# ***Chapter 1: Exploring Life and Science***

Characteristics shared by living organisms:

- They are organized from the atom to the biosphere
- They use materials and energy from the environment
- They maintain a relatively constant internal environment ('homeostasis')
- They respond to internal and external stimuli
- They reproduce and grow
- Have an evolutionary history through which organisms change over time.

What distinguishes humans from other living organisms?

- Cultural heritage or patterns of our behavior passed from one generation to the next (social community)
- Highly developed brains (helps us respond to change in the environment and different type of social processes)
- Completely upright stance (presence of the spinal cord, backbone)
- Creative language skills (no other organisms have)
- Varied tool use (for perpetuation of the species to protect themselves, survival; example: fire, weapons, tools)
- Modification of our environment for our own purpose which may affect the biosphere. (some of those help and others destroy)

How do we classify humans?

| | **Human** | **House cat** |
|---|---|---|
| Domain | Eukarya | Eukarya |
| Kingdom | Animalia | Animalia (Both are animals) |
| Phylum | Chordata | Chordata (Spinal cord) |
| Class | Mammalia | Mammalia (production of mammary glands in females, body covered of hair) |
| Order | Primates (upright stance, doesn't eat their own kind) | Carnivora |
| Family | Hominidae | Felidae |
| Genus | Homo | Felis |
| Species | sapiens | domesticus |

What do we know about science?

- Science is a way of knowing about the natural world. (The process in which we come to know our environment and our biological system; functions, structures and remedies)
- Science and scientists should be objective.(no emotions, cannot be subjective for the betterment of life)
- Scientific conclusions may change or be modified as our understanding and technology increase. (facilitates networking and communication)
- Science is studied using the scientific method

The Scientific Method
Observations: New observations are made, and previous data are studied and compared.
Hypothesis: Input from various sources is used to formulate a testable statement. (statement of a possibility)
Experiment/Observations: The hypothesis is tested by experiment or further observations.
Conclusions: The results are analyzed, and the hypothesis is supported or rejected. If rejected, rewrite the hypothesis. If supported, it becomes a scientific theory.
Scientific Theory: Many experiments and observations support a theory.

A controlled study
Variables

- Experimental variable is the variable that is purposely changed or manipulated.(test)
- All other variables need to remain constant.

Groups

- Test group is a group of subjects that are exposed to the experimental variable.
- Control group is a group for comparison that is not exposed to the experimental variable.

How the cause of ulcers was discovered: The scientific method in action

- Observations: Many patients had a particular bacterium near their ulcers.
- Hypothesis: *Helicobacter pylori* is the cause of gastritis and ulcers.
- Experiment/observations:

1st – *H. pylori* was isolated and grown from ulcer patients.

2nd – Humans swallowing a *H. pylori* solution developed inflammation in their stomachs.

- Conclusion: *H. pylori* was the cause of most ulcers and can be cured by antibiotics.

Does science have social responsibilities?

- Science is a way of acquiring knowledge about the natural world through a systematic process separating it from ethics, religion, and aesthetics.

- Technology is the application of scientific knowledge to human interests.
  - Biotechnology (genetically modified bacteria and genetically modified crops)
  - Gene technology (cloning of humans or gene therapy to modify inheritance)
  - Use of stem cells from embryos (embryonic stem cells) (they grow into tissue for that particular patients lost0

Everyone is responsible

- Science and technology should be used to improve our lives.
- All citizens should assume responsibility.
- Everyone needs to be involved in making value judgments about the proper use of technology.

Vocabulary:

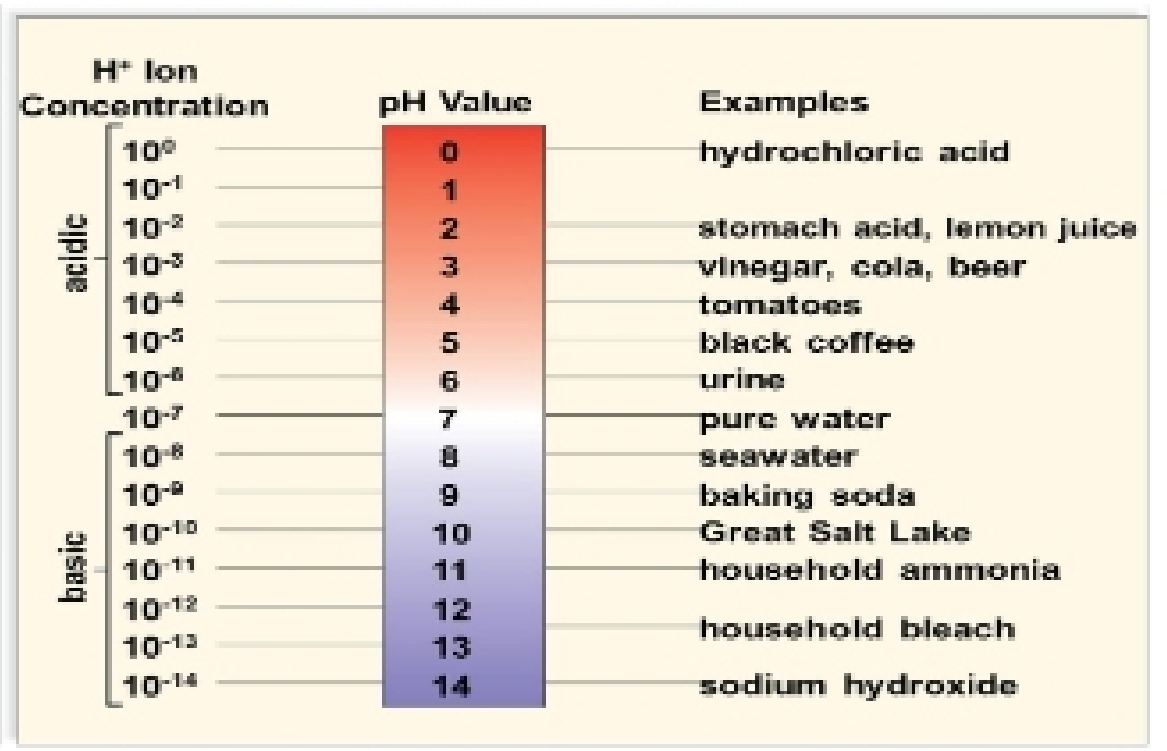
- **Atoms**: smallest unit of all maters. Made of positive protons, negative electrons and uncharged neutrons.
- **Biosphere**: everything
- **ATP**: energy currency of the cell.
- **Materials**
- **Energy**
- **Homeostasis**: to maintain a relatively constant internal environment. Homeo; uniform and stasis; static. Example: body temperature, if you have a fever, a particular mechanisms will move into action to restore homeostasis once again.
- **Stimuli**: change in surroundings or environment; stimulus. Example:  if it's hot outside the body will release the heat in form of sweat.
- **Evolution**: the process in which organisms change over time. (allowed by nature)
- **Reproduction**: formation of a new generation; the way a species is continued.
- Polar molecules: Hydrophilic molecules that are made when a negative pole and a positive pole attract.
- Nonpolar molecules: Hydrophobic molecules. Ex. Vegetable oil.

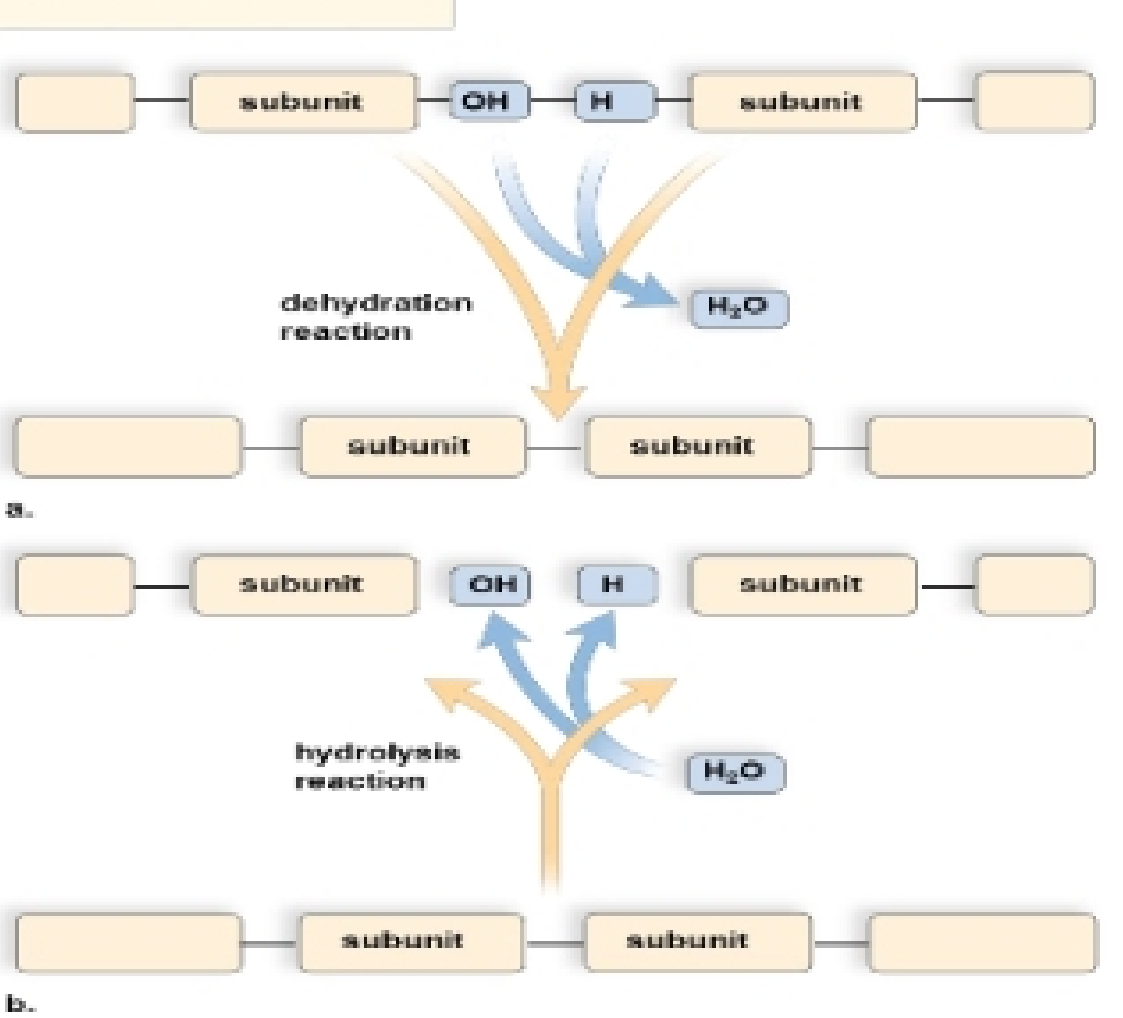
# ***Chapter 2: Chemistry of life***

- Water is liquid at room temperature.
- The first cell evolved in water.
- All living organisms are 70%-90% water.
- Liquid water does not change temperature quickly.
- Water has a high heat of evaporation.
- Frozen water is less dense than liquid water. (lighter)
- Molecules of water cling together.
- Water is a solvent for polar molecules.
- Hydrogen bonds occur between hydrogen in a covalent bond and a negatively charged atom and they hold water molecules together. These are relatively weak bonds.

Vocabulary:

- Cell: functional and structional unit of all life.
- Unicellular: one cell. (bacteria, fungi)
- Multicellular: many cells (humans, animals, plants)
- Acids are substances that dissociate and release hydrogen ions (H+).
- Bases are substances that take up hydrogen ions (H+) or release hydroxide ions (OH-).
- Ph Scale: is a measure of hydrogen ion (H+) concentration.
    - Working scale is 0 – 14 with 7 being neutral
    - A pH below 7 is acidic and above 7 is basic.




***How organic molecules are built and broken down.***

- Dehydration reaction – the removal of water that allows subunits to link together into larger molecules
- Hydrolysis reaction – the addition of water that breaks larger molecules into their subunits.