Chapter 1 Notes (Day 1)

Objective: Outline and explain each of the major themes found in biology.

Chuck Norris

Hobbies: All things science-related, Reading Shakespearean Sonets, and Spin Kicks

Birthplace: Pittsburgh

Most Anticipated Biology-Related Topic: Osmosis

Superpower and Use: Super finger-flick. I would use this superpower to flick away all of the world's stinkbugs.

Chapter 1: Themes of Biology

- Biology: <u>“Bio” = life</u> <u>“-ology” = study of</u>

Living things have certain characteristics in common.

All living organisms share general properties that separate them from non-living things!

1 – Cellular Structure & Function

Cell: basic unit of all life.

Human body has over 100 trillion cells all of which have a certain job or function!

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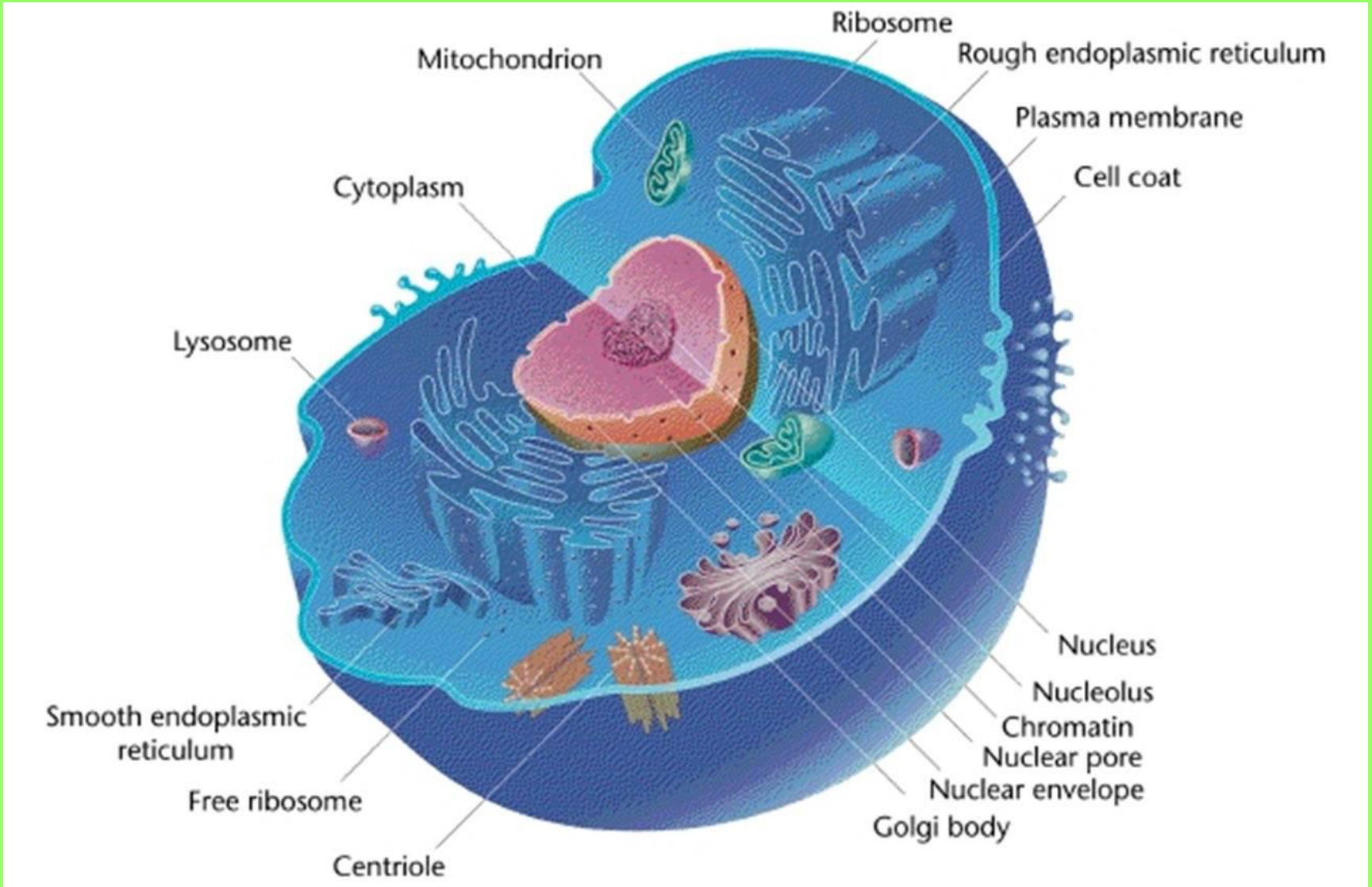
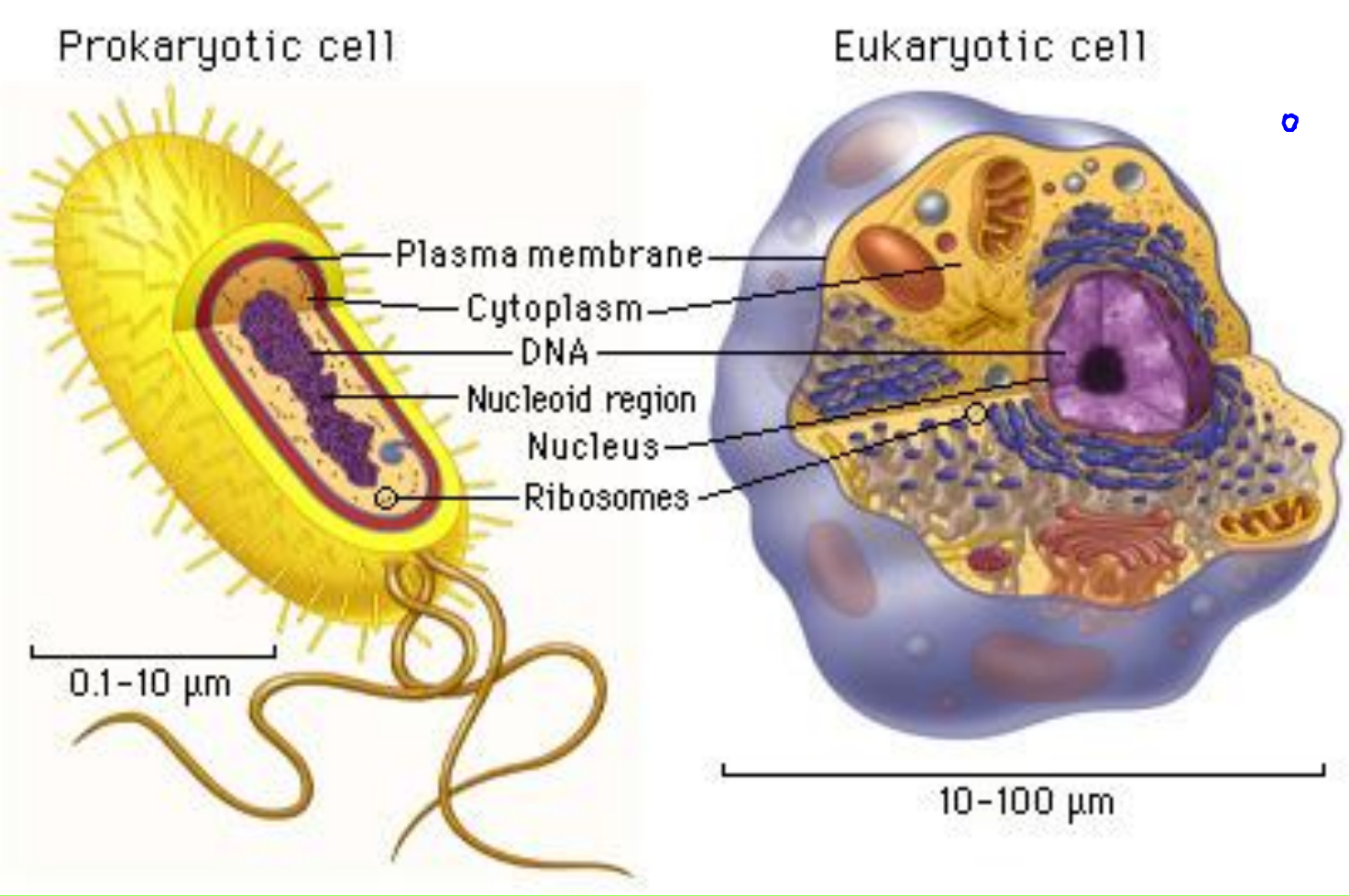

Ribosome
Mitochondrion
Rough endoplasmic reticulum
Plasma membrane
Cytoplasm
Cell coat
Lysosome
Nucleus
Nucleolus
Chromatin
Nuclear pore
Nuclear envelope
Golgi body
Smooth endoplasmic reticulum
Free ribosome
Centriole

The Prokes and the Eukes

- It is important to understand that there are two general catagories of cells.
  - Prokaryotes:
    - Very small.
    - Not much inside (no nucleus, ER, Golgi, mitochondria).
    - Example: Bacteria

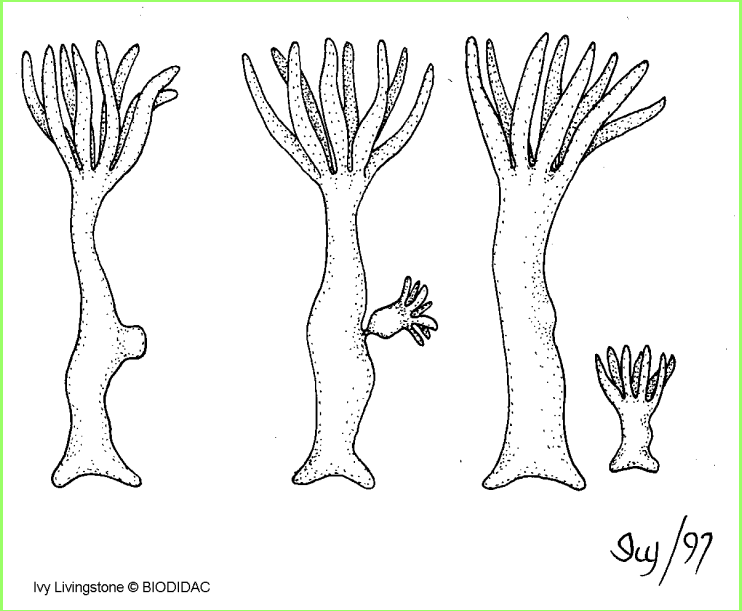
- Eukaryotes
  - Usually more than 10x the size of prokaryotes.
  - Have lots of stuff in the inside (Nucleus, ER, Golgi, and Mitochondria to name a few).
  - Example: All Protist, Fungus, Plant, and Animal Cells (everything but bacteria).


Prokaryotic cell
Eukaryotic cell
Plasma membrane
Cytoplasm
DNA
Nucleoid region
Nucleus
Ribosomes
0.1–10 µm
10–100 µm

2 - Reproduction

No organism lives forever!

Creates new generations. All living things can reproduce either sexually or asexually.



3 - Metabolism

Obtain & use of energy to run the processes of life.

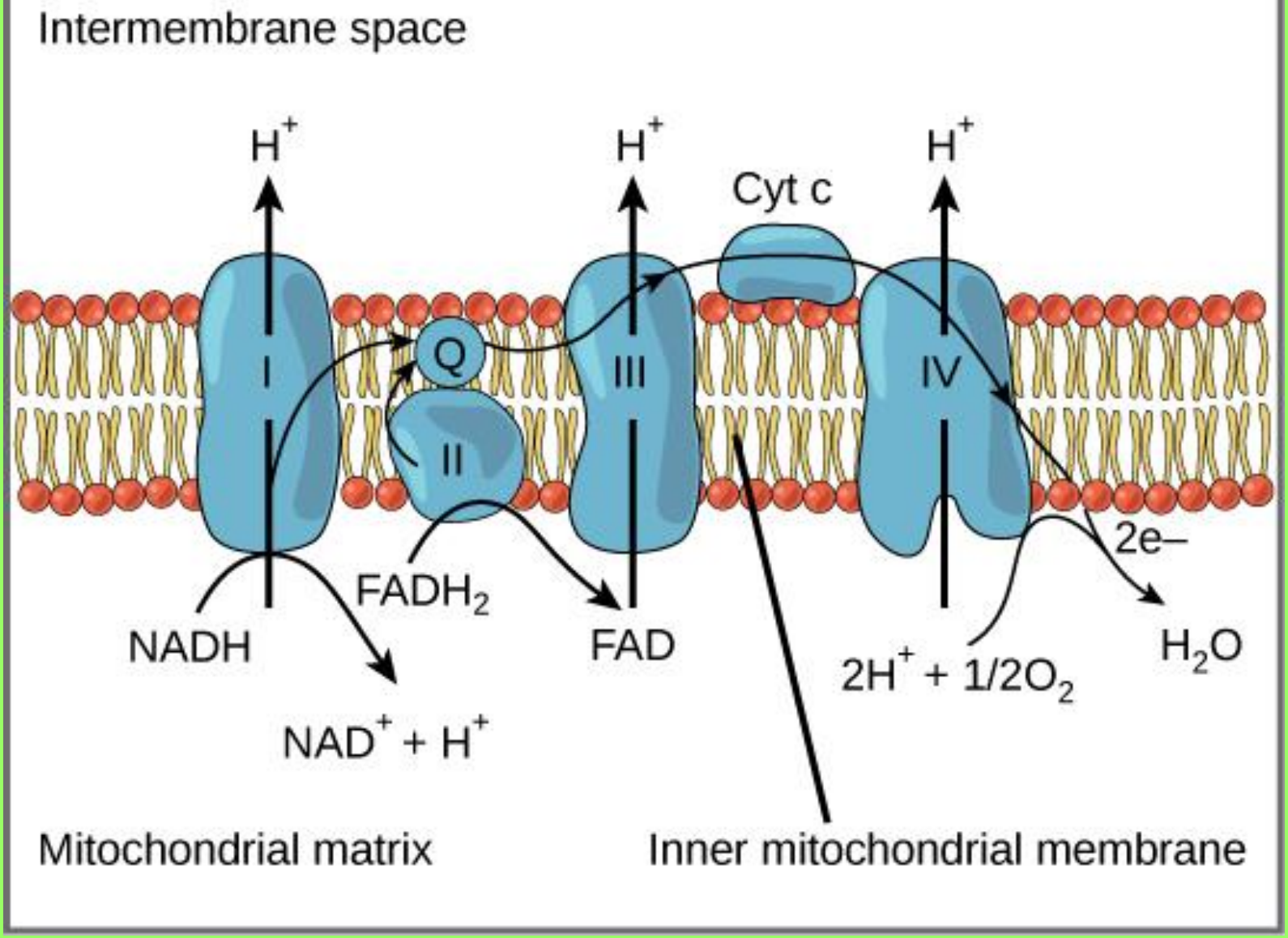
Photosynthesis and Cellular Respiration are the two main reactions responsible for metabolism

Metabolism

- Photosynthesis: makes food in the form of glucose (not cell friendly food). Think of raw ground beef.

- Cellular Respiration: Takes glucose and changes it a bit to make ATP which is sort of like cell food. Think a delicious hamburger.

Electron Transport Chain



Homeostasis and temperature control

Nervous system signals dermal blood vessels to dilate and sweat glands to secrete

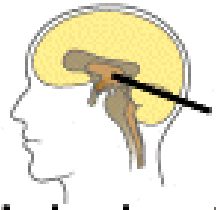
Body heat is lost to its surroundings

Body temperature rises above normal

Body temperature drops toward normal

Normal body temperature 37°C (98.6°F)

Body temperature drops below normal



hypothalamus

Body temperature rises toward normal

Hypothalamic set point

Nervous system signals dermal blood vessels to constrict and sweat glands to remain inactive

Body heat is conserved

If body temperature continues to drop, nervous system signals muscles to contract involuntarily

Muscle activity generates body heat

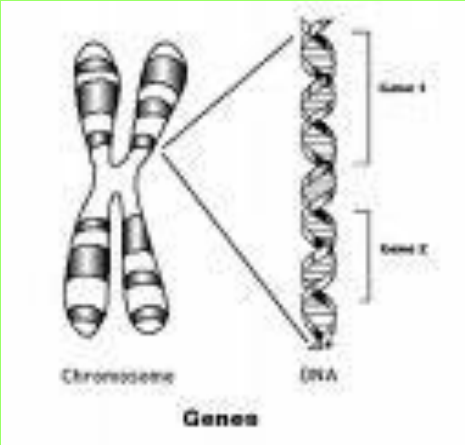
Examples of homeostasis

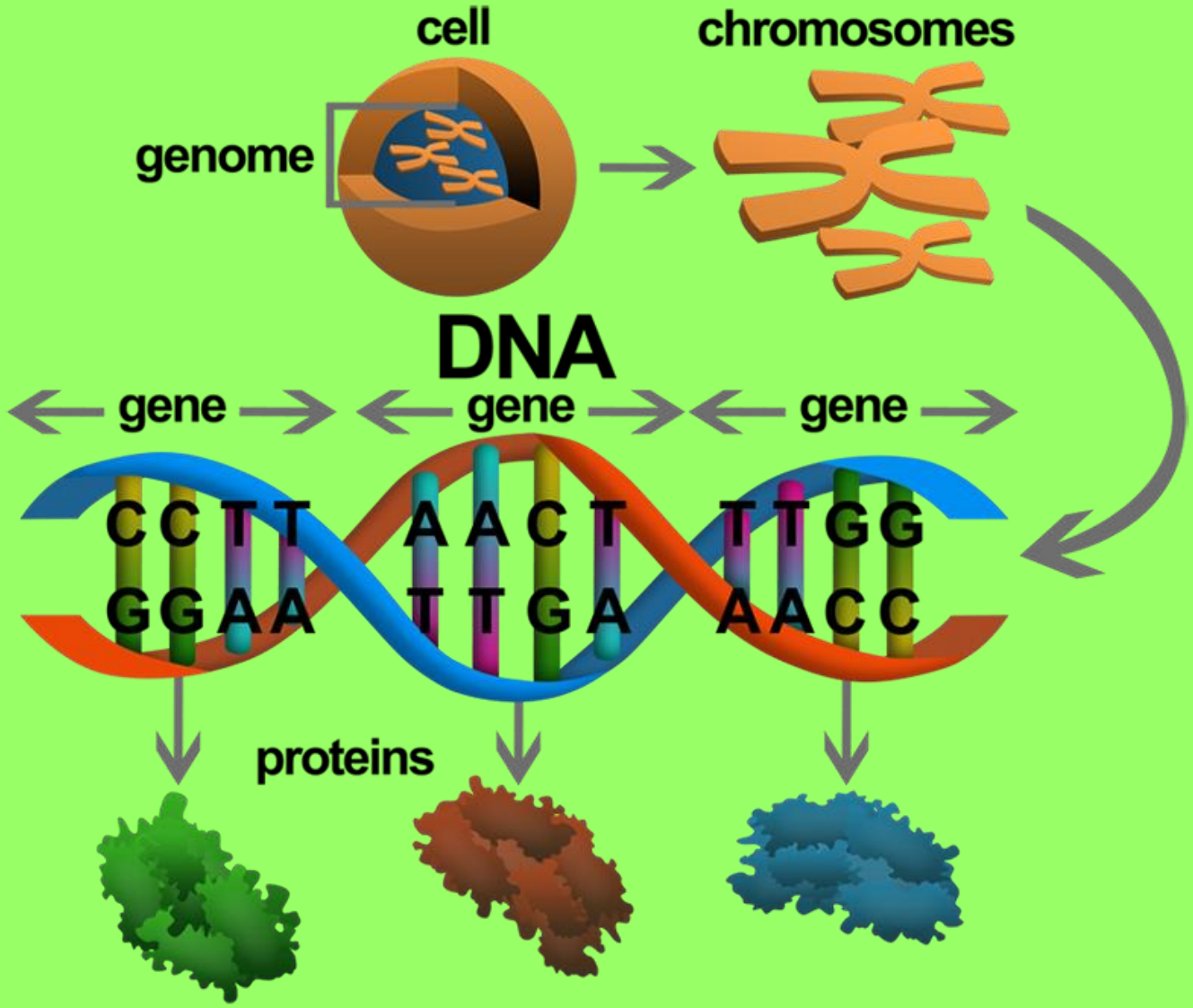
- Sweating to cool down body temperature.
- Gills to better obtain oxygen in an aquatic environment.
- Immune system to counter infection.

5 - Heredity

All living things must pass down traits to offspring through genes (which are made up of DNA).

Genes - Mutations




cell
chromosomes
genome
DNA
gene
gene
gene
C C T T
G G A A
A A C T
T T G A
T T G G
A A C C
proteins

6 – Respond & Adjust to Environment

Adaptation: Acquiring a characteristic (structural/behavioral) that helps one survive in an environment.

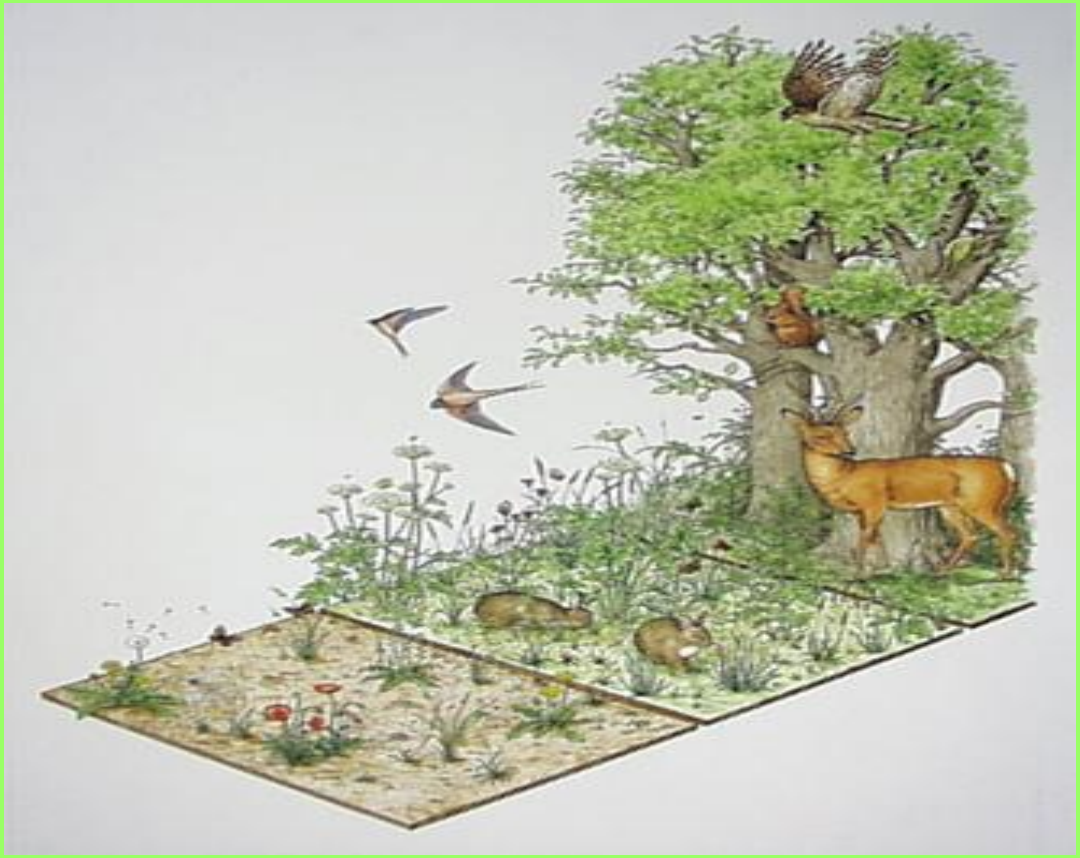
Evolution – Change in inherited traits of a species over time. Can lead to adaptation.

7 – Growth & Development

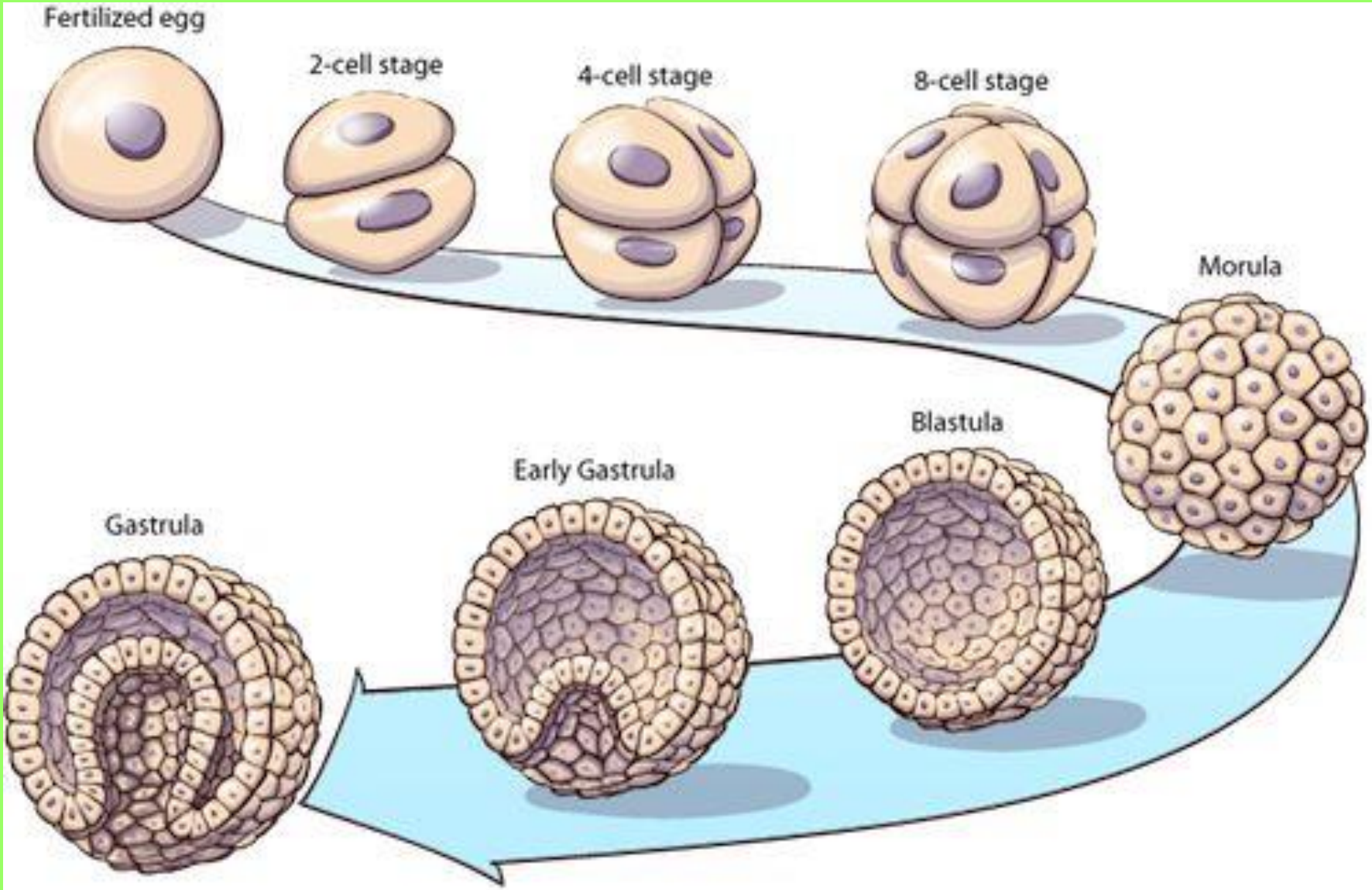
Interdependence between organisms

Ecology

Extinction



- Growth = increasing mass due to size and number of cells.
- Development = cells changing their identity over time.



Cell Cleavage

Process by which the number of cells in a developing embryo is multiplied through cell division.

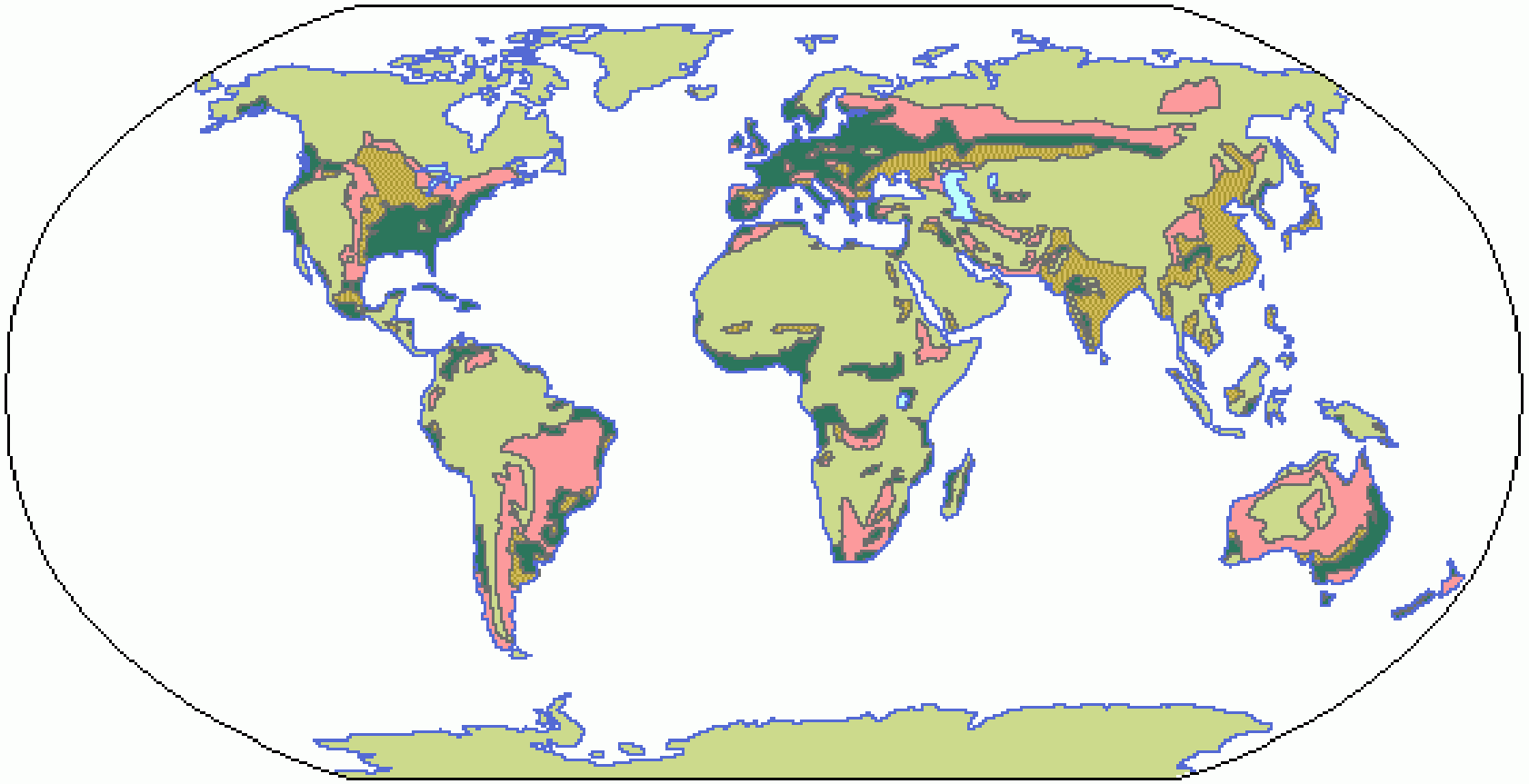
Chapter 1 Notes (Day 3): Importance of Biology

Objectives: Identify 3 benefits we receive from the biological sciences..

#1 Crops

* Bioengineered crops to become insect resistant and increase crop yields.

* Bioengineered crops have been made to withstand harsher environments, thus increasing the areas that they can be planted.



Predominantly mixed farming
Predominantly livestock grazing
Predominantly cereal crops
Non-arable lands, forests

Agriculture
Climatic Zones
Geology
Languages
Population
Natural Vegetation
Precipitation
Temperature
Plate Tectonics
National Parks
Time Zones
Religion
Ocean Currents and Wind Systems

#2 Medicine: new biotechnology has and will continue improved healthcare.

Some Top Research Areas:

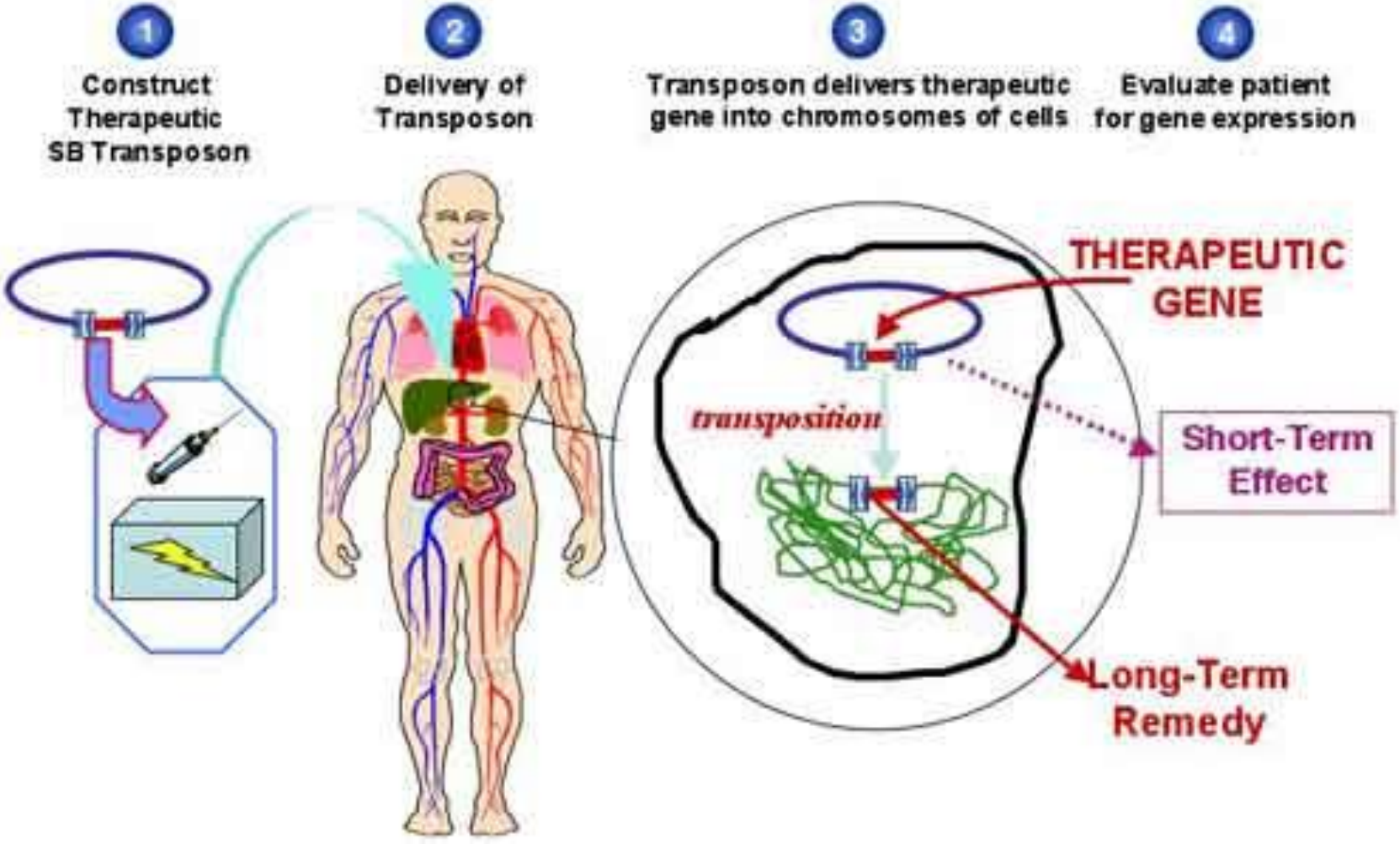
1) AIDS Treatment and Prevention

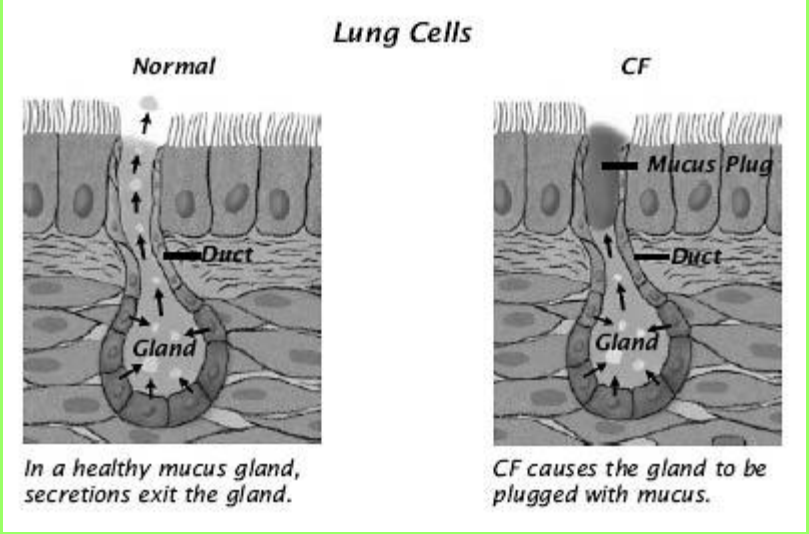
2) Cancer Treatment and Prevention

Example: Taxol, a chemical found in Pacific Yew Trees is found to be effective in treating ovarian and breast cancer.

Sleeping Beauty- Mediated Gene Therapy

— A Straightforward Procedure —





Medical Success Story

Cystic Fibrosis: normally a fatal disorder caused by a defective gene.

Gene therapy has been able to switch the defective gene with one that functions normally.

Biology is linked to our quality of life.

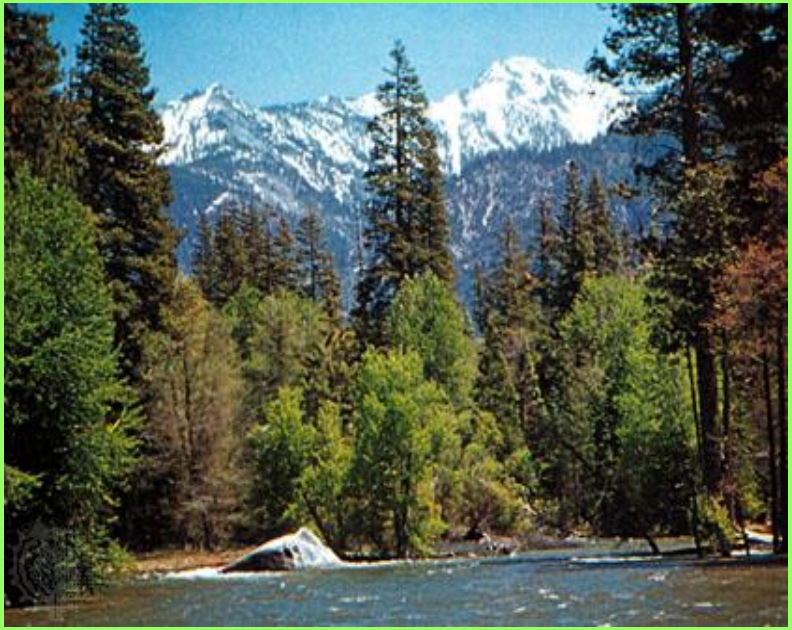
So your health, nutrition, food availability, longevity are all somewhat linked to the biological sciences.

Chapter 1 Notes (Day 2)

Objective: Create a hypothetical experiment using the scientific method. Clearly label each step.

Biologists David Bradford & John Harte

Early 1980s– Noticed decline in number of Frogs & Tiger Salamanders in ponds in Rocky Mountains



Ambystoma tigrinum

1 - COLLECTING OBSERVATIONS

For 2 years:

The scientists collected observations pertaining to:

- **H20 samples**
- **Food**
- **Behavior**
- **Reproduction**
- **Environmental Conditions**

They noticed tiger sa  **ulation decreased by 65%**

2 – ASKING QUESTIONS

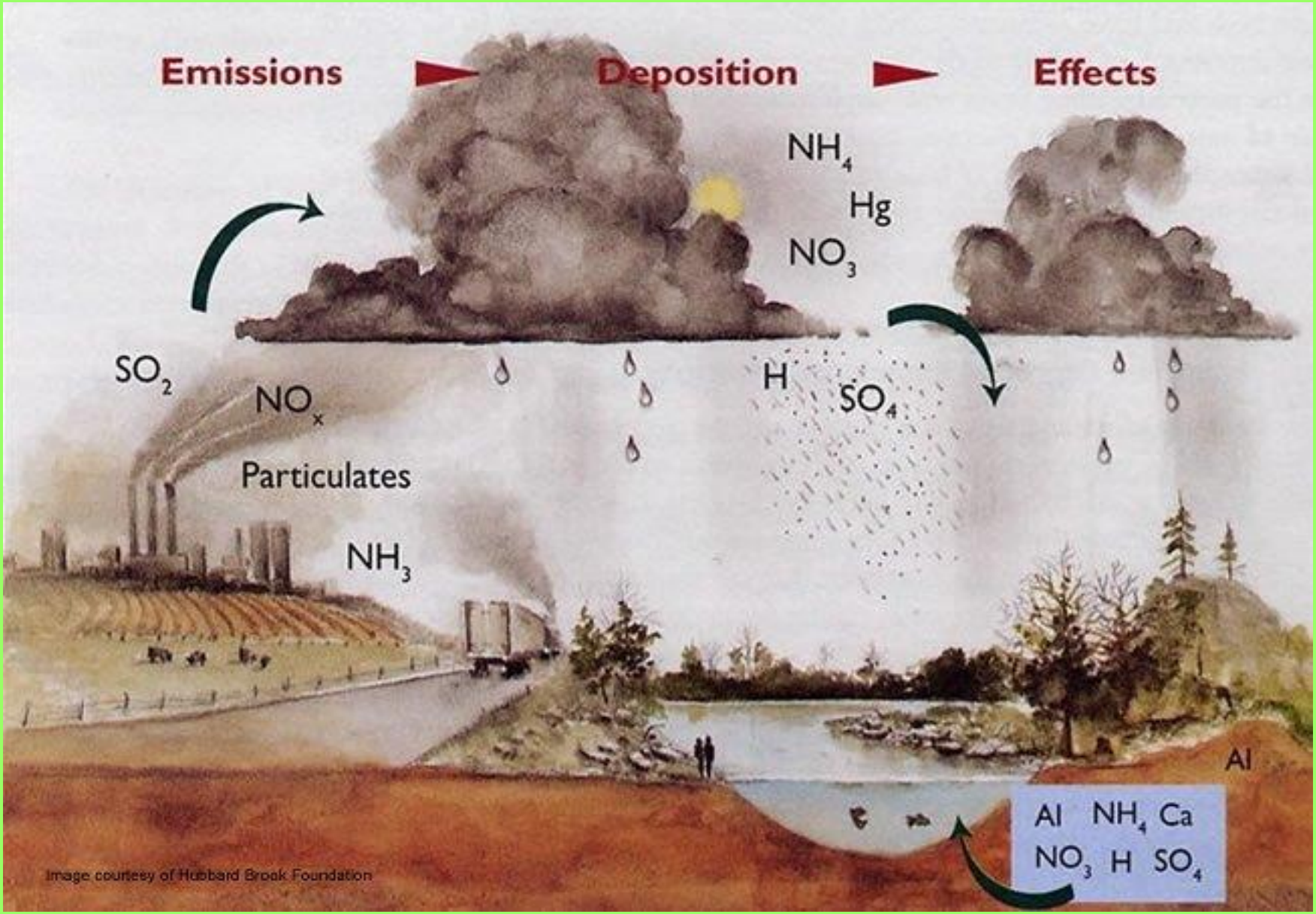
The obvious one is →Why are the salamander populations decreasing?

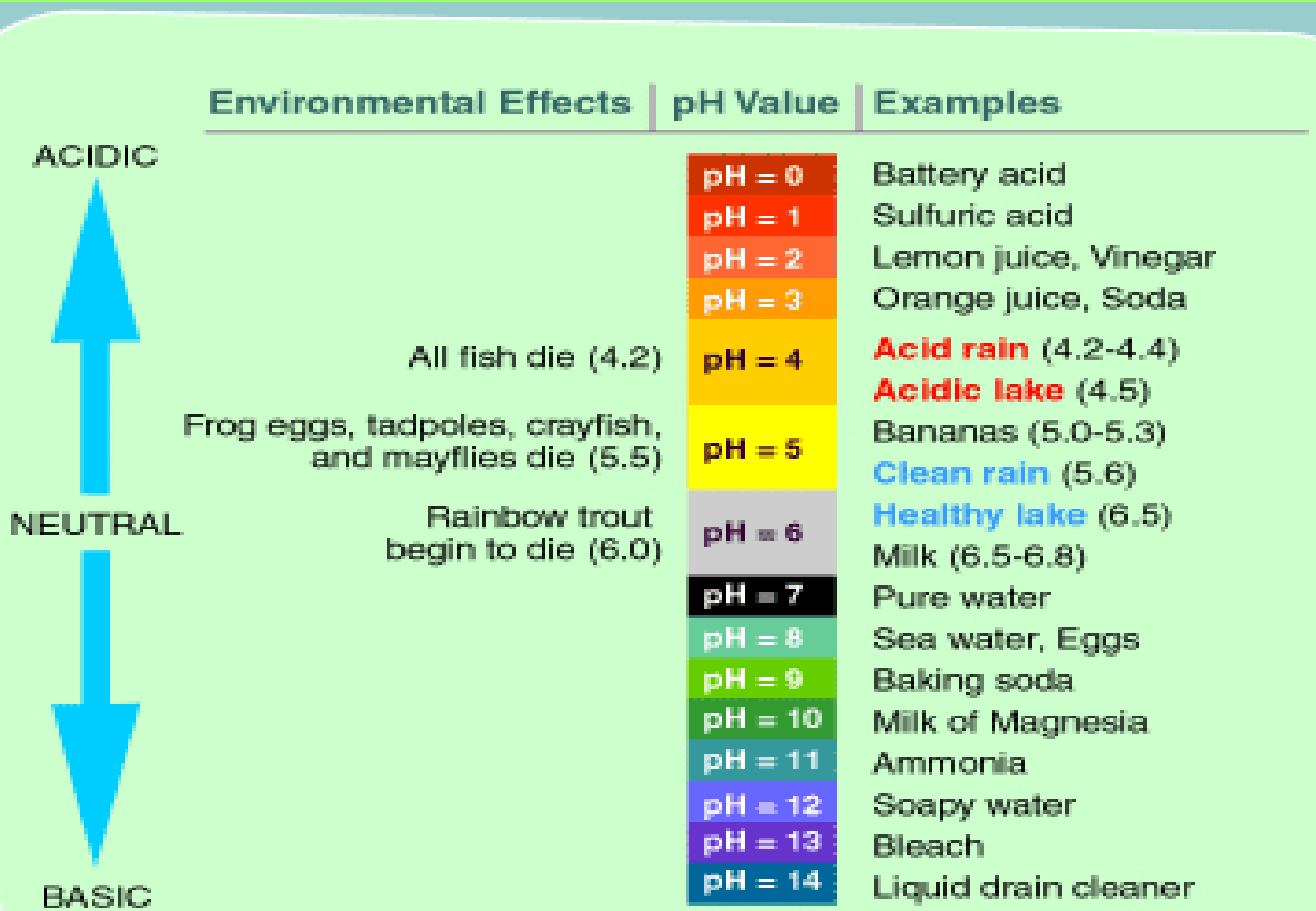
Usually scientists begin doing a background research at this point. Sometimes the questions can be answered here before going any further.

Example:

Rocky Mountains have moisture high in H_2SO_4 (Sulfuric Acid) from power plants that burn high sulfur coal – low pH

Results in Acid Deposition – snow melt in late May – Just when salamanders lay eggs!


Emissions
Deposition
Effects
NH_4
Hg
NO_3
SO_2
NO_x
Particulates
NH_3
H
SO_4
Al
Al NH_4 Ca
NO_3 H SO_4
Image courtesy of Hubbard Brook Foundation


Environmental Effects
pH Value
Examples
ACIDIC
NEUTRAL
BASIC
All fish die (4.2)
Frog eggs, tadpoles, crayfish, and mayflies die (5.5)
Rainbow trout begin to die (6.0)
pH = 0
pH = 1
pH = 2
pH = 3
pH = 4
pH = 5
pH = 6
pH = 7
pH = 8
pH = 9
pH = 10
pH = 11
pH = 12
pH = 13
pH = 14
Battery acid
Sulfuric acid
Lemon juice, Vinegar
Orange juice, Soda
Acid rain (4.2-4.4)
Acidic lake (4.5)
Bananas (5.0-5.3)
Clean rain (5.6)
Healthy lake (6.5)
Milk (6.5-6.8)
Pure water
Sea water, Eggs
Baking soda
Milk of Magnesia
Ammonia
Soapy water
Bleach
Liquid drain cleaner

3 – **FORMING HYPOTHESIS & MAKING PREDICTONS**

Hypothesis – A statement that can be tested by additional observations/experiments

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1 – Acids formed in the upper atmosphere by pollutants were falling in the Rocky Mts. as snow.

2 - Melting snow made ponds acidic and harmed salamander embryos in late May.

Experiment - A planned procedure to test a Hypothesis.

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Experimental Group – Receives experimental treatment

INDEPENDENT VARIABLE :
(pH Level)
Experimental factor is **varied.**

DEPENDENT VARIABLE
(# of salamanders hatched from eggs)
Experimental factor is **measured**.

Control Group – Receives NO experimental treatment

EXPERIMENT

Allowed captive salamanders to lay eggs in regular pond H20 with a neutral pH.

Collected and divided into 5 groups.

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Group 1: **CONTROL GROUP**

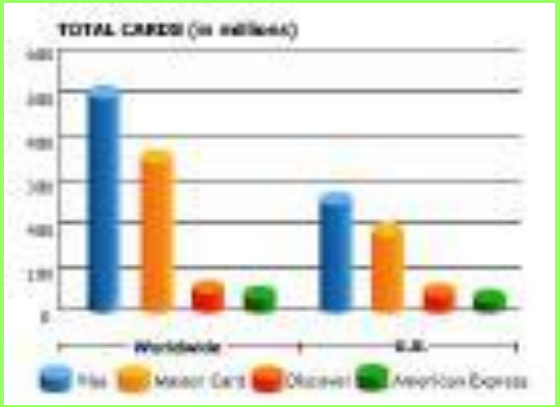
Eggs placed in pond H20 with neutral pH.

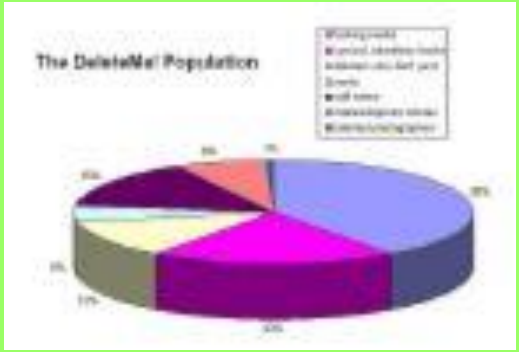
Other Groups: **EXPERIMENTAL GROUPS**

Eggs placed in pond H20 with different pHs similar to levels after snow melt.

Data/Observations

- Usually in the form of:
  - Data Tables
  - Graphs
  - Sometimes Descriptive





Results

- Stating the results from the experiment.
- Often an explanation of the data. This is where graphs and data tables are explained.

5 – DRAWING CONCLUSIONS

Data is analyzed. This is where scientists “connect the dots”.

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Melting snow in Rocky Mts. could cause acid absorbed from atmospheric pollution to be released into ponds of snow melt, harming salamander embryos!

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Data supported both his Hypotheses!

6 – PUBLISHING RESULTS IN SCIENTIFIC JOURNAL

Reviewed by other scientists to confirm results & conclusions

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THEORY: **Set of related Hypotheses that have been tested and confirmed many times by many scientists!**

Inference: a conclusion reached without data from experimentation. Only observations are used.

Future evidence may cause revision/rejection!

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