

4.4 Punnett Squares

Genotype: Genes that are passed on from parents, represented by letters (Rr)

Phenotype: The trait that an organism has (curly hair)

Dominant allele: Capital letter (R) and Trait will be seen

Recessive allele: Lower case letter (r) and Trait will be hidden unless both alleles are recessive (rr)

Homozygous Individual: Both alleles are the same (RR or rr)

Heterozygous Individual: Alleles are different (Rr)

Below is an example of how to cross a Heterozygous individual (Rr) and a homozygous recessive individual (rr).

| | | |
|---|----|----|
| | R | r |
| r | Rr | rr |
| r | Rr | rr |

Possible offspring from the above parental cross, as filled in the Punnett Square are:

2 out of 4 (50%) that could be Rr (Heterozygous individuals)

2 out of 4 (50%) could be rr (Homozygous recessive)

Below is an example of how to cross two heterozygous pea plants. Also given are the Genotype and Phenotype ratios and percentages.

Dominant and Recessive
(T = Tall & t = short
Cross: Tt x Tt)

| | | |
|---|----|----|
| | T | t |
| T | TT | Tt |
| t | Tt | tt |

Genotypic ratio: 1 : 2 : 1 (TT=25% Tt=50% tt=25%)
Phenotypic ratio: 3 : 1 (Tall=75% Short=25%)

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Science Booklet

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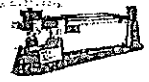

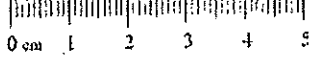
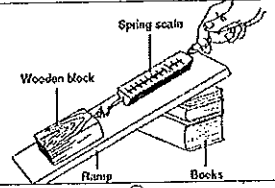


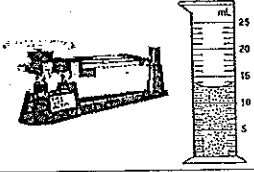
4.1 Sexual vs. Asexual Reproduction

4.2 Flower Reproductive Structures

4.3 Genes, Chromosomes & Inherited Traits

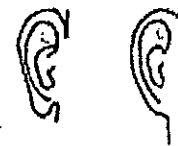
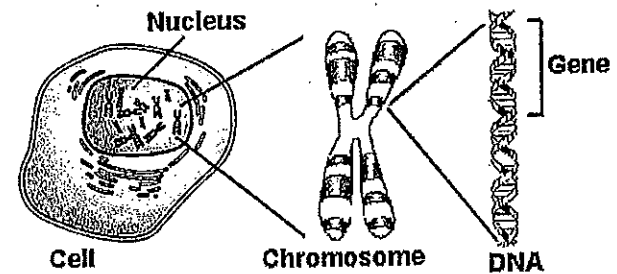
4.4 Punnett Squares

TE 1 & Inq 2 Tools

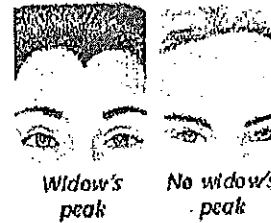
| Measure: | Tool: | Picture: | Unit: |
|-------------------------|------------------------------|---|---|
| Mass | Balance |  | Grams (g) |
| Volume | Graduated Cylinder |  | Milliliters (mL) |
| Length / Width / Height | Meter Stick |  | Meters (m) or Centimeters (cm) |
| Force | Spring Scale |  | Newtons (N) |
| Temperature | Thermometer |  | Celsius (C) |
| Time | Stopwatch |  | Seconds (s) or Minutes (min) or Hours (hr) |
| Density | Balance & Graduated Cylinder |  | Grams/Centimeter cubed (g/cm ³) |

4.3 Genes, Chromosomes, Inherited Traits

Your Inherited Traits (everything about you including looks) come from your genes. These genes are sections found on your Chromosomes. Chromosomes are tightly coiled up DNA found in each and every cell's nucleus.

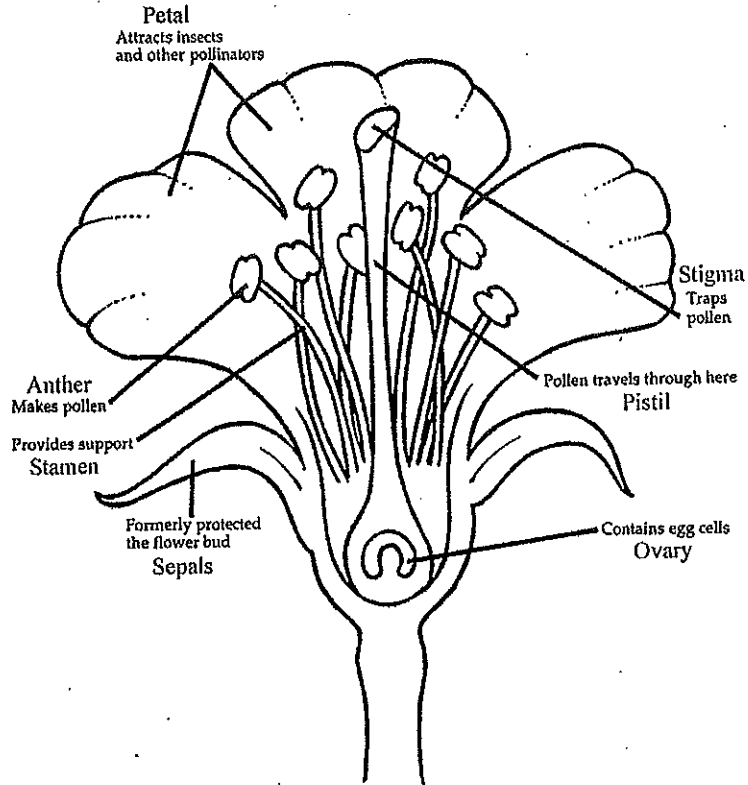


Inherited Traits – characteristic due to genes



4.2 Flower Reproductive Structures

Parts of a Flower



MALE (STAMEN)

- Anther: pollen
- Filament: holds up anther

FEMALE (PISTIL)

- Stigma: traps and collects pollen
- Style: tube joining stigma to ovary
- Ovary: contains ovules
- Ovules: eggs (becomes seed when fertilized by pollen)

Other

- Petal: attracts pollinators (insects and bees)
- Sepal: protects the bud
- Stem: provides water and nutrients from the ground

**The transfer of Pollen (male) to the Ovule (female) is called pollination. The joining of the two is sexual reproduction.*

TE 1 & Inq 2 Tools

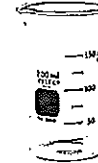
Tools Used in Science that have Purpose, but take no measurements:

- Test Tube



Perform experiments in

- Beaker



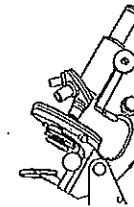
Used to pour liquids in to hold (fancy cup holder)

- Hand Lens



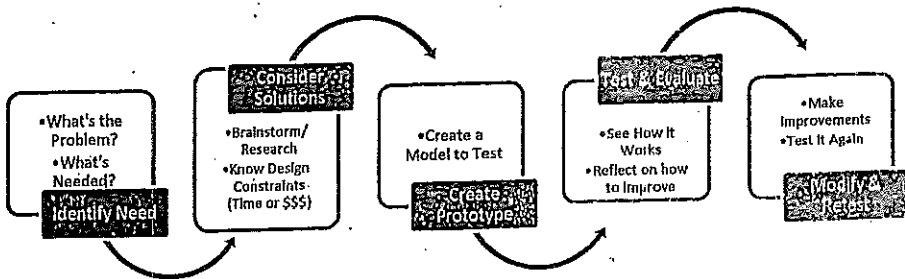
View object's details by making them appear larger

- Microscope



View objects that can not be seen with unaided eye

TE 2 Engineering Design Process



TE 3 Intended Benefits and Unintended Consequences of Technology

Intended Benefit: *Purpose* of a technology being created

Unintended Consequence: Happened as a *Result* of the technology created

Example:

Technology – Cell Phone

Intended Benefit – Make Calls

Unintended Consequence – Internet & Texting (positive)

Unintended Consequence – Increase in Car Accidents (negative)

Example:

Technology – use of pesticide DDT on crops

Intended Benefit – Keep Insects from Eating and Destroying Crops

Unintended Consequence – Weakening of Eagle Egg Shells (negative)

TE 4 Assistive vs. Adaptive Bioengineered Technologies

Assistive:

- Created to assist the general population
- Example: glasses, contacts, crutches, hearing aids

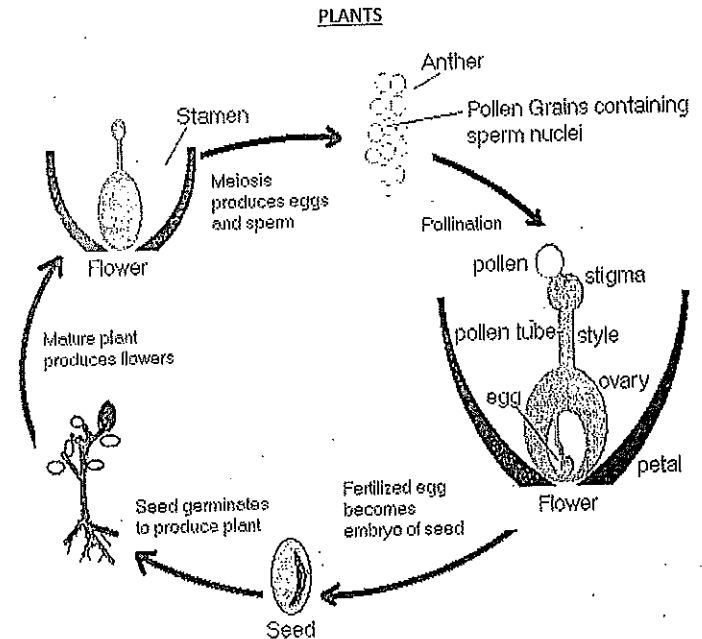
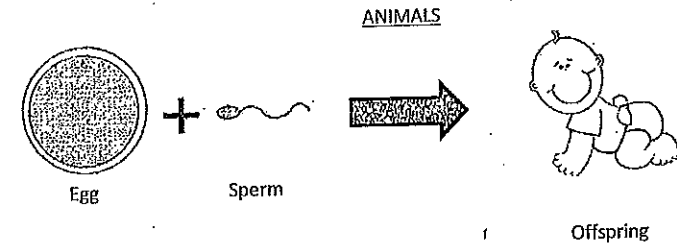
Adaptive:

- Technology that has been made or modified for a person with a disability
- Example: cochlear implant, braille, extra-large print keyboard
- Genetically modified plants is an example of adaptive engineering in plants

4.1 Sexual vs. Asexual Reproduction

Sexual Reproduction:

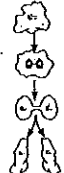
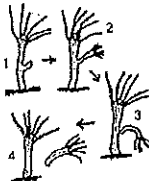


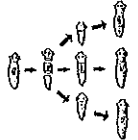
- 2 parents
- Requires the joining of sex cells (gametes)
- Sperm + Egg = Offspring in animals
- Pollen + Ovule = Seed in plants
- Combination of parents genes (great genetic variation)



4.1 Sexual vs. Asexual Reproduction

Asexual Reproduction:

- 1 parent
- Offspring genetically identical to parent
- Happens in our regular cells (mitosis)

| Some Methods of Asexual Reproduction | |
|--|---|
| 1. binary fission -- equal division of both the organism cytoplasm and nucleus to form two identical organisms --the diagram of bacteria |  |
| 2. budding -- involves one parent dividing its nucleus (genetic material) equally, but cytoplasm unequally -- the diagram of a hydra |  |
| 3. sporulation (spore formation) -- is reproduction involving specialized single cells coming from one parent -- the diagram is of mold spores |  |
| 4. runners -- underground stem off of parent plant produces identical offspring --the diagram of strawberry runner |  |
| 5. regeneration -- piece cut off has ability to regenerate body and sustain life --the diagram of planarian |  |

Inq 1 Control and Variables

Control:

- What remains the same throughout each experimental trial
- What you refer back to, to see if the independent variable affects anything

Independent Variable:

- What is changed so that you have an experiment

Dependent Variable:

- The measureable results

Example:

A student performed a science experiment to see if adding different ingredients to a cut roses water would make it live longer. The student put all the roses in the same environment (amount of water, sunlight, and temperature were constant). To one rose the student added an aspirin tablet. To another rose, the student added a penny. To another rose the student added plant food. And to one rose the student did nothing special to. What the student found from the experiment was that the rose that received the plant food lived for four days longer than all the other roses.

Controls: Same environment (amount of water, sunlight, and temperature) & the rose that the student did nothing special to.

Independent Variable: What the student added to the roses (aspirin, penny, and plant food).

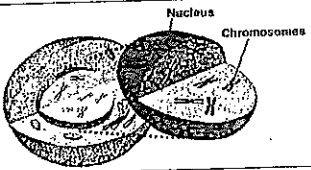
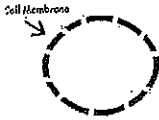
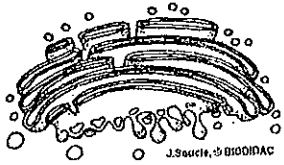





Dependent Variable: The results. The rose with the plant food lived four days longer.

Inq 5 Bias and Experimental Error

Bias -- when opinion or someone's wishes may influence or impact an experiment or its results

Experimental Error -- mistakes that are made due to equipment or human error

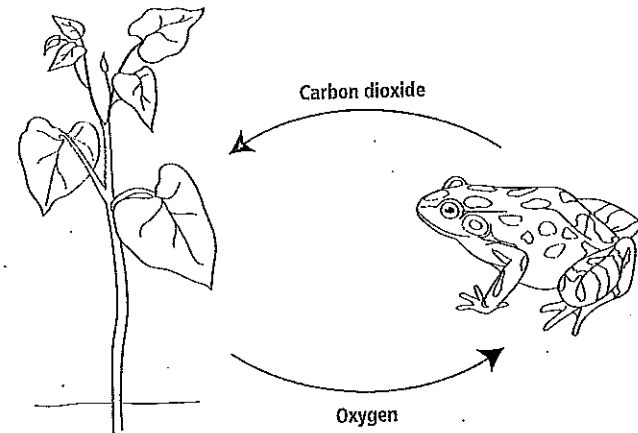
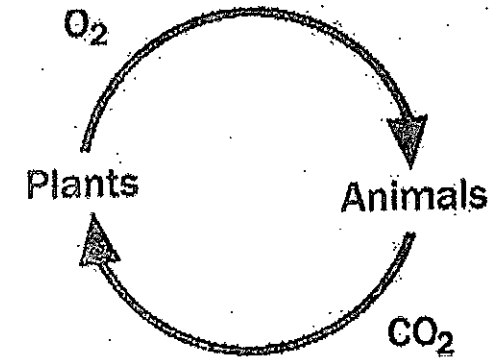
1.1 Cell Organelles

| | | |
|------------------------------|---|--|
| Nucleus |  | Controls all activities that are carried on within the cell, contains chromosomes (DNA). |
| Cell Membrane |  | Semi-permeable outermost edge of cell that controls what enters and exits the cell. |
| Endoplasmic Reticulum |  | Packages and transports proteins to the Golgi Apparatus. 2 types: rough (with ribosomes) and smooth (without ribosomes). Surrounds the nucleus. Also makes lipids and breaks down drugs. |
| Ribosome |  | Tiny spherical structures that make proteins from the directions given by DNA on how to connect amino acids. Float around within the cell or can be attached to the ER. |
| Mitochondria |  | Breaks down sugar molecules (glucose) to release ATP (energy), which is used by the cell. |
| Golgi Apparatus |  | Processes and ships proteins and other materials out of the cell. Found floating within the cytoplasm, usually away from the nucleus. |
| Centrioles |  | Tube like structures that release spindle fibers that attach to chromosomes making cell division possible. |
| Lysosomes |  | Contain digestive enzymes that breakdown worn out organelles, destroys foreign particles, waste, and digests food particles. |

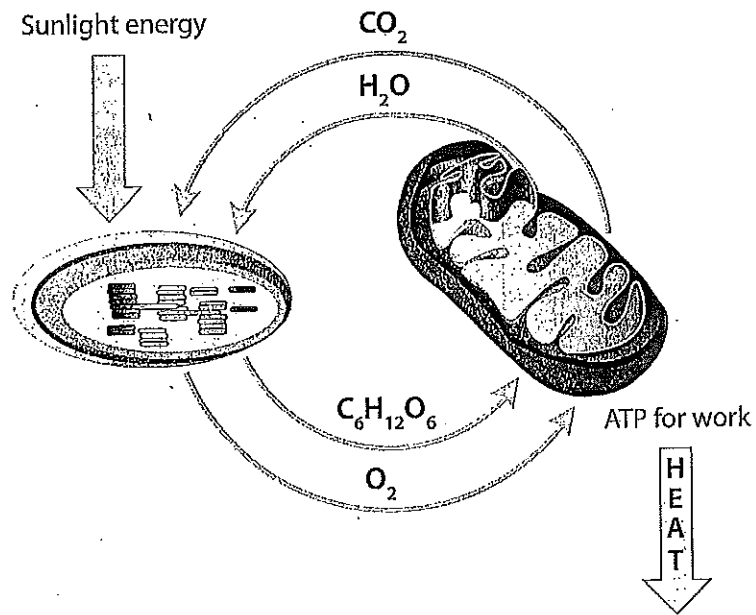
3.2 CO₂ & O₂ Cycle

Plants: Use Carbon Dioxide (CO₂) and Give off Oxygen (O₂)

Animals: Use Oxygen (O₂) and Give off Carbon Dioxide (CO₂)



3.1 Photosynthesis & Cellular Respiration

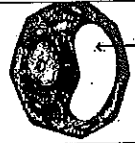
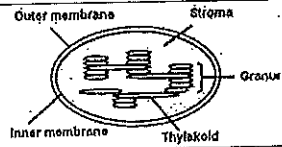
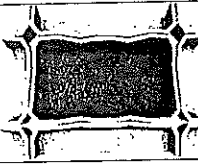



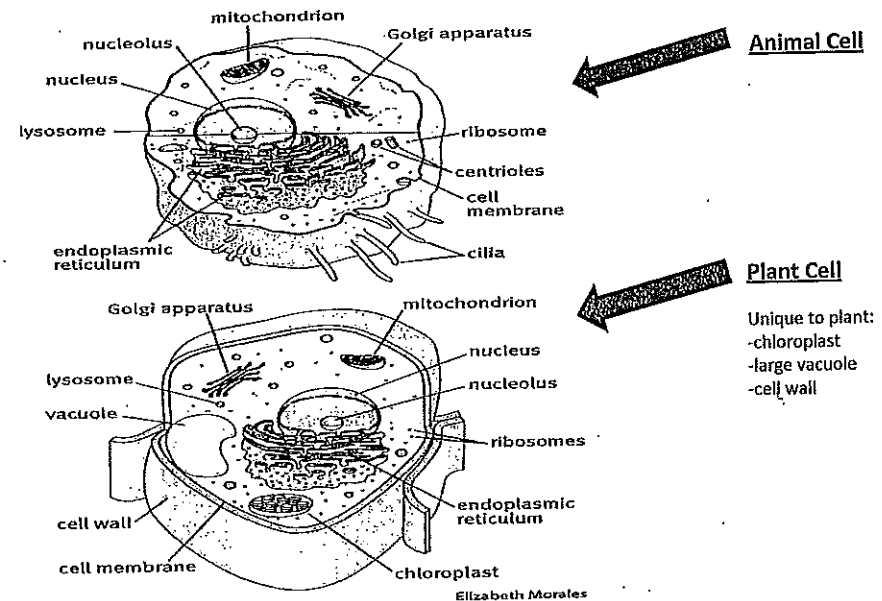
Photosynthesis

- It takes place in a chloroplast.
- Carbon dioxide and water react, using light energy, to produce glucose and oxygen.
- Light energy from the sun changes to chemical energy in glucose.

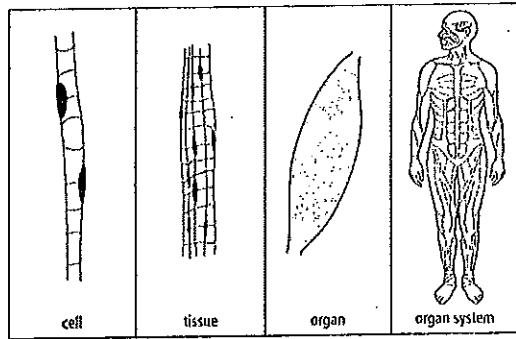
Cellular respiration

- It takes place in a mitochondrion.
- Glucose and oxygen react to produce carbon dioxide, water, and energy (ATP).
- Chemical energy in glucose changes to chemical energy in ATP.

| | | |
|-------------|---|---|
| Vacuoles |  | Stores food, water, and waste. Large Central Vacuole found ONLY IN PLANT CELLS. |
| Chloroplast |  | Uses sunlight to make food (glucose). ONLY IN PLANT CELLS. |
| Cell Wall |  | Outermost structure of plant cell that provides support. ONLY IN PLANT CELLS. |
| Cytoplasm |  | Jelly-like substance that fills the inside of the cell. |



1.2 Levels of Organization of Life

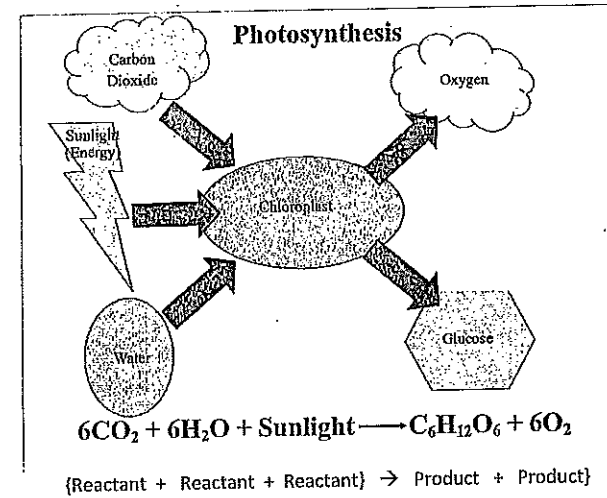


Cell → Tissue → Organ → Organ System → Organism
 Least Complex → Most Complex

3.1 Photosynthesis & Cellular Respiration

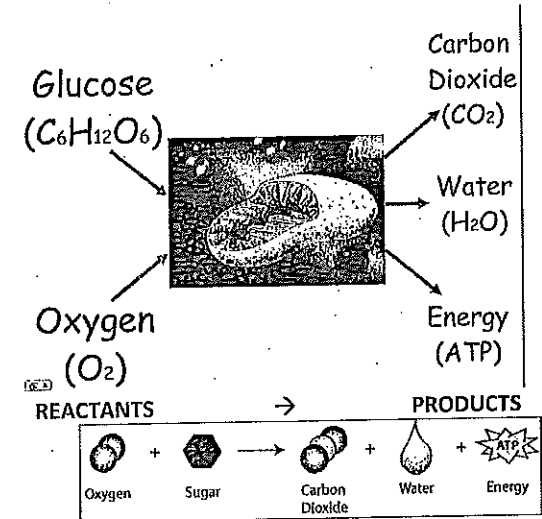
PHOTOSYNTHESIS

- Plants make food (glucose / $C_6H_{12}O_6$ / sugar)
- Chloroplast



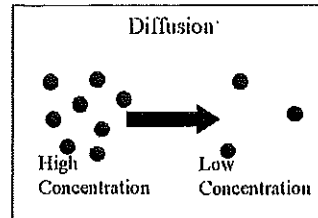
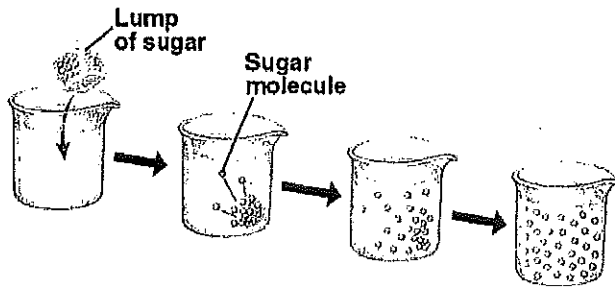
CELLULAR RESPIRATION

- Cells break down huge glucose ($C_6H_{12}O_6$) molecules into smaller pieces the cell can use (ATP)
- Mitochondria



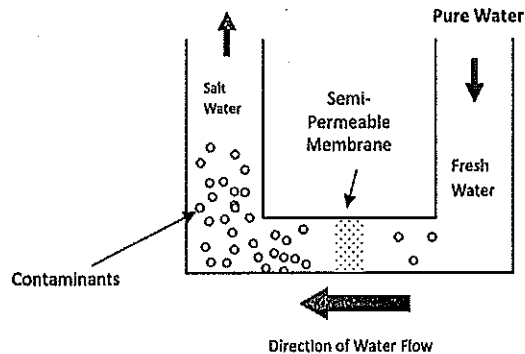
1.5 Simple Diffusion

Diffusion



Diffusion –the movement of particles from an area of high concentration to an area of low concentration until equilibrium/isotonic is reached. (high to low)

Osmosis



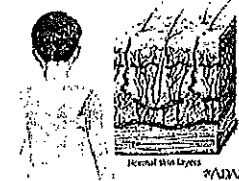
Osmosis –the diffusion of WATER through a semi-permeable membrane. The water moves from an area of a high concentration of water to an area of a low concentration of water until equilibrium/isotonic is reached. (water moves toward solutes) Solutes are the dissolved pieces of a substances' particles. Shown above as contaminants.

1.3 Organ Systems

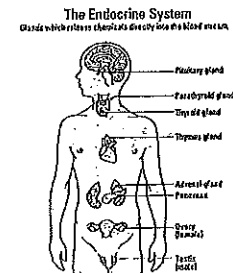
| System | Function -Major Organs |
|--------------------------------|---|
| Digestive | Breaks Down Food, Absorbs Water and Nutrients -Mouth, Teeth, Stomach, Intestines, Rectum |
| Integumentary | Covering that Protects Internal Tissues, Barrier Between Inside and Outside of Body -Skin, Hair, Nails |
| Endocrine | Secretes Hormones that Regulate Body Functions -Pituitary Gland, Thyroid, Adrenal Glands, Testes(male); Ovaries(female) |
| Lymphatic/Immune | Defends Against Infection and Disease -Lymph Nodes, White Blood Cells |
| Urinary/Excretory | Filters and Excretes Waste Products From Blood -Kidneys, Bladder, Urethra |
| Skeletal | Protects Vital Organs, Serves as Attachments for Muscles, Supports Body -Bones, Cartilage |
| Muscular | Enables Movement, Moves Materials Through the Body, Generates Heat -Skeletal Muscles, Tendons, Smooth Muscle |
| Respiratory | Supplies Blood With Oxygen and Removes Carbon Dioxide by Breathing -Nose, Trachea, Lungs |
| Circulatory/ Cardiovascular | Pumps Blood, Transports Oxygen, Nutrients and Other Needed Materials to Cells, Transports Waste Away from Cells -Heart, Blood Vessels, Blood |
| Reproductive | Produces Sex Cells and Hormones That Can Produce Offspring, Supports Embryo and Provides Milk In Females -Testes, Penis, Vas Deferens (male) –Ovaries, Vagina, Uterus (female) |
| Nervous | Control System that Detects and Responds to Changes in the Environment -Brain, Spinal Cord, Nerves |



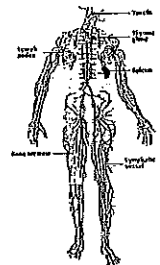
Digestive



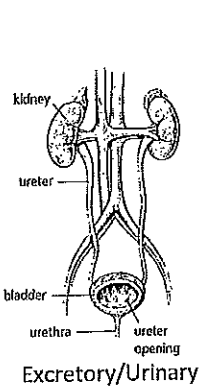
Integumentary



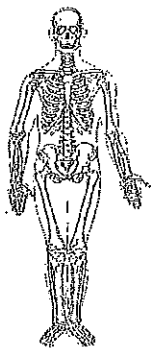
Endocrine



Lymphatic/Immune



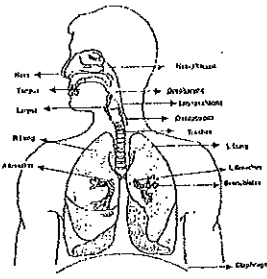
Excretory/Urinary



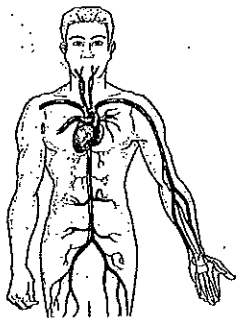
Skeletal



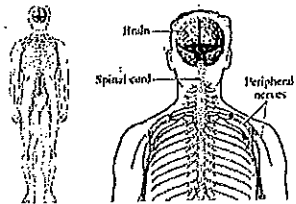
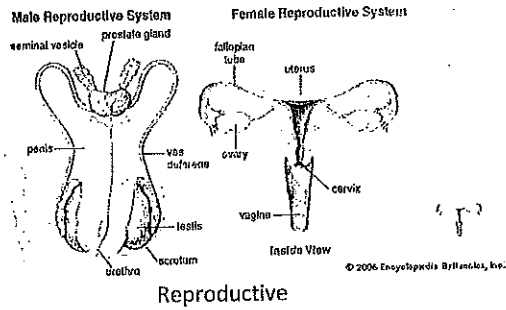
Muscular



Respiratory

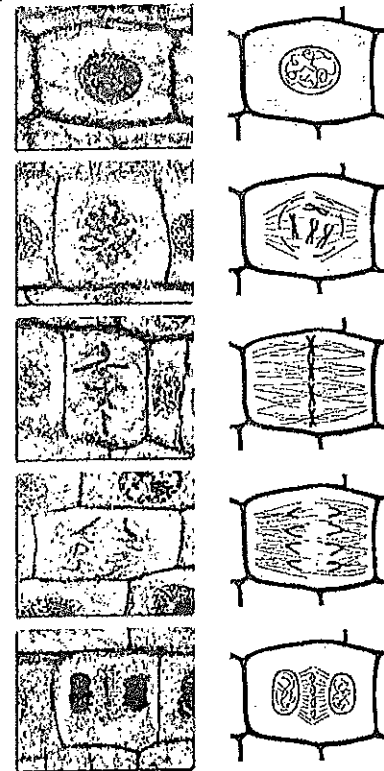


Circulatory/Cardiovascular



Nervous

1.4 Mitosis



| | |
|------------|--|
| Interphase | Chromosomes (DNA) is copied |
| Prophase | Chromosomes condense and centrioles move to the poles |
| Metaphase | Chromosomes line up in the <u>m</u> iddle |
| Anaphase | Chromatids pull <u>a</u> part |
| Telophase | <u>T</u> wo identical cells are now separated by a cell plate that once cytokinesis is completed forms a cell wall |

- Type of Asexual Reproduction that results in two identical daughter cells
- Also known as Cell Division
- During Telophase of Plant Mitosis – a Cell Plate forms