

Chapter 1: Biology - The Study of Life

Section 1.1 What is Biology?

I. The Science of Biology

- ***Biology*** = the study of life
- A key aspect of biology is simply learning about ***the different types*** of living things around you. Biologists have not yet answered all of the questions about life.

- When studying the different types of living things, you'll ask ***what, why, and how*** questions about life.

- Biologists study the interactions of life
 - Living things do not exist in ***isolation***; they are all functioning parts in the balance of nature.

II. Biologists Study the Diversity of Life

A. Biologists study the interactions of the environment

- When studying living things, a biologist must study all the *living (biotic) and nonliving (abiotic)* things to get a thorough understanding of nature.

B. Biologists study problems and *propose solutions.*

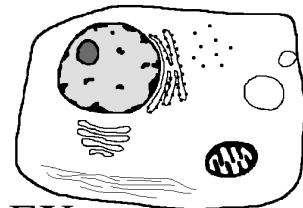
Section Ch. 1.2 Unifying Themes of Biology

A. *Organism* = anything that possesses all of the characteristics of life.

B. Characteristics of living things

1. Have an *orderly structure*

- Living things are highly organized. EX: we are **composed of cells**
 - Some organisms are single-celled (*unicellular*), such as bacteria.
 - An organism with more than one cell is said to be *multicellular*.



- Cells are the basic building blocks of all living things. The *human body* is composed of *trillions* of cells.
- Cells provide *structure* for the body, *take in nutrients* from food, *convert those nutrients* into energy, and *carry out specialized functions*.
- Cells also contain the body's *hereditary material* and can *make copies of themselves*.

2. All organisms need a *source of energy* to carry out life processes.

- Energy is important for *metabolism*, or all chemical processes that build up or break down materials.



3. Adjust to changes in the environment

- Organisms must be able to *respond to stimuli* in their environment.
- All organisms must be able to *react* to their environment to survive.
- Light, temperature, and touch are just a few of the *physical factors*, called stimuli, to which organisms must respond



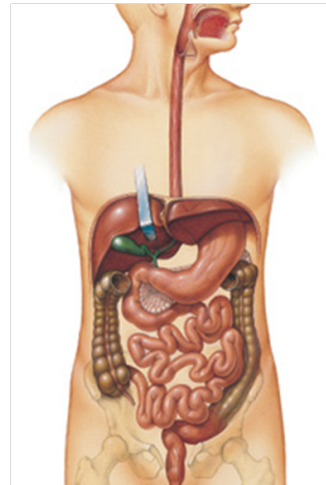
4. Produce offspring

- Living things are able to *reproduce*.
- Reproduction is *not essential* for the survival of an individual organism, but is *essential* for the continuation of the organism's species.
- All have *DNA* that they pass on to offspring
- *Specie* = a group of organisms that can interbreed and produce fertile offspring.



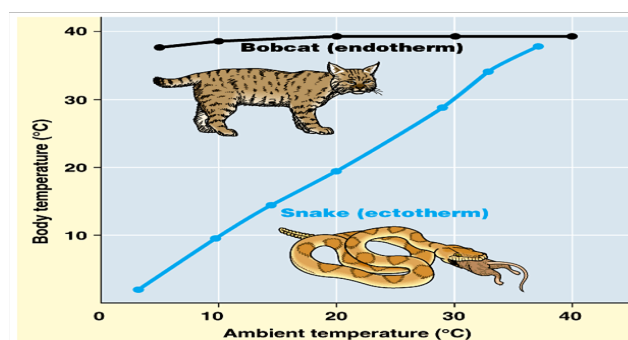
5. All levels of life have *systems of related parts*.

- A system is an *organized group* of interacting parts.
- A **cell** is a system of chemicals and processes.
- A **body system** includes organs that interact.



6. Organisms must maintain *homeostasis* to survive in diverse environments.

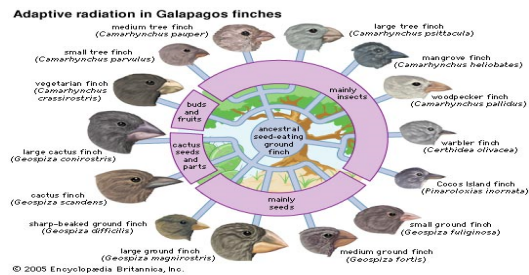
- **Homeostasis** is the maintenance of constant internal conditions, and is usually maintained through *negative feedback*.
- **Negative feedback** systems return a condition to its normal (set) point.



7. Living things adapt and evolve.

- Any *inherited* structure, behavior, or internal process that enables an organism to respond to environmental factors and live to produce offspring is called *adaptation*.
- The gradual change in a species over time is *evolution*.

- *Species evolve, NOT individuals.*



Section 1.3 Scientific Thinking & Processes

I. Observing and Hypothesizing

A. The methods biologists use

- The scientific method:

1. Make *observations* - using your senses.

2. Form a *hypothesis*

= An **educated guess** to test an explanation or to answer a question.

3. Collect and analyze data.

= includes *experimenting to collect the data*.

4. Evaluate & publish results, and possibly begin the cycle again

Other scientists will **analyze** the procedure, **examine** the evidence, **identify** faulty reasoning, **point out** statements that go beyond the evidence, and **suggest** alternative explanations for the same observations.

5. Form a theory

= a hypothesis that is supported by a *large body of scientific evidence*.

What If.....?

- If necessary, develop a *new* hypothesis or
- *Revise* the theory
 - Scientists always revise their theories as new evidence is discovered.

B. Experimenting

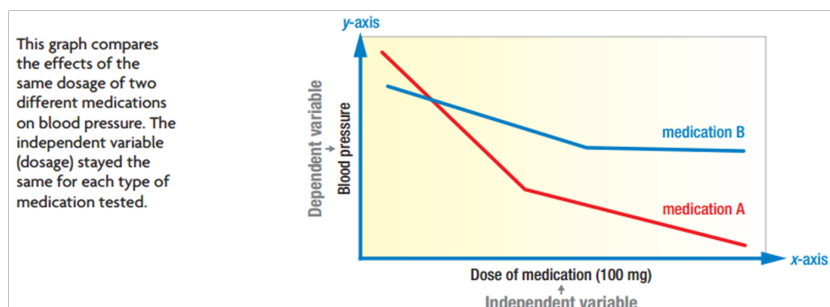
1. What is a controlled experiment?

Most experiments involve two groups:

- The **control** group = the part of the experiment that is the standard against which results are compared (**nothing changes**).
- The **experimental** group = the test group that receives experimental treatment (something, a **variable**, has been changed).

2. Designing an experiment

- Independent** variable = the condition in the experiment that is tested.
- Dependent** variable = the condition that results from changes in the independent variable.
- Constants** are conditions that are kept the same



Section 1.4 Biologists' Tools and Technology

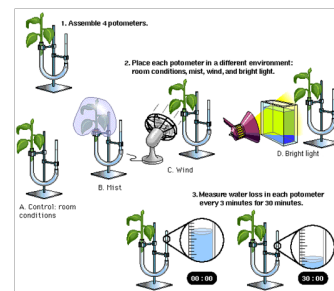
I. Types of Investigation

A. A descriptive investigation involves describing and/or *quantifying parts* of a natural system.

- example: *observing cells* under a microscope and diagramming what is seen.

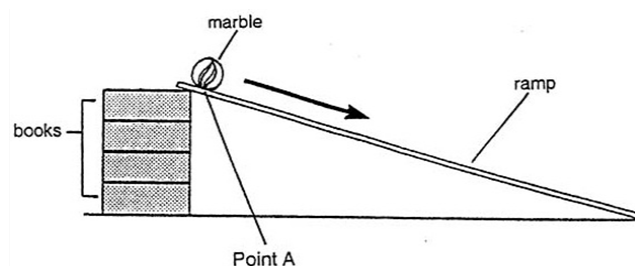


B. A comparative investigation involves collecting data on different populations /organisms, under *different conditions* (ex. times of year, locations), *to make a comparison.*



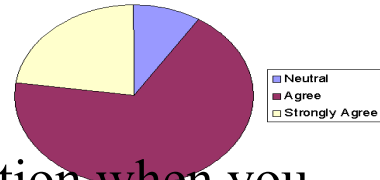
C. An experimental investigation is when a “fair test” is designed in which *variables are actively manipulated*, controlled, and measured in an effort to gather evidence to support or refute a causal relationship.

- example: *testing* the height of a ramp to determine how far a marble will roll

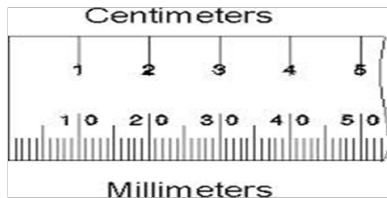


II. Kinds of Data

A. *Quantitative* information



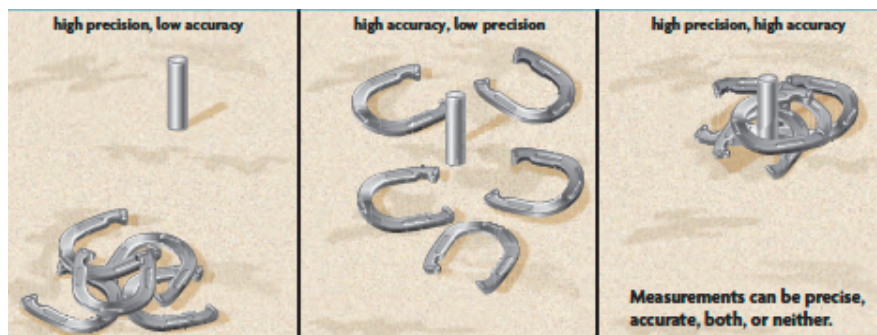
- You obtain this kind of information when you conduct an experiment that results in counts or *measurement*.
- Quantitative data may be used to make *graphs or tables*.
- EX: Count how many *Paramecium* can survive at a certain temperature.



Quantitative → Quantity



- *Accuracy* = how close a measurement is to the true value of the quantity measured.
- *Precision* = the exactness of a measurement.



B. *Qualitative* information

- This is *observable* data - that is, written descriptions of what scientists observe.
- This data is useful because some phenomena **aren't** easily expressed as numbers.

Qualitative → *Quality*

Deals with descriptions. Data can be observed but not measured. *Colors, textures, smells, tastes, appearance, etc.*



VISUAL VOCAB

The **independent variable** is a condition that is manipulated, or changed, by a scientist.

independent variable



dependent variable

Dependent variables are observed and measured during an experiment; they are the experimental data.