

# SCIENCE

Science = organized way of gathering and analyzing evidence of the natural world  
way of observing and thinking about the world

Biology = study of life

The physical universe is a system composed of parts and processes that interact  
All objects in the universe, and all interactions among those objects, are governed by  
universal natural laws

The goal of science is to provide natural explanations for events in the natural world,  
and aims to use those explanations to understand patterns in nature and to make useful  
predictions about natural events

The scientific method involves observing and asking questions making inferences and forming  
hypotheses conducting controlled experiments, collecting and analyzing data and drawing conclusions

1) Asking questions Observing = the act of noticing and describing events or processes carefully  
and observing = observations then lead to asking questions

2) forming After asking questions people use observations to make inferences

Hypothesis = inference = logical interpretation based on what scientist already know  
inferences lead to hypothesis, which is a scientific explanation for a set of  
observations that can be tested in ways that support or reject it

3) Testing testing a scientific hypothesis often involves designing an experiment that

Hypothesis = keeps track of various factors that can change (variables)

A hypothesis should be tested by an experiment in which only one variable is  
changed and all other should be unchanged /controlled → controlled experiment

Independent variable = the variable that is deliberately changed (manipulated)

dependent variable = variable that is observed and that changes in response  
to the independent variable (responding)

control group = exposed to same conditions as experimental group, except for  
one independent variable

4) Collecting and Scientists make detailed records of experimental observations

Analyzing Data = gathering information called data

Quantitative data = numbers obtained by counting or measuring

Qualitative data = descriptive and involve characteristics that can't be counted

5) Drawing Scientists use experimental data as evidence to support, refute, or revise the  
conclusions: hypothesis being tested, and to draw a valid conclusion

Theory = a summary of a hypothesis/group of hypothesis that have been supported with testing  
law = a generalization of a body of observations

## CHARACTERISTICS OF LIFE

Living things are made up of basic units called cells. Are based on a universal genetic code, obtain and use materials and energy, grow and develop, reproduce, respond to their environment, maintain a stable internal environment and change over time.

Living things are all organisms store the complex information they need to live, grow, based on genetic code; and reproduce in a genetic code written in a molecule called DNA that info is copied and passed from parent to offspring

All living things organisms are composed of one or more cells → the smallest unit fully are made of cells = considered alive

cells can grow, respond to their surroundings, and reproduce

cells are complex and highly organized

levels of organization: cell → tissue → organ → organ system → organism

Living things all organisms reproduce, which means they produce new similar organisms

reproduce = sexual reproduction = 2 parents make new organism

asexual reproduction = 1 parent makes identical offspring

Living things every organism has a particular pattern of growth/development

grow and develop = growth = increase in # of cells (or get bigger)

development = defined as the physical, biochemical changes that occur throughout an organism's life

Living things organisms detect and respond to stimuli from their environment

respond to environment = stimulus = something in environment that causes a reaction

response = reaction to stimulus (body making adjustments)

homeostasis = maintenance of a steady state of the internal environment for survival, even when external conditions change

Living things make all organisms must take in materials and energy to grow, obtain energy = develop and reproduce

metabolism = the combination of chemical reactions through which an organism builds up or breaks down materials

Living things over generations, groups of organisms evolve or change over time

evolve or adapt = adaptation = any structure, behavior, process which allows an organism to respond to the environment or survive and produce offspring

evolution = adaptations over time; can cause gradual species change

## THE CHEMISTRY OF LIFE

**Organic:** Compounds that contain carbon atoms that are covalently bonded to other elements, typically hydrogen, oxygen, and other carbon atoms

All living things are made up of 6 essential elements: S P O N C H

S = sulfur P = phosphorus O = oxygen N = nitrogen C = carbon H = hydrogen

Elements join together by chemical bonds to form compounds

3 types of chemical bonds = hydrogen bonds, covalent bonds, and ionic bonds

There are 4 major categories of organic molecules that are make up our bodies

They are the macromolecules of life: lipids, carbohydrates, proteins, and nucleic acids

**Lipids:** elements = carbon, hydrogen, oxygen

Structure = 3 fatty acid chains linked by a glycerol backbone

Function = building blocks of the cell membrane and energy storing molecules

Examples = cholesterol and fats

**Carbohydrates:** elements = carbon, hydrogen, oxygen

Structure = monosaccharides (glucose molecules) bonded together in long chains called polysaccharides (starch)

Function = key source of energy

Examples = sugar and starch

**Proteins:** elements = carbon, hydrogen, oxygen, nitrogen

Structure = amino acids are bonded in long chains that coil together and fold into specific shapes called proteins

Function = some proteins are enzymes (speed up reactions) some are structural (hair, muscle) and some are antibodies (protect body from infection) both plant and animal cells

Examples = enzymes, collagen, antibodies

**Nucleic Acids:** elements = carbon, hydrogen, oxygen, nitrogen, phosphorus

Structure = long chain of nucleotides bonded together

Function = some are DNA (store hereditary information) and some are RNA (aid in building proteins)

Examples = DNA, RNA

**Chemical Reaction:** The process during which chemical bonds between atoms are broken and new ones formed

Reaction = are formed, producing one or more different substances

**Activation energy:** the energy needed to start a chemical reaction

**Enzyme** = proteins that increase the speed of a chemical reaction

they are catalysts, reduce the activation energy needed for a chemical reaction to take place

Any factors that affect the shape of an enzyme affect the enzyme's activity.

Enzymes work well within very specific ranges of pH and temperature. If the pH or temperature changes to outside of the range, the enzyme shape changes and thus no longer works to speed up the reaction

## CELL BIOLOGY

**Plasma Membrane** = encloses the cell and separates the cytoplasm from its surrounding;  
regulates what enters and leaves the cell  
in both plant and animal cells

**Nuclear Envelope** = separates the nucleus from the cytoplasm  
in both plant and animal cells

**Nucleus** = is the control center of the cells; stores DNA and makes mRNA  
in both plant and animal cells

**Nucleolus** = located inside the nucleus, mRNA are made here  
in both plant and animal cells