



# Unit 1: Sub-fields of Biology

## 1.1 Sub-fields of Biology

### Objectives

At the end of this section, the student will be able to:

- *Define the sub-fields of biology*
- *List the sub-fields of biology*

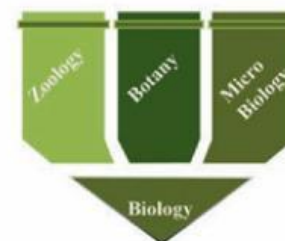
### Recall

You have defined the term 'biology' in grade nine unit 1, and briefly discussed what biology studies about. In this unit, you will study the different sub-field of biology.



*Which sub-fields of biology do you know?*

The scope of biology is so broad that it contains many branches and sub-disciplines. In this unit, thus, you will study the sub-fields of biology. Based on the type of organism it studies, biology is subdivided into three: Zoology, Botany, and Microbiology. In addition to these three sub-fields, there is a huge array of sub-disciplines or fields of biology. Many have been around for hundreds of years whilst others are far newer and are often developing very rapidly. The three major sub-divisions and their area of concern are described in the next page.



#### Unit One: Sub-fields of Biology

#### Activity 1.1: THINK-PAIR-SHARE

Make a group of three students and write down the names of organisms you know that would be categorized under the three major divisions of biology. Share with other groups what you have written and compare with yours.



Figure 1.1 *Capra walie* (*Waliya ibex*) (in Simien Mountains of Ethiopia)



Figure 1.2 *Ruta chalepensis* L. ('Tena Adam')

#### Zoology

Animal biology, also known as zoology, is the study of animals and includes disciplines such as herpetology (reptiles), ichthyology (fish), mammalogy (mammals), ornithology (birds), and entomology (insects). Zoology is concerned with all aspects of animal life, such as embryonic development to mature adulthood; behaviour, such as interactions with other animals or food finding; and genetics. Figure 1.1 shows one of the endemic wild animals of Ethiopia.

#### Botany

Botany is a field of biology that studies about plants. It deals with plants' structure, properties, and biochemical processes. It also studies about classification and diseases of plants and their interactions with the environment. The principles and findings of botany have provided the base for such applied sciences as agriculture, horticulture, and forestry.

Plants have long been used as a source of food, shelter, clothing, medicine, ornament, and tools. Green plants are now known to be essential to all life on earth. In addition to their practical and economic values, through the process of photosynthesis, plants convert energy from the Sun into the chemical energy of food, which allows all life to exist. The formation and release of oxygen as a by-product of photosynthesis is the second unique and important capability of green plants. *Ruta chalepensis* L. ('Tena Adam' in Amharic), a known

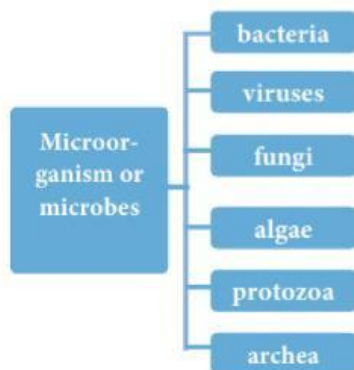


Figure 1.3. The microorganisms

traditional herbal medicine of Ethiopia, is shown as an example (see Fig 1.2).

### Microbiology

Microbiology is the study of microscopic organisms or microbes that cannot be seen by unaided eye. It includes bacteria, archaea, protists, viruses, microscopic algae and fungi. This branch of biology is further subdivided into sub-disciplines, which are frequently defined by specific microbes. Bacteriology, for example, is the study of bacteria, whereas mycology is the study of fungi. The majority of bacteria and other microbial species have yet to be identified due to the difficulty of isolating a single microscopic species. Microbiology is a rapidly expanding field of study; however, new technology and

Unit One: Sub-fields of Biology

developments in the field are constantly assisting in the identification of new species. Activity 1.2 below will help you study the different types of micro-organisms independently.

#### Activity 1.2 The Microorganisms

Microorganisms of different types are given in this activity. Work in a pair and do the following activities:

1. Define bacteria, viruses, fungi, algae, microscopic protozoa and archaea.
2. Draw typical bacteria, viruses, fungi, algae, microscopic protozoa and archaea.

Table 1.1 shows how various branches of biology are related to the structure we are studying. Anatomy, for example, is a branch of biology that studies the physical structures and parts of organisms, whereas morphology is a branch of biology that studies the form and structure (internal and external) of organisms and their specific structural features. Table 1.1 shows the various fields of biology based on the structure they study.

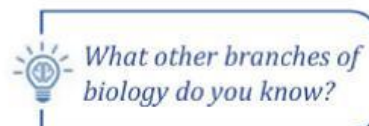


*Do you know how different branches of biology are related to the structure we study?*

**Table 1.1 Different fields of biology based on the structure studied**

| Sub-branch of biology | Definition                                                                                                                             | Example of the structures studied       |
|-----------------------|----------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------|
| Morphology            | Study of external form and structure                                                                                                   | Shape, the texture of leaves, stem, etc |
| Anatomy               | Study of the bodily structure of animals, and other living organisms, especially as revealed by dissection and the separation of parts | Stomach, liver, heart, etc              |
| Histology             | Study of the details of tissue structure                                                                                               | Parenchyma, connective tissue           |
| Cytology              | Study of cells                                                                                                                         | A plant cell, a nerve cell              |
| Cell biology          | Study of the structure, function, and various aspects of cell and its components                                                       | Mitochondrion, ribosome, nucleus, etc   |
| Molecular Biology     | Study of structure and function of informational molecules                                                                             | DNA, RNA                                |

Many other branches of biology are concerned with the various life processes, such as how an organism multiplies or forms identical copies of itself, its evolution over millions of years, and its relationship with the environment. Table 1.2 lists some of these fields with the environment.



**Table 1.3 Knowledge taken from other subjects that help to explain biological phenomenon**

| Structure/mechanism studied                            | Example                                                                                                      | Related Science | Knowledge of other sciences is required because                                                                                               |
|--------------------------------------------------------|--------------------------------------------------------------------------------------------------------------|-----------------|-----------------------------------------------------------------------------------------------------------------------------------------------|
| Cell membrane                                          | Structure of lipids and proteins                                                                             | Chemistry       | Living organisms are made of inorganic and organic compounds                                                                                  |
| Transportation of Oxygen (O <sub>2</sub> ) in the body | Formation of Oxyhaemoglobin (haemoglobin with oxygen)                                                        | Chemistry       | All metabolic pathways involve chemical change                                                                                                |
| Excretory system                                       | Absorption and elimination of salts                                                                          | Chemistry       | Homeostasis involves acid-base equilibrium to maintain the pH of living organisms                                                             |
| Absorption of food/water                               | Absorption of sugars, amino acids, fatty acids, water, or salts                                              | Chemistry       | During diffusion and osmosis molecules move into and out of the cell                                                                          |
| Transportation of water in plants                      | Conduction of water from root to leaves                                                                      | Physics         | Liquids have certain properties like cohesion and adhesion to result in surface tension and capillary action which helps in certain processes |
| Release of energy during respiration                   | Electron transport chain (transfer electrons from electron donors to electron acceptors via redox reactions) | Chemistry       | Energy transfer and transport from electron donor to electron acceptor                                                                        |

### Activity 1.3: Group Discussion

Which other relationships of biology with other disciplines do you know?

Discuss the relationships of biology with other disciplines.

#### Part I: choose the correct answer for the following questions

1. Which field of biology focuses on the study of tissues?  
A. Histology                      B. Cytology                      C. Anatomy                      D. Morphology
2. The field concerned with the origin, distribution, and future of life in the universe is known as:  
A. Taxonomy                      B. Exobiology  
C. Ecology                      D. Paleontology
3. Which discipline in microbiology specifically studies fungi?  
A. Protistology                      B. Virology  
C. Mycology                      D. Bacteriology
4. Which science is primarily required to explain the release of energy during respiration in biology?  
A. Geology                      B. Chemistry                      C. Physics                      D. Mathematics
5. The study of interactions between organisms and their living environment is called:  
A. Evolution                      B. Genetics  
C. Ecology                      D. Taxonomy
6. Which branch of biology focuses on heredity and variation?  
A. Genetics                      B. Physiology                      C. Embryology                      D. Taxonomy
7. Which field studies the form and structure of organisms, including their specific external and internal structural features?  
A. Morphology                      B. Anatomy                      C. Physiology                      D. Cell biology

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## Part II: Answer the following questions as “True” or “False”

1. Microbiology is the study of organisms that can be seen by the unaided eye.
2. Photosynthesis is a process studied in the field of botany.
3. Cytology is the branch of biology that focuses specifically on the study of tissues.
4. Zoology is solely concerned with the behavior of animals.
5. Physics principles are used in biology to explain the transportation of water in plants.
6. The field of taxonomy deals with the identification, nomenclature, and classification of organisms.
7. Molecular biology focuses on the physical structure of leaves and stems.
8. Archaea are considered a type of microorganism.
9. Physiology studies the normal functions of living organisms and their parts.
10. Morphology and Anatomy are exactly the same field of study.
11. Biology is completely independent of other sciences like Chemistry and Physics.
12. Mycology is the specific study of bacteria.