

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.
 - o **Biotechnology** (genetically modified bacteria and genetically modified crops)
 - o **Gene technology** (cloning of humans or gene therapy to modify inheritance)
 - o Use of **stem cells** from embryos (embryonic stem cells) (they grow into tissue for that particular patients lost)

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 matters. 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 structural 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.
 - o Working scale is 0 – 14 with 7 being neutral
 - o A pH below 7 is acidic and above 7 is basic.

	H ⁺ Ion Concentration	pH Value	Examples
acidic	10 ⁰	0	hydrochloric acid
	10 ⁻¹	1	
	10 ⁻²	2	stomach acid, lemon juice
	10 ⁻³	3	vinegar, cola, beer
	10 ⁻⁴	4	tomatoes
	10 ⁻⁵	5	black coffee
	10 ⁻⁶	6	urine
	10 ⁻⁷	7	pure water
basic	10 ⁻⁸	8	seawater
	10 ⁻⁹	9	baking soda
	10 ⁻¹⁰	10	Great Salt Lake
	10 ⁻¹¹	11	household ammonia
	10 ⁻¹²	12	
	10 ⁻¹³	13	household bleach
	10 ⁻¹⁴	14	sodium hydroxide

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.

