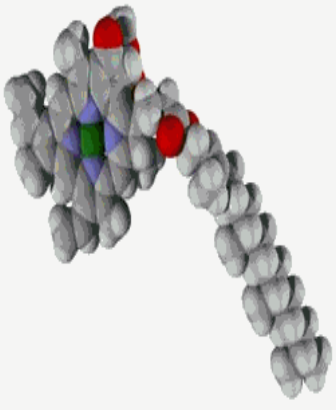
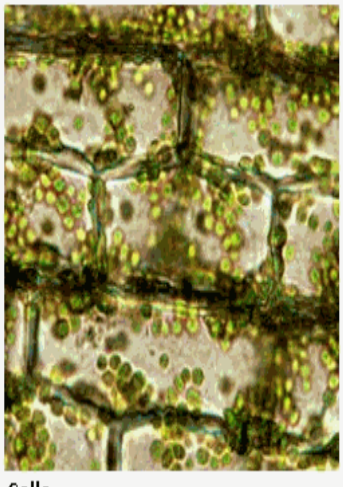
Biology EOC Review

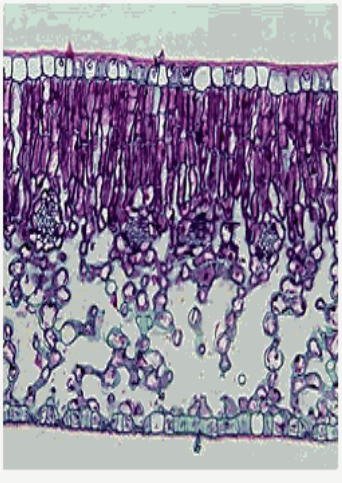


Molecule

Organelle

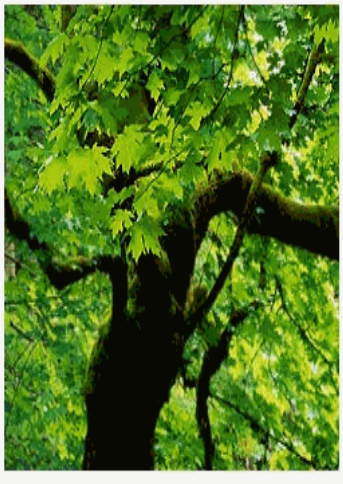


Cells



Tissues

Organ



Community

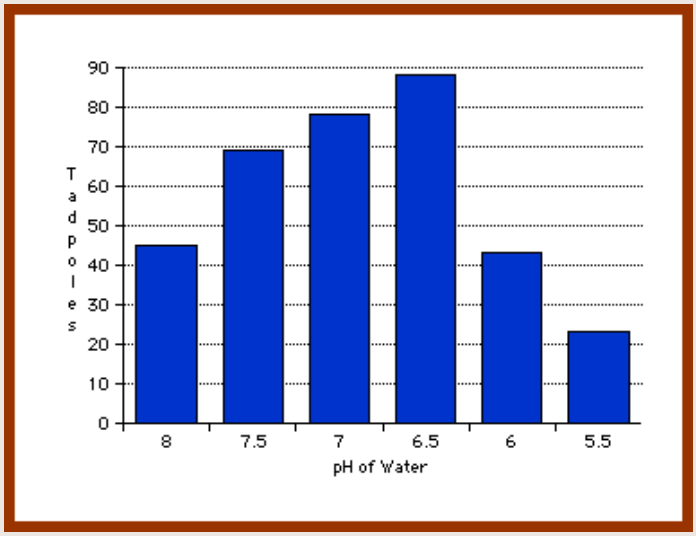
Science Methods

- **Steps used to solve a problem**
- **Observation**
- **Questioning and stating problems**
- **Hypothesizing**
- **Experimenting – including a control and experimental group**
  IV – independent variable
  DV – dependent variable
- **Tables and Graphs**
- **IV on x-axis and DV on y-axis of a graph**

Ex) Effects of pH on Tadpole Survival

IV – pH

DV-Number of Tadpoles



Characteristics of Life

All living things exhibit several basic life characteristics:

- Cellular organization
  - *unicellular – one celled
  - * multicellular – many celled with levels of organization (cells→tissues→organs→ systems →organism)
- Reproduction
  - *asexual – offspring are genetic clones of parent
  - *sexual – offspring have genetic variation from parents
- Metabolism
  - * energy is required for life processes
  - * autotrophs make their own food (photosynthesis/chemosynthesis)
  - * heterotrophs eat other organisms for food
- Homeostasis
  - * maintenance or regulation of body conditions such as body temperature, blood sugar level, water balance
- Heredity
  - * DNA – deoxyribonucleic acid – is the genetic material that codes for proteins of all organisms. The genetic code is "universal"
- Response to stimuli
  - * responding to the biotic and abiotic factors in the environment are key to survival
- Growth and Development
  - * growth – increase in the amount of living matter either by cell division or cell enlargement
  - * development – any change from conception to death - embryonic, puberty, aging
- Evolutionary Adaptation
  - * adaptations – structures, behaviors, or processes that aid in an organisms survival are passed on from parent to offspring.

Chemistry

- **Organisms are composed of organic compounds – carbon containing compounds that can be very large macromolecules**
- **Macromolecules are often built by dehydration synthesis and polymerization**
- **Four main types**

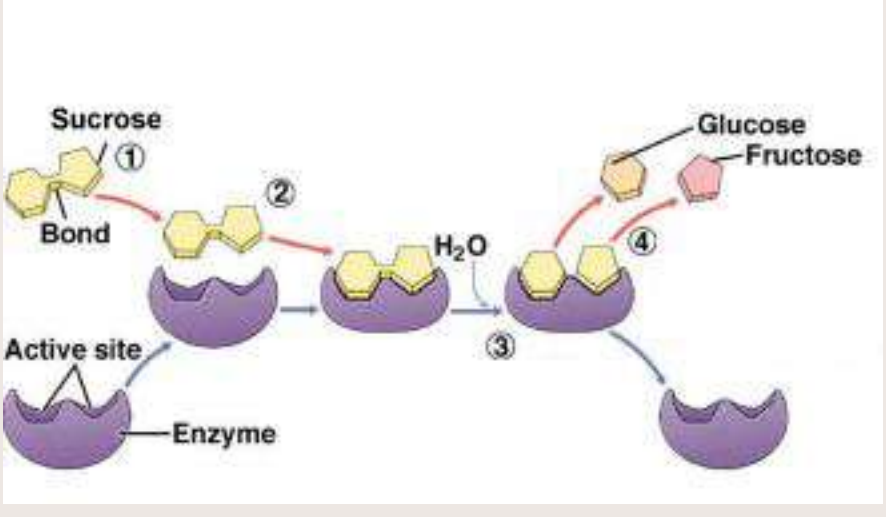
1) Carbohydrates – composed of monosaccharides primarily glucose

2) Lipids – composed of fatty acids joined to glycerol and sometimes phosphate groups, can also include the steroids

3) Proteins – composed of amino acids (20 different types) – do most of the work in organisms and are major structural components

4) Nucleic Acids – are composed of nucleotides – either DNA or RNA

- **Metabolism – is the chemistry of life – all metabolism is controlled by the action of enzymes**
- **Enzymes are proteins that function to speed up chemical reactions in the cell. They have a specific shape and interact with a specific substrate which binds at the active site.**



- **Enzymes are reusable and are not changed during a chemical reaction. They can be damaged at temperature and pH extremes.**

Ecology

- **Ecology – is the study of interactions between organisms and the environment**
- **Levels of Organization**

Biosphere→Biomes→Ecosystem →Community→Population→Organism

- **We study an organisms habitat, niche, and trophic level**
- **Populations – are members of the same species living in the same place at the same time with the potential to interbreed**

Population growth – exponential (J-shape) and logistic (S-Shape)

*** Limited by factors like disease and competition that are density-dependent or by density-independent factors like natural disaster.**

*** Carrying capacity is seen in logistic growth – the maximum number the environment can support**

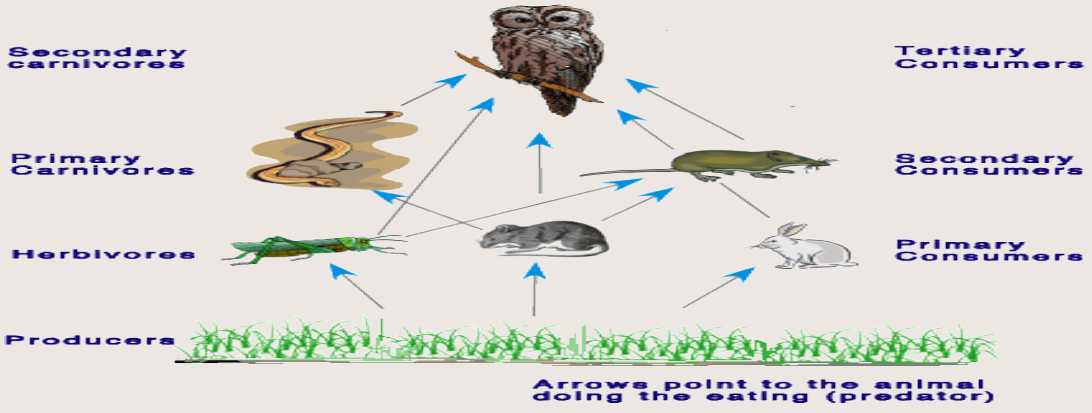
Community Interactions

*** Competition – intraspecific (same species) or interspecific (diff sp)**

*** Symbiosis – parasitism, commensalism, and mutualism**

*** Succession – both primary (bare rock) and secondary (soil)**

Ecosystem Level – food chains and webs and matter recycling



Cells

- **Cell theory - 3 parts**

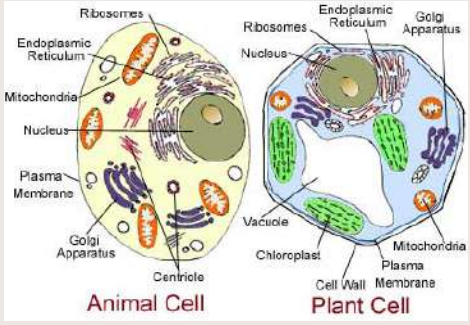
1) cells are basic unit of life
2) cells come from existing cells
3) all organisms are composed of cells

- **Prokaryotic versus Eukaryotic**

A) simple — **A) complex**
B) has no nucleus — **B) has a MB nucleus**
C) has no MB organelles — **C) has MB organelles**
D) includes bacteria — **D) includes protists, fungi, plants, and animals**

- **Organelles – compartments for carrying out specific jobs / chemical reactions**

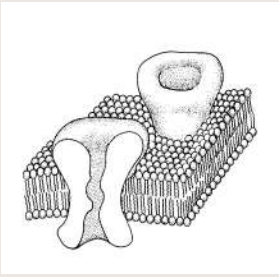
1) chloroplast – photosynthesis
2) mitochondria – cellular respiration
3) ribosomes – protein synthesis
4) vacuoles – storage
5) nucleus – contains DNA and controls cell actions
6) nucleolus – site of ribosome formation



- **Plant versus Animal**

A) has cell wall — **A) no cell wall**
B) has chloroplasts/plastids — **B) has no plastids/chloroplasts**
C) has large vacuole — **C) has small vacuoles**

Cellular Transport



- Plasma membrane controls homeostasis (balance)
- Structure – composed of a phospholipid bilayer with embedded proteins "gates"

- Function – acts as a selectively permeable boundary around the cell

- Types of Passive Transport – no energy required

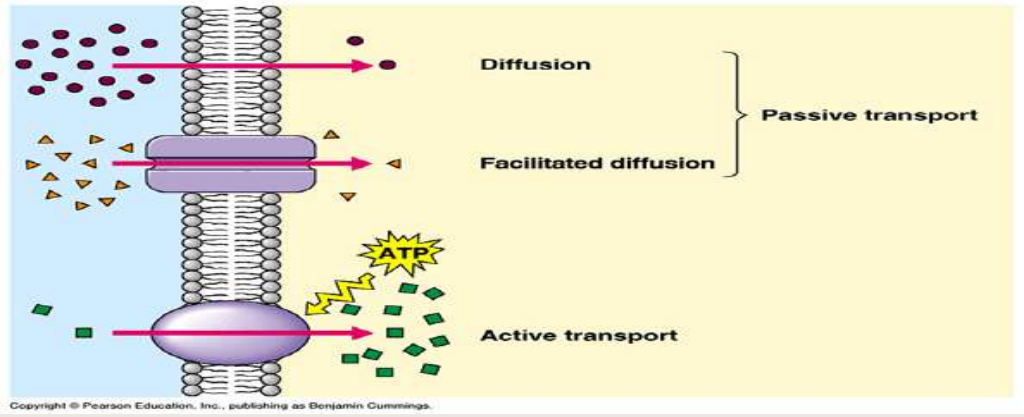
1) Diffusion – moves substances from high to low concentrations down their concentration gradient

2) Osmosis – the diffusion of water from high to lower water concentrations down its concentration gradient

Ex) cell in salt water – shrivels Ex) cell in fresh water swells

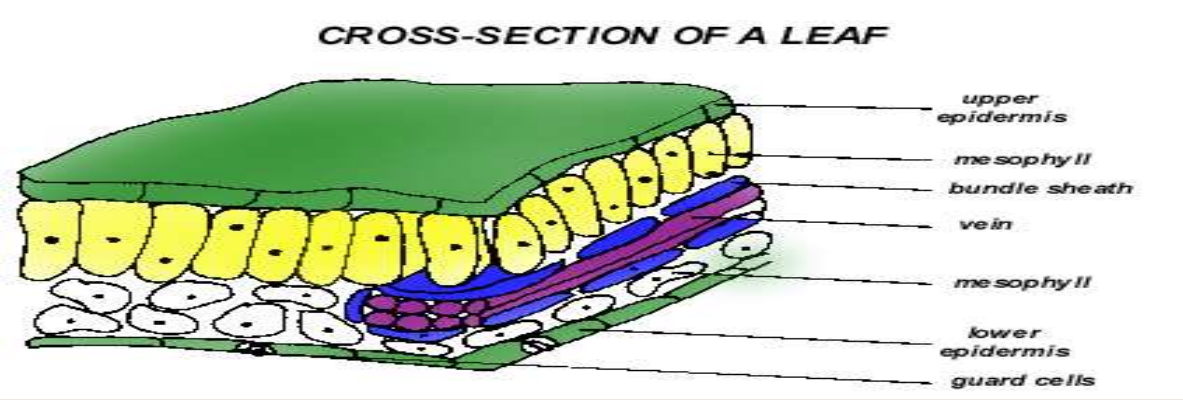
3) Facilitated diffusion – movement of a substance down its concentration through a transport protein channel

- Active Transport – requires energy – moves substances against the concentration gradient from low to high concentrations

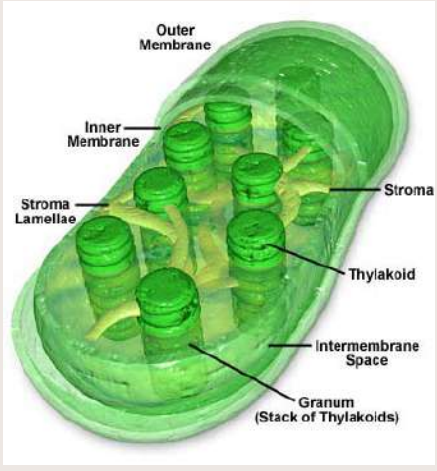


Photosynthesis

- **The process used by producers to convert sunlight to chemical energy in glucose**
- **Overall equation: $6CO_2 + 6H_2O \rightarrow C_6H_{12}O_6 + 6O_2$**
- **Occurs in the palisade layer of leaves (yellow layer under the upper epidermis)**



- **Large numbers of chloroplasts are found in these mesophyll cells.**
- **Chloroplasts are the cellular site of photosynthesis. The light reaction of photosynthesis occurs on the inner membrane called the thylakoid. The dark reaction (aka Calvin Cycle) occurs in the stroma**



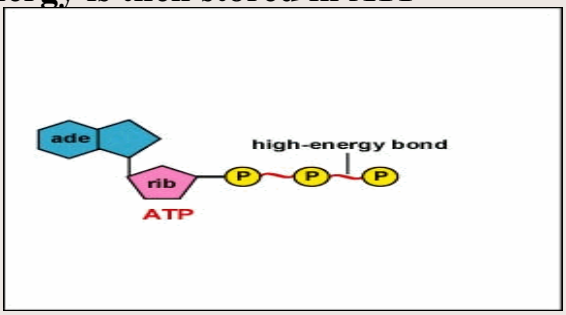
- **Pigments absorb light energy**
- **Chlorophyll / carotenoids**

	Input	Output	
Light Reaction	**light, water**	**NADPH**	**O_2, ATP**
Dark Reaction	**ATP, CO_2**	**NADPH**	**GLUCOSE**

Cellular Respiration

- **Cellular respiration is the process by which organisms break down food to release its energy. This energy is then stored in ATP (Adenosine triphosphate)**
- **Three parts to ATP**

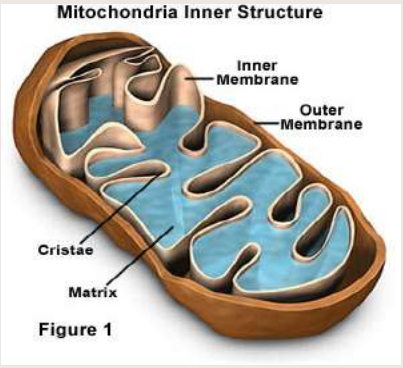
1) adenine (Nbase)
2) ribose (5-C sugar)
3) 3 phosphates (high energy)



- **ATP/ADP cycle – when energy is needed for cell work ATP loses a phosphate to become ADP**
- **Overall equation: $C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O + 38$ ATP**
- **Respiration can be aerobic or anaerobic**

Aerobic	Anaerobic
O_2 required	no O_2 required
most organisms are aerobes	few anaerobes (yeast/bacteria)
38 ATP	2 ATP
3 steps – glycolysis, Krebs cycle, transport	2 steps – glycolysis and electron fermentation (alcoholic and lactic acid)

- **Glycolysis is the first step of both forms of respiration and occurs in the cytoplasm**
- **If no oxygen is present after glycolysis, then fermentation occurs**
- **If oxygen is present, then the Krebs cycle and e-transport occur in the mitochondria**



DNA, RNA, and Protein Synthesis

- **DNA and RNA are composed of nucleotides**

DNA	RNA
Deoxyribose	Ribose
A, C, G	A, C, G
Thymine	Uracil
Double helix	Single helix
Codes for proteins/RNA	Copy of DNA info

- **Replication – the process used by cells to copy DNA – enzyme unzips DNA and each side of the ladder acts as a template for the building of the new half. Use the N-base paring rules : A-T ; C-G**

EX) TACGGAC (old strand)
ATGCCTG (new strand

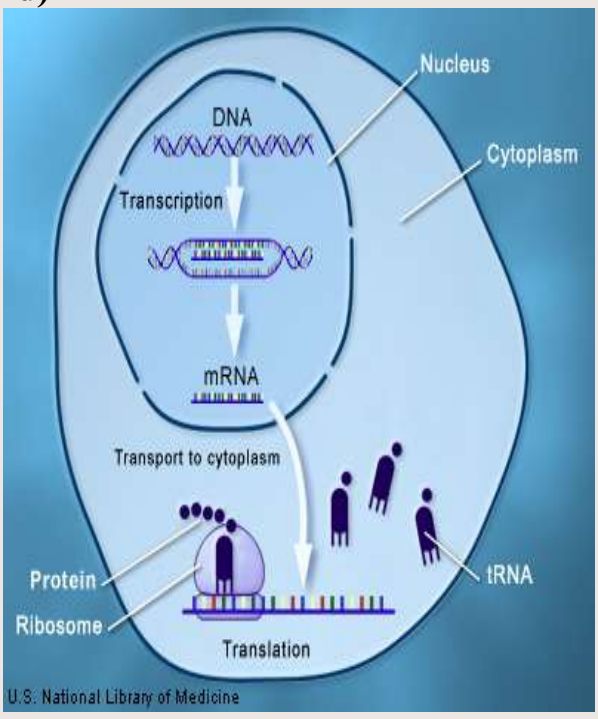
- **Transcription – the process of making RNA from DNA**

EX) TACGGAC (template DNA strand)
AUGCCUG (RNA built)

- **3 Types of RNA have a role in protein synthesis**

1) mRNA – messenger-blueprint for how to build protein
2) tRNA – transfer - carries amino acids to ribosome
3) rRNA – ribosomal – makes up a ribosome

- **Translation – the process of of building a protein by matching Codons in mRNA to anticodons of tRNA (use codon chart)**



Reproduction

- **Reproduction is a fundamental characteristic of life**
- **Propagates your species**
- **2 form: asexual and sexual**

Asexual	Sexual
-1 parent	-2 parents (usually)
-No gametes	-Fusion of gametes
-Offspring are genetically identical to the parent (clones)	-Offspring genetically unique
-Fast, efficient, less energy	-Slower, less efficient, more energy
-No variation	-Huge amounts of variation
-Stable Environment	-Changing Environment

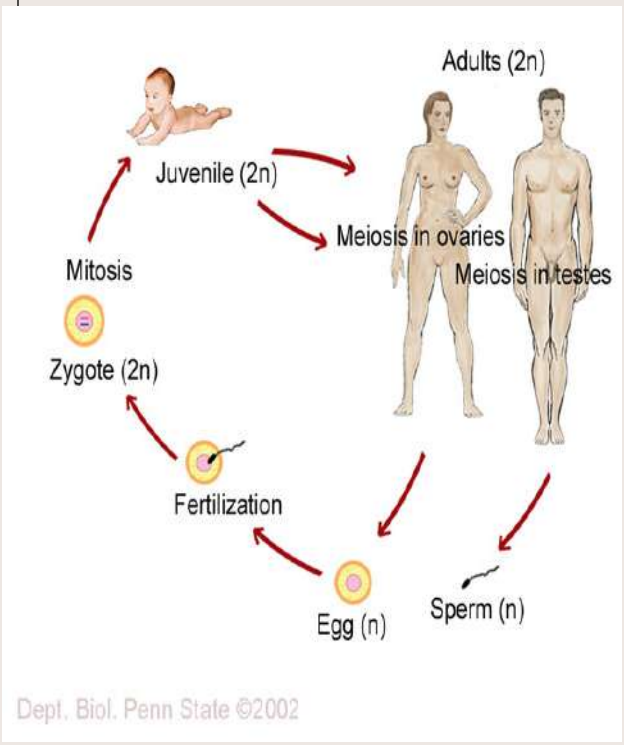
- **Asexual Strategies**

1) binary fission
2) budding
3) fragmentation/fission

- **Sexual strategies**

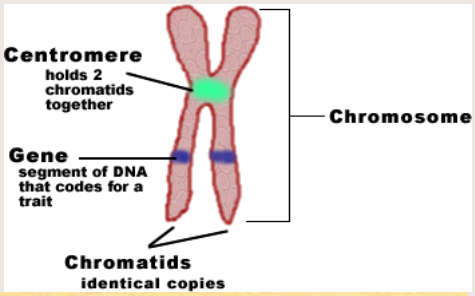
1) Internal fertilization
Copulation (vagina/penis) – sperm meets egg in female
2) External fertilization
Spawning – eggs and sperm released into the environment usually aquatic

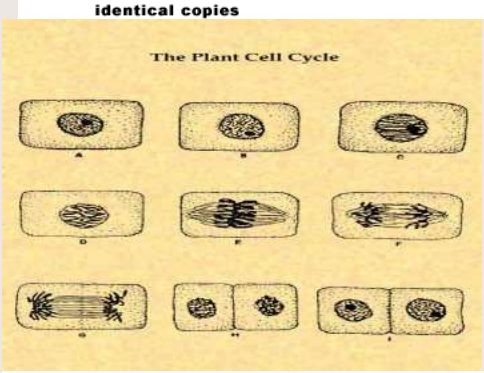
- **In humans fertilization occurs in the fallopian tube.**



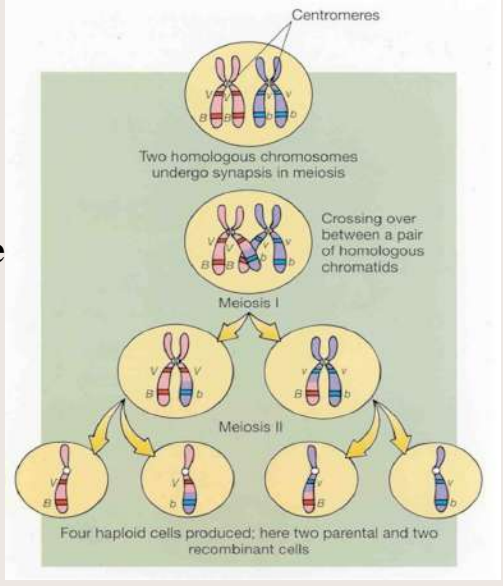
Cell Division

- **Haploid – having one set of chromosomes (n) – gametes – sperm/egg**
- **Diploid – having two sets of chromosomes (2n) – body cells – one set is maternal and one is paternal**
- **The cell cycle – Interphase – growth**
  - Mitosis – division
- **Mitosis creates diploid cells and is for the purpose of tissue repair and growth in animals**
- **DNA coils to form chromosomes during cell division**
- **Stages of the cell cycle (see diagram) Interphase, Prophase, Metaphase, Anaphase, Telophase, Cytokinesis**





- **Meiosis – cell division that creates 4 haploid cells called gametes – aka – reduction division**
- **Meiosis involves 2 divisions – Meiosis I and Meiosis II**
- **Meiosis I has some special events:**
- **In Prophase I homologous chromosome pair up and crossing over occurs. This recombination increases genetic variation for the species**
- **Metaphase I – Pairs line up**
- **Anaphase I – pairs are separated**
- **Meiosis II is similar to mitosis**



Simple Genetics

- **Gregor Mendel worked with pea plants to learn the basic patterns of inheritance.**
- **Phenotype – what the organism looks like**
- **Genotype – the gene combination – either Homozygous (TT or tt) or Heterozygous (Tt)**

Monohybrid Cross – follows 1 trait through several generations

P(parental) TT x tt

	T	T
t	Tt	Tt
t	Tt	Tt

geno- all Tt

pheno – all tall

(3:1 ratio)

T T t t

	T	t
T	TT	Tt
t	Tt	tt

T geno – ¼ TT, ½ Tt, ¼ tt

t pheno – ¾ Tall; ¼ short

Other important monohybrid crosses

T t T t

	T	t
T	Tt	Tt
t	Tt	tt

geno- ½ TT; ½ Tt

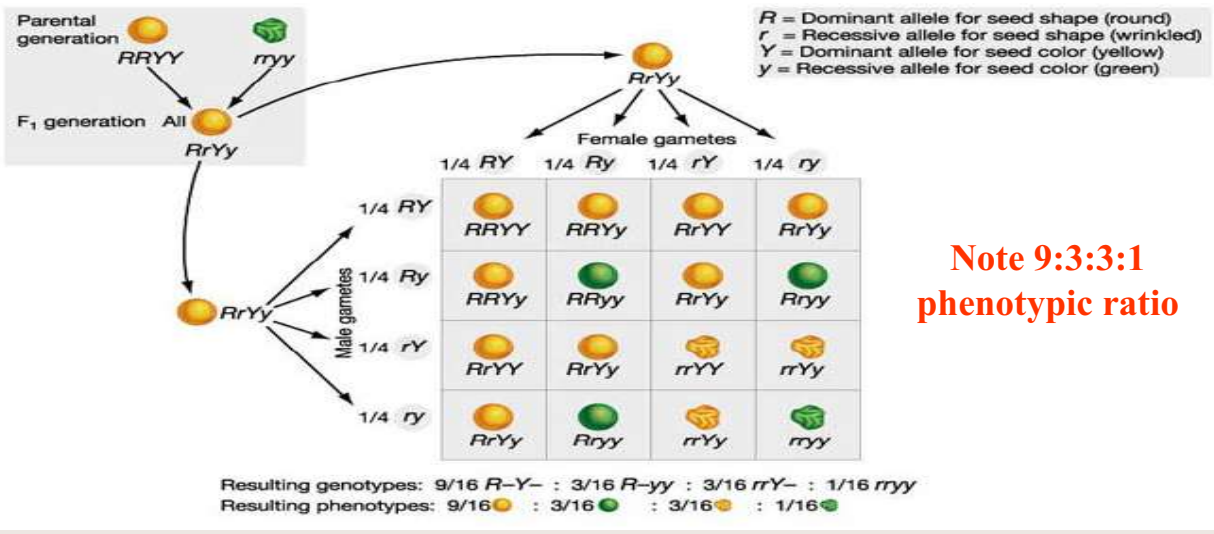
pheno – all Tall

	T	t
T	TT	Tt
t	Tt	tt

t geno – ½ Tt; ½ tt

t pheno– Tall; ½ short

- **Dihybrid cross – follows two traits**



Note 9:3:3:1 phenotypic ratio

Complex Genetics

- **Incomplete Dominance – intermediate/blended phenotype**

Ex) snap dragons → Red (RR) X White (R'R') → all Pink

R RR R'

R'	RR'	RR'
	RR'	RR'

geno- all RR'

R'

pheno- all pink

R'

RR	RR'	
RR'	R'R'	

geno- ¼ RR; ½ RR'; ¼ R'R'

pheno- ¼red; ½ pink; ¼ white

- **Codominance – both parental phenotypes show up in offspring**

Ex) Chickens → Black x White →Black and White feathers

- **Multiple Allelism – trait with 3+ alleles**

ex) A, B, O blood types

Phenotypes (Blood Group)	Genotypes
O	ii
A	I^AI^A or I^Ai
B	I^BI^B or I^Bi
AB	I^AI^B

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- **Sex Linkage – genes carried on sex chromosomes**

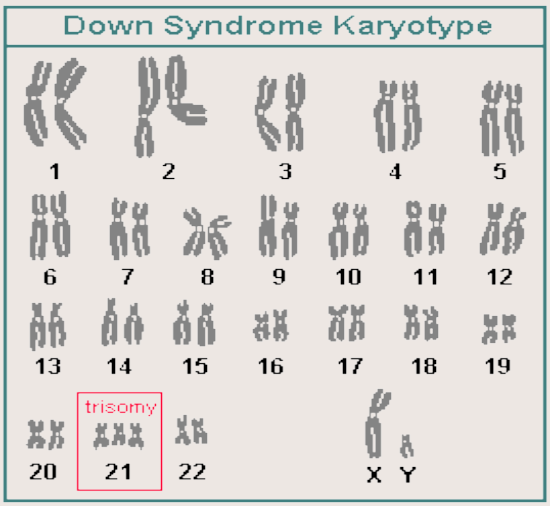
Ex) hemophilia, color blindness Cross shows a carrier female and a normal male. For a female to inherit the trait the father must have it and the mother must at least be a carrier

♀ \ ♂	X^N	Y
X^N	X^NX^N	X^NY
X^n	X^NX^n	X^nY

- **Polygenic Inheritance – traits controlled by many genes Ex) Height, hair color**

- **Aneuploidy – condition caused by having abnormal chromosome number.**

Ex) Down's Syndrome aka Trisomy 21



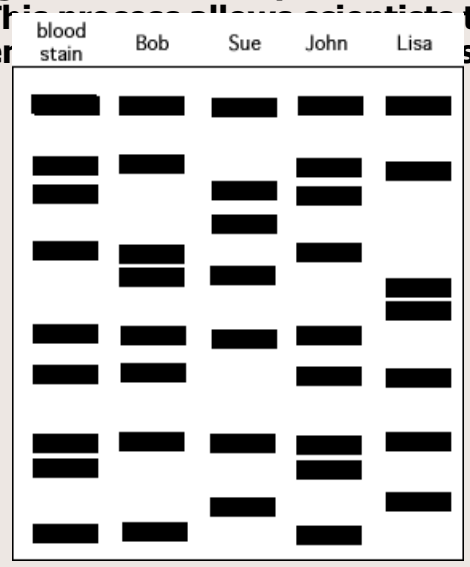
DNA Technology

- **Today, DNA techniques include:**

1) DNA Extraction – the opening of cells to separate/isolate DNA from other cell parts

2) Cutting DNA – large DNA molecules are cut into smaller fragments using restriction enzymes. These enzymes recognize and cut DNA at specific sequences. See Fig 13-5 p322.

3) Separating DNA – DNA fragments can be separated and analyzed using gel electrophoresis. Th to compare genomes of differer s, and create DNA "fingerprints"



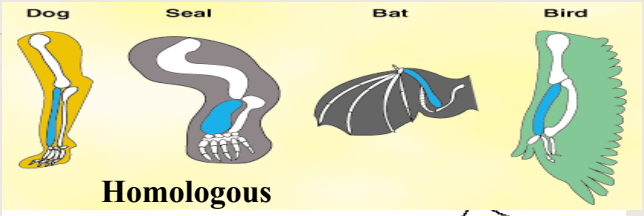
4) Sequencing DNA – this process allows scientists to determine the sequence of N-bases in DNA.

5) Recombinant DNA – scientists can cut DNA from two sources with the same restriction enzyme and combine them. This is used in genetic engineering. This process has been used to create human proteins used to treat disease, create pest-resistant crops, and for many other purposes.

6) Copying DNA – polymerase chain reaction (PCR) has been developed that makes many copies of a small amount of DNA. See Fig 13-8 p325.

Evolution

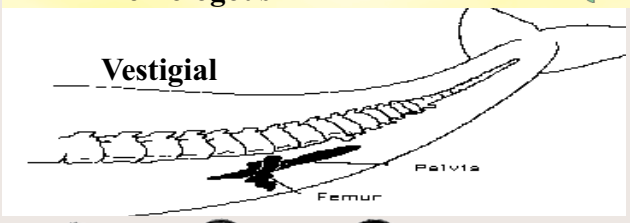
- **Charles Darwin – proposed that organisms (species or populations) change over time**
- **Occurs by Natural Selection – "survival of the fittest"**
- **Lines of evidence**



Homologous

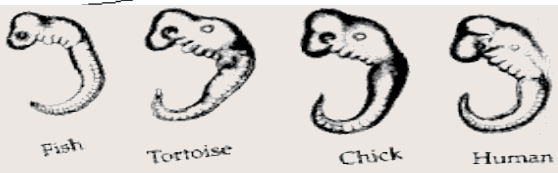
1) fossils (geologic time)

2) Homologous Structures – same basic structure formed from same embryonic tissue



3) Analogous Structures – same basic functions due to same environmental pressures

4) Vestigial Structures – structures that have lost function ex) appendix



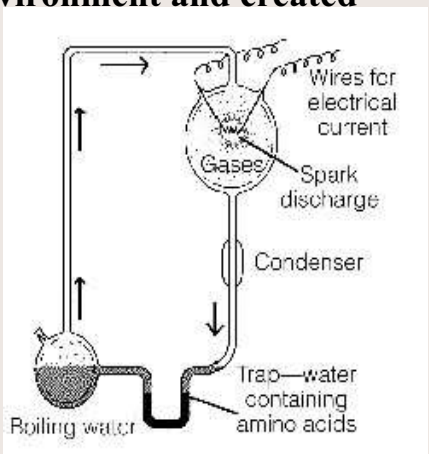
5) Embryology – embryos of various species appear identical

6) Biochemistry – DNA and protein amino acid sequence comparisons

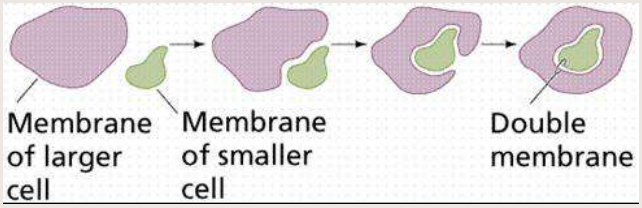
- **Adaptive radiation – an ancestral species radiates or diverges into many species. Ex) Galapagos Finches**

- **Origin Ideas**

Urey and Miller simulated Earth's early environment and created organic compounds like amino acid

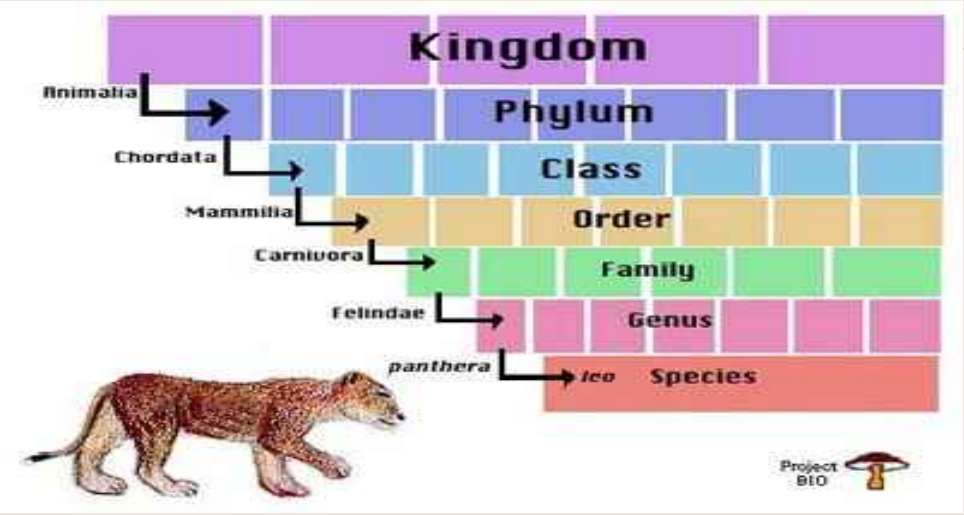


Endosymbiont theory – eukaryotic cells formed when prokaryotic cells began to live together permanently



Classification

- **Carolus Linnaeus – developed 7 categories of classification**



- **Also developed binomial nomenclature – naming using the genus and species names to refer to an organism**
- **Classification tools include dichotomous keys – a series of paired statements that lead to the name of an organism**

1a) Object has no sides . . . . . .Go to 2
1b) Object has sides . . . . . Go to 3
2a) Object is oblong . . . . . oval
2b) Object is symmetrical . . . . . circle
3a) Object has 3 sides . . . . . triangle
3b) Object has 4 sides . . . . . Go to 4
4a) Object has 4 equal sides . . . . . square
4b) Object doesn't have 4 equal sides . . rectangle

Kingdoms

- http://www.ric.edu/ptiskus/Six_Kingdoms/Index.htm
- How are organism placed into their kingdoms?

1) Cell type, complex or simple

2) Their ability to make food

- **3) The number of cells in their body**
- **Five Kingdom System**

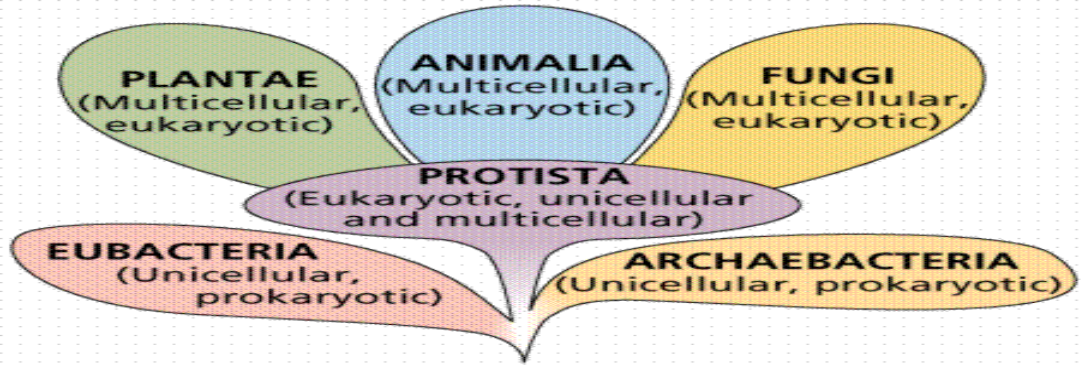
Monera – all prokaryotic includes the bacteria

Protista – most are unicellular, eukaryotic, and aquatic

Fungi – all eukaryotic heterotrophs that act as decomposers

Plantae – all eukaryotic autotrophs

Animalia – all eukaryotic heterotrophs that must eat other organisms for food



- **In Six Kingdom system the Kingdom Monera has been divided into the Archaebacteria and the Eubacteria**

Archaebacteria – are extremists that live in hot, acidic, saline, or other harsh environments

Eubacteria are "true" bacteria that come in 3 shapes

1) round (coccus)

2) rod (bacillus)

3) spiral (spirillus)

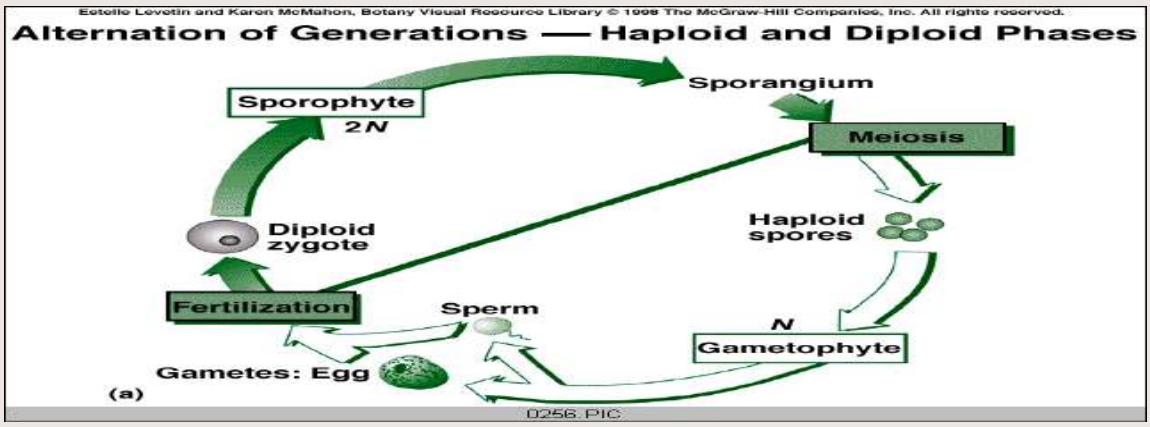
Plants

- Plant cell structure – cell walls, large vacuole, chloroplasts
- Photosynthesis
- Classification – 4 groups

1) Nonvascular – no true roots/stems/leaves – ex) mosses (Bryophytes)
2) Seedless vascular plants – Ferns
3) Vascular with seeds in cones – Gymnosperms (pines, fir, spruce)
4) Vascular with seeds in fruits – Angiosperms – flowering plants

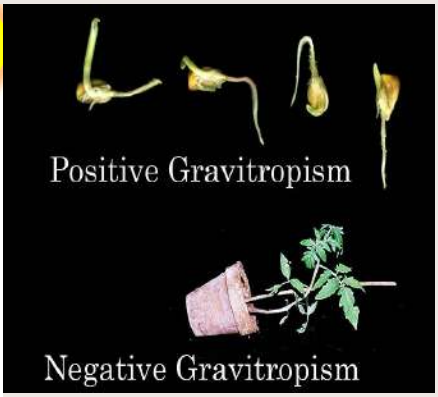
- Types of Vascular Tissue

A) Xylem – transports water from roots to leaves
B) Phloem – transports sugars from leaves to roots
Reproductive Life Cycle – called Alternation of Generations



- Tropisms – growth responses to stimuli – often controlled by hormones like auxins and gibberellins

Phototropism



Gravitropism

Thigmotropism

Animals

- **Modes of reproduction**
- **Animal cell structure – no cell wall, small vacuoles, no plastids, centrioles**
- **Classification – 2 main groups**

Vertebrates	Invertebrates
Phylum Chordata	9 Phyla
3 classes of fish	Arthropods – insects (6 legs)
Amphibians	(exoskeleton) - arachnids (8 legs)
Reptiles	- crustaceans
Aves (birds)	Mollusks – have shell created by
Mammals	structure called mantel

Human Anatomy – Look through the chapters in your book regarding anatomy.

*** Neurons**

*** Heart**

*** Kidneys**

Animal Behavior – responses that allow an organism to respond to stimuli

1) Innate Behavior – instincts, inherited, inborn behaviors

ex) circadian rhythms – daily patterns of activity – including feeding behaviors - nocturnal

ex) annual rhythms – yearly patterns of activity – including courtship, estivation, hibernation, migration

2) Learned Behavior – based on experience

ex) imprinting – recognition of parents

ex) Trial and error learning

ex) Conditioning (Pavlov's dog) – learning by association

3) Social Behavior – division of labor as in a termite or ant colony

Biologists

- **Robert Hooke – discovered and named the cell with crude microscope**
- **Anton van Leeuwenhoek - saw "wee little beasties" living cells for the first time**
- **Gregor Mendel – is the father of genetics – discovered the basic patterns of inheritance in pea plants**
- **Charles Darwin – is the father of evolution theory – proposed that organisms that are most fit or best adapted to their environment are more likely to survive – called Natural Selection**
- **James Watson and Francis Crick – discovered the double helix structure of DNA by examining an x-ray made by Rosalind Franklin and Maurice Wilkins**
- **Charles Drew – associated with our understanding of the ABO blood groups and transfusion**
- **Carolus Linnaeus – binomial nomenclature and classification of organisms**
- **Rachel Carson – wrote "Silent Spring" bringing to public attention the dangers of pesticides particularly DDT – this toxin bioaccumulates in the bodies of top consumers**
- **Jane Goodall – studied chimpanzee behavior**
- **Louis Pasteur – helped disprove abiogenesis or spontaneous generation by creating a s-neck flask and showing that microorganisms spoil food**