#1: OBSERVATION

- To witness using the 5 senses (hearing, tasting, touching, smelling, sight)
- Using an instrument to extend powers of observation
  - Ex- taking measurments (data)

#2: INFERENCE

- To interpret, predict or guess based on what you observe.

#3: Steps of the SCIENTIFIC METHOD

1. **Problem** .....(a question)
2. **Hypothesis** .....(your prediction)
3. **Materials** ..... (what you need)
4. **Procedure** .....(step by step plan)
5. **Observation**...(measurement, data, graph)
6. **Conclusion** .....(what you discover)
7. **Error** .....(where mistakes and outside factors effected results)

"**P**lease **H**elp **M**y **P**oor **O**ld **C**at **E**rnie"

#4: INDEPENDENT Variable

- The "I" change variable
- **MANIPULATED** variable
- What was changed before the experiment starts

#5: DEPENDENT Variable

- **MEASURED** change in experiment
- What you OBSERVE
- Collect DATA on
- Responds / reacts to the Independent Variable

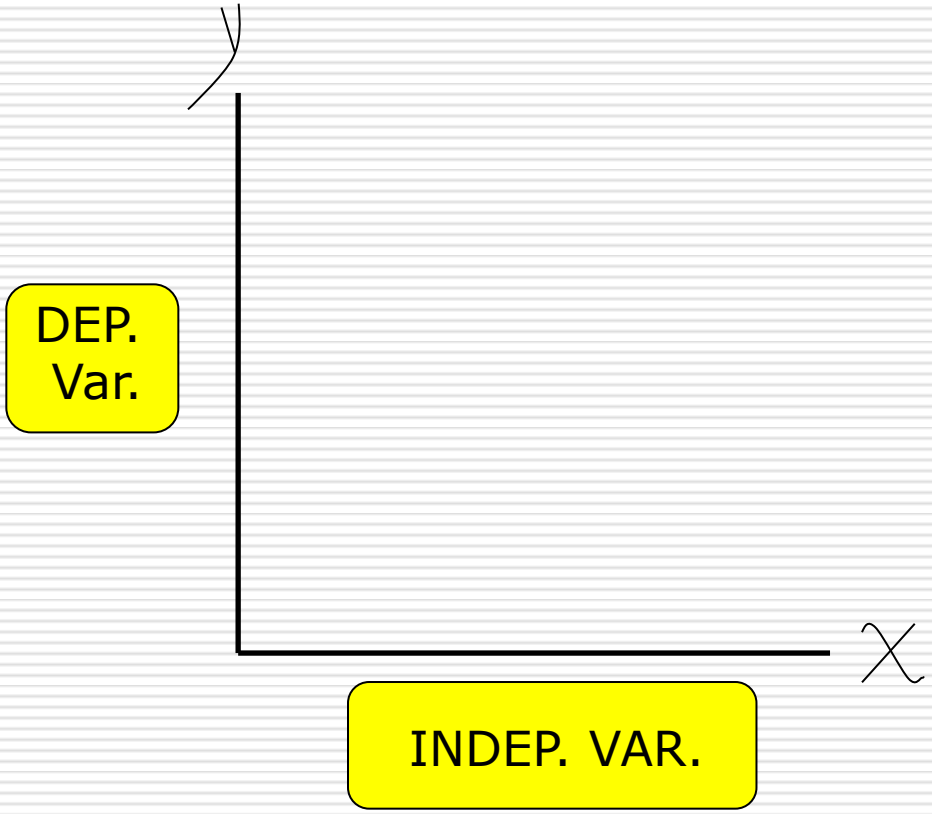
#6: Control Group vs. Experimental Group

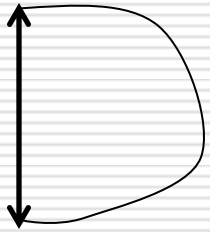
- The EXPERIMENTAL Group gets the Independent Variable. Can have multiple experimental groups

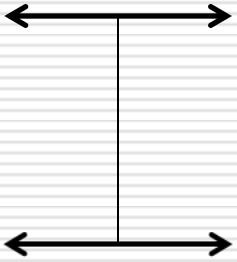
- **CONTROL** group is exactly the **same *minus*** *the* ***independent variable***

- You compare the results of the experimental group to the control group.

#6B: Graphing Variables







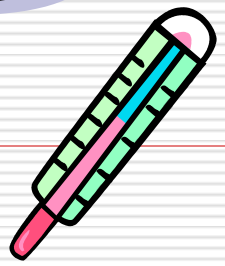
#7: Tools of Measurment

- Length: Ruler (cm)

- Volume: Graduated Cylinder (ml or cc)

- Mass: Triple Beam Balance

- Temperature: Thermometer



#8: MASS

- The amount of MATTER (**atoms and molecules**) in a substance.
- Measured in Grams (g)
- Mass is not Weight!
  - Weight is mass x gravity
  - An object has a downward force or weight due to it's mass and gravity
- Instrument -***TRIPLE BEAM BALANCE***

#9: VOLUME

- The amount of SPACE an object takes up
- Measured in cm^3 or ml
- Regular solid = LxWxH
- Irregular solids = water displacement method

#10: DENSITY

- **Amount of Mass per Volume**
- **# of grams (g) in a ml or cm^3 or cc**
- **D = M/V**
- **Units:**
  - **g/cc**
  - **g/ml**
  - **g/cm^3**

#10B: Density Facts

- Density never changes for a pure substance
  - It is a PROPERTY of matter
    - Ex- Aluminum is 2.7 g/cc
    - If you cut it in half each piece is still 2.7 g/cc
- Water is 1.0 g/cc
    - Greater then will sink
    - Less then will float

#11: Cell Theory

- All living things are made of cells.
- Cells are made by other cells
- Cells carry out all life functions

#12: Cell Organization

- Cells → Tissues → Organs → Organ System → Organism

- Cells make up Tissue, Tissues make up Organs make up Organ Systems which make up the Organism.

14: Cytoplasm

- The “gel-like” substance in a cell that all the organelles (parts of the cell) are sort of floating in.

13: Cell Membrane

- Surrounds and Protects the cell
- Allows “stuff” (nutrients,water,waste) into and out of the cell

15: Cell Nucleus

- "Brain" of Cell
- Controls all cell functions
- Has the D.N.A.

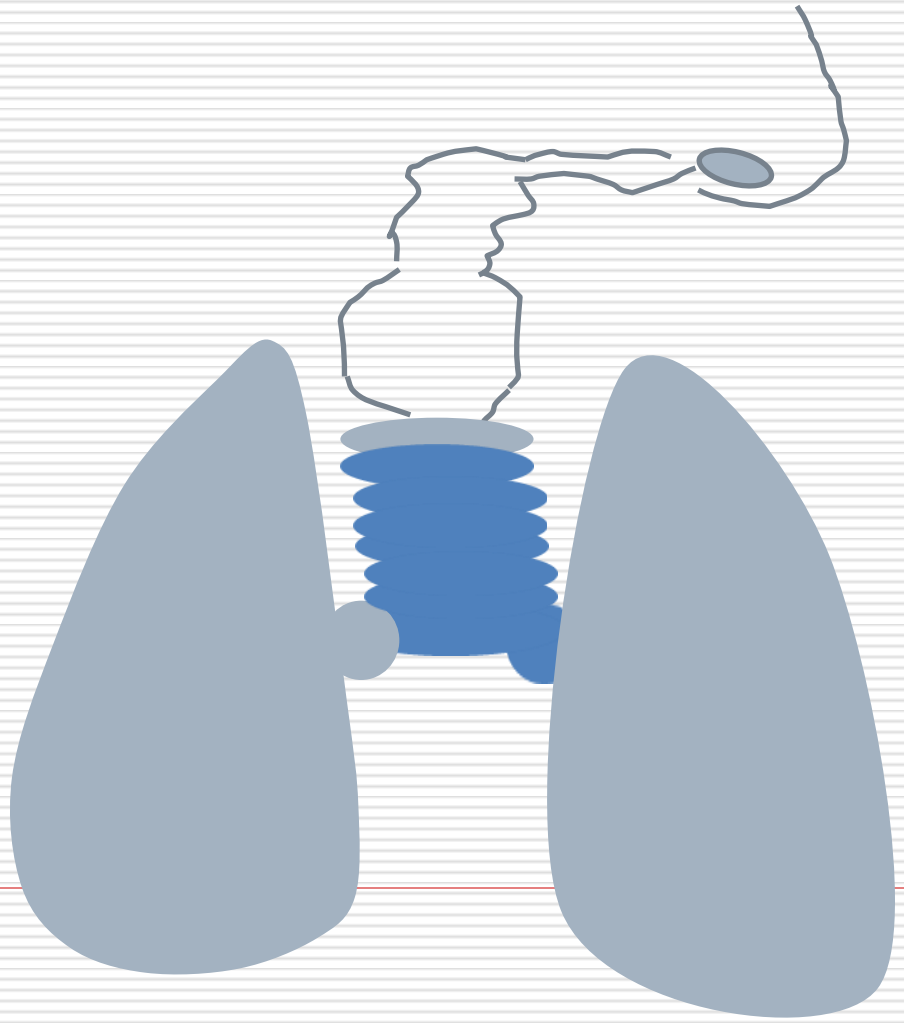
#16: Endoplasmic Reticulum (ER)

- "Highway" of the cell
- Looks like a network of tubes
- Allows stuff (nutrients/waste), to move around the cell from one area to another
- "Rough ER": has Ribosomes
  - RIBOSOMES MAKE PROTEIN

#18: Respiration

- The process by which a body gets and uses oxygen and releases carbon dioxide and water.
- **Cellular Respiration** is when the ***Mitochondria*** releases energy stored in **glucose (sugar / $C_6H_{12}O_6$)**

#19: Parts of Respiratory Sys.



#20: ALVEOLI

- Tiny sacs in lungs surrounded by capillaries (blood vessels)
- **Diffusion** / gas exchange occurs
  - **oxygen enters bloodstream**
  - **carbon dioxide and water vapor exits**

#21: Diaphragm and Epiglottis

- Muscles that **contract involuntarily**
  - **DIAPHRAGM**: located at the base of chest cavity contracts to enlarge volume and draw air into Lungs
  - **EPIGLOTTIS:** located at back of throat contracts when swallowing to prevent food / liquids from entering trachea / lungs

#22: Respiratory Diseases

- VIRAL INFECTIONS within the lungs that make it difficult to breath
  - SARS
  - Influenza ("Flu")
- Bronchitis – bacterial infection that causes bronchi to swell
- Emphysema – damage alveoli can't absorb oxygen efficiently from habitual smoking

23: Excretory System

- Excrete (**get rid of**) wastes (liquid and gas)
  - carbon dioxide, water, salt, urea and uric acid
    - ***NOT*** SOLID WASTE (egestion=feces)

#24: Parts of Excretory Sys.

- **Skin**- ***removes*** excess **water, salt, urea**
- **Lungs**- ***removes*** **CO_2** and excess heat by breathing
- **Kidney and Liver**- ***Filters*** (urea, toxins) from **BLOOD**

25: Steps of DIGESTION

- **Ingestion**: taking in food
- **Digestion**: breaking down food into nutrients
- **Absorption**: taking in nutrients by cells
- **Egestion**: removing any leftover wastes

26: Types of DIGESTION

- Mechanical (physical)
  - Mouth / Teeth / Stomach
    - Chew, Tear, Grind, Mash, Mix
- Chemical
  - **ACIDS and ENZYMES** breakdown:
    - **Carbohydrates** (sugars / starches)
    - **Proteins** (meat / nuts)
    - **Lipids** (fats / oils)

27: Digestive System Parts

1. **MOUTH**: mechanical breakdown, starts chemical of carbs by saliva
2. **ESOPHOGUS**: "food tube" to stomach, secretes lubricating mucus, PERISTALSIS
3. **STOMACH**: "J" shape mechanical muscle / enzymes and acids chem. breakdown of fats, proteins
4. **SMALL INTESTINE**: absorption
   - **VILLI- diffusion of nutrients into capillaries**
5. **LARGE INTESTINE**: absorbs water
6. **RECTUM**: stores feces / whatever is left

28: Circulatory System

- -**transport oxygen** and **nutrients** to cells
- -***carry wastes away from cells*** to organs for disposal
- PARTS
  - **HEART**- pumps
  - **BLOOD**
    - ***Ateries away*** from Heart / Veins toward
    - CAPILLARIES: tiny vessels that connect them

29: Parts of Heart

- **SEPTUM** – divides the heart into two sides
- **ATRIUM** – Upper chambers of the heart (***receive the blood*** – thinner walls)
- **VENTRICLES** – Lower chambers of the heart (pumps ***blood out of the heart-*** thicker muscular walls)
- **VALVES** help stop the blood from flowing backwards

30: Blood Cells

- **RED** : no nucleus / dohnut shaped / carry oxygen to cells / made in bone marrow

- **WHITE :** large / no shape / identify and kill pathogens (microscopic invaders, microbes) / have nucleus

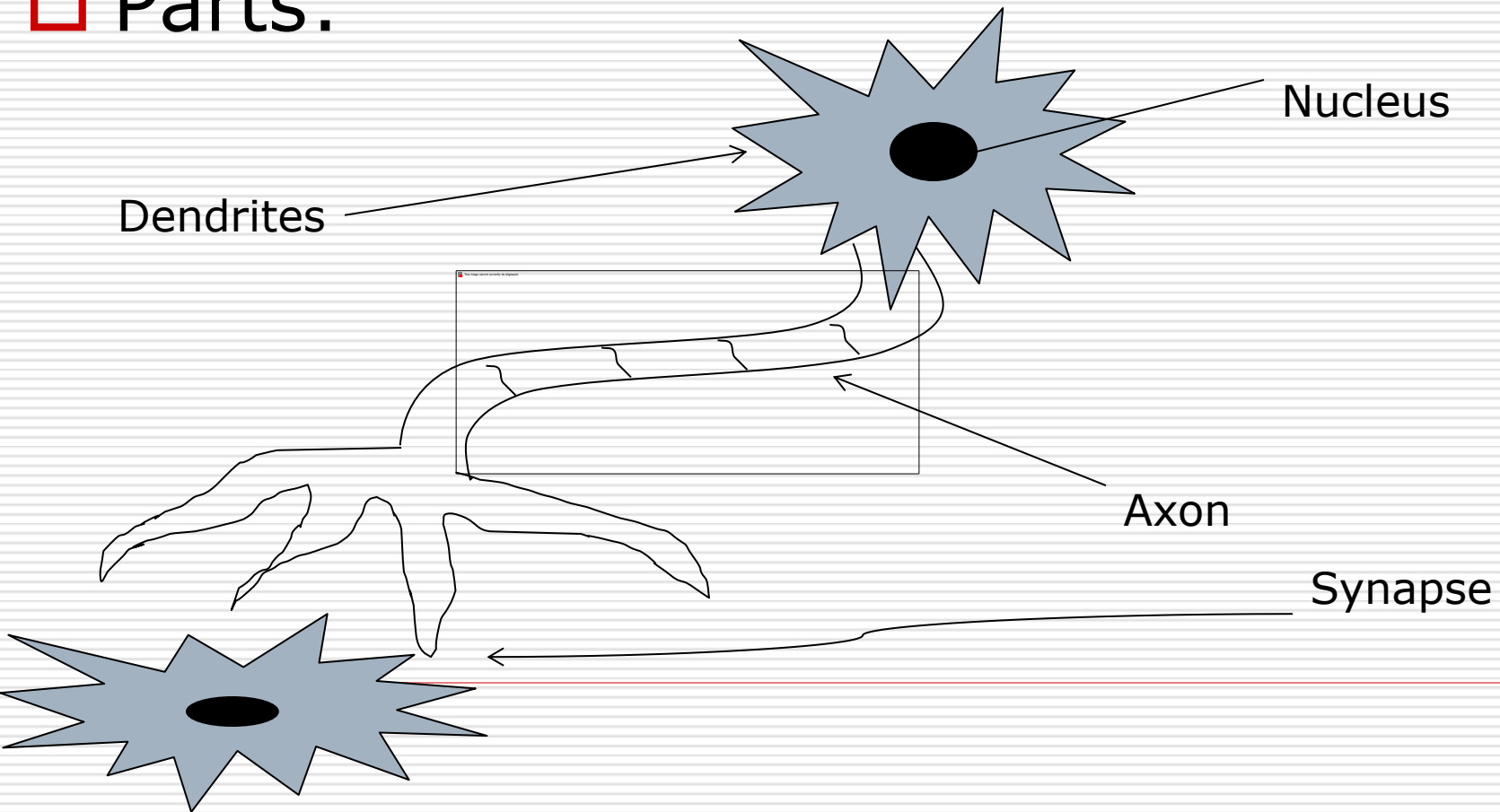
- **PLATELETS:** very small / clotting / heals cuts

#31: Nervous System

- Controls all body activities
- Main Parts
  - Peripheral
    - nerves
  - CNS (central nervous sys)
    - BRAIN
    - SPINAL CHORD

32: NEURON

- Nerve cell- carry message to and from brain
- Parts:



33: Stimuli / Response

- **Stimulus**- any environmental or external factor that causes a response from your Nervous System
  - EX: NOISES, CHANGE IN TEMP., LIGHT, TOUCH, SMELLS, ETC…
- **Response**- when RECEPTOR cells or organs (skin, eyes, ears, nose, antennae) *REACT to outside stimuli*

34: Types of NEURONS

- **SENSORY** (senses)
  - Receptors to brain
    - Eyes, ears, nose, tongue, skin

- **MOTOR**
  - **BRAIN to EFFECTORS=** Central Nervous System (CNS) to muscles

35: Parts of Brain

- Cerebrum
  - Voluntary action (picking up a pencil)
  - Senses
  - Memory
- Cerebellum
  - Coordination / Motor skills (balance, walking, writing
- Medulla (brain stem)
  - Involuntary (breathing, heartbeat)

36: Endocrine System

- Helps body:
  - coordinate life processes
  - maintain ***HOMEOSTASIS***
  - Respond to environment
- Made of:
  - ***Glands*** – secretes hormones into plasma of blood
    - ***Hormones*** – chemical messengers that tell organs to exert their function

37: Head and Neck Glands

- **Hypothalamus** Gland- brain region controlling pituitary gland
- **Pituitary** Gland(master gland)- at the base of the brain, controls activities of many other glands, produces growth hormones
- **Parathyroid** Gland- part of thyroid, controls calcium, produces parathyroid hormone
- **Thyroid**- in the neck, produces thyroxin which controls metabolism

38: Midsection Glands

- **Adrenal Glands**: located at the top of kidneys, produces ***adrenalin***, speeds up heart rate and blood flow, sweaty palms
  - Helped ancestors hunt and run from danger, helps you score on the soccer field, etc…

- **Pancreas**: Top stomach, produces ***insulin***, lowers blood sugar

39: Gonads

- Reproductive (sex) Glands
  - **TESTES** / Males
    - Location – scrotum
    - Produces – **TESTOSTERONE** (male hormone) and Sperm (male reproductive cell)
  - **OVARIES** / Females
    - Location – inside abdomen
    - Produces – **ESTROGEN** (female hormone) and Egg (female reproductive cell)

#40 Skeletal System

- Supports and protects the body
- Protects organs
- Stores minerals (calcium, etc…)
- ***MARROW***
  - *Produces* **Blood** Cells
    - **WBC**
    - **RBC**
    - Platelets

#41:Parts of Bone

- Spongy bone- part of bone with many small pores(spaces)
- Compact Bone- mostly solid, dense part of bone
- Marrow- soft tissue in bones, produce blood cells

#42 Joints

- Where two bones meet
  - Fixed joints: no movement (skull plates)
  - Movable joints
    - Ball and socket (hip)
    - Gliding (wrist)
    - Hinge (elbow and knee)
    - Pivotal (neck)
  - Partly movable: little bit of movement
    - Spine
    - Where ribs meet sternum

#43: Muscles

- More than 600 in the body
- Long fibers / cell
  - Contract (get smaller) when signaled by brain to move body
- Help body move
  - INVOLUNTARY
  - VOLUNTARY

44: Voluntary vs. Involuntary Muscle

- **Voluntary**
  - You are in control by thinking about it
    - Bicep- moves your arm
      - CEREBRUM
- **Involuntary**
  - They work automatically
    - digestion, breathing, blood circulation.
      - MEDULLA

45: Types of Muscle

- Smooth
  - **Not** striated (striped) / ***IN****VOLUNTARY*
  - found around the **internal organs**
    - blood vessels, stomach
- Cardiac
  - Striated / ***IN****VOLUNTARY*
  - In **heart only**
- Skeletal
  - Striated / *VOLUNTARY*
  - Attached to bones / **moves skeleton**

#46: Tendon vs. Ligament

- TENDON
  - Bone to Muscle
    - Moves the joint
- LIGAMENT
  - Bone to bone
    - Stabalizes the joint

#45: Plant Cell vs. Animal Cell

- Only plant cells have –
  - Cell Wall (cellulose / fiber)
  - Chloroplasts (green chlorophyll for photosynthesis)
  - Only one very large vacuole
  - Plant Cells DO **NOT** have Lysosomes

#47: Taxonomy

- Classification system for life on Earth
- Remember="King Philip Came Over For Good Soup"
- Kingdom
  - Phylum
    - Class
      - Order
        - Family
          - Genus
            - Species

#48: Vertebrates

- Kingdom - Animalia
  - Phylum – Chordata (Vertebrates)
    - **5** Animal *CLASSES* with an **INTERNAL SKELETON** / BACKBONE or Spine
    - Ex- FISH , AMPHIBIANS, REPTILES, BIRDS, MAMMALS DINOSAURS too
    - **F.A.R.B.M.**

#49: Invertebrates

- Animals without a skeleton or backbone
  - Phyla-**Arthropoda**: EXOSKELETON
    - **Insects**
    - **Spiders** (arachnida),
    - **Crustaceans** (crabs, lobsters, isopods: horseshoe crabs, "rolly-pollies," sand crabs)
- **Other Invertebrates:**

  Phyla- Molluska (squid, snails, clams)

  Phyla- Annelida (worms)

  Phyla- Cnideria (jellyfish, coral)

  Softbodied

  Phyla- Echinodermata (starfish, sand-dollars, sea urchins)

#50: Adaptation

- Physical or Behavioral characteristics that make an organism better suited for survival in it's environment.
  - EX:
    - Long neck of giraffe enables it to reach high branches for food.
    - Pack hunting techniques of Lionesses and Wolves
    - Camoflauge
    - Mimicry (leaf bug, flies that look like wasps)

#51: Dichotomous Key

- Tool used by scientists to name organisms

- A series of YES/NO questions about the ***physical characteristics*** that leads to a name

#52: Exothermic

- (Outside – Heat)
- Animals that can not produce their own body heat
- “Cold-Blooded”
- Must get heat from their environment / surroundings
- Ex- Amphibians, Reptiles, Fish, All Invertebrates

#53: Endothermic

- (Inside – Heat)
- Animals that produce their own body-heat
- "WARM BLOODED"
- EX- **Mammals** and **Birds**

#54: Body Symmetry

- **RADIAL –** like a starfish, outward from center in all directions (radius) ex-starfish

- **BILATERAL** – Left side identical to right side, most animals have
  - ex- all vertebrates, all arthropods

- **ASYMMETRY** – without symmetry, like coral and sponges, ex- coral

#55: Reproduction

- **SEXUAL**: 2 individuals create a new organism mixing their DNA (sperm and egg)
  - Almost all plants and animals

- **Asexual**: (NON SEXUAL) one organism makes a genetic clone / copy of itself
  - Ex: Fission – amoeba, algae, plankton, bacteria
    Budding – hydra, yeast
    Spores – Fungi (mold, mushrooms)
    - Ferns

#56: Metamorphosis

- **COMPLETE**
  - **Egg → Larva → Pupa → Adult**
    - **Ex- catepillar → cocoon → butterfly**

- INCOMPLETE

  Egg → Nymph → Adult

  ex- grasshopper

#57: Photosynthesis

- How plants (**autotrophs / producers**) can make their own food.

  - $H_2O + CO_2 + Light = C_6H_{12}O_6 + O_2$

  - water + carbon dioxide + energy = glucose + oxygen

#58: Respiration

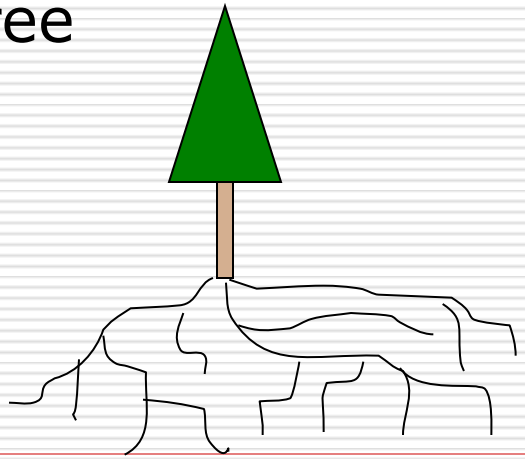
- The burning of Glucose (sugar) for energy in Plants and Animals

  - Glucose+Oxygen → Water+Carbon Dioxide+Energy

  - $C_6H_{12}O_6 + O_2 \longrightarrow H_2O + CO_2 + \text{Heat}$

#59: Roots

- Supports / Anchors plant in ground
- Draws up water and nutrients
- Two Types
  - **TAPROOT –** Carrot, Beets
  - **FIBROUS -** tree



#60: Leaves

- Releases excess water through stomata
  - TRANSPIRATION
- PHOTOSYNTHESIS takes place (GREEN)

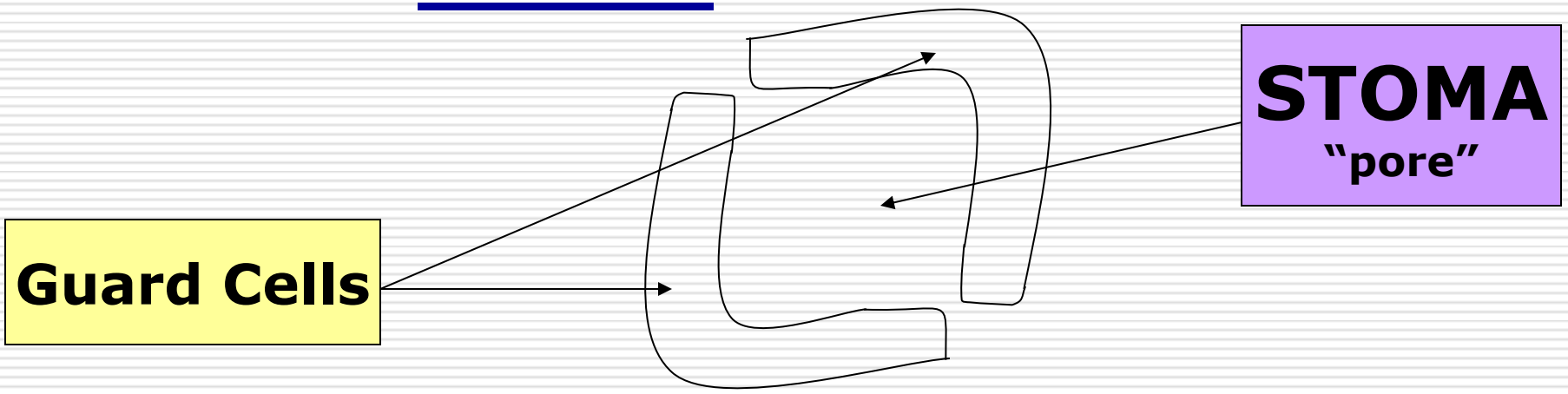
#61: Stems

- Supports Plant Leaves
- Transports water, food, nutrients through vein-like structures
  - **XYLEM**- WATER UP FROM ROOTS
  - **PHLOEM**-FOOD DOWN FROM LEAVES
- Types:
  - **HERBACEOUS –** soft, green (photosynthesis), Dies in winter, ex- grass
  - **WOODY –** stiff, not green (no photo.), lives year round, ex- tree or bush

"Photosynthesis phloem down"

#62: Transpiration

- Process where plants release excess water and gases through the **STOMATA**
  - Pore made by two guard cells in **LEAVES**

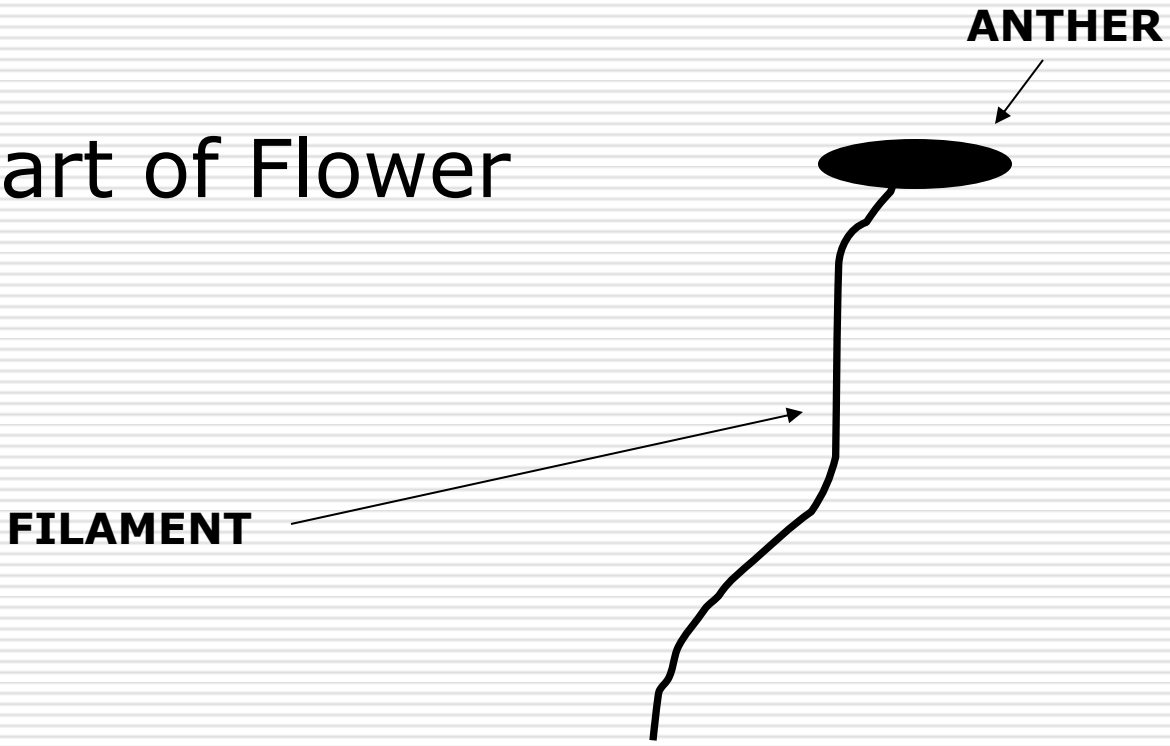


#63: 4 Ways Water Enters Plant

- **Osmosis**: water moves across cell membrane
- **Transpiration**: water out stomata
- **Capillarity**: water up through air spaces (like paper towel)
- **Root Pressure**: roots soak up water and force water up

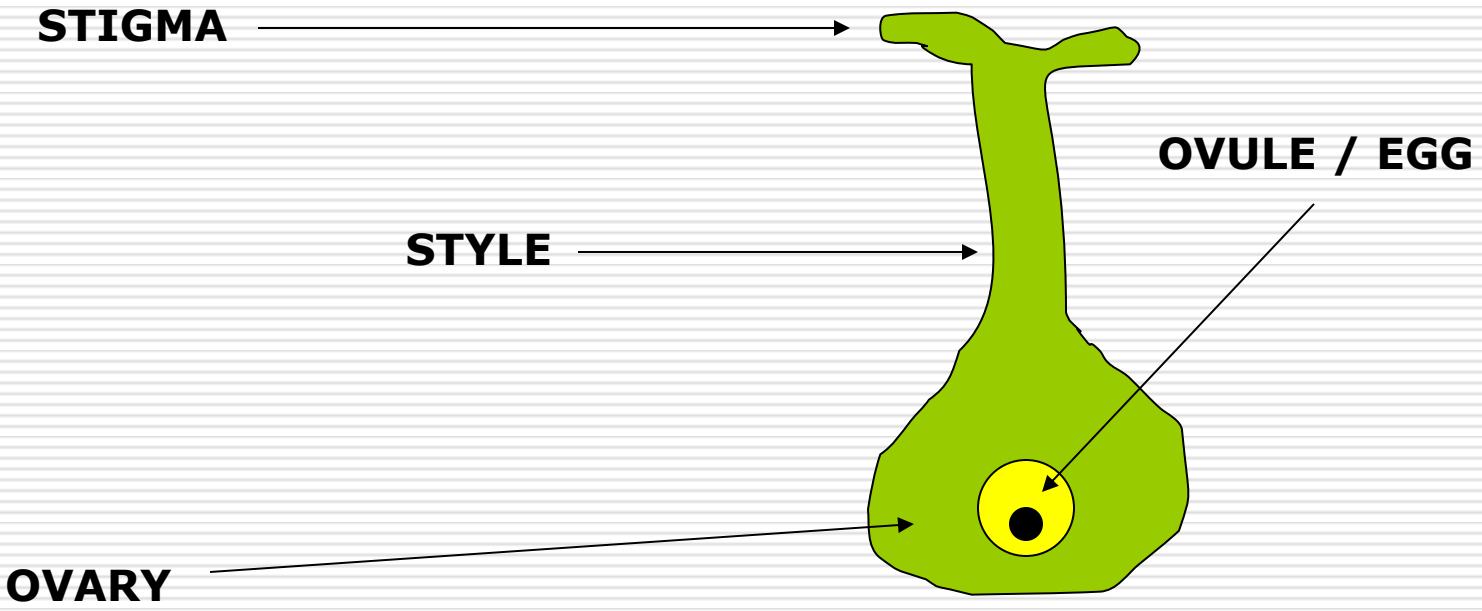
#64: Stamen

- Male part of Flower



#65: Pistil

- Female part of Flower



#66: Filament

- Stalk part of STAMEN
- Holds up / supports the ANTHER

#67: ANTHER

- Top part of STAMEN
- Makes POLLEN
  - Contains Sperm Cell

#68: OVARY

- Bottom part of PISTIL
- Holds Ovule with Egg Cell inside
- Grows into a fruit after Fertilization
  - Mmmmmmmmm!

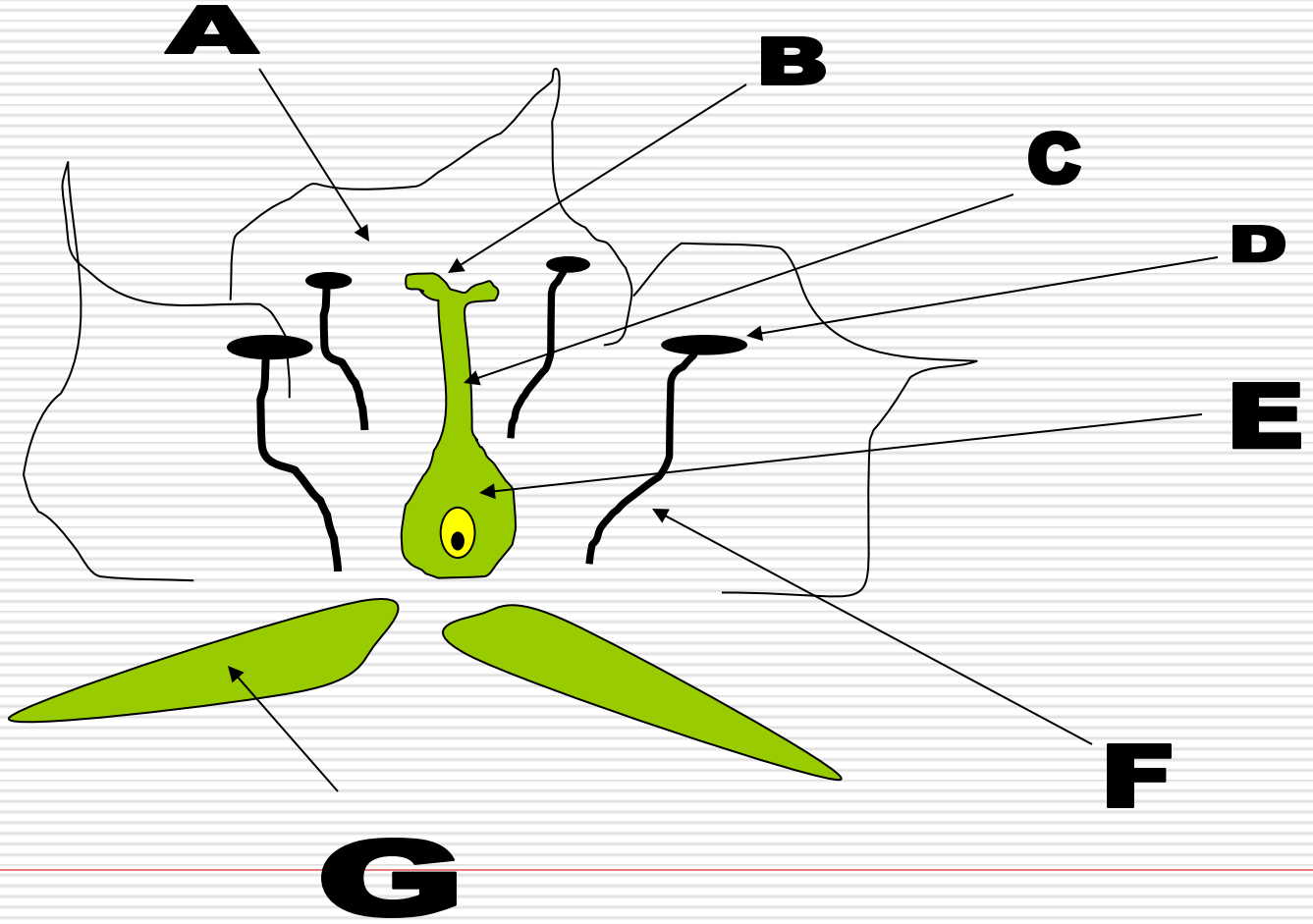
#69: STIGMA

- Top part of PISTIL
- **Sticky** to catch Pollen Grains
- “Sticky Stigma”

#70: STYLE

- TUBE part of Pistil
- Sperm cell travels down Style from pollen grain to egg in ovule

#71



Back of #71

- A – PETAL
- B - STIGMA
- C - STYLE
- D - ANTHER
- E - OVARY
- F - FILAMENT
- G - SEPAL

#72: Pollination

- When pollen from one flower sticks to the Stigma of another flower
  - Animal Pollination – Bees / Flowers
  - Wind Pollination – Pine Cones

#73: Fertilization

- When the sperm cell from pollen reaches the egg cell in ovule after traveling down the Style.

#74: Germination

- When **Temperature, Moisture** and **Sunlight** are right, the EMBRYO begins to grow or Germinate from the seed.

- Seeds will "sleep" or be **DORMANT,** until conditions are right.

#75: Types of Flowers

- **Perfect** Flower – (SEX) Has both male and female parts, Stamen / Pistil

- **Imperfect** Flower – Only Stamen or Pistil, Male or Female

- **Complete** Flower – Has all major flower parts, Pistil / Stamen / Petals / Sepal
  - **Some flowers don't have sepals or petals**

#76: TRACHEOPHYTA

- Complex Plants
- Most Plants
- PHYLUM → **VASCULAR** plants
  - Have Phloem / Xylem (transport tubes)
  - Have true ROOTS / STEMS / LEAVES

#77: BRYOPHYTA

- PHYLUM:
  - Simple / Primitive / Small
- NO TRUE – roots, stems, leaves
- No Flower = No sex = SPORES
  - ASEXUAL
- Ex: Liverworts, Moss

#78: Parts of BRYOPHYTES

- **THALLUS** - leaf like part
- **RHIZOID** – root like part
- **STALK** – stem like part

#79 : GYMNOSPERMS

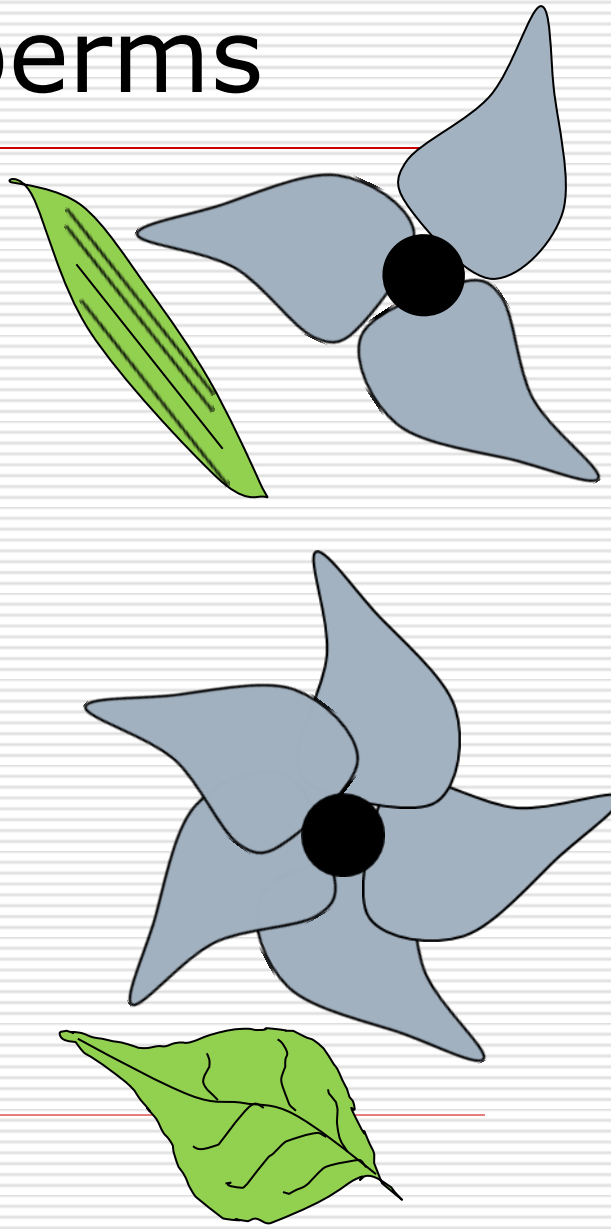
- Two major Classes
  - Conifers (aka: Pines / Evergreens)
  - Palms
- Seeds produced in **CONES**
- Leaves are **NEEDLES**
- Class of Vascular plant (tracheophyte)

#80: ANGIOSPERMS

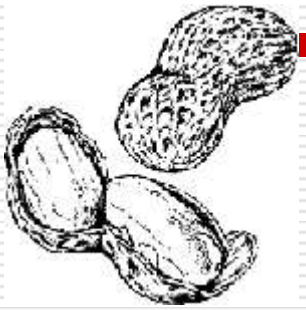
- Class of Vascular Plants (tracheophyte)
- **FLOWERING PLANTS**
- Flower makes fruit / seed inside is the offspring (sexual reproduction)

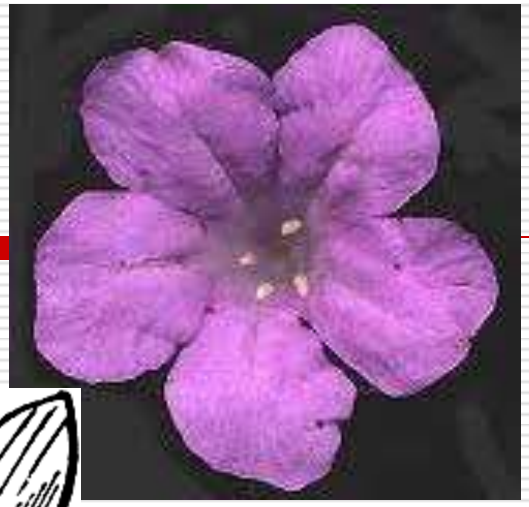
#81: Types of Angiosperms

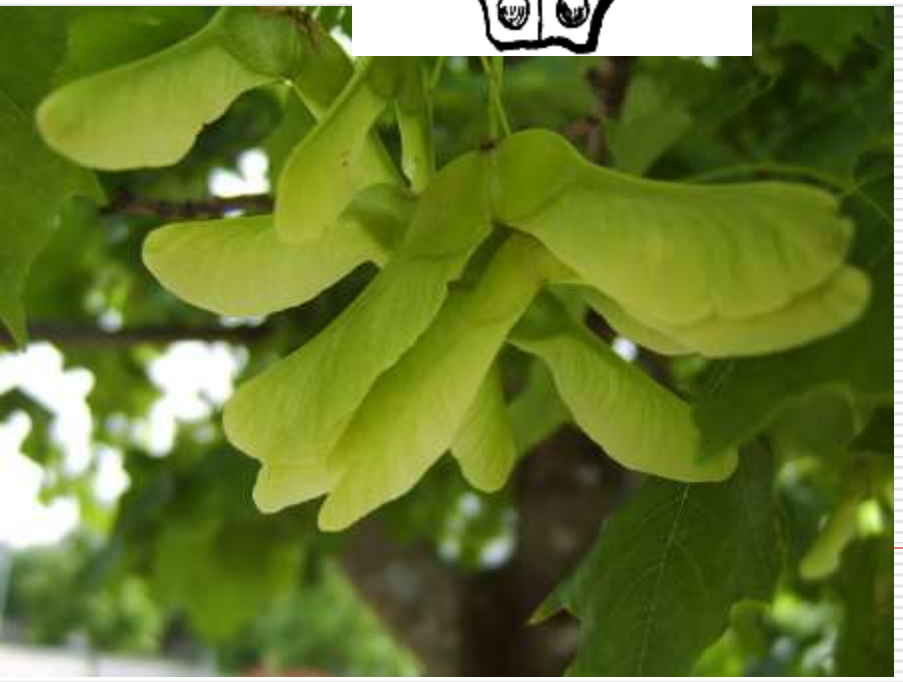
- **MONOCOT**
  - One Cotyledon / one seed leaf
  - Flower Petals groups of 3
  - Parallel veins on leaves
    - Ex: CORN and GRASS
- **DICOT**
  - Two cotyledon / two seed leaves
  - Flower Petals groups of 4 or 5
  - Branching veins on leaves
    - EX: Maple Tree / Peanuts



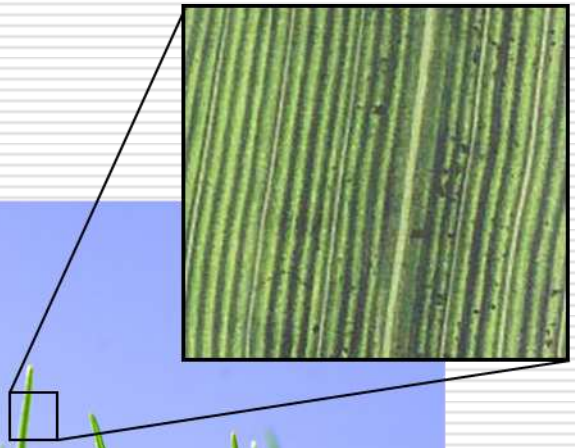
DICOTS

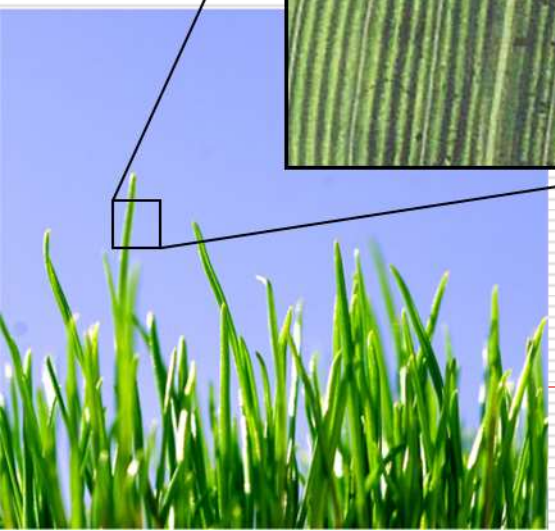






MONOCOT





#82: ECOLOGY

- Study of Living things and their relationship with the Environment

#83: Ecosystem

- All of the **Living** (BIOTIC) and **Non-living** (ABIOTIC) things in an area

#84: Population

- A group of organisms of the same species in an ecosystem

#85: Community

- All of the groups of species (POPULATIONS) in an Ecosystem.

#86: HABITAT

- The place an organism (plant or animal) lives
  - Provides-
    - FOOD
    - SHELTER
    - WATER
      - EXAMPLE: Deer in a forest

#87: NICHE

- Job or role an organism fills in it's environment
  - EXAMPLES-
    - Grass- food for herbivores
    - Rabbit- food for carnivores
    - Coyote- controls rabbit population
    - Bacteria- decomposer of all dead stuff

#88: Producers

- An organism that makes it's own food
  - PHOTOSYNTHESIS
    - Plants / Algae

#89: Consumer

- An organism that obtains food (energy) by eating other living organisms (plants / animals)
  - Ex- Cow, People, Dog, Beetle, Shark
    - Basically any animal

#90: Decomposer

- An organism that **breaks down** (eats) waste or **remains of other organisms** (dead plant and animal matter)
  - Ex- Bacteria / Fungus (mold and mushrooms)

#91: Biodiversity

- The **amount of different types of life** living in an Ecosystem
- The more different species (diversity) the healthier the ecosystem

#92: Competition

* More then one organisms struggling for the same resources (food, water, space)

* Can be two groups of same species or two different species

Ex; 1. An Oak tree and a Spruce Tree competing for space / light
2. Two prides of lions competing for zebra's

#93: Types of Relationships in an Ecosystem

- **Predator + Prey-** one hunts / eats another (lion + zebra)

- **Symbiosis** – Two organisms live together
  - **Mutualism** (+,+): both benefit
    - clown fish and sea anemone
  - **Commensalism** (+,N): one benefit, one unaffected
    - Barnacles on a whale, shark and remora
  - **Parasitism** (+,-): one benefits, one harmed
    - Ticks, fleas, tapeworm

Types of Symbiosis

- **Parasitism** – One lives off the other
  - tick= parasite
  - dog= host

Carrying Capacity

Limiting Factors