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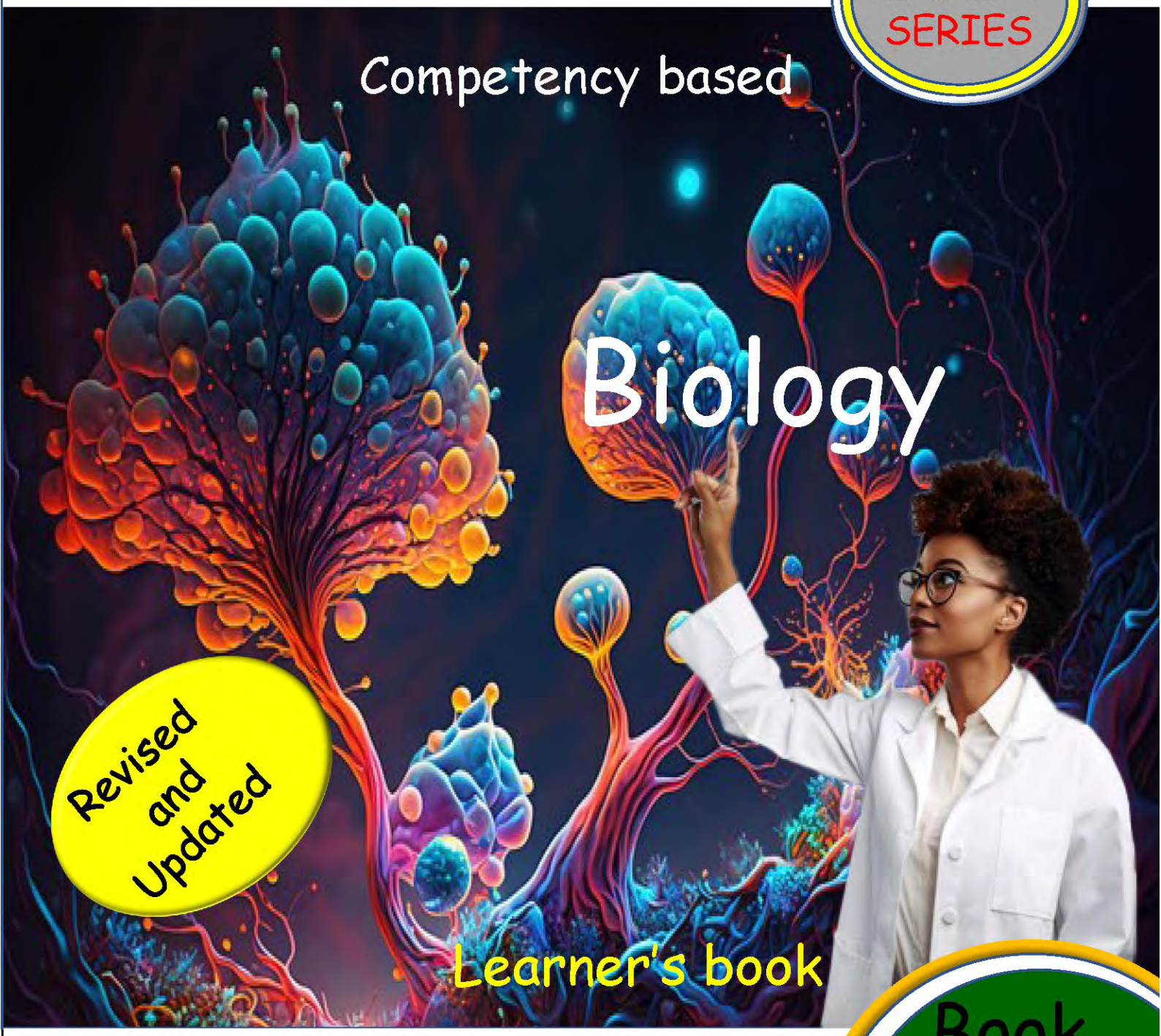

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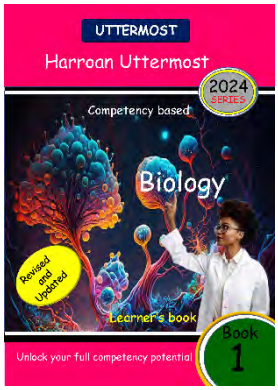

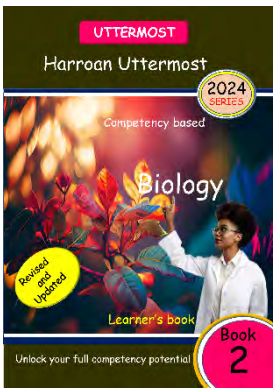

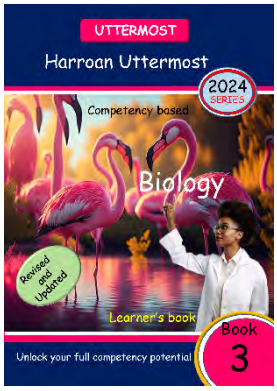

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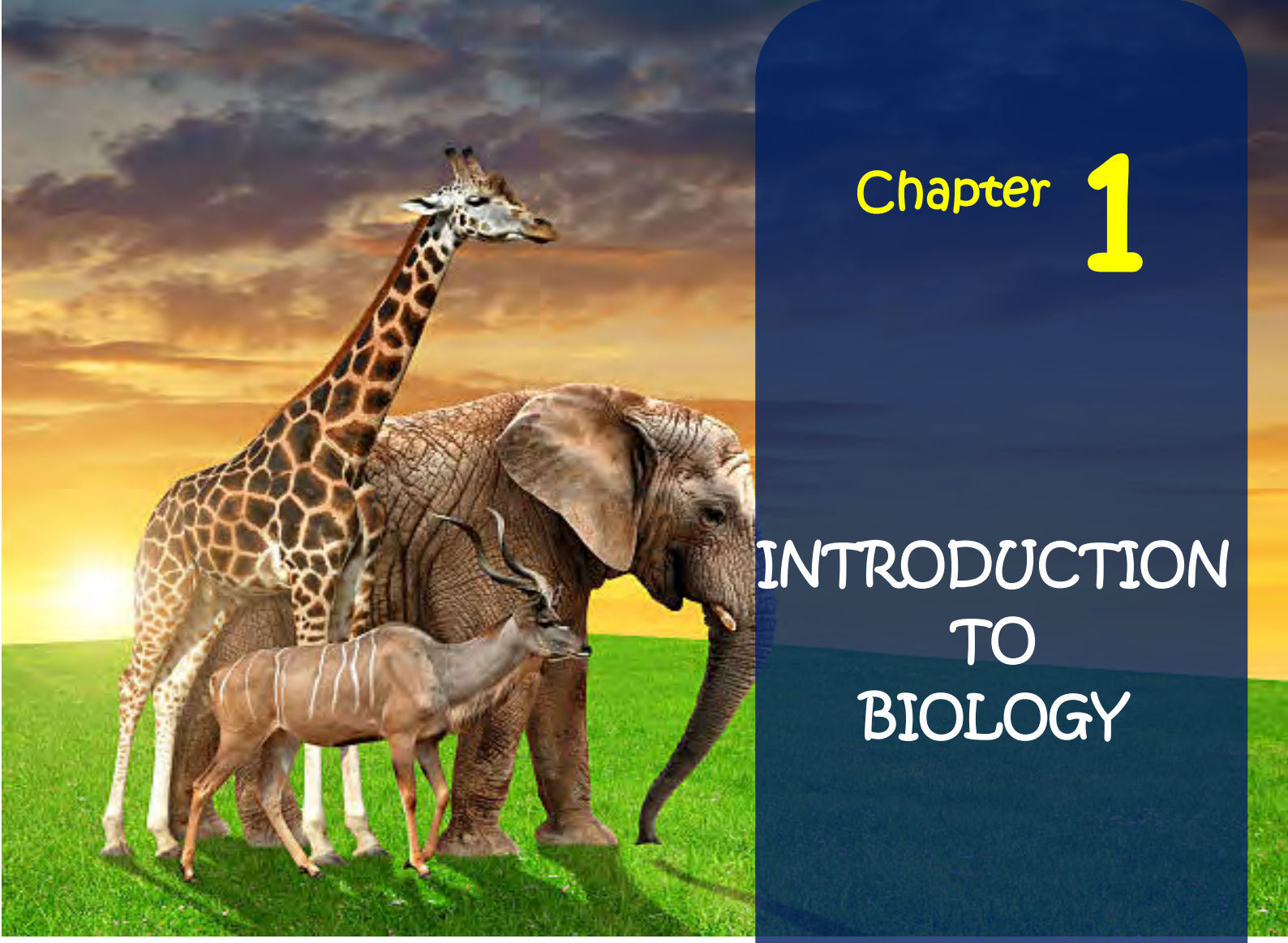


Chapter 1

INTRODUCTION TO BIOLOGY

By the end of this chapter, you should be able to;

- Be able to define biology and its branches
- Be able to relate biology with everyday life activities
- Be able to identify and define the life processes of living things
- Be able to explain the importance of life processes and how they differ in different organisms.

1.1 Defining Biology

Key question: How has been biology involved in agriculture?

Introduction to Biology

Have you ever wondered about the incredible diversity of life on Earth? From the tiniest microorganisms to the majestic creatures that roam the land and swim in the oceans, biology seeks to unravel the mysteries of life itself. It is a field of science that goes deep into understanding the living world and the intricate processes that govern it. The term **'Biology'** comes from two Greek words. bios that means 'life' and logos that means 'study'. Therefore, Biology is a branch of science that deals with the study of life. A person who studies Biology is called a **Biologist.**

How we encounter biology in our daily lives

- Brushing Teeth: When we brush our teeth, we are practicing oral hygiene to remove plaque and prevent tooth decay and gum disease. Biology enables us understand interaction of bacteria in our mouths, which can contribute to oral health issues if not properly managed.
- Eating a Balanced Diet: Choosing a well-balanced diet is essential for maintaining good health. Biology enables us to understand nutrients in food, enzymes, balanced diet, importance of feeding on a balanced diet, malnutrition diseases and how we can control them.
- Gardening: Whether growing flowers or vegetables, gardening involves various biological processes. From planting seeds and nurturing plants to understanding their growth requirements, gardeners rely on knowledge of biology. When we grow plants or make compost, we use biological cycles such as photosynthesis, respiration, and decomposition.
- Exercise and Physical Activity: Engaging in physical activities like running or weightlifting involves the study of exercise physiology. It focuses on how the body responds to exercise, including changes in heart rate, oxygen consumption, and muscle development.

Biology enables us to understand the importance of brushing teeth

Physical exercise involves biological processes

Biology enables us to learn and acquire a balanced diet

Some of the reasons why we study biology

1. To become medical workers that is to say doctors, nurses, midwives, laboratory technicians.

- Doctors are medical professionals who diagnose and treat diseases and injuries in humans and animals. They use their knowledge of biology to provide health care and advice to their patients. Doctors can specialize in various fields, such as surgery, pediatrics, cardiology, oncology, etc
- Laboratory technicians are scientists who perform tests and experiments in laboratories. They use their skills in biology, to analyze biological samples, such as blood, urine, DNA, etc. They also operate and maintain laboratory equipment and instruments, such as microscopes etc. Laboratory technicians can work in various settings, such as hospitals, schools, universities, industries, etc.
- Nurses are health care professionals who provide care and support to patients and their families. They use their knowledge of biology to assess, plan, implement, and evaluate nursing interventions. Nurses can work in various settings, such as hospitals, clinics, schools, homes, etc. They can also specialize in different areas, such as geriatrics, pediatrics, oncology, etc.
- Midwives are health care professionals who provide care and support to women during pregnancy, childbirth, and postnatal period. They use their knowledge of biology to monitor, advise, and assist women and their babies. Midwives can work in various settings, such as hospitals, birthing centers, homes, etc. They can also collaborate with doctors, nurses, and other health care providers.

A doctor performing a check up on a child patient

A doctor clumping the umbilical cord of a newly born child

A laboratory technician viewing biological samples

A nurse taking a blood pressure measurement of a patient

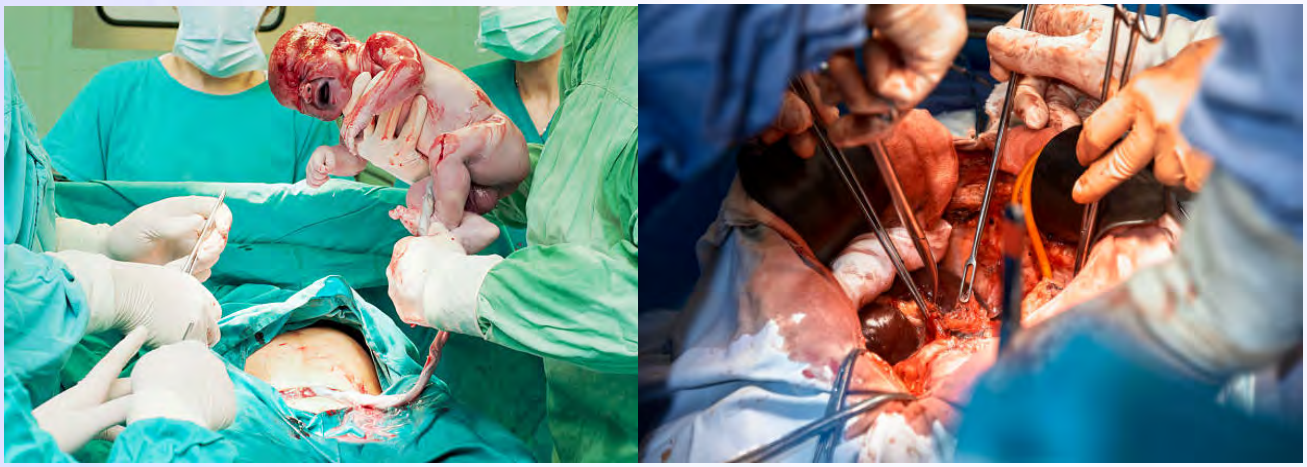
A midwife with a pregnant mother who is soon delivering

A nurse looking after an old man patient in a hospital.

2. To become biology teachers: Biology teachers teach students various concepts of biological sciences. They work in schools and other education institutions and deliver lectures while performing tasks such as lesson planning and conducting skill assessment tests. They empower students to develop an abiding appreciation for the natural world and everything in it.
3. To acquire skills and knowledge about life: Apart from developing future health workers, teachers and other professions, biology equips learners with skills even if their future occupations are not biology related. Biology equips us with the knowledge of understanding genetic inheritance. This enables us to understand how to improve on the quality of our crops and animals through crossbreeding and genetic engineering.
4. To protect the environment from bad practices that would harm it: Biology equips us with knowledge to understand how to solve problems using measures which don't harm the environment. For example, we learn that we can use fish to destroy mosquito larva in a pond other than using insecticides which could harm other organisms. Biology enables us to understand the effects of practices like deforestation, bush burning to the environment.
5. To protect ourselves and the community from pathogens which could cause diseases. We learn about immunization, sanitation, personal hygiene and their importance to us. Biology equips us with knowledge about germs, how to protect ourselves from bacteria, viruses and infections. Healthy habits learnt from biology prevents germs and infections from spreading. Health habits include handling food safely, washing hands always, etc.

How biology is applied in common occupations

Surgeons. A surgeon is a doctor who specializes in operating on patients. Surgeries can be done to diagnose, or treat diseases or injury in the operating room. The operating room where surgeries are done is called a theatre.
How biology is applied/ involved in surgery: The structure and location of body organs and tissues studied in biology enables surgeons to perform successful surgeries and not to injure the other surrounding organs. Surgeons normally study about structures and location of organs close to where the surgery is to be done such that they don't injure the organs. For example, a surgeon needs to know the structure and function of the heart and blood vessels, as well as the causes and effects of cardiovascular diseases, to perform a heart bypass surgery.



Surgeons learn about the structure and location of organs from biology before surgery such that they don't injure surrounding organs

Baking: A baker is a person who makes and sells bread and cakes

How biology is applied/ involved in baking: Yeast respires sugar within the dough producing carbon dioxide in a process of fermentation. Carbon dioxide expands causing the bread to rise (expand). Biology enables bakers to rise the bread using the knowledge of respiration of yeast.

Laboratory technician: Is a person who works in a laboratory performing analytic or experimental procedures, maintaining laboratory equipments and assisting scientists with their work.

How biology is applied by Laboratory technicians

The knowledge of microscopes and structures of pathogens studied in biology enables laboratory technicians to understand the pathogens in the material they are testing.



Baking and laboratory diagnostics involve the knowledge of biology

Group activity:

Group activity:

1. Apart from the ones mentioned already, describe other ways we encounter biology in our daily life.
2. The pictures below show some of the economic activities carried out by people in our community. Discuss about each of them in your groups and answer the questions that follow.

A

B

C

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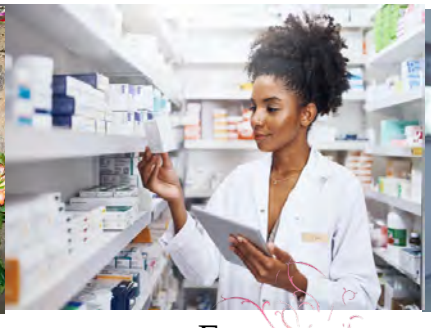

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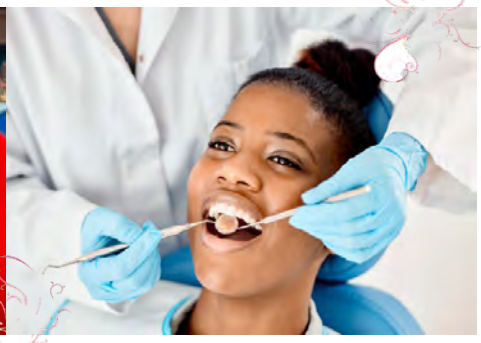

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a) Identify the economic activities in the pictures.

b) Identify the activities where the knowledge of biology used and those where the knowledge of biology isn't used.

i) Activities where biology is used ii) Activities where biology is not used

3. Agriculture is one of the major economic activities carried out in Uganda. Years ago farmers produced poor yields of crops and poor animal qualities due to use of primitive farming methods and depending on local breeds. Farmers depended on temperature and rainfall to decide farming and when the soil lost fertility, they left it and looked for another one which they cleared by bush burning. But as of 2024, biology and technology has improved agriculture in various ways. Explain how biology and technology have improved farming in Uganda

A farmer struggling to cultivate hard soil with a hoe

A farmer keeping poor quality breeds of livestock

Farmers producing poor yield of same crop season after season.

Use your brain power!

4. John's family owns a farm, and they have been experiencing a decline in crop yields and an increase in pest infestations. They are looking for ways to improve their farming practices and increase productivity. what biology related strategies can be recommended to improve farming practices and mitigate pest problems?

My notes

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1.2 Branches of Biology

Key question: What is the importance of branches of biology

Branches of Biology

Biology has a wide range of specialization however, all the branches of biology study the same essential element, i.e. cells which are the smallest fundamental units of life. There are many branches but the major **two** branches include zoology, and botany. **Zoology** is a branch of biology that deals with the study of animals. It helps us understand how animals live, grow and survive. Zoology encompasses various aspects of animal life, including their anatomy, physiology, behaviour, classification and evolution. Zoologists preserve animals and prevents extinction. They also examine animals' structures, functions, habitats and interactions within ecosystems. **Botany** is a branch of biology that deals with the study of plants. Botany focusses on the scientific study of plants, including their structure, growth, reproduction and classification. Plants play a role in our ecosystems and provide the foundation of all terrestrial life. Understanding their biology helps us comprehend their adaptations and interactions within the environment.

Occupations related with zoology

- Veterinarian: is a person who diagnose, treat and research medical conditions and diseases of pets, livestock and other animals. They teach owners preventive health care. They are also known as a veterinary doctor. They treat Health conditions and injuries in non- human animals. In some situations, they perform emergency surgeries.
- Zoo keeper: Is a person who manages zoo animals that are bred and kept in captivity. They provide services for pets that physicians would for their human counter parts. They monitor the animal behavior, ensure that animals are fed and that their habitats are kept clean and safe. Sometimes he is called an animal keeper. Zoo keepers work in zoos, aquariums, and wildlife refuges in a country.
- Wild life biologist: is a person who studies animals and their behavior along with the role each plays in its habitat. They conduct census projects and research studies They work to save endangered species. They evaluate the impact of commercial ventures on local wildlife. They must be good at communication skills critical-thinking skills, observation skills, outdoor skills, problem solving skills. They study the impact of environmental change on species survival and growth rates.
- Zoo educator: Is a person who teach visitors about the animals that live in the zoo or game park and promote conservation efforts. They may also work at animal parks, aquariums, marine parks, environmental educational centers They share information formally in lectures and guided tours.
- Aquarist: Is a person responsible for caretaking of aquatic animals like fish, dolphins etc. they also manage aquariums. They monitor the animal's diet, cleanliness and recognize signs of sickness or distress. Aquarists travel to oceans, rivers or lakes to collect or observe new specimens

- Park ranger: Is also known as a park warden. Is a person entrusted with protecting and preserving part of a national park. They patrol, monitor wildlife, combat poaching, manage fires and assist with tourism. They also protect natural resources, ecosystems and the people who visit the park.
- Conservationist: Is a person who advocates for the protection and preservation of the environment and wildlife. They strongly promote preservation and careful management of natural resources and of the environment.

A veterinarian looking after a wounded dog

A veterinary doctor performing a surgery on a cat

A wild life biologist with an endangered kangaroo

A zoo keeper manages animals kept in captivity

An aquarist playing with a dolphin infront of children

A game ranger monitoring part of the game park he is protecting

Occupations related with botany

- Florist: is a person who deals with the study of flowers and ornamental plants. Florists specialize in the art and craft of flower arrangement and design, working with a wide variety of flowers and plants to create pleasing floral displays for various occasions. Florists often have a deep knowledge of different flower species, their growth patterns, color combinations, and care requirements. They may also have expertise in preserving and maintaining the freshness and quality of cut flowers.
- Arborist: also known as a tree surgeon, is a professional who specializes in the care, maintenance, and management of trees. Arborists apply their knowledge of botany, to assess and maintain the health, structure, and safety of individual trees and tree populations. They are skilled in diagnosing and treating tree diseases, pests, and nutrient deficiencies. Arborists also have expertise in tree pruning and trimming techniques to shape trees and promote healthy growth.

Group activity:

1. In groups, research using textbooks and internet and complete the table below about the branches of biology

Branch of biology	Definition	importance
Zoology	Is a branch of biology that deals with the study of animals	It helps us understand how animals live, grow and survive Zoologists preserve animals and prevents extinction
Botany		
Physiology		
Taxonomy		
Anatomy		
Entomology		
Microbiology		
Bacteriology		
Mycology		
Nutrition		

2. In your groups, you are required to research and complete the table below about economic activities in various branches of biology

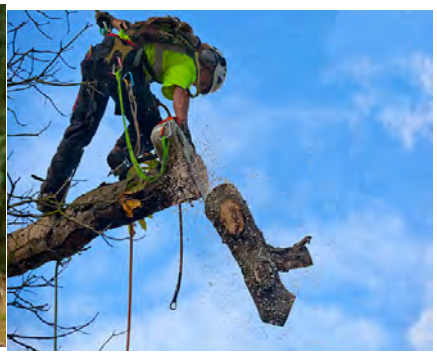
Branch	Occupation	Description
Zoology	Animal trainer	Is a person who teaches animals specific responses to specific conditions.
	Animal nutritionist	

Botany	Florist	
	Agronomist	
	Horticulturalist	
	Arborist	
Microbiology	Laboratory technician	
	Immunologist	
	Mycologist	
	Biomedical scientist	
Nutrition	Nutritionist	
	Dietician	
	Sports nutritionist	
Ecology	Ecologist	
Anatomy	Chiropractor	
Genetics	Genetic counselor	
entomology	Apiarists	
	Forensic entomologists	

3. The pictures below show some of the economic activities related with various branches of biology. Use them to answer the questions that follow

A

B



C

a) Identify the professions shown and state the branch of biology for each.

c) Outline the importance of each of the profession to our community.

Use your brain power!

4. John is concerned about the increasing pollution levels in his city. He wants to contribute to environmental conservation and pollution control. Determine the branch of biology that focuses on studying the impact of pollutants on ecosystems and suggest measures to mitigate pollution and protect the environment.

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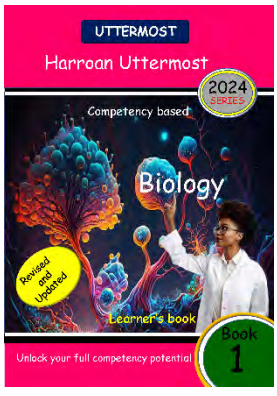

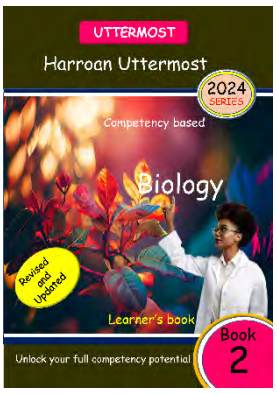

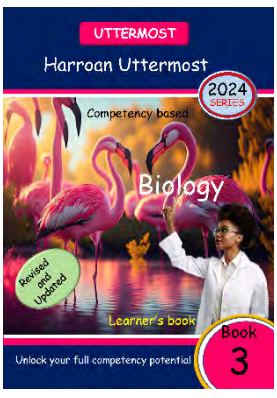

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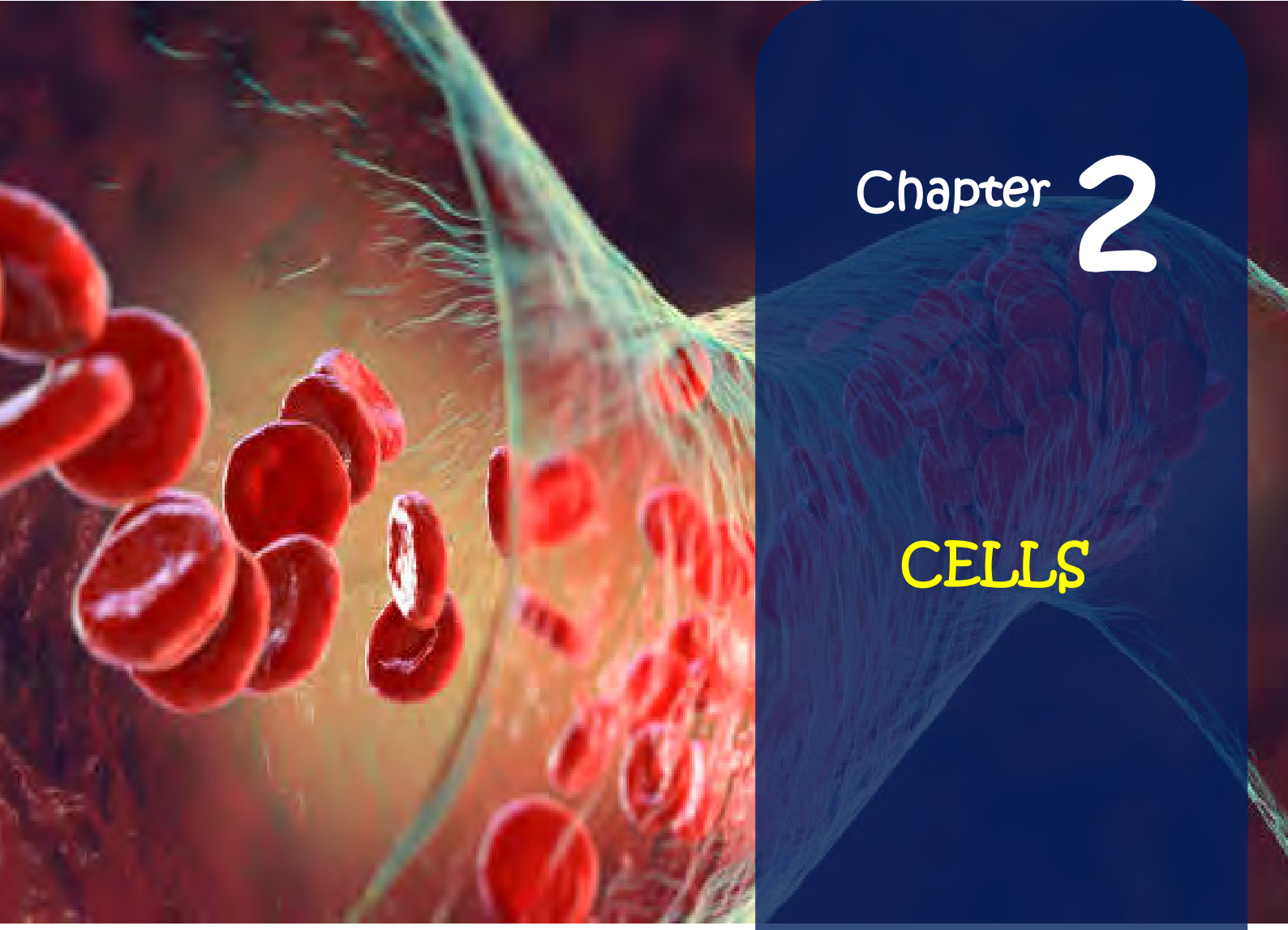


Chapter 2

CELLS

By the end of this chapter, you should be able to;

- Define a cell
- Identify parts of an animal cell with their functions
- Identify parts of a plant cell with their functions
- Define specialized cell
- Explain the structures of specialized cells in relation to their functions
- Distinguish levels of cellular organization
- Apply the knowledge of cells to everyday life

2.1 Plant and Animal Cell

Key question: Draw and label a plant and an animal cell viewed under a microscope

Cells

All living things are made up of cells. The cell is the basic functional unit of life. Organisms can be either unicellular (single-celled) or multicellular (composed of many cells).

In 1665, Robert Hooke, an English scientist, designed a microscope and used it to examine cork from the bark of a tree. He noticed that, the cork was made up of many box-like units which were packed together to form a structure like a honeycomb. He called these units cells. This is how the cell was discovered. All living things are made up of cells. Life processes take place inside the cell. Therefore, **cells are the basic functional units of life.**

The observations and conclusions by Hooke and other scientists led to the development of the cell theory. The **theory is a widely accepted explanation** of the relationship between cells and living things.

The following are the **components of the cell theory:**

- All living things are composed of cells.
- Cells are the basic unit of structure and functions of living things.
- All cells are produced from other cells.
- Cells contain inherited information which controls their activities.
- All cells are basically the same in chemical composition
- All life processes take place in the cells

The cell theory applies to all living things no matter how big or small. Since cells are common to all living things, they can provide information about life. Scientists can study cells to learn about nutrition, growth, reproduction, respiration, movement, sensitivity and excretion.

Types of cells.

Based on nuclear organization, there are two basic types of cells: prokaryotic and eukaryotic cells.

Prokaryotic cells

The prokaryotic cell is a type of a cell in which nuclear material (chromosomes, DNA) are not bound with a membrane. The cell is found in organisms called prokaryotes.

Prokaryotes are single- celled organisms such as bacteria.

Eukaryotic cells

These are types of cells whose organelles are enclosed in membranes.

The cells are found in organisms called eukaryotes.

Eukaryotic cells can be in form of unicellular organisms such as amoeba and euglena, or multicellular organisms such as animals and plants.

Cell organelles.

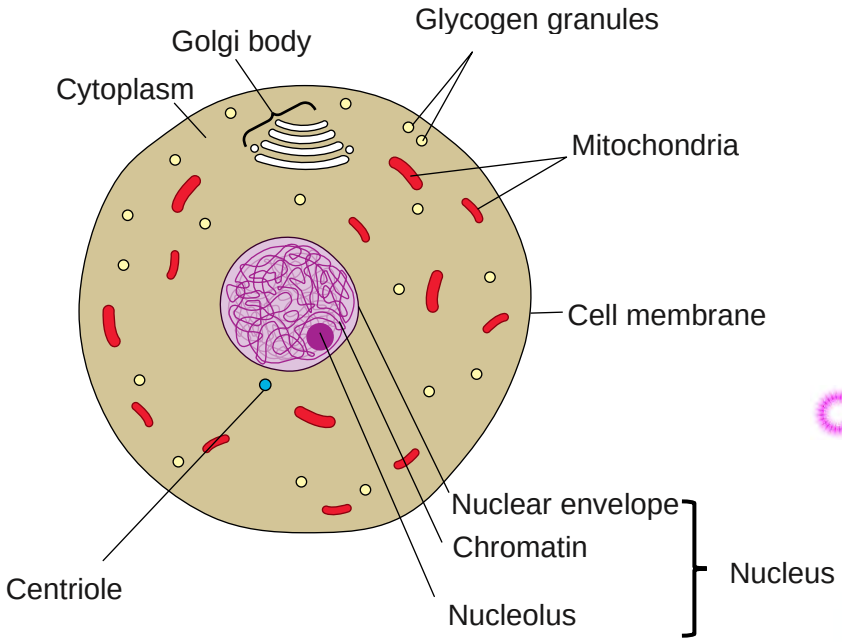
Are structures found within cytoplasm that performs one or more specific functions
Cell organelles include; nucleus, mitochondria, endoplasmic reticulum, Golgi apparatus, vesicles, vacuoles, chloroplasts. Cell organelles perform function like energy production, secretion, responding to external stimuli, destroying harmful toxins and manufacturing food.

Animal cell and plant cell

Both animals and plants are made up of eukaryotic cells. However, these cells differ in their structure and functions.

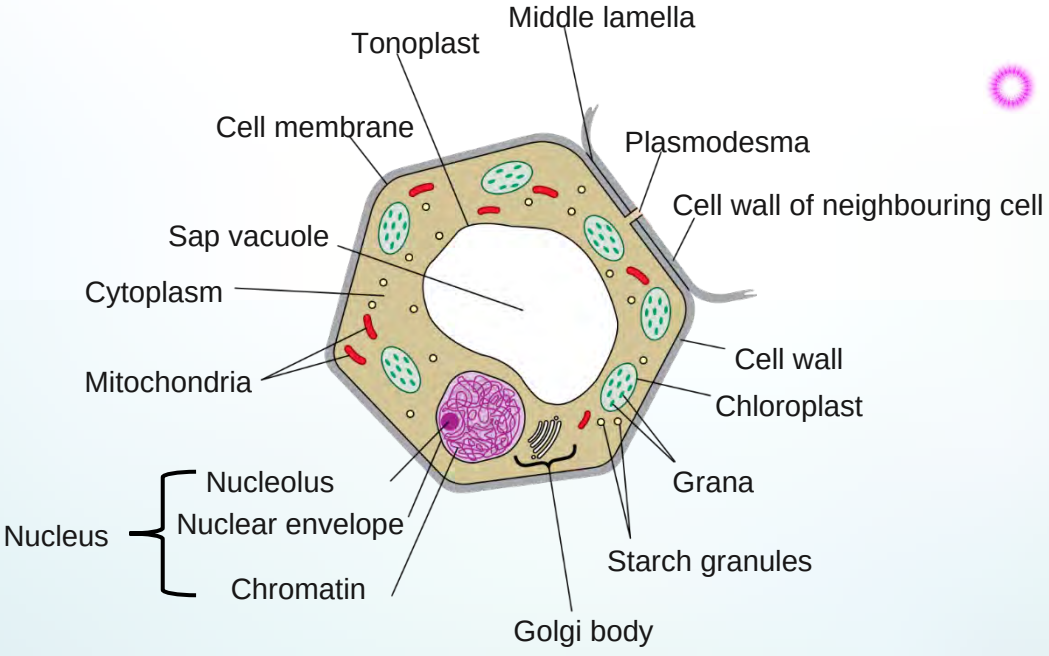
The animal cell

Structure of an animal cell seen under a high-quality light microscope



The plant cell

Structure of a plant cell seen under a high-quality light microscope



Group activity:

Group activity:

Viewing a plant and animal cell under a microscope

A. Observing animal cells under a microscope

Materials

Animal cell (cheek cell), methylene blue solution, distilled water, filter paper and toothpick

Apparatus

Glass slides, cover slips, light microscope, dropper and mounting needle

Procedure

- Gently scrape the inside of the cheek with a blunt tooth pick.
- Transfer the scrapping into a drop of water on a clean glass slide and cover with the cover slip.
- Stain the cheek cells with methylene blue solution using the irrigation technique.
- Examine the cheek cells through a light microscope. Draw the cheek cells that can be observed. Record the magnification power.

Preparation of animal cell

Discussion

- What are the components of the cell that can be observed through the light microscope?
- Does the human cheek cell have a permanent shape?
- Can you see dark blue spots on the prepared cheek cell?

B. Observing plant cells under a microscope

Materials

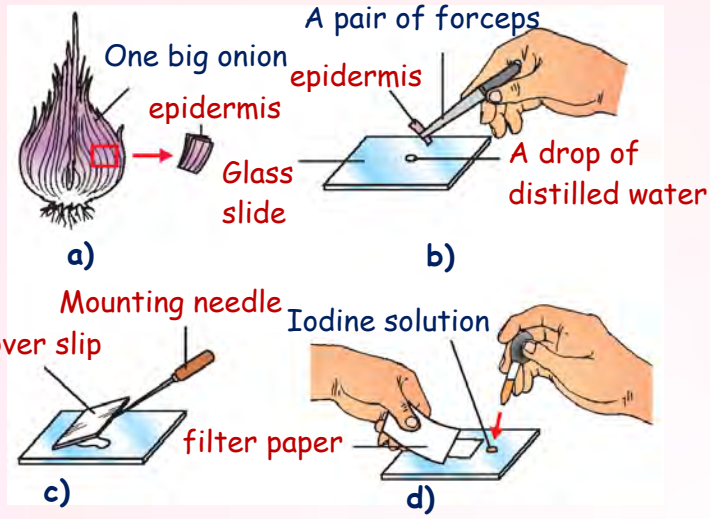
One big onion, iodine solution, distilled water and filter paper

Apparatus

Glass slides, cover slips, light microscope, scalpel, a pair of forceps, dropper and mounting needle

Procedure

- Cut a piece of scale leaf from a big onion (a).
- Remove the translucent epidermis from the inside of the scale leaf using a scalpel.
- Add a drop of distilled water at the centre of the slide and lay the onion epidermis on the water (b).
- Using a mounting needle, cover the onion epidermis with a cover slip by placing it at a 45° angle to the slide and slowly press it down. The temporary slide of this specimen is named as wet mount. Make sure there are no air bubbles trapped in the wet mount slide (c) and the onion epidermis is not folded.
- Add a drop of iodine solution on one side of the cover slip. Place the filter paper at the opposite end of the cover slip to draw the iodine solution to absorb and stain the entire onion epidermis. This technique is known as the irrigation technique (d).



Preparation of plant cell slide

Take Note!

Air bubbles that are trapped under the cover slip can be removed by gently tapping the cover slip with the tip of a sharp pencil.

- Use a piece of filter paper to absorb excess iodine and distilled water.
- Observe the slide through a light microscope with a low-power objective lens and then with a high-power objective lens.

Discussion

- What are the components of the cell that can be observed through the light microscope?
- Does a plant cell have a fixed shape?
- Name another type of plant that can be used in this activity to replace the onion

Questions

1 a) Draw and label the animal cells as observed under a light microscope
b) Outline the functions of each of the part labelled
c) Draw and label the plant cells as viewed under a light microscope
d) Outline the functions of each of the part labelled.

2. Compare a plant cell and an animal cell. Give similarities and differences.

Use your brain power!

3. While observing both plant and animal cells, Tom noticed that plant cells contain a rigid structure not found in animal cells. Tom wondered why this structural difference exists and how it influences cellular functions. He also wondered what would happen to a plant cell incase it loses this rigid structure. Identify to Tom that rigid structure, help him understand the advantages a plant cell has over the animal cell due to the presence of the rigid structure and what would happen to the plant cell incase it loses the rigid structure.

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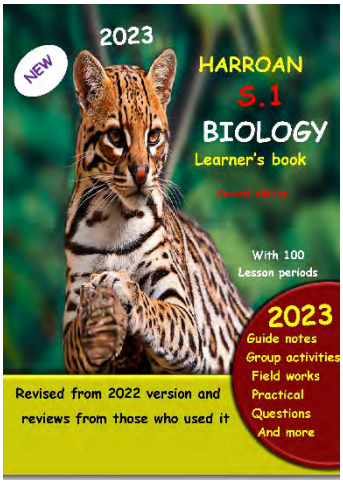

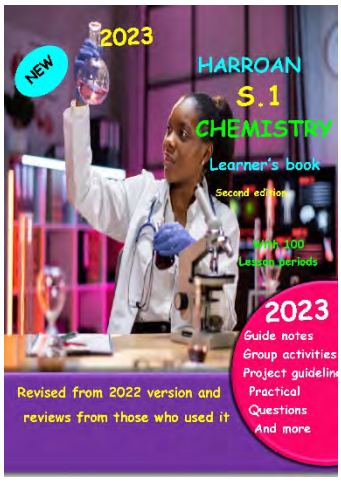

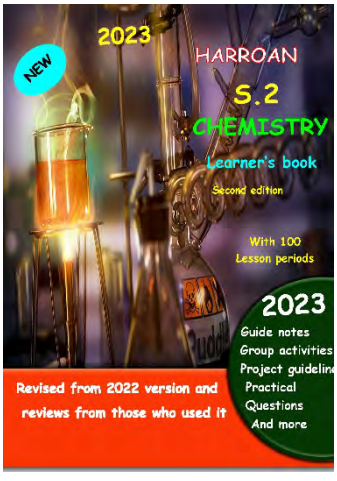

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Chapter 3

CLASSIFICATION

By the end of this chapter, you should be able to;

- Understand how living organisms are grouped.
- Know the scientific names of some living things.
- Identify examples and characteristic of organisms in the five kingdoms
- Describe viruses, examples, mode of transmission and effects on other organisms.

3.1 The concept of classification

Key question: What is the importance classification?

Introduction

There are different kinds of organisms in the world. Some organisms are too small to be seen by naked eyes and are called microorganisms. Others can be seen by naked eyes and are called macro-organisms. Due to the existing diversity of organisms, it is difficult to clearly understand their characteristics. The competencies developed from classification will enable you identify and classify new organisms by comparing their characteristics with already classified organisms.

The concept of classification

The process of grouping organisms according to their similarities and differences is called **classification.** Organisms that are similar are placed in the same group. These similarities can be in terms of their evolutionary relationship or the way they carry out life processes such as feeding and reproduction. The field of biology that deals with classifying organisms is called taxonomy

Classification systems

There are two main types of biological classification systems, namely artificial and natural classification.

Artificial system of classification

Artificial classification groups organisms according to a few observable features for example, the presence of legs or wings. Based on this, bees, birds, and bats would be grouped together because they have wings. Snakes, earthworms and snails would also be grouped together because they do not have legs. Artificial classification also involves classifying organisms according to their size, how they move, where they live, or what they eat.

In the third century BC, Aristotle (a Greek philosopher) used artificial classification to classify plants. He grouped them according to their shape, size, and whether they were useful to human or not.

Advantages of artificial system of classification

- It is based on simple and easily observable features. Artificial classification is therefore straight forward and easy to use.
- It is simple to identify and classify organisms since newly discovered organisms with just a few known features can be easily fitted in.
- It is stable because it does not change with time or discovery of new organisms.
- It is less expensive because it uses few observable features to group the organism.
- It does not require special classification techniques or highly skilled personnel.

Disadvantages of artificial system of classification

- Some organisms that are unrelated in their internal make up can be grouped together because of the resemblances of their few external features for exmaple bats and birds.
- Similar organisms may be placed in different groups because of the use of only few observable features for example bats and rats.
- It provides only limited information about each member. For example, organisms such as bacteria and some fungi are grouped as microorganisms because they are microscopic. This classification has ignored other features such as their modes of feeding, reproduction, and cell structure.
- It does not allow the prediction of information; hence it limits more advancement in taxonomy.
- It is less accurate because it uses only few observable characteristics for example mode of feeding, habitat, locomotion, or presence of wings.

Natural system of classification

In the natural system of classification organisms are grouped based on many features in common particularly those related to evolutionary relationship. In this system, characters that show homology or similarity of origin must be distinguished from those that exhibit analogy or similarity of use. For example, the arms of man, forelimbs of whales, and wings of birds and bats are homologous structures. In contrast, the wings of birds and insects performs similar functions but are different in origins hence they are analogous.

Advantages of natural system of classification

- It allows organisms which are genetically and evolutionally related to be grouped together.
- It is more accurate since it involves scientific research to gather enough information before the actual placement of an organism into a particular group is decided.
- It enables placing or newly discovered organisms into groups they belong.
- It allows addition of new features when they are discovered.

Disadvantages of natural system of classification

- It is very expensive since it involves experiments, research, and high classification skills.
- It is tedious and time consuming since it uses many features in grouping organisms.
- It is not stable because it can change anytime due to addition of newly discovered features or information.

Terms used in classification

Taxonomy; is the science of identifying and classifying of organisms into groups.

Taxonomist; is a scientist who identifies and names organisms basing on their similarities and differences.

A dichotomous key; is a tool used to identify organisms. It uses a sense of questions, each with only two answers

Classifying common organisms;

Here is a list of living things


Maize


Goat


Cow


Tiger


Lion


Bean

When classifying the organisms above using observable characteristics,

We choose to look for an observable characteristic that can divide the organisms into two groups

The characteristic is presence of green colouring matter (chlorophyll). It divides the organisms into two groups.

Presence of green colouring matter(chlorophyll)	
Group 1 (have chlorophyll)	Group 2(lack chlorophyll)
Bean, Maize	Goat Lion Cow tiger

In group 1, we can further divide the organisms into two groups basing on an observable feature of the type of leaf venation. Maize has an observable parallel leaf venation. A bean has an observable network leaf venation.

(Group 1) Type of leaf venation	
Group 1a (have network leaf venation)	Group 1b (have a parallel leaf venation)
Bean	Maize

In group 2, we can further divide the organisms into two groups basing on an observable feature of having or lacking horns. A cow and a goat have horns where as a lion and a tiger lack horns.

(Group 2) have or lack horns	
Group 2a (have horns)	Group 2b (lack horns)
Cow goat	Lion tiger

In group 2a), we can further divide the organisms into two groups basing on an observable feature of the length of the tail. A cow has a longer tail and a goat has a sorter tail.

(Group 2a) short or long tail	
Group 2ai) (have a short tail)	Group 2aii) (have long tail)
goat	cow

(Group 2b) have or lack mane	
Group 2ai) (have a mane)	Group 2aii) (lack a mane)
Lion	tiger

In group 2b), we can further divide the organisms into two groups basing on an observable feature of presence of a mane. A lion has a mane and a tiger lacks a mane.

Group activity:

Group activity: 1. Describe the importance of classification of organisms

2. follow the instructions below and group living organisms around your school.

Materials: a variety of small plants, insects and other animals.

Procedure:

- Walk around your school compound and collect a variety of plants, insects and other animals.
- Group the collected organisms according to their similarities and differences.
- Discuss with your classmates the similarities and differences of the grouped organisms.

Caution: Do not collect poisonous plants and stinging animals such as scorpions

Questions

a) What did you learn from the activity?

b) Why do you think it is important to classify organisms?

3. The picture below shows a number of books delivered by the government to your school. The books are to be filled in your new school library. Use it to answer the questions that follow.

a) You have been chosen to provide instructions to a group of your fellow students who are supposed to put those books in the shelves. In not more than 60 words, write the instructions to be followed in sorting the books so that library users can easily get easily access to the book needed

(b) Draw conclusions on the following questions basing on what you have answered in a)

i) Which characteristics did you look at in order to place a book in a particular group?

ii) Did any book fit in more than one group?

Use your brain power!

4. As part of a biology club activity, students are asked to create a field guide of organisms found in the school compound. The aim is to help others identify and learn about organisms. Describe guidelines to students on how they can accurately classify and categorize organisms in the school compound

My notes

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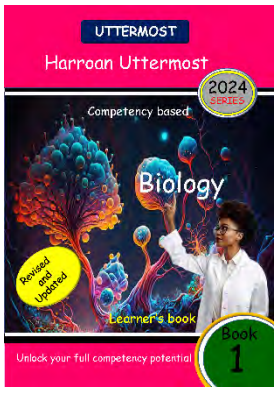

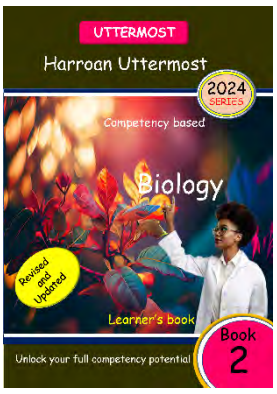

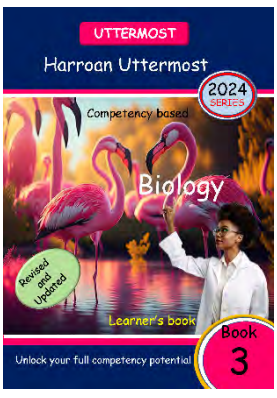

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3.6 Kingdom Monera

Key question: Describe the uses of organisms in kingdom Monera

Kingdom Monera

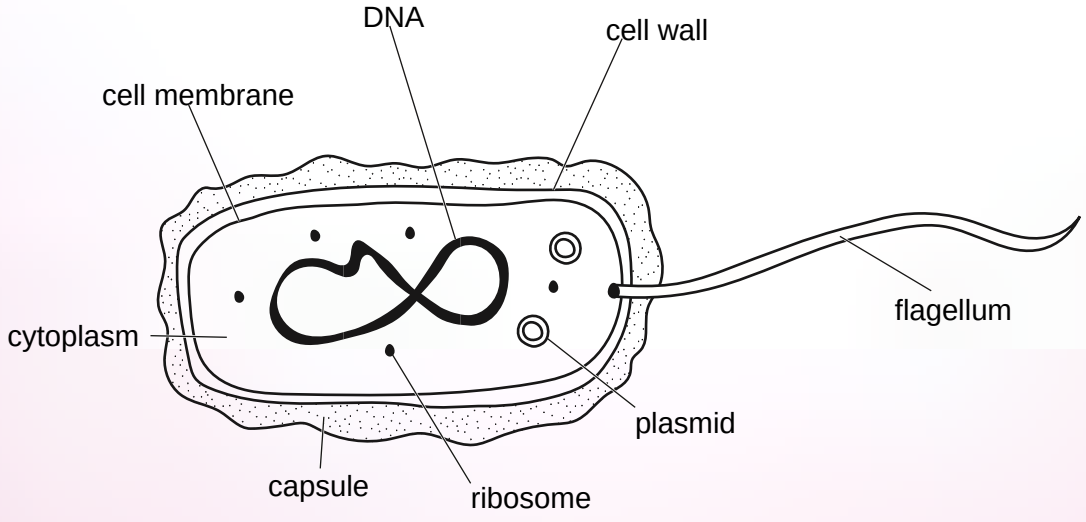
Kingdom Monera is one of the five kingdoms in the classification of living organisms, according to the Five Kingdom classification system. This kingdom consists of bacteria which are prokaryotic organisms characterized by the absence of a nucleus and membrane-bound organelles. The scientific study of bacteria is called Bacteriology.

Characteristics of bacteria

- They are prokaryotic. Their cells lack a well-defined nucleus, since they have no nuclear membrane. They also lack other membrane bound organelles.
- They are small unicellular organisms. Some bacteria stick together to form chains or clusters called colonies.
- Some are free-living while others are parasites or saprophytes. Free living bacteria means that they exist on their own, for example in sewage or soil. These bacteria do not need to form a relationship to other organisms in order to survive. Parasitic bacteria depend on other organisms known as hosts for their needs. Examples of hosts are human beings and other animals. Saprophytic bacteria get their food from dead organic matter.
- Free-living bacteria have flagella for movement.
- Bacteria have a slimy outer layer. This layer helps to protect them from parasites like viruses and predators such as protozoa.
- They reproduce asexually by binary fission.
- They occur in various shapes. There are five known shapes of bacteria. These are spherical or cocci (singular: coccus), rod or bacilli (singular: bacillus), spiral or spirilla (singular spirillum), comma or vibrio (singular vibrion) and corkscrew or spirochaetes (singular spirochaete)

General structure of bacteria

Bacteria have circular DNA suspended in the cytoplasm without being enclosed by the nuclear membrane. The cell wall encloses the cell membrane.



Importance of bacteria in crop growing

Nutrient Cycling: Bacteria help in the breakdown of organic matter, such as plant residues and animal waste, into simpler compounds. This decomposition process releases essential nutrients like nitrogen, phosphorus, and potassium, making them available for uptake by plants. This nutrient cycling ensures healthy soil fertility and promotes plant growth.

Nitrogen Fixation: Certain bacteria, known as nitrogen-fixing bacteria like the rhizobium bacteria, have the ability to convert atmospheric nitrogen into a usable form for plants. These bacteria form symbiotic relationships with leguminous crops, such as beans, peas, and soybeans, and convert nitrogen gas into forms, which plants can utilize for their growth. This reduces the need for synthetic nitrogen fertilizers and helps improve soil quality.

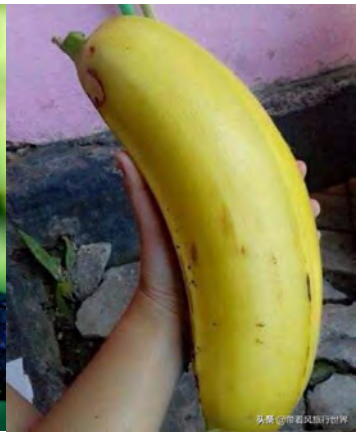
Disease Suppression: Some bacteria are beneficial as they can suppress harmful pathogens in the soil. For example, certain strains of bacteria called biocontrol agents can inhibit the growth of plant pathogens by competing for resources or producing antimicrobial compounds. This natural disease suppression can reduce the reliance on chemical pesticides, making farming more sustainable.

Decomposition and Composting: Bacteria are essential in the process of decomposition and composting. By breaking down organic matter, bacteria aid in the creation of nutrient-rich compost, which can be used as a natural fertilizer. Composting helps farmers recycle agricultural waste, improve soil structure, and enhance overall soil health.

Plant Growth Promotion: Certain bacteria known as plant growth-promoting rhizobacteria (PGPR) can enhance plant growth and development. These bacteria colonize the rhizosphere (the region around plant roots) and provide benefits like increased nutrient uptake, hormone production, protection against stress, and improved root health. Farmers can use PGPR as biofertilizers or biopesticides to maximize crop productivity.

A bacteria enhanced banana plantation.

A smaller apple and a bigger bacteria enhanced apple.



A bigger bacteria enhanced banana.

A large jackfruit whose growth is enhanced by bacteria

A smaller pumpkin and a bigger bacteria enhanced pumpkin

smaller watermelons and a bigger bacteria enhanced watermelon.

Group activity:

1. Describe the uses and harmful effects of organisms in Kingdom Monera.

2. Complete the table below on diseases spread by bacteria

Disease	Bacteria which cause the disease	Signs and symptoms	Prevention and control
cholera			
Typhoid			
Tetanus			
Tuberculosis			
Syphilis			
Gonorrhea			

Use your brain power!

3. a school reports an outbreak of bacteria caused diseases. Several students exhibit symptoms like nausea, vomiting, and diarrhea. Others present persistent cough, chest pain, and difficulty breathing. As a public health investigator, what steps would you take in response to this the outbreak?

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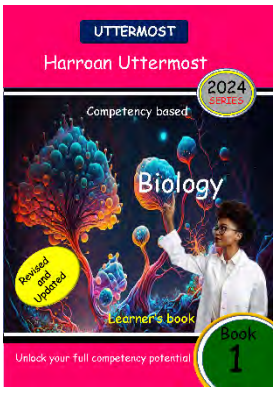

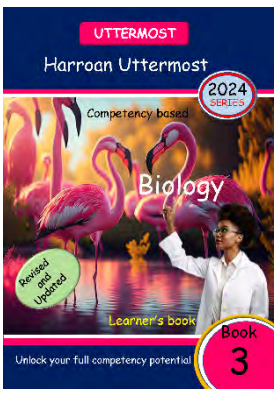

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