01 Introduction to Biology

Nature scope and importance of biology with reference to challenges faced by the mankind

Biology is a Science which is focused on studying of living organisms. (Bios- Life, logos ”study of”)

The conceptof “LIFE” is not easy to define. Still scientists are unable to provide an acceptable definition for life.

“Life” is something special and unique which cannot be explained using laws of chemistry and physics.

Biology is a subject which is very complex and vast. Hence for the convenience of studying, it has been divided into three primary braches: Zoology (the study of animals), Botany (study of plants) and Microbiology (study of microorganisms). Some areas of study in these branches:

- Cell Biology (studying cells)
- Histology (studying tissues)
- Anatomy (studying about gross structure of the body)
- Physiology (studying function)
- Biochemistry (studying biological molecules)
- Genetics (studying inheritance)
- Ecology (studying environment)

Issues pertaining to Biology

Understanding biological Diversity

At present our planet is rich in diversity. Life on earth formed around 3.8 billion years ago. The first formed organisms are believed to be heterotrophic, anaerobic prokaryotes. Since then the evolutionary process resulted in the extensive biodiversity which exists in the biosphere now.

Scientists assume, based on their studies that there are about 10 to over 100 million species in the world. There is a dynamic relationship between living world and the inanimate world and each and every organism has a specific role in the environment for existence of the Biosphere.

The variety of life on earth, the number of species of plants, animals and microorganisms, the diversity of genes in these species, the different ecosystems on the earth such as deserts, rainforests and coral reefs are all part of a biologically diverse earth.

Understanding the human Body and its functions

When studying biology,especially by studying histology, anatomy of the human body,one can gain the knowledge about the structure of the organs. This results in understanding and appreciation of the organization of the human body and understanding the functions of different organ systems and the relationship between structure and functions.

Sustainable use and Management of natural resources and Environment

Natural resources are sources of materials and energy found naturally which are used in everyday life and for economic development.

These natural resources are limited on earth. Due to the increase of growth rate of human population, overuse of natural resources is taking place. It causes threat of depletion of natural resources.

Due to over exploitation of natural resources, various environmental problems arise such as;

- Environmental pollution
- Loss of Biodiversity
- Desertification

Hence to overcome the above problems management of natural resources and Environment should be practiced. Knowledge of Biology is useful to bring about remedies for the above problems.

Sustainable Food production

Sustainable food production is the production of sufficient amounts of food for the

human population using environmentally safe methods.

The current human population is about 7 billion and expected to be double in less than 40 years. Therefore, for the survival of human beings sustainable food production is necessary.

To maintain sustainable food production following methods can be applied, which are based on knowledge in biology.

- Production of high yielding varieties of plants and animals.
- Production of disease resistant plants and animal varieties.
- Improve the post harvest technological methods.

Understanding plant life

Plants are the primary producers in the world. All the animals depend directly or indirectly on plants. Therefore understanding plant life is important. As the time human population is increasing we need to increase the productivity. Therefore understanding plant function and biology is important to produce high yielding plants, disease resistant plants, etc.

Understanding diseases and causes

To maintain healthy human body one should have the knowledge of causes of the diseases and their effects.

Some dangerous diseases which exist in current world are non communicable diseases such as cancers, heart diseases, diabetes, chronic renal diseases and communicable diseases such as dengue, AIDS, etc.

Cancers- causes for this is not fully understood yet. Cancers are one of the leading causes of death .

AIDS- is a viral disease which is a serious and growing health problem worldwide.

Heart diseases- This is also a serious and growing health problem worldwide. Causes are not fully understood yet.

Chronic renal diseases- In Sri Lanka, recentlyCKDu has become a serious health problem.

Currently scientists are working on prevention, remedial measures and cures for such diseases.

Solving some legal and ethical issues

Knowledge and application of biological concepts is important in solving some legal issues, such as parentage testing, in criminal investigations and to solve immigration disputes.

DNA fingerprinting is used in above circumstances.

The nature and the organizational patterns of the living world

In accordance with different criteria we can see a diversity among living organisms. Organisms are diverse based on size, shape, form and habitats.

- Living organisms show a wide range of variation in size, shape, form and habitat.
- Size – Bacteria – 0.25 μm – 2 μm to Giant Sequoia (Giant Red Wood)– 100m
- Shape – Organisms are diverse in shape, Ex: Cylindrical (earth worm), streamline shape(birds, fish)
- Form –Unicellular (Amoeba), multicellular (any plant or animal)
- Habitat – Terrestrial (Rat), aquatic (Fish), arboreal (Loris), aerial(Birds)

Characteristics of organisms

In order to survive, each organism whether simple or complex must be able to perform certain functions. Following features are the characteristics of organisms.

(i) Order and organization

From molecular level to biosphere there is an order and organization in organisms to perform their biological activities efficiently.

Lower level components are organized in a methodical pattern in upper level to make it most efficient.e.g: plant leaf and human eyes.

(ii) Metabolism

The sum of all chemical activities taking place in an organism is its metabolism. It includes catabolic reactions and anabolic reactions.

(iii) Growth and development

All organisms begin their life as a single cell. During growth an irreversible increase in dry mass occurs, which is characterized only by the living. Irreversible changes that occur during the life span of an organism is development.Growth and development are two consequent processes that happen in the life span of organisms.

(iv) Irritability and coordination

Irritability is the ability to respond to stimuli from both internal and external environment. Movement of organisms occurs as a result of irritability and coordination. In animals

this happens as a result of coordinated efforts of nervous, hormonal, muscular and skeletal systems

(v) Adaptation

Adaptation is a peculiarity of structure, physiology or behavior that promotes the likelihood of an organism's survival and reproduction in a particular environment. E.g: Sunken stomata in Xerophytes, Viviparity in some mangroves, Splayed out foot in camels.

(vi) Reproduction

Ability to produce offspring for continuous existence of species

(vii) Heredity & Evolution

Organisms have genes that pass from one generation to the next and control specific physiological, morphological and behavioral characters of organisms.

Ability of organisms to change over time as a result of genetic modification is evolution

Many non living entities may have one or more of these characteristics but not all of them e.g., crystals grow, waves move but only living organisms display all these characteristics simultaneously or at some point during their life cycle.

By considering this it can be said that these are occurring in single celled organisms as well as highly complex organisms such as humans and Anthophytes (flowering plants).

Hierarchiel levels of organization of living things

The cell is the basic structural and functional unit of life. Some organisms are unicellular while others are multicellular.Cell is composed of several organells which are formed by different organic molecules.Then hierarchieal levels of organization of living things can be constructed by using relevant examples at each level.

Molecules,Organells, Cells, Tissues, Organs, Organ systems, Organisms, Populations, Communities, Ecosystems, Biosphere