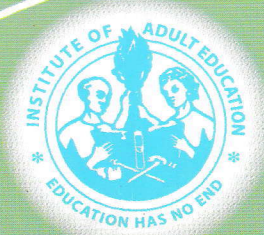
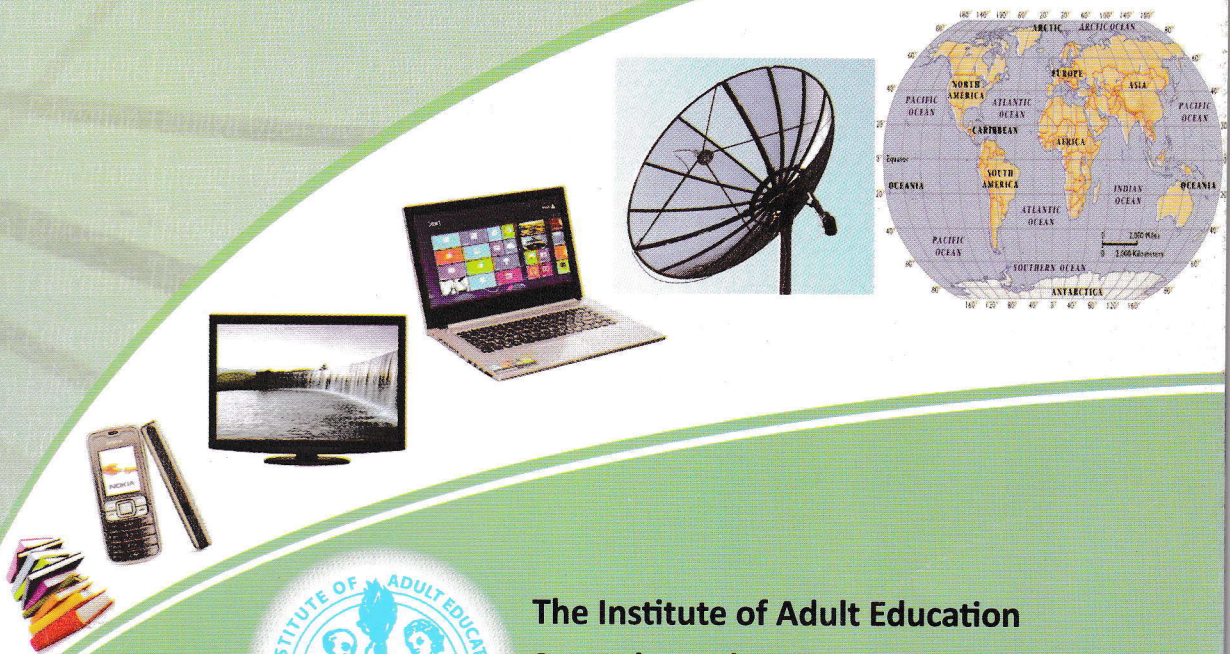


**Module
III**

BIOLOGY

Stage I

Understanding Cell Structure and Classification of Living Things



**The Institute of Adult Education
Secondary Education Programme through
Open and Distance Learning**

BIOLOGY

Understanding Cell Structure and Classification of Living Things

Institute of Adult Education
Secondary Education Programme Through ODL

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About this module

This module has been produced by Institute of Adult Education. All modules produced by the Institute of Adult Education are structured in the same way, as outlined below.

How this module is structured

The course overview

The module overview gives you a general introduction to the module. Information contained in the module overview will help you determine:

- If the module is suitable for you.
- What you already need to know.
- What you can expect from the module.
- How much time you will need to invest to complete the module.

The overview also provides guidance on:

- Study skills.
- Where to get help.
- Unit assignments.
- Activity icons.
- Units.

We strongly recommend that you read the overview *carefully* before starting your study.

The module content

The module is broken down into units. Each unit comprises:

- An introduction to the unit content.
- Unit outcomes.
- New terminologies.



About this Module

- Core content of the unit with variety of learning activities.
- Unit reflection.
- Unit assignments.

Resources

For those interested in learning more on this subject, we provide you with a list of additional resources at the end of this module; these may be books, articles or web sites.

Your comments

After completing this module we would appreciate it if you could take a few moments to give us your feedback on any aspect of this module. Your feedback might include comments on:

- Module content and structure,
- Module reading materials and resources,
- Unit assignments,
- Module assessments,
- Module duration,
- Module support (assigned tutors, technical help, etc.)

Your constructive feedback will help us to improve and enhance this module.



Module overview

Welcome to this module

Dear learner, I know you have started developing great interest on Biology. Join me in this module on Understanding Cell Structure and Classification of Living Things, to explore more about this wonderful subject. This module will answer some of the questions that you might be asking but without getting any answers such as what makes up an organism, how to group organisms and many more.

General competence



By the end of this module you should be able to:

- Demonstrate ability to identify, draw and describe different parts of a cell of living things.



Study skills



As an out of school learner your approach to learning will be different to that from your school days: you will choose what you want to study, you will have professional and/or personal motivation for doing so and you will most likely be fitting your study activities around other professional or domestic responsibilities.

Essentially you will be taking control of your learning environment. As a consequence result, you will need to consider performance issues related to time management, goal setting, stress management, etc. Perhaps you will also need to learn about essay planning, coping with examinations and using the web as a learning tools.

Your most significant considerations will be *time* and *space* i.e. the time you dedicate to your learning and the environment in which you engage in that learning.

We recommend that you take time now—before starting your self-study—to familiarize yourself with these issues. There are a number of excellent resources on the web. A few suggested links are:

- <http://www.how-to-study.com/>

The “How to study” web site is dedicated to study skills resources. You will find links to study preparation (a list of nine essentials for a good study place), taking notes, strategies for reading text books, using reference sources, test anxiety.

- <http://www.ucc.vt.edu/stdysk/stdyhlp.html>

This is the web site of the Virginia Tech, Division of Student Affairs. You will find links to time scheduling (including a “where does time go?” link), a study skill checklist, basic concentration techniques, control of the study environment, note taking, how to read essays for analysis, memory skills (“remembering”).

- <http://www.howtostudy.org/resources.php>

Another “How to study” web site with useful links to time management, efficient reading, questioning/listening/observing skills, getting the most out of doing (“hands-on” learning), memory building, tips for staying motivated, developing a learning plan.

The above links are our suggestions to start with on your way. At the time of writing, these web links were active. If you want to look for more go to www.google.com and type “self-study basics”,

“self-study tips”, “self-study skills” or similar.



Need help?



Dear learner, in the course of your study, you may need help in various issues such as the location and how to get support from resource centres, clarification of various issues pertaining to your study materials (modules) and so on. If this happens, you are advised to ask for the help from your centre coordinator or facilitator, you can also visit the website of the Institute of Adult Education which is www.iae.ac.tz or ask for help by using phone no. +255 22 2150838.

Module assessment



After each unit, you will be required to attempt one unit assignment. These are not meant for submission rather for reflection on what you have learned in the whole module. You will also be given tests and assignments for submission as you will be guided by your module facilitator. You will also sit for mock examinations to accomplish your continuous assessment.























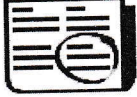


Getting around this module

Margin icons

While working through this module you will notice the frequent use of margin icons. These icons serve to “signpost” a particular piece of text, a new task or change in activity; they have been included to help you to find your way around this module.

A complete icon set is shown below. We suggest that you familiarize yourself with the icons and their meanings before starting your study.

			
Activity	Assessment	Unit assignment	Case study
			
Discussion	Group activity	Help	Note it!
			
Outcomes	Reading	Reflection	Study skills
			
Reflection	Terminology	Time	Tip
			
Computer-Based Learning	Audio	Video	Feedback
			
Objectives	Basic Competence	Answers to Assessments	



Unit 1

Cell Structure and Organization

Introduction

Dear learner, congratulation for completing with great success the previous units; you learned in biology. I hope you enjoyed studying this subject. Studying life leads us into laboratories to examine more closely how organisms work. Biology draws us into the microscopic world of the fundamental units known as cells.

In this unit you will learn the Cell Concept, Cell Theory, Cell Differentiation and Organizations. During your studies, I would like to advise you to visit Biology laboratory in a nearby secondary school, and observe different cells under a microscope.

I wish you a nice study of the unit which will enable you to understand about animal and plant cells.

Learning Outcomes



Upon completion of this unit you should be able to:

- Identify different types of cells;
- Draw and label diagrams of cells; and
- Describe different cells.

The Cell Concept

Dear learner, we hope you are doing well. The house which you live in is made up of many bricks or pieces of wood. However, many modern buildings are made up of concrete blocks. We can say in general that substances are made of small units.

Living organisms are made up of small units (living units). These units are known as *cells*.



A cell is the structure and functional unit of organisms (living things). Any living organism is composed of one or more cells. An organism like amoeba whose body is made of one cell only is known as **unicellular** organism. Other organisms like plants and animals have the bodies with many cells and hence are called **multicellular** organisms. Cells contain hereditary information which is passed from one generation to another.

Examples of cells are: nerve cells, red blood cells, smooth muscle cells in animals and root hairs in plants

a) Cell Theory

Cell theory states that cell is the fundamental unit of life and that all living things are composed of one or more cells. All cells originate from pre-existing cells.

b) Cell structure and function

I hope now after reading this part you can be able to give the meaning of cell and its function. We said that modern houses are made up of bricks but do you know what makes these bricks? What role does each component play? To answer these, let us turn them to a cell to see what make a cell and its function.

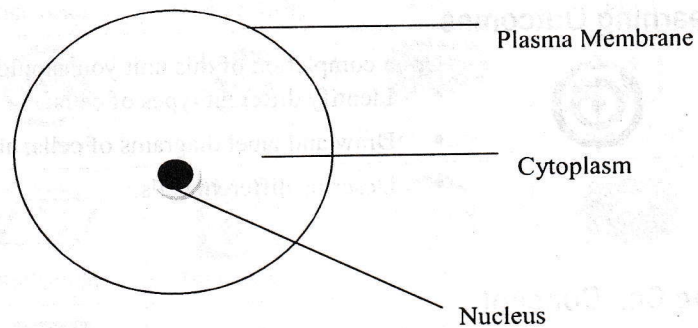


Figure 1: Generalized structure of an animal cell

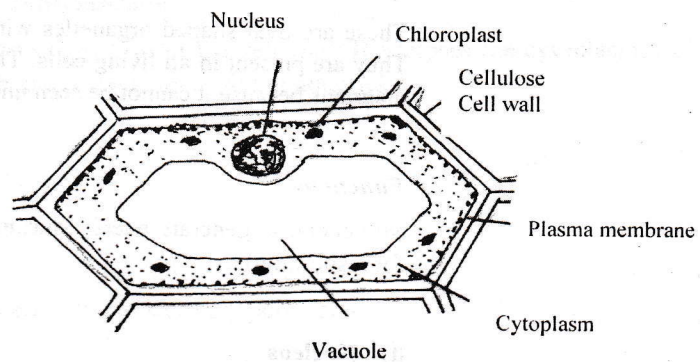


Figure 2: A generalized plant cell

After knowing what a cell is let us now look at its some contents, that is its structures as seen under the light microscope and its functions.

Cell membrane or plasma membrane

Cell membrane is made up of living materials. It surrounds all cells. It separates the inner parts of the cell from the outer environment.

Functions

- Protects the protoplasm.
- Controls the flow of materials in and out of the cell and therefore it is selectively permeable.
- It gives the cell mechanical strength and shape.

b) Cytoplasm

It is a semi-fluid material which fills most of the cells. It is composed of a mixture of chemical compounds and a high proportion of water.

Functions

- It is a site for chemical reactions
- Suspends cell organelles.
- Storage of food.



c) Mitochondria

These are oval shaped organelles with large internal surface area. They are present in all living cells. This part is not indicated in the diagrams because it cannot be seen under the light microscope.

Functions

Mitochondria generate energy during aerobic respiration (i.e. site for respiration).

d) Nucleus

It is a spherical oval body composed of a fluid called nucleoplasm which is surrounded by a membrane called *nucleo-membrane*.

Functions

- Controls cellular activities (metabolism) e.g. protein synthesis and cell division.
- Controls the hereditary characteristics of an organism.

e) Cell wall

It is a rigid outer layer that surrounds the cell membrane. It is made up of non living materials called cellulose.

Functions

- Gives shape to the cell.
- Protects the internal parts of the cell.
- Allows passage of molecules of substances in and out of the cell
- Provides mechanical support to the plant body.

f) Middle lamella

This part is just under the cell wall. It connects adjacent cells.



g) Cell Membrane

This part is just under the cell wall. It encloses the cytoplasm. Cell membrane is made up of living materials.

Functions

- Protects the protoplasm.
- Controls the flow of materials in and out of the cell and therefore is selectively permeable.

h) Chloroplasts

These are egg-shaped green pigment containing organelles called chlorophyll.

Functions

Traps light energy during the day for breaking water molecule during the process of food manufacture (Photosynthesis). It is therefore the site of photosynthesis process.

i) Vacuole

This is a cavity within the cytoplasm. It is filled with a liquid called cell sap, which contains dilute solution of salts and other soluble substances.

Functions:

- Stores water
- Stores coloured pigments which give colour to flowers, fruits and some leaves.
- Responsible for upright standing of young plants (seedlings)

The part you read answers your question on what make a cell. What are the differences between an animal cell and a plant cell?

**Table 1: Differences between Plant Cells and Animal Cells**

Organelle	Animals cells	Plant cells
Cell wall	No cell wall.	Have cell wall made up of cellulose.
Vacuoles	Have small temporary vacuole or none.	Have large permanent vacuole.
Chloroplasts	Have no chloroplasts.	Have chloroplasts.
Shape	Have irregular shape.	Have definite shape.
Size	Have small sizes	They are generally large

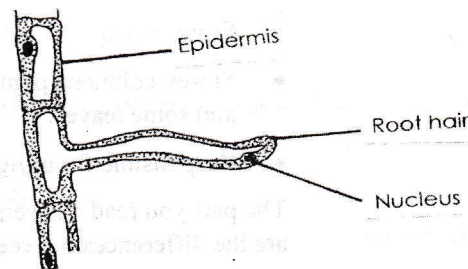
Cell Differentiation and Organization

Consider your society. Are all people doing the same activities? Did they study in the same college? Ask them. Why do you think is important to everyone to do different activity? Visit the near market. Different items are sold there. Are they sold by one person? Dear learner do you know that, your body is like the big market? It is like that big market because; it has different cells which perform different activities. What your cells should do in order to carry out all life activities like reproduction, excretion, growth etc? To answer this question let us join in our discussion below.

Cell differentiation is a structural and physiological modification of a cell in order to perform a specific function. The following examples show that different cells have been modified to suit specific function.

Root hair

It is an elongated epidermal cell for the purpose of increasing the surface area for absorption of water from the soil.

**Figure 3: Position of root hair**



Red blood cell

It is modified by losing its nucleus. This increases the surface area for the transport of gases such as oxygen.

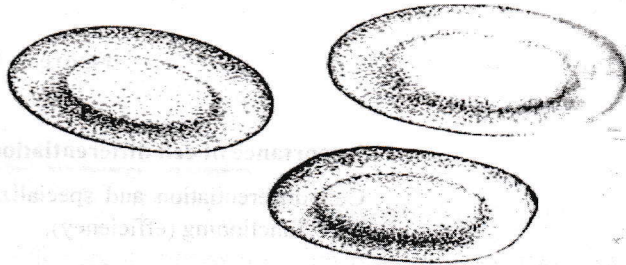


Figure 4: Red blood cells

Smooth muscle

It is elongated and spindle shaped. This allows it to contract and cause movement.

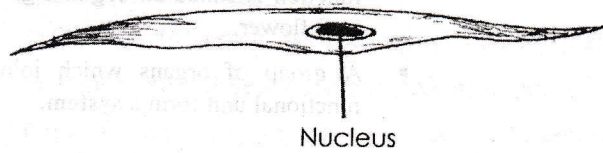


Figure 5: Smooth muscle

Nerve cell (neurone)

Has a cell body with protoplasmic extensions called dendrites and long thin axon which has several terminal processes. Its function is to transmit nerve impulses/messages.

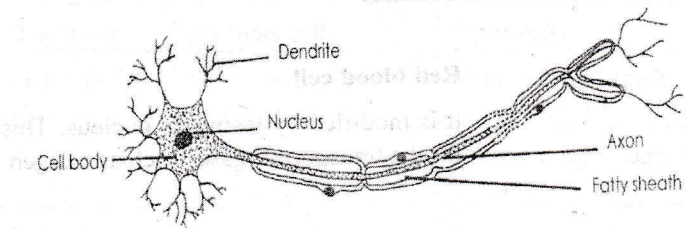


Figure 6: Nerve cell

Importance of cell differentiation

Cell differentiation and specialization ensures smooth and easier body functioning (efficiency).

Cell organization

Cells of multicellular organisms are organized in order to facilitate smooth running of body activities.

- A group of cells similar in structure and function forms a **tissue** e.g. nervous tissue, blood tissue, mesophyll tissue, xylem tissue and phloem tissue.
- A group of different tissues performing the same common function is called an **organ** e.g. heart, liver, kidney, pancreas, leaf, flower.
- A group of organs which joins and works together as a functional unit form a **system**.

Example of systems:-

- Circulatory system.
- Digestive system.
- Respiratory system.
- Reproductive system.
- Transport system.
- Nervous system.



Unit Reflection



After the completion of this unit reflect on the following:

1. Do you think this unit is important to you? Why?
2. Which part of this unit interested you? Why?
3. Can you relate what you have learnt from this unit with your everyday life? How?

Unit Assignment

Do the following questions and remember to keep your work in your portfolio.



1. (a) Organisms whose bodies are made up of one cell only are called _____. Give one example.
(b) Organisms which are made up of many cells are known as _____. Give one example.
2. (a) Write down three ideas about the cell theory.
3. Rearrange the following in sequential order. Tissue, Organism, Cell, Organ, System.
4. a) Give the differences between animal cell and plant cell.
b) Define cell differentiation and give its importance.
5. Explain the importance of cell differentiate and specialization.
6. Draw a well diagram of plant cell as seen under the light microscope and explain the functions of its parts.



Unit 2

Classifying Living Things

Introduction

Dear learner, I hope you enjoyed the previous unit about cell. We live in an environment which is full of different organisms. Organisms differ ranging from very small ones to very large organisms. Due to large number of organisms on the earth, it has been difficult for human to relate and differentiate them easily.

In this unit you will learn about classification, in which different ways of putting organisms into different groups are discussed.

I hope you will enjoy the lesson after knowing how you relate with other organisms in your surroundings.

Learning Outcomes



Upon completion of this unit you should be able to:

- Apply key scientific knowledge, concept and principles in the grouping of living things.
- Describe the structure of viruses and bacteria and their economic importance.

The General Concept of Classification



Look around in your environment; identify different living things around you. Can you give their names? Example; grasshoppers, cats, house flies, butterfly, mosquitoes, cows, etc. Do these organisms mentioned here resemble each other? Or, they are different? Group them according to their resemblances. The process of sorting living things based on their similarities or differences is called **classification**.

Examples of the features used in classifying organisms are:-

- Organisms with or without mammary glands.
- Body covered or not covered with hairs.
- Birth giving or egg laying.



- Plants based on leaf shape, root system, leaf venation, appearance of stems.
- Number of cotyledon in seeds.

Importance of Classification



Visit the market near your home, observe different items sold. Are the items sold mixed up? Or are they arranged? What problem will the seller face if they are not in order? What advantages would you get if they were arranged?

Arranging means classifying. Would you please give importance of classification? If you can, it is ok, if not read the next part.

- Helps biologists to know much about all organisms.
- Gives room to fit new similar organisms in future.
- Study of members of such a group enables human to describe biologically the rest of the members of the group e.g. studying the reproductive system of the pigeon is enough to all birds.
- It makes easy to communicate among Biologists worldwide because each organism bears one scientific name, thus avoiding confusion and repetitions.
- It shows evolutionary relationship that exists between closely related organisms.

Types of Classification systems

Usually there are two ways (types) of grouping organisms, these are artificial classification and natural classification.

i) Artificial system of classification

In an artificial system of classification only one or few features are considered at a time when sorting living things into groups. For example:

- Dog, cow, lizard and frog are placed in one group simply because they all have four legs.
- Bird, bat and grasshopper are grouped together due to presence of wings.

Advantages

The system is very easy and simple to use.

Disadvantage

Unrelated organisms are grouped together while closely related ones are placed in different groups because of the presence or absence of a particular feature.



For example, if we consider the ability to fly and the modification of the forelimb into wings the bats and birds would be placed in the same group. But in reality bats and birds have several biological features which differentiate each others. Bats have hair while birds have feathers. Bats also have glands mammary, sweat glands and different types of teeth while birds have beaks, lay shelled eggs.

ii) Natural system of classification

In this system organisms are classified basing on their similarities and differences in structures and functions.

Points considered in natural system of classification:

- Organisms with many features in common are placed together.
- Homologous are distinguished from analogous ones.

Examples: structures like, arm of human, fore limbs of a cow, forelimbs of a whale, wings of a bird and bat are homologous structures i.e. similar in origin but different in functions. Such organisms have descended from a common ancestor.

- Wings of bird and insects are analogous structures i.e. different in origin but similar in function hence organisms come from different ancestors.

Advantages

- Give accurate information about organisms.
- Show true evolutionary trend of organisms.
- Closely related organisms are placed in the same group.

Disadvantages

- It is tedious
- Expensive
- Time consuming
- Needs knowledgeable person.

Dear learner, I think you know now the meaning of classification and its types. Which type uses few observable features?

If you use this type you can put organisms on different ranks.

For example, plants can be separated from all other living organisms, because they are green. But even green plants can be separated again if we consider those with flowers and those with no flowers. Flowering plants can also be divided into dicot and monocot. You can continue doing this unit you get a unique group.



Major groups of Living Things

Dear learner, there are five major groups of living things, namely:

- Kingdom Monera
- Kingdom Protocista
- Kingdom Fungi
- Kingdom Plantae
- Kingdom Animalia

Study carefully the following examples of how organisms can be ranked. This will enable you to classify organisms easily.

Organisms are grouped according to their similarities and differences. For example:

- Tomato, cabbage, orange and mango trees are green plants, hence are more similar.
- Fish, frog, cat, chimpanzee and human being have backbone/vertebral column.
- Frog, cat, chimpanzee and human being have four limbs. Therefore are more similar.
- Cat, chimpanzee, man have mammary glands hence are more similar.
- Chimpanzee and human digits bear nails hence are more similar.
- Chimpanzee's legs are shorter than arms. In human legs are longer than arms less similar.
- All humans resemble each other more than they do with chimpanzee more similar.
- There are degrees of resemblances among organisms.

From the above, we can have:

Organisms – all living things

Animals – Living things like, snail, human, bird and tapeworm.

Vertebrates – animals with backbone like fish, frog, lizard, bird, human.

Tetrapod – four limbed vertebrates e.g. frog.

Mammals – animals with mammary glands e.g. cat, human.

Primate – animals whose eyes are directed forward, large complex brain, limb bears five digits with nails, e.g. chimpanzee and human.

Ranks of classification

Ranking is a hierarchical arrangement of groups of organisms ranging from the largest group to the smallest one.



Each taxonomic level is more comprehensive than the previous one.

In classification of living things there are seven ranks as shown below:

- Kingdom
- Phylum/Division
- Class
- Order
- Family
- Genus
- Species.

Kingdom is the highest classification rank; comprises organisms of closely related phyla/divisions.

Phylum/division is a group of closely related classes.

Example:

- Phylum chordata (all animals with backbone) e.g. fish, frog, lizard, bird and human.
- Division angiospermophyta (e.g. beans, maize, grass and banana).

Class comprises living organisms of closely related orders

Examples: class mammalia, ave, amphibian, monocotyledonae, dicotyledonae.

Order is formed by closely related families.

Family consists of closely related genera (singular genus).

Genus (plural: genera) is formed by two or more different species having many features/characteristics in common. Donkey, zebra and horses belong to the same genus. However, they cannot interbreed a viable (fertile) offspring.

Species is a group of living organisms which can interbreed freely to produce fertile offspring. It is a group of living organisms having many features in common and it is the smallest group in classification. Organisms in this group are distinct and different from other organisms. Thus all human beings belong to the same species.



Table 2: Example of classification ranking

Organism Rank	Maize	Human being
Kingdom	Plantae	Animalia
Phylum/Division	Agiospermae	Chordata
Class	Monocotyledone	Mammalia
Order	Poales	Primate
Family	Graminae	Homonidae
Genus	Zea	Homo
Species	Mays	Sapiens
Scientific name	<i>Zea mays</i>	<i>Homo sapiens</i>

- Number of organisms decreases downwards.
- Number of related features/character (similarities) increases downwards.
- Kingdom has a greater number of organisms than species.
- The Kingdom has lesser similarities among organisms than species.

From the table above, which group do you think has many members? Are they increasing upward the kingdom or downward the species? Share your answers with your friends.

Assigning Scientific Names to Living Things /nomenclature

All organisms have names. I hope you know many names of organisms surrounding you in your local language. What is the name of the following organisms in your language?

- A cow
- A mango tree
- A dog
- A goat.
- A person/man.

Probably your local names are different from those given above. Do you know why? It is because usually organisms bear names which differ from one tribe to another and place.

Dear learner, write down names of different things in your language and compare them with Swahili, English or language of other tribe you know. By considering your language, do you think other people know what you mean if you use it? What do you think should be done in order to make communication easy?



The art of assigning names to organisms is known as nomenclature. All organisms have two names i.e. the common name and the scientific name.

The common name differs from place to place e.g.

- Kamongo – Luo
- Kambale – Kiswahili
- Lung fish – English

From this example the English people also will not understand what kambale means. The Luo and Swahili people also will not understand what lung fish is. There will also be misunderstanding for the meaning of kamongo and kambale between Luo and Swahili people.

The best solution to such problem is to provide only one scientific name to each organism. Such names should be known worldwide.

Examples:

Human: *Homo sapiens*

Maize: *Zea mays*

Cockroach: *Periplaneta americana*

Rules of Nomenclature

Assigning scientific name to organism is not an easy task and it does not done randomly. There are some rules to be followed.

These rules include:

- Every organism must have only one scientific name.
- Scientific names must be written in Latin language which does not change.
- The binomial system of generic and specific names is to be used.
- If several names have been given to an organism, the earlier is the valid one (after Linnaeus,) founder of classification and Binomial Nomenclature.
- The generic name must start with a capital letter and the specific name with a small letter.
- A scientific name may be underlined if hand written/typed or written in italic letters.
- A scientific name should include the name of the author at the end, e.g. *Homo sapiens* (L).



- Nomina conservanda/names are valid only when authorized by the international commissions.

I hope now you are familiar with scientific names of organisms and how to name them. Forget about local names we have been given our parents or grandparents which are very easy to be assigned and no rules to be followed.

The next discussion is about grouping these organisms. How many groups of organisms do we have? What features make these organisms different? To get answers of these questions join in our discussion that follows.

Viruses

Do you think viruses are living things or non living things?

Dear learner, have you heard people talking about viruses? What are the viruses? Which group does viruses belong? Viruses are smallest particles compared to bacteria that they can only be seen by an electron microscope. They have both living and non-living features. They are able to pass through filters which retain bacteria. They are not belonging to any group due to the following features:

General characteristics/features of viruses

Viruses have the following general characteristics:-

Viruses have both living and non-living characteristics i.e. they are on the boundary between living and non-living things as seen in table 3:

Table 3: Characteristics of living and non-living organisms

Living characteristics	Non-Living characteristics
• The simplest/smallest organisms.	• Lack cellular structure.
• Have nucleic acid; either Deoxyribonucleic Acid (DNA) or Ribonucleic Acid (RNA) but not both.	• Can crystallize/become inert/inactive.
• The nucleic acid (genetic material) is covered by a protein coat.	• Does not reproduce outside host cell/organism.
• Reproduces only inside cells of living organisms, hence are parasites of plants, animals or bacteria.	
• Show specificity to their hosts.	



Distinctive features of virus

Let us now look at distinctive features of virus.

- Reproduce only inside host cells
- Can mutate (Retrovirus) e. g. Human Immunodeficiency Virus (HIV) virus.
- Can have either RNA or DNA but not both.

a) The structure of a virus

Virus is a fragment or particle with a coat of nucleic acid (either DNA or RNA but not both). Most of the viruses are enclosed in a protein coat called capsid. However, a few of them have no protective coat. These are considered to be naked. Below are examples of the viruses.

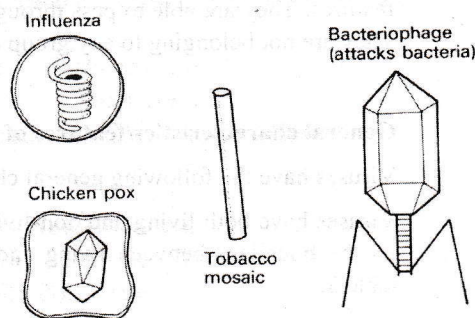


Figure 7: Viral structure

From what you have learnt about virus, do you know any viral diseases? Can you mention at least two of them? Does virus have any importance to human life? Or any impact to human life? The discussion below will help you to know the impacts of virus on human life.

b) Advantage and Disadvantage of viruses

After discussing the general and distinctive features of virus, let us now see how Virus are good or bad.

All viruses are endoparasites. They cause diseases to living organisms. Examples of viral diseases in humans are: AIDS which is caused by HIV virus (a retrovirus) that is RNA virus.



- Poliomyelitis (polio) is caused by polio virus which is RNA virus.
- Influenza is caused by DNA virus.
- Hepatitis B is caused by DNA virus.
- Mumps is caused by RNA virus.
- Measles is caused by RNA virus.
- Small pox is caused DNA virus.
- Yellow fever is caused by RNA virus

We have seen that viruses cause diseases to other organisms but in other side viruses have advantages as they are used in making vaccine e.g. vaccine for polio.

Dear learner, do you remember why living things are classified. Why virus is not placed in kingdoms of living things. Can you mention kingdoms of organism you know?

The following part will explain to you the groups of living things starting from the lowest to highest one.

Kingdom of Living Things

Dear learner, welcome to this unit parts but keep in mind that you have to remember well the general concept of classification. I believe that you enjoyed the previously lesson and that you understood it well. "Do you remember how living organisms are classified?"

What is the number of groups in which living thing belong?

We have seen also that different living things are classified according to their similarities and differences from the highest rank to the lowest rank. Also we observed that viruses are either living organisms and sometimes can be non-living organisms. Follow me in the following section where you will learn much on true kingdom of living organisms. By the way forget about virus. Let us concentrate on this section which you are going to learn about **monera, protocista, fungi** and some of the member of **plantae kingdom**. Among these groups of living things which one has smallest organisms? Can you give one example?

1. Kingdom Monera

In the previous lesson we said that viruses are very small particles that we cannot see them with our naked eyes. Viruses have characteristic of being living organisms and sometimes non-living organisms. Members of Monera differ from viruses because they occur as living organisms only. All bacteria belong to kingdom monera



General characteristics/features

- Unicellular living organisms.
- Have rigid cell wall made up of murain which gives the framework of the cells.
- Lack true nucleus. Instead, have naked circular DNA (genetic material) suspended in the cytoplasm.
- Some are able to fix nitrogen.
- They are all prokaryotes as they lack true nucleus.
- Some are autotrophs e.g. blue green bacteria.
- Others are heterotrophs e.g. saprophytic bacteria (decomposer) and parasitic bacteria.

Distinctive features

- Rigid cell wall made up of murain.
- Some of them have ability to fix nitrogen.
- Naked circular DNA.
- Lack most organelles.

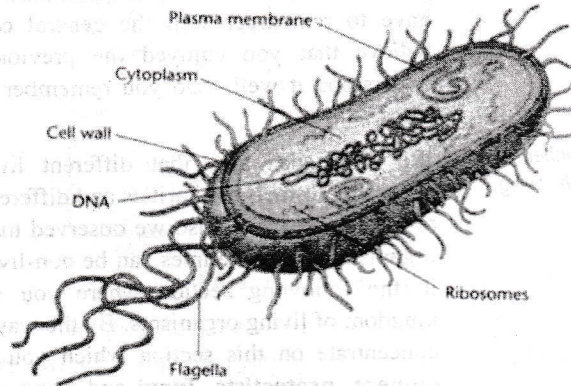


Figure 8: Diagram of bacterium

Advantages and disadvantages of the kingdom monera

Bacteria occur in a wide range of habitats. Some are found in water, others in soil and air and others are found in or on other organisms.

Are you familiar with advantages and disadvantages that we get from bacteria? Mention two of each. If not yet, join in our discussion here.



Advantages of bacteria

- Some bacteria fix or convert atmospheric nitrogen into a form of nitrates that can be used by themselves and other organisms. Such bacteria are called *Nitrogen Fixing Bacteria*. They enrich the soil with nitrates, hence increase soil fertility.
- Saprophytic bacteria make the soil fertile by decomposing dead organic materials such as dead plants and animals.
- Nitrifying bacteria add nitrogen in the soil. Bacteria also help treat our sewage, i.e. decompose the organic matter in the sewage into harmless form.
- Some bacteria in the stomach or appendix of herbivores help to digest cellulose of plant material.
- Some bacteria are used in fermentation e.g. brewing industries.
- Some are used in making antibiotics.

Disadvantages of bacteria

- Some bacteria spoil food. E.g. sour milk, rotten fruits, and spoiled meat are caused by bacteria.
- Some bacteria cause diseases to animals and plants

Examples of bacteria and the diseases they cause in animals:-

- Vibrio cholerae – cause cholera.
- Treponema pallidum cause syphilis.
- Clostridium tetani – cause tetanus.
- Salmonella typhi – cause typhoid fever.
- Diplococcus – cause pneumonia.

a) Kingdom Protocista

This kingdom includes all organisms that are no longer classified as plants, animals or fungi. They are however eukaryotes.

General characteristics/ features

- They are eukaryotic living organisms that they have true membrane bound nucleus in the cytoplasm.
- They range from unicellular, filamentous to multicellular organisms.
- Some of them are free living whereas others are parasitic e.g. Plasmodium sp (parasitic), spirogyra sp (free living).



- The majority are heterotrophy while some are autotrophs, e.g. chlorophytes.

Distinctive feature

The following is distinctive feature of kingdom Protocista:

The organisms resemble the ancestors of plant, animals and fungi.

Examples: Plasmodium sp., spirogyra sp., Euglena sp., Entamoeba sp

Phyla of kingdom protocista

Kingdom protocista has the following phyla:

Phylum	Example
(1) Oomycota	Phytophthora-infestans
(2) Euglenophyta	Euglena
(3) Rhizopoda	<u>Entamoeba histolytica</u>
(4) Apicomplexa	<u>Plasmodium sp.</u>
(5) Chlorophyta	Spirogyra sp.
(6) Ciliophora	Paramecium sp.

What are the representatives of phylum Protocista?

Dear learner, although we have mentioned six phyla of kingdom Protocista, in this discussion we are going to select only three representative members of phyla rhizopoda, Euglenophyta and ciliophora that are amoeba, euglena and paramecium respectively for more explanations.



Phylum Rhizopoda: Example amoeba

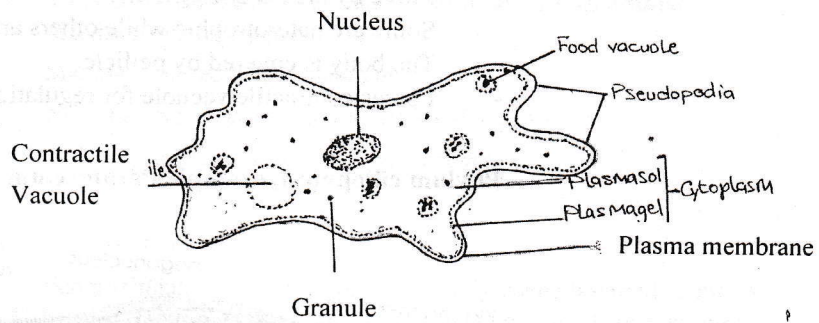


Figure 9: The structure of amoeba

Features of Amoeba

Amoeba have the following features:

- Are irregular
- Jelly like mass of protoplasm
- Have a double membrane, the outer layer which is grayish known as ectoplasm and the inner layer which is granular called the endoplasm.
- The nucleus is found in the endoplasm and appears as a dense patch.
- Endoplasm usually contains a number of food vacuole.
- They move by means of pseudopodia.
- Pseudopodia are also used to take in food.
- No special organelles for locomotion.

Phylum Euglenophyta: Example Euglena

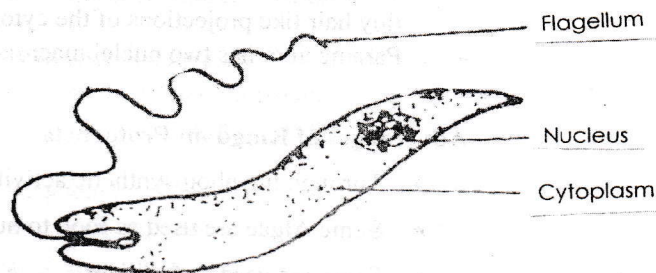


Figure 10: Euglena sp



Features of Euglena sp

- Move by means of flagella.
- Some are heterotrophic while others are autotrophs.
- The body is covered by pellicle.
- Posses contractile vacuole for regulation of water and solutes.

Phylum ciliophora, example Paramecium

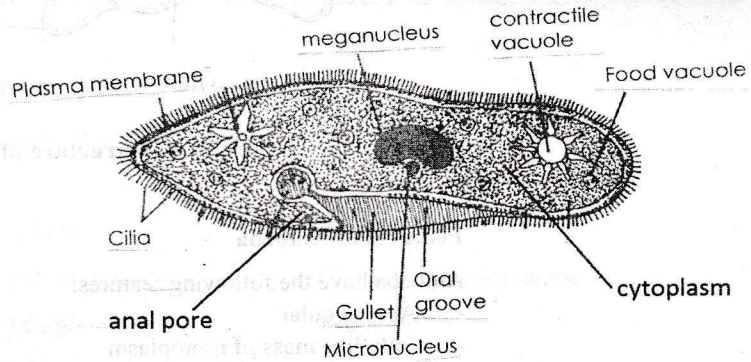


Figure 11: Paramecium

Paramecium is a unicellular organism which has two nucleic. There is a small nucleus (micronucleus) and a large nucleus (macronucleus). Its body is covered by the hair like structures called **cilia**.

Features of paramecium

- They are ciliated; movement is by means of cillia. Cillia are tiny hair like projections of the cytoplasm.
- Paramecium has two nuclei macronucleus and micronucleus.

Advantages of Kingdom Protoctista

- Through the photosynthetic activities the produce Oxygen
- Some Algae are used as food to human being
- Some are used as fertilizer



Disadvantage of Kingdom Protoctista

They cause diseases to plants and animals. Eg of animal diseases caused by protozoa are;

Malaria – caused by *Plasmodium*

Amoebic dysentery caused by *Entamoeba histolytica*

Sleeping sickness caused by *Trypanosoma*

How do fungi
classified

c) Kingdom Fungi

Fungi (singular: fungus) have traditionally been classified as plants because they look like plants rather than animals. However, since fungi have unique characteristics, they have been placed in their own kingdom. Fungi include mushrooms, moulds and yeasts.

General characteristics/ features

Kingdom Fungi have the following characteristics.

- Eukaryotic organisms.
- They range from unicellular to multicellular.
- They are heterotrophs because they lack chlorophyll.
- Cells are surrounded by rigid cell walls made up of chitin.
- Body is usually mycelium, made up of tubular filaments called **hyphae**.
- They store carbohydrates in form of glycogen.
- They reproduce asexually by spores or budding.
- Sexual reproduction is by gametes.
- They are non-motile.
- Some are parasites and others are saprophytes.
- Cells have centrioles.
- Have external digestion, hence absorptive nutrition.
- Some are multinucleated.

Distinctive features

- Extra-cellular digestion.
- Mycelium body of hyphae.

Kingdom fungi are divided into three phyla:

- Zygomycota e.g. mucor (bread mould)
- Ascomycota e.g. yeast
- Basidiomycota e.g. mushroom.



Phylum zygomycota

Some of these are unicellular organisms and others occur as filaments. They reproduce asexually by producing spores. A typical example in this phylum is the mucor.

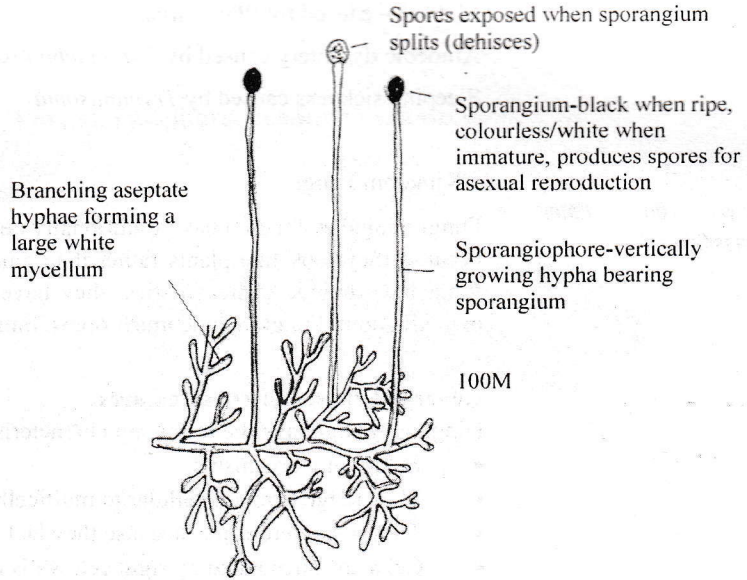


Figure 12: Mucor

Phylum Ascomycota

They have saclike structures called **asci** (singular, ascus) which produce ascospores. Yeasts belong to this group. Yeast reproduces asexually by budding and sexually by forming ascospores.

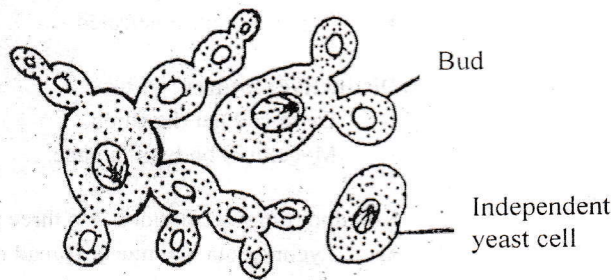


Figure 13: Yeast



Phylum Basidiomycota

Have you come across with mushroom? If yes, do you think mushroom will be considered as plant? Give reasons. So far most people get confused about mushrooms, they consider them as plant but in real sense mushroom is not a plant. It is a fungus; and belongs to phylum Basidiomycota. See fig. 13.

The large fungi such as mushroom and puffballs belong to this phylum. They have sexual spores born internally on club-shaped structures called **basidia**.

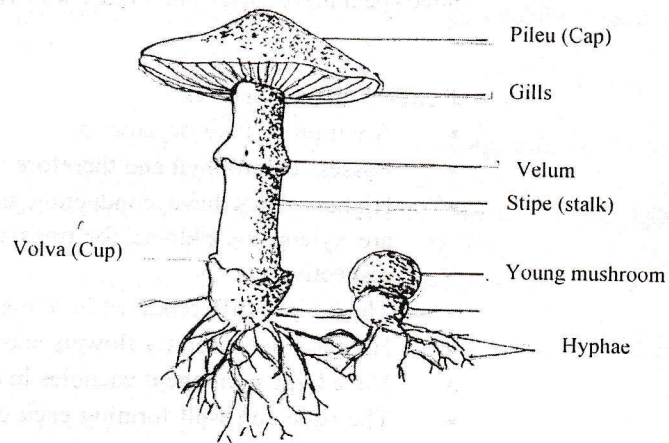


Figure 14: Mushroom

Advantages of kingdom Fungi

If you remember in the previous discussion, we explained that bacteria have both advantages and disadvantages. Similarly fungi have both advantages and disadvantage. The following are advantages of kingdom fungi.

- Some fungi e.g. Penicillium sp is used to manufacture antibiotics.
- Some are edible e.g. Agaricus sp.
- Some are used in fermentation process to get alcohol and in bakeries to raise the dough e.g. yeast.
- Other fungi like mucor and Rhizopus decompose the dead bodies and hence contributing the nutrient re-cycling in nature.
- Saprophytic fungi feed on dead organic matter.
- Some saprophytic fungi destroy crops in the fields or stores.



- Some fungi cause diseases to humans e.g. ring worm, Candida albicans causes thrush.
- Some mushrooms are poisonous. If eaten, cause death or serious health problems.

d) Kingdom Plantae

It is large group composed of a wide variety of plants. Plants are eukaryotes with green multicellular body of differentiated tissues and organs. The cell has a nucleus and cellulose cell wall. Most have specialized absorbing organs known as *rhizoids* or roots.

General characteristics

- Are multicellular organisms.
- Possess chlorophyll and therefore are autotrophs.
- Higher plants have conducting tissues/vascular tissues that are xylem and phloem for transportation of water and food respectively.
- The body is differentiated into true roots and shoots.
- Higher plants produce flowers and seeds.
- Have large permanent vacuoles in body cells.
- The rigid cell wall forming each cell is made up of cellulose materials.
- Have branching body.
- They store carbohydrates in form of starch.
- They have plastids, e.g. chloroplasts containing chlorophylls and chloroplasts.
- Chloroplasts containing coloured pigment which give colour in flowers, fruits.

Distinctive features

- Body differentiated into true root system and shoot system.
- Higher plants produce flowers and seeds.
- Presence of xylem and phloem cells.

Examples of plants are maize, grass, mango tree, bean plant and ferns.



Divisions of kingdom plantae

The kingdom plantae have the following division:

- Division Bryophyta e.g. liverworts and moss plants
- Division Filicinophyta e.g. ferns
- Division Coniferophyta e.g. pine, cedar and cypress
- Division Angiospermophyta e.g. flowering plants such as beans and maize.

Division Bryophyta

Bryophytes occurs in two forms or generations called the gametophyte and the sporophyte. The gametophyte generation is dominant than sporophytes generation.

General characteristics/features

- These plants live and grow in damp and shady habitats/ places.
- They lack conducting vascular tissue i.e. no xylem or phloem.
- They reproduce both by spores and gametes.
- They have no true leaves, stems or roots.
- They have rhizoids for attachment in the soil and absorption of water and mineral salt.

Distinctive features

- Lack of true structures i.e. no true leaves, stems and roots.
- Example: Moss (*Funaria* sp).

Division of Bryophyta

- Class hepaticae e.g. liverworts
- Class musci e.g. moss plants

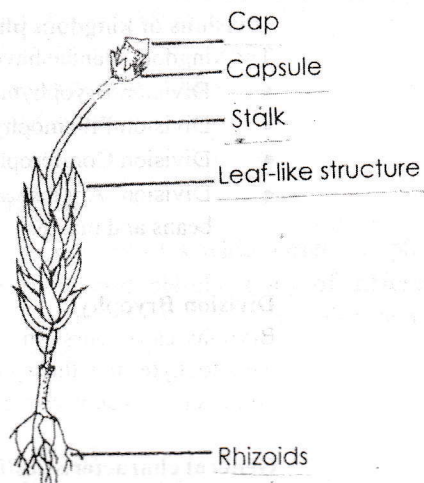


Figure 15: Moss plant

Classification of moss (musci)

Mosses are land plants. They have upright green shoots which have leaf-like structures and root-like structures called rhizoids.

- They have simple stem and leaves.
- They lack true root instead they possess rhizoids see Fig. 14
- Reproduce by spores and gametes.

Advantage of mosses

- Source of oxygen.
- Important in weathering process.
- When they rot they increase soil fertility.
- They are habitat of other organisms.

Disadvantage of mosses

- Can destroy buildings through weathering process.
- They are weed in farm and garden

Division Filicinophyta

These are found in many parts of the world, growing in moist shady area. The plants have the following general characteristics:-

General characteristics

- These are terrestrial plants growing in damp, shady habit / places.



- Have relatively large leaves called *fronds*.
- Have elementary conducting tissues e.g. tracheids as xylem for water conduction and sieve elements as phloem for conduction of food.
- Young leaves are incircinate (rolled) shape.
- Have true structures ie. true leaves, stem and roots.
- They are multicellular eukaryotes.
- Produce spores in clustered sporangia called **sori**.

Distinctive features

- Relatively large leaves/fronds.
- Circinate (rolled) young leaves. Example: All fern

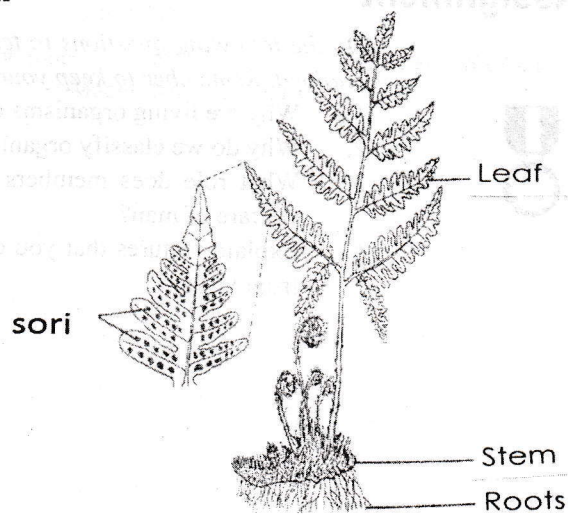


Figure 16: Fern

Advantages of ferns

- They are used for decoration.
- They are habitat for other organisms.
- They prevent soil erosion
- They are source of food to other organism



Unit Reflection



From what you have learnt in this unit, you can now reflect by responding to the following:

1. Which part of this unit is most interesting to you? Please explain.
2. Which part was very difficult to you? Why?
3. What would you do to that difficult part?

Unit Assignment




Do the following questions to test yourself if the learning aimed is attained. Remember to keep your work in your portfolio.

1. Why are living organisms classified?
2. Why do we classify organisms?
3. What role does members of monera and fungi play in the welfare of man?
4. Explain features that you can use to differentiate plant group from virus.



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