

GENERAL BIOLOGY

Introduction to Biology

What is Biology?

- **Biology** is the study of all living things
- Living things are called **organisms**
- Organisms include bacteria, protists, fungi, plants, & animals

Biology:

Is the scientific study of life in all its living forms, plants, animals and microorganisms, including man

The term “Biology” derived from

Bios = life

and

logos = science

All Living Things Share Common Characteristics

known as:

The Characteristics of Life

1. Order (organization)

Living organisms are organized in several levels of increasing complexity best described as a :

The Characteristics of Life

Hierarchy of life levels:

Atoms

Molecules

Organelles

Cells –life starts here

Tissues

Organs

System

Organism

Population

Community

Ecosystem

Biosphere

Hierarchy of life levels

- **Atom**
- **Molecules** - clusters of atoms
- **Organelles** - membrane-bound structures with different jobs inside Cells
- **Cells** - life starts here. The simplest entity that has all the properties of life
- **Tissues** - made of groups of similar cells that carries out a particular function in an organism
- **Organs** - A structure consisting of two or more tissues that performs specialized functions within an organism
- **Organ systems** - have specific functions; are composed of organs that carries out a particular function in an organism

Life's hierarchy of organization

- **Organism:** An individual living thing that can react to stimuli, reproduce, grow and maintain homeostasis
- **Population:** All the individuals of a species only interbreed with each other within a specific area
- **Community:** The array of organisms (different populations) living in a particular ecosystem
- **Ecosystem:** All the organisms (communities) living in a particular area
- **Biosphere:** All the environments (ecosystems) on Earth that support life

The Characteristics of Life

2. **Metabolism:**

Sum of all the chemical reactions in an organism.
Organized synthesis and break down of molecules;
can produce energy to power life processes.

3. **Energy processing:**

Acquiring energy and transforming it to a form
useful for the organism through metabolism

4. **Motility:**

Organisms can move themselves or their parts.

5. **Responsiveness:**

An ability to respond to environmental stimuli

The Characteristics of Life

6. Regulation:

An ability to maintain an internal environment consistent with life (Homeostasis) Within The Ranges Required For Life. Stable internal conditions of pH, temperature, water balance, etc

7. Development:

Develop from simple to more complex organism.

8. Reproduction:

The ability to perpetuate the species, genes are passed from parent to offspring; genes control an organism's phenotype

The Characteristics of Life

9. Evolution:

Evolution is the process of change that transforms life. Populations change over time as they adapt to their environment.

10. Adaptations:

The innate fitness of an organism for its environmental condition. The environment selects organisms with traits that are best suited for an organisms environment (**natural selection.**)

Adaptations are the result of evolution

Living organisms interact with their environments, exchanging matter and energy

- **Life requires interactions between living and nonliving components**
 - **Photosynthetic organisms provide food and are called **Producers****
 - **Others eat plants (or animals that profit from plants) and are called **Consumers****
 - **Decomposers: Recycle all organic materials (Dead plants and animals)**
- **The **nonliving** components are chemical nutrients required for life**

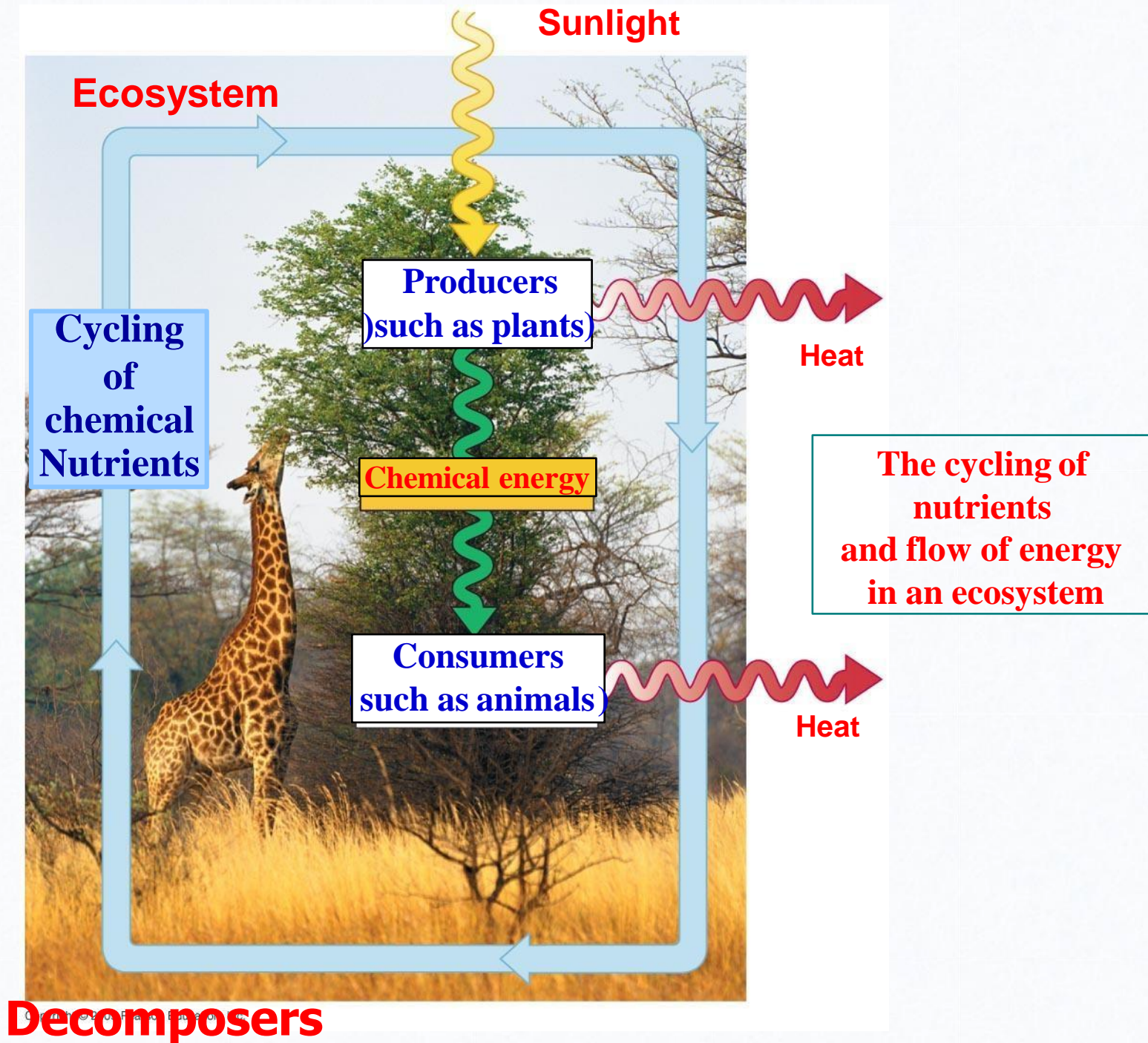
Living organisms interact with their environments, exchanging matter and energy

- **To be successful, an ecosystem must accomplish two things:**

- **Recycle chemicals necessary for life**

- **Move energy through the ecosystem**

Energy enters as light and exits as heat

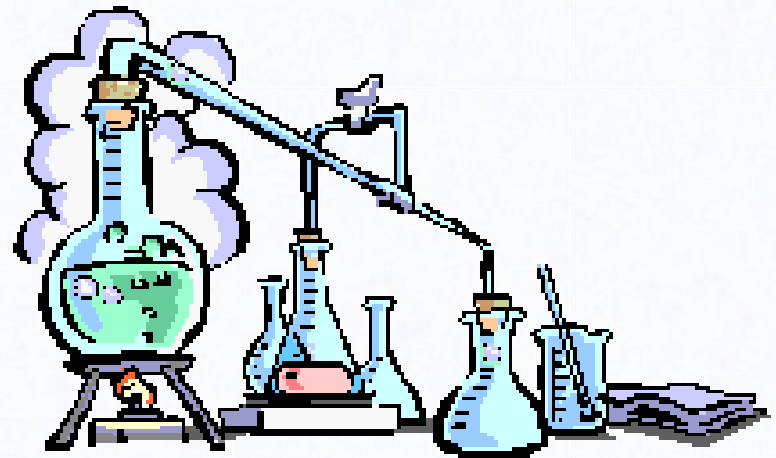


THE PROCESS OF SCIENCE

Scientific Method

Steps in the Scientific Method

- **Observation**
- **Hypothesis**
- **Experiment**
- **Data Collection**
- **Conclusion**
- **Retest**



Scientists use two main approaches to learn about nature

- **Two approaches are used to understand natural causes for natural phenomena**

1. Discovery based science:

- **Results that have been found from actually having carried out the experiment or investigation.**
- **Uses verifiable observations and measurements to describe science.**

2. Hypothesis- based science:

- **An educated guess by a scientist of what will happen during an experiment or investigation.**
- **Uses the data from discovery science to explain science. This requires proposing and testing of hypotheses.**

Scientists use two main approaches to learn about nature

- **There is a difference between a **theory** and a **hypothesis****
 - **A **hypothesis** is a proposed explanation for a set of **observations****
 - **A **theory** is supported by a large and usually growing body of **evidence****

The Process of Science

- **Deductive reasoning:**

Draws specific conclusions based on information (facts)

- **Inductive reasoning:**

Draws general conclusions based on specific (observations)

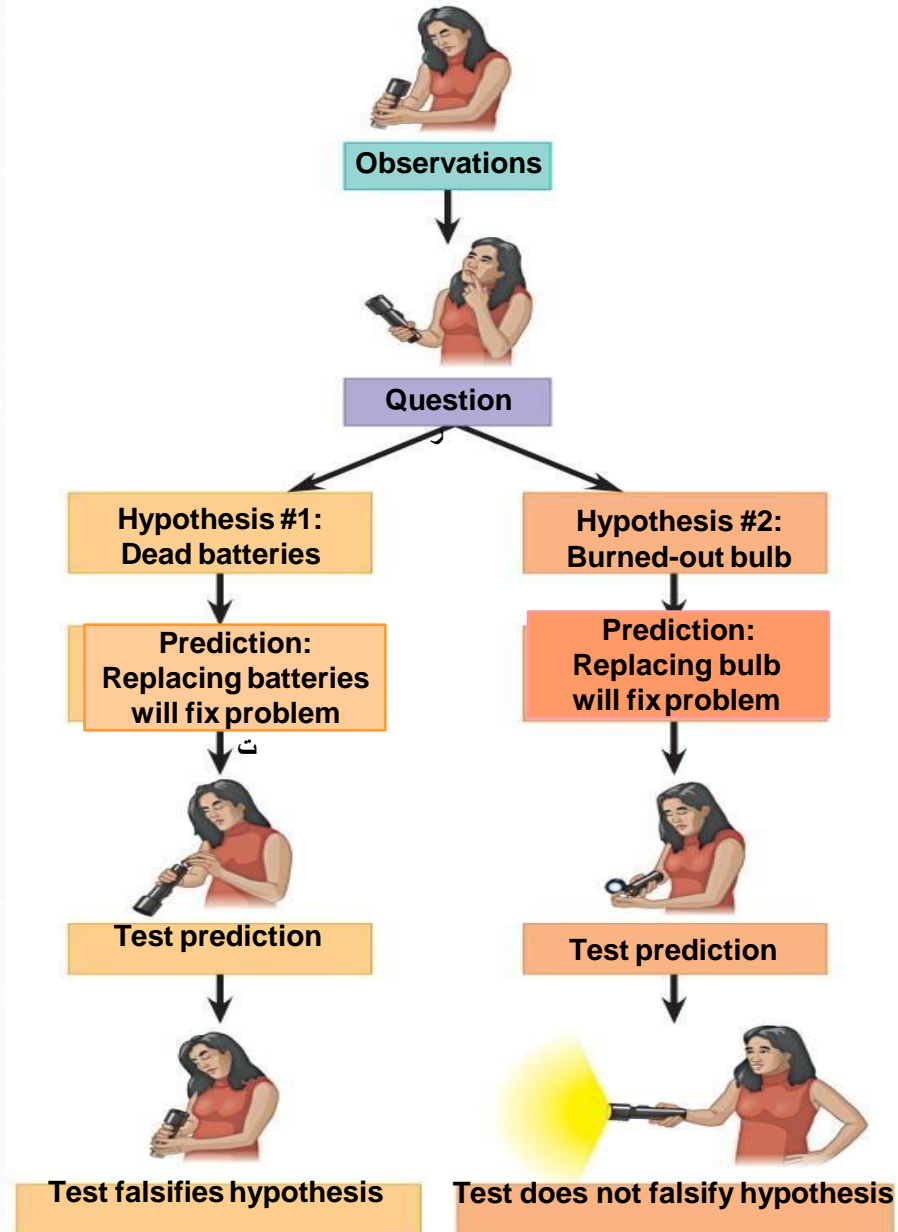
The Scientific Method

Steps in the Scientific Method

- **Observation**
- **Question or problem**
- **Hypotheses**
- **Testable predictions**
- **Experiments**
- **Analyze data**
- **Conclusions**

With hypothesis-based science, we pose and test hypotheses

- **We solve everyday problems by using hypotheses**
 - An example would be the reasoning we use to answer the question, “Why doesn’t the flashlight work?”
 - Using deductive reasoning we realize that the problem is either the:
(1) bulb or (2) batteries.
 - The hypothesis must be testable
 - The hypothesis must be falsifiable



The Hypothesis

- A **tentative (temporary)** explanation for observations
- Consistent with **facts**
- Can be **tested**
- Tests can be **repeated** by others
- Can be **rejected**

Testing Predictions by Experiment

- **Prediction**
- **Deductive product of a hypothesis**
- **Control group**
- **Closely matches experimental group**
- **Experimental group**
- **Differs from control group in 1 variable**

Observation

?

Hypothesis 1

Hypothesis 2

Hypothesis 3

Hypothesis 4

Potential hypotheses

Experiment

Reject hypotheses 2 and 4

Hypothesis 1

Hypothesis 3

Remaining possible hypotheses

Reject hypothesis 1

Experiment

Last remaining possible hypothesis

Hypothesis 3

Predictions

Experiment 1

Experiment 2

Experiment 3

Predictions Confirmed

no

yes

Theory