 and lactic acid or alcohol
- Two Types: Alcoholic Fermentation and Lactic Acid Fermentation



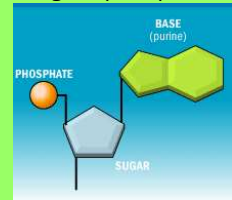
Autotroph vs. Heterotroph

- Obtain energy from the environment
- Photosynthesis or chemosynthesis
- "Producers"
- Obtain energy from other living things
- "Consumers"



DNA / RNA

- Carry genetic information
- Made of a chain of nucleotides
- Nucleotides contain a sugar, phosphate, and a nitrogen base



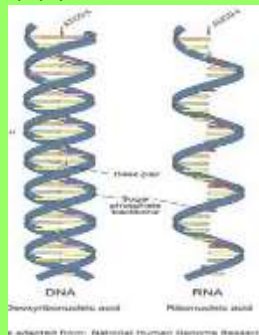
DNA / RNA

DNA

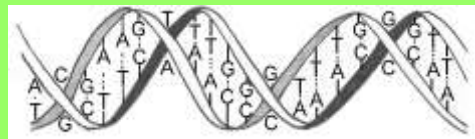
- Double stranded
- "Double Helix"
- Four base pairs: ATGC
- Sugar is Deoxyribose
- Found in nucleus

RNA

- Single stranded
- Four base pairs: AUCG
- Sugar is Ribose



Base Pair Rule



- In DNA, Adenine always pairs with Thymine, and Guanine always pairs with Cytosine

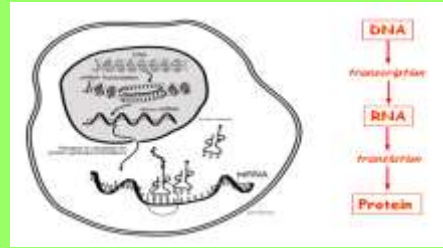
Replication

- Making of an identical strand of DNA
- "semi" conservative

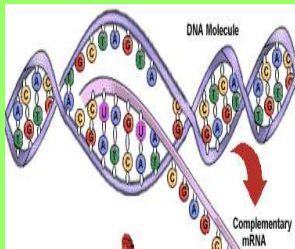


Central Dogma

DNA → RNA → protein → trait



Transcription



- DNA → mRNA
- Occurs in nucleus
- Complementary mRNA strand is produced from a segment of DNA

Translation

- Connects amino acids in the correct order to make a protein
- Occurs in the cytoplasm within the ribosomes

- A- amino acid
- B- tRNA
- C- anticodon
- D- codon
- E- mRNA
- F- Ribosome
- G- polypeptide



Codon

- Sequence of three mRNA nucleotides that code for an amino acid

First Letter	Second Letter			Third Letter
	G	C	A	
U	phenylalanine	serine	tyrosine	cysteine
	phenylalanine	serine	tyrosine	cysteine
	leucine	serine	stop	stop
C	leucine	proline	stop	tryptophan
	leucine	proline	histidine	arginine
	leucine	proline	histidine	arginine
A	leucine	proline	glutamine	arginine
	isoleucine	threonine	asparagine	serine
	isoleucine	threonine	asparagine	serine
G	isoleucine	threonine	lysine	arginine
	isoleucine	threonine	lysine	arginine
	valine	alanine	asparagine	glycine
C	valine	alanine	asparagine	glycine
	valine	alanine	glutamate	glycine
	valine	alanine	glutamate	glycine

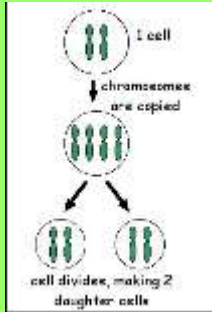
Mutations

- Change in DNA code
- May cause a change in protein produced
- NOT always harmful

Sickle Cell Mutation



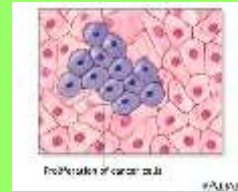
Mitosis



- Cell division
- Produces two identical diploid daughter cells
- Occurs in body cells to grow and repair

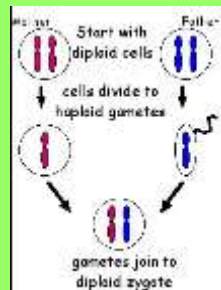
Cancer

- Error in cell growth with causes uncontrolled cell growth
- Has environment and genetic variables

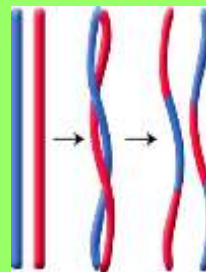


Meiosis

- Cell division
- Produces four different haploid daughter cells (gametes)
- Occurs in sex cells to form gametes



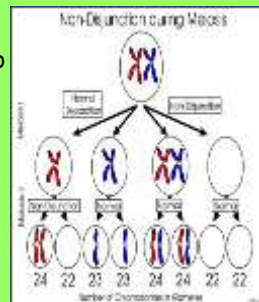
Crossing Over



- Homologous chromosomes exchange parts of their DNA
- Creates variation in gametes

Nondisjunction

- Homologous chromosomes fail to separate during meiosis
- Can lead to Down Syndrome, Turners Syndrome, and Klinefelters Syndrome



Asexual vs. Sexual Reproduction

Asexual

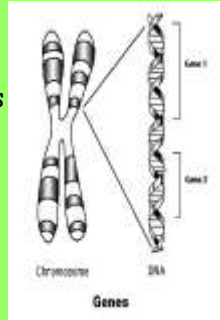
- One parent
- Identical offspring
- Variation only thru mutations
- Examples: budding, fragmentation, fission

Sexual

- Two parents
- Offspring different from parents
- More variation
- Fertilization (fusion of gametes)

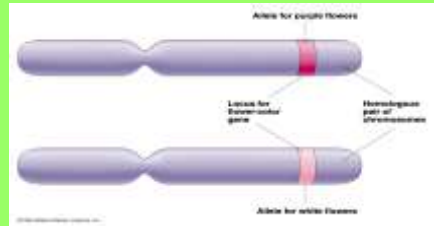
Inheritance

- Traits are specific characteristics inherited from parents
- Genes are the factors that determine traits
- The different forms of a gene are called alleles



Dominant/Recessive Alleles

- Dominant alleles are expressed, if present, and recessive are hidden



Genotype

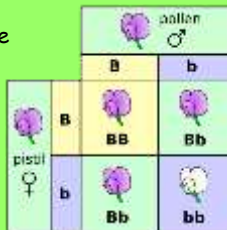
actual alleles an individual has for a trait

Homozygous

- Both alleles are the same
- Ex. BB or bb

Heterozygous

- Both alleles are different
- Ex. Bb



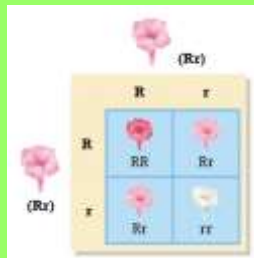
Phenotype

- The actual characteristic displayed by the individual (ex. brown eyes, Hemophiliac)



Incomplete Dominance

- Heterozygote shows a blending of the dominant and recessive phenotypes



Codominance

- Heterozygote expresses BOTH dominant and recessive traits
- Ex. Roan animals



Polygenic Traits

- Traits are influenced by more than one gene
- Ex. skin color

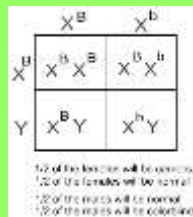


Multiple Alleles

- More than two alleles for a trait (an individual still only inherits two)
- Ex. Blood Type (I^A, I^B, i)
 - type A = $I^A I^A$ or $I^A i$
 - type B = $I^B I^B$ or $I^B i$
 - type AB = $I^A I^B$
 - type O = ii

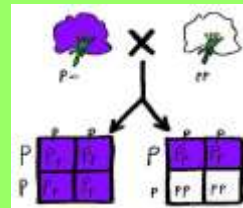
Sex Linked Traits

- Sex Chromosomes
 - Female = XX
 - Male = XY
- Sex linked traits are carried on the X chromosome
- Ex. Hemophilia, red-green colorblindness



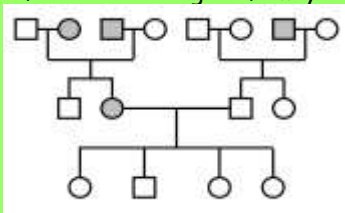
Test Cross

- used to determine the phenotype of an unknown dominant individual
- uses a homozygous recessive individual as the "test"



Pedigree

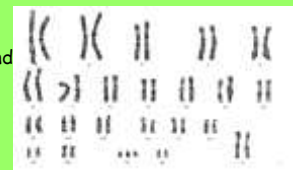
- similar to a family tree
- Shows pattern of inheritance of a specific trait through a family



Karyotype

- Picture of someone's chromosomes
- Can detect chromosomal disorders

Ex. Down Syndrome, Klinefelter's Syndrome, and Turners Syndrome



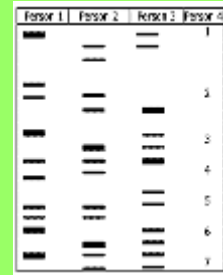
Human Genome Project

- Sequencing of human DNA
- Being used to develop gene therapies



Gel Electrophoresis

- Technique used to separate molecules (DNA or proteins) based on their size
- Sometimes called a DNA fingerprint
- Used to analyze and compare DNA



Recombinant DNA



- Cell with DNA from another source
- Bacteria used to produce human insulin
- Human gene inserted into bacterial plasmid

Transgenic Organism

- An organism with a gene from another source
- used to improve food supply, research, and healthcare



Clone

- An organism made from one cell of another organism
- A genetically identical copy



Origin of Life

- Abiotic earth LACKED Oxygen
- Early organisms anaerobic prokaryotes

Miller and Urey
Experiment recreating
The abiotic atmosphere



Endosymbiotic Theory

- Eukaryotic cells evolved from prokaryotes
- Early prokaryotes engulfed other prokaryotes and developed symbiotic relationships
- Evidence includes mitochondria and chloroplast have prokaryotic type DNA



Abiogenesis

- Living from non-living or spontaneous generation
- Disproved by Redi and Pasteur's experiments

Biogenesis

- Living from Living

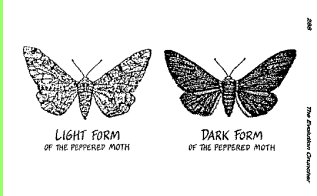


Natural Selection

- Theory of Evolution
- Fit organisms survive, reproduce, and pass on traits

Requirements:

- Variation
- Competition



Adaptations



- Trait that increases survival
- For Example,
 - Beaks that make it easier to eat insects
 - Bright flowers to attract pollinators
 - Vascular tissue in plants to adapt to life on land

Evidence for Evolution



- Fossil Record
- Biochemical Similarities
- Shared anatomical structures



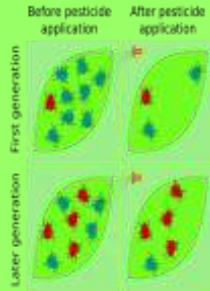
Speciation

- Evolution of a new species
- must be isolation between populations



Antibiotic and Pesticide Resistance

- Populations will eventually become resistant to pesticides and antibiotics with overuse



Coevolution

- Two organisms evolve in response to each other

Ex. Flowering plants and their pollinators



Binomial Nomenclature

- Two word naming system
- Scientific name is much smaller than full classification
- Uses **Genus** and **Species** names only (not full classification of Kingdom, Phylum, Class, Order, Family, Genus, Species)

- Ex. Dogs: *Canis familiaris*

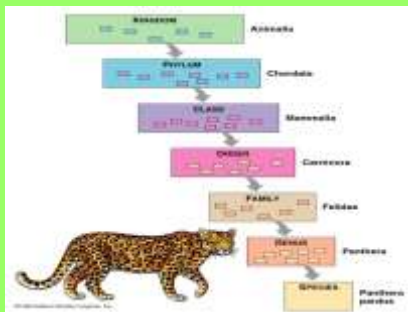


Dichotomous Keys

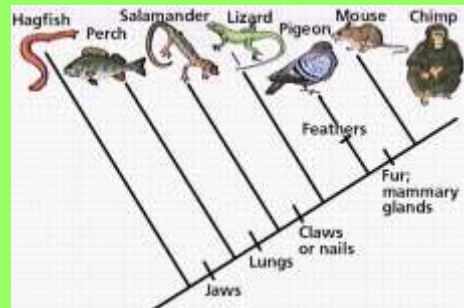
- Used to identify organisms
- Paired set of questions with two choices



Levels of Organization

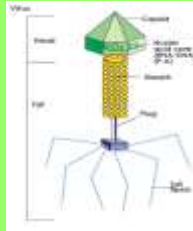


Phylogenetic tree



Viruses

- Not considered living things
- Pathogens that can mutate to resist vaccines
- Ex. HIV, Influenza, Smallpox



Genetic Disorders and the Environment

- Many diseases have both genetic and environmental factors
- Ex. Cancer, diabetes, PKU



Immune Response

B-cells

- Fight antigens in body fluids
- B-cells make antibodies
- Make memory cells after exposure to antigen



T-cells

- Fight pathogens inside living cells
- May help B-cells to make antibodies
- Make memory cells after exposure to pathogen

Immunity

Passive Immunity

- Antibodies are introduced into the body
- Short term
- Such as mother transfers antibodies to infant through breast feeding

Active Immunity

- Antibodies are acquired when an immune response is activated in the body
- Long term
- Ex. Vaccines are weak/dead antigens that are introduced to the body

Parasites

- Lives on or within a host
- Benefits while causing harm to the host
- Ex. Plasmodium causes malaria (genetic influence-carriers of sickle cell are resistant to malaria)



Toxins

- Chemical that causes harm to the body
- Can be man-made or produced by microorganisms
- Ex. Mercury and Lead



Ecosystems

- Collection of abiotic (nonliving) and biotic (living) factors in an area
- Together they influence growth, survival, and productivity of an organism



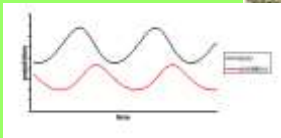
Symbiotic Relationships

- Relationship between two organisms
- Types:
 - Mutualism (+,+)
 - Parasitism (+,-)
 - Commensalism (+, 0)



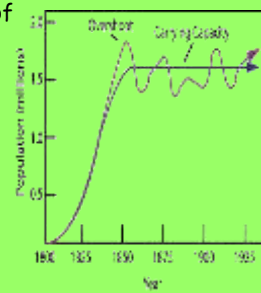
Predation

- Predator eats prey
- Evolve in response to one another

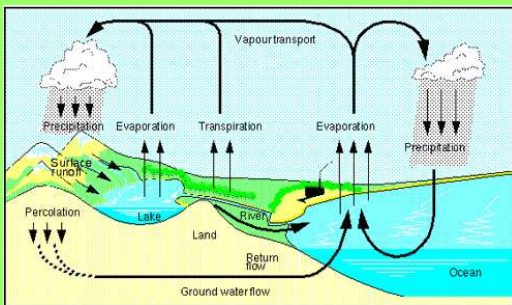


Carrying Capacity

- Maximum number of individuals that an ecosystem can support
- Limiting factors:
 - Food availability
 - Competition
 - Disease
 - Predation
 - Natural Disasters



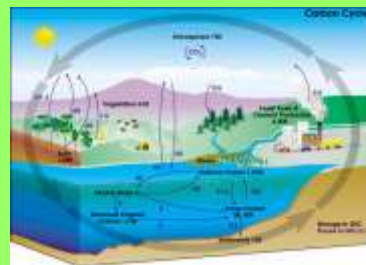
Water Cycle



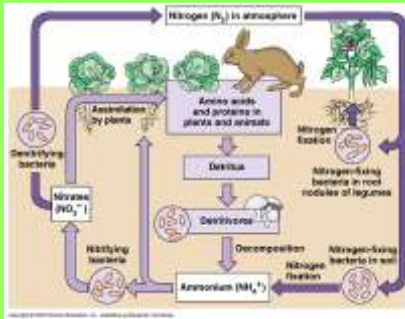
Courtesy Erich Roeckner, Max Planck Institute for Meteorology

Carbon Cycle

CARBON ENTERS THE FOOD CHAIN THROUGH PHOTOSYNTHESIS!!!!



Nitrogen Cycle

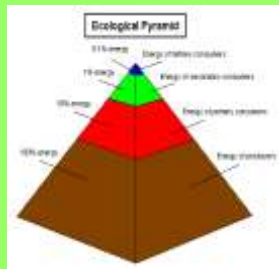


Oxygen Cycle



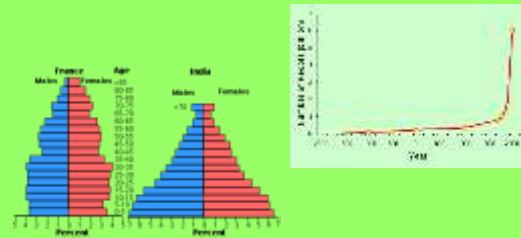
Trophic Levels

- Steps in a food chain/web
- Energy passes from one organism to another
- About 10% of the energy at one level passes to the next



Human Population

- Growth = birth rate - death rate



Human Impacts

Positive

- Reforestation
- Cover Cropping
- Recycling
- Sustainable practice

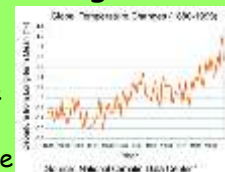
Negative

- Acid Rain
- Deforestation
- Habitat Destruction
- Invasive Species
- Ozone depletion from the release of CFCs



Global Warming

- Increase in the average temperature of the earth
- Caused by the release of too much CO₂ into the atmosphere which amplifies the greenhouse effect
- Burning of fossil fuels, volcanic eruptions



Bioaccumulation



- An increase in environmental toxins at higher trophic levels
- Ex. DDT and birds of prey

Innate Behavior

- Behaviors an animal is born with
- Includes suckling, migration, hibernation
- Ex. weaving of spider webs



Learned Behavior



- Behavior an animal acquires during its lifetime
- Includes
 - Habituation
 - Conditioning
 - Trial and error

Social Behavior

- Communication between individuals of the same species
- Can be courtship, territorial or chemical (pheromones)

