

# INTRODUCTION TO BIOLOGY

Week 2

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## Meaning of Science and Biology

Science can be defined as a **systematic process of making inquiry** about the living and non-living things in our environment. Science is both an organized body of knowledge and a process of finding out knowledge.

Biology is the branch of science that studies living things. The word '**biology**' is derived from two Greek words: '**bios**' which **means life**, and '**logos**' which **means study**. Biology therefore means **the study of life or of living things**. Biology has several branches, these include:

1. **Botany** (study of plants)
2. **Zoology** (study of animals)
3. **Morphology** (study of the external features of living things)
4. **Anatomy** (study of internal structure of living things)
5. **Physiology** (Study of how living things function)
6. **Ecology** (study of the relationships between living things and their environment),
7. **Genetics** (Study of how living things inherit characters from their parents) etc.

The prime purpose of science is research, i.e. finding out about things, so biology involves finding out or making inquiry about living things, their interaction with themselves and with nature.

## Methods of Science (The Scientific Method)

The method of science involves systematically making inquiries about something under study. It **begins with**;

- 1. Observation** (that is, looking at something carefully with a view to finding an answer to a question). This involves using all the senses i.e. sight, hearing, touch, feeling, pressure, taste, etc. and instruments (e.g. ruler, microscope, magnifying lens,

weighing balance, telescopes, barometer, etc.) where necessary. Observation is followed by a:

**2. Hypothesis** i.e. a sensible, reasonable guess which is capable of being tested or verified. The hypothesis is tested by an **experiment**.

**3. Experiments** usually involve measurements/counting, as such they have to be carried out as accurately as possible. Scientific experiments have a control. The control experiment is identical with the experiment proper, but the factor to be tested is omitted. This gives the investigator a higher degree of confidence in his result and conclusion.

**4. Results** from an experiment are put together and a **conclusion** (inference/generalization) is made. Other scientists may repeat the same experiment and if similar results are obtained then the generalization is accepted as a theory. When a theory has been tested extensively, worldwide and found to be consistently true, it becomes a law e.g. the law of gravity.

### **Experimental Pattern**

Experiments are designed to eliminate all forms of bias so as to avoid making false conclusions. To achieve this, only the factor being tested is varied, all other factors that may affect the result are kept constant. These experiments are known as controlled experiments. While experimenting, a biologist uses processes of science such as counting, measuring, classifying, organizing data, communicating, recording and interpreting data.

In recording an experiment/giving the account of a scientific investigation, the following pattern is used:

1. Date of experiment
2. Aim/purpose of experiment
3. Apparatus/materials required
4. Procedure/method used (including control and precautions)
5. Observations
6. Inference (deduction from what is already known)

In biology, experiments are carried out on living things. It may not be possible to get a sample of test population with identical organisms. This problem can be reduced by using large test samples and also repeating the experiment many times.

## **Living and Non-living Things**

Everything in the world can be classified as either a living thing or non-living thing. Living things include plants and animals (things that have life) e.g. Man, Monkey, Earthworm, Flies, Mango, Fresh okra plant, Hibiscus etc. Non-living things **do not** have life e.g. stone, water, air, table, etc.

## **Characteristics of Living Things**

They carry out seven basic life processes namely;

**(i) Movement:** This is defined as the ability of an organism to change its position. Living things move in order to look for food, shelter, mates (reproduction) and to escape from danger. Generally, most animals can walk, swim, or fly from one place to another but plants can only move parts of themselves in response to external stimuli. Movement from place to place is also referred to as

**Locomotion.**

**(ii) Nutrition:** This is the ability of an organism to feed. Plants manufacture their own food through the process of photosynthesis (autotrophic nutrition). Animals cannot manufacture their own food but depend directly or indirectly on plants for food (heterotrophic nutrition).

**(iii) Respiration:** This involves the taking in of oxygen in order to burn down (oxidize) food substances to release energy which is used to carry out all life processes. Carbon dioxide is given off in the process.

**(iv) Excretion:** This is the removal of metabolic waste products from the body. Many chemical activities go on in an organism and produce waste. The waste products of metabolism include carbon dioxide, water, urea, etc.

**(v) Irritability or Sensitivity:** This is the ability of an organism to perceive and respond to stimuli (changes in the surrounding). Living things exhibit sensitivity in order to survive in their environment. The response is often by some form of movement. Stimuli include heat, light, pain, sounds, chemical substances, etc.

**(vi) Growth:** This is defined as permanent increase in size and mass of an organism especially while young. Organisms also replace and repair worn or damaged parts of the body throughout life. The food eaten provides the basis of growth.

**(vii) Reproduction:** This is the ability of a living organism to produce young ones or offsprings. This ensures continuity of life. Reproduction occurs in two forms.

**Asexual reproduction** – This involves only one organism producing offsprings from itself.

**Sexual reproduction** – This involves two organisms coming together to produce offspring(s).

Apart from these seven basic life processes another characteristic of living things is that they all **die**. All living things have a definite and limited period of existence, and they pass through five basic stages of existence;

Birth → Growth → Maturity → Decline (old age) → Death.

#### Differences between Plants and Animals

PLANTS	ANIMALS
Green plants carry out photosynthesis	Animals cannot carry out photosynthesis; they depend on plants for their food.
Plants do not move from one place to another and do not have organs of movement.	Animals move from one place to another and have organs of movement. They exhibit locomotion.
Growth is indefinite (continues throughout life) and apical.	Growth is definite and occurs uniformly in every part of the body. It stops when they become adults.
Plants do not have specialized organs for excretion, respiration and coordination.	Animals have specific organs for excretion, respiration and coordination.
Plants are slow in response to stimuli	Animals are fast in their response to stimuli
Excess carbohydrates are stored as starch	Excess carbohydrates are stored in form of glycogen
They have many branches	They do not have any branches

**Some organisms exist which possess characteristics of both plants and animals an example is *Euglena viridis*. *Euglena viridis* is a microscopic unicellular organism, which lives in water.**

The characteristics of *Euglena* which make it an animal are;

1. Possession of flagellum used for movement.
2. Possession of gullet for passage of food and which acts as a reservoir.
3. Presence of eye spot which enables it to respond to light.
4. Possession of contractile vacuole used for excretion.
5. Possession of pellicle which makes its body flexible.
6. It can feed on other organisms (holozoic nutrition) in the absence of sunlight.

The plant characteristics of *Euglena* are;

1. Possession of chloroplast which enables it to carry out photosynthesis.
2. Possession of pyrenoid where starch is stored
3. It can produce its own food (holophytic or autotrophic nutrition)

## **Levels of Organisation of Life**

The bodies of living things are highly organized. This organization occurs in levels, with the simplest structure occurring at the lowest levels (single cells) which interact to build up more complex structures (multicellular organisms).

The basic levels of organization of life in organisms are; cells, tissues, organs and systems.

**(i) Cell:** This is the smallest unit of living organism. It is the first and simplest level of organization of life. Plants and animals are made up of cells. One celled organisms are called unicellular organisms. They include Amoeba, Plasmodium, *Euglena*, Paramecium, etc. Organisms made up of many cells are called multicellular organisms e.g man, mango, trees etc. The single celled organism can carry out all life processes on its own.

**(ii) Tissues:** This is a group of similar cells which come together to perform a particular function. e.g. the mesophyll layer in leaves, xylem tissue in stems, muscles, blood (a liquid tissue) etc. Organisms which exist at the tissue level include the hydra, jelly fish, sponge etc.

**(iii) Organ:** Is a group of similar tissues which come together to perform a specific function. Examples in plants are flowers, roots, leaves, seeds, a rhizome, a corm, an onion bulb, a tuber, etc. Examples in animals are the skin, stomach, heart, brain, liver, eyes, ears, kidney, etc.

**(iv) System:** This is a group of functionally related organs which work together to perform specific functions. Examples in plants include the shoot system and root system. Examples in animals include the digestive, nervous, excretory and circulatory systems. Examples in plants are the transport system, shoot and root system.

### **Complex Multicellular Organisms**

The climax of organization in higher living things is the aggregation of systems to form an organism. Complex multicellular organisms are composed of several organ systems which work harmoniously for the benefit of the organism. All animals from Platyhelminthes to Mammals, and all vascular plants are organized on this level.

### **Complexity of Organization In Higher Animals**

As organisms acquire more layers of cells, they become complex in structure, thus there is an increase in complexity from unicellular to multicellular organism.

### **Advantages of Complexity**

1. It leads to internal structural specialization in which the tissues become specialized to carry out specific functions.
2. Complexity makes higher organisms to be more efficient in carrying out life processes.
3. Complexity leads to increase in size of organisms.
4. It makes it possible for organisms to become more resistant to adverse condition within the environment.

### **Disadvantages of Complexity**

1. The cells lose their independence and become increasingly dependent on one another's activities.
2. Slower rate of diffusion of oxygen or respiratory gas to individual cells.
3. Slower rate of expulsion of waste products from cells.
4. Decrease in ability to regenerate
5. Difficulties in reproduction.

## **ASSIGNMENT**

1. What do you understand by Science and Biology
2. Give five (5) difference between plants and animals
3. List three (3) advantages and disadvantages of complexity
4. State the seven (7) characteristics of living thing
5. List and explain the various scientific methods.