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Biological Knowledge in Our Lives

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Abstract. *Life on Earth cannot be imagined without living organisms. Biology is the science that studies organisms possessing all the characteristics of life. Living organisms are mainly classified into four major kingdoms: plants, bacteria, fungi, and animals. Viruses, however, are acellular forms of life and can reproduce only by entering the cells of other organisms. Various methods are used to study living organisms, including observation, experimentation, measurement, and microscopy. In addition, to facilitate their study, biologists classify organisms into groups based on common characteristics. In modern systematics, the origin of organisms, their structural features, and their evolutionary relationships are taken into account. Living organisms can be found on land, in water, in the air, and inside the bodies of other organisms. Within the biosphere, which is a complex system, the circulation of matter and energy occurs continuously. As a result of human activities, nature is sometimes exposed to strong negative impacts, and waste is generated daily in industrial and household activities. This waste is one of the main sources of environmental pollution and contributes to the disruption of ecological balance. To prevent this, recycling, more efficient use of natural resources, and environmental protection measures are essential factors.*

Keywords: *cell, microscope, experiment, evolution, biogeocenosis*

Introduction

Biology is a branch of science that studies living organisms. The word “biology” originates from the Greek terms bios (life) and logos (study or science). The development of biological science has a long and ancient history. The earliest scientific works related to living organisms date back to the period before the Common Era. During the 4th–3rd centuries BC, the Greek philosopher Aristotle composed works such as “History of Animals,” while Theophrastus, in the 4th century BC, wrote “History of Plants”. As biological knowledge expanded over time, the question of how life originated became a topic of continuous scientific debate. Some scholars argued that life emerged from non-living matter, whereas others claimed that it originated from pre-existing living organisms. Additionally, certain thinkers supported the idea that nature is unchangeable (metaphysics), while others emphasized its constant transformation and development (dialectics).

By the 20th century, biology had become one of the leading natural sciences (Eybatov & Mammadkhanli, 2010). Through continuous development and integration with information technologies, it has gained significant importance in addressing major issues related to medicine, agriculture, ecology, and environmental conservation.

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Today, biology is closely interconnected with numerous scientific disciplines, including biochemistry, biophysics, cybernetics, biotechnology, biogeography, and others. Furthermore, biology includes many specialized branches that focus on different groups or aspects of living organisms, such as botany, zoology, mycology, microbiology, cytology, histology, morphology, anatomy, physiology, molecular biology, systematics, embryology, genetics, breeding, phenology, and ecology.

Although living and non-living components of nature are closely related, living organisms possess several distinctive characteristics (Mammadov, 2013):

1. Chemical composition – Living and non-living matter share similar chemical elements, primarily oxygen, carbon, hydrogen, and nitrogen.
2. Metabolism and energy exchange – Living organisms carry out metabolic processes within cells, including assimilation (synthesis) and dissimilation (breakdown).
3. Reproduction – Since the lifespan of an organism is limited, reproduction ensures the continuity of life, which is made possible through heredity.
4. Growth and development – Living organisms are capable of increasing in size and mass; in plants this process continues throughout life, while in animals it occurs up to a certain stage.
5. Responsiveness to stimuli – Organisms can react to changes and influences from their external environment.
6. Adaptation to environmental conditions – Living systems adjust their structure and functions to survive and operate effectively in specific environments.
7. Discrete organization – Biological systems are composed of distinct functional and structural units, such as individuals, species, and biocenoses, which interact with one another.
8. Historical development – Living organisms undergo long-term evolutionary changes, progressing from simpler to more complex forms.

For the study of living organisms, several levels of biological organization are conventionally distinguished (Mikayilov, 2011):

1. Molecular level – All living organisms are composed of biological molecules such as proteins, nucleic acids, and polysaccharides. At this level, metabolic processes, energy transformations, and the transmission of genetic information begin.
2. Cellular level – The cell represents the smallest structural and functional unit of life and plays a key role in metabolism and information transfer.
3. Organismal level – At this level, individual organisms function as integrated systems, with organs and organ systems performing specific tasks throughout the life cycle from birth to death.
4. Population–species level – A population consists of individuals of the same species living in a defined area and represents the basic structural unit of a species, where elementary evolutionary changes occur.
5. Biogeocenotic level – This level involves the coexistence and interaction of different species within a shared environment, resulting in a stable and dynamic ecological system.
6. Biospheric level – The biosphere encompasses all biogeocenoses on Earth and includes global processes such as the circulation of matter and the transformation of energy.

Methods

All living organisms are composed of small cells that cannot be seen with the naked eye. Cells were discovered only after optical lenses were invented. The development of the microscope created broad opportunities for the study of various objects. As a result of these studies, scientists succeeded in obtaining unusual observations (Khan, 2014; Madigan et al., 2012; Faust & Raes, 2012). In addition to all this, certain technical tools are used to study biological objects, such as microscopes, centrifuges, computers, and so on. In biology, observation is employed to visually monitor events and biological entities; experiments are conducted to reveal their characteristics; comparison is used to identify natural patterns; historical development is studied to understand growth processes; and descriptive methods are also applied.

Organisms have acquired various adaptations in the struggle for survival. These adaptations are very diverse. The external and internal structure of animals, their instincts, behaviors, as well as their adaptation to living conditions are all interconnected. Plants living in different natural environments have also developed a number of adaptations to environmental factors. In adaptation to drought, leaves may transform into thorns or scales, while in adaptation to cold, plants are generally shorter with very small leaves, roots are located close to the soil surface, sugar accumulates in cells, and water content is low.

In general, the facts demonstrating organisms' adaptation to the environment are as follows:

- Morphological adaptation — coloration suitable for the environment, warning colors, camouflage, etc.
- Physiological adaptation — hibernation, subcutaneous fat layer, dense fur coverage, etc.
- Biochemical adaptation — hemoglobin molecules' function of binding and transporting gases, etc.
- Ethological (behavioral) adaptation — mating behavior, parental care, protection from predators, migration, etc., in animals with highly developed nervous systems.

In the biosphere, organisms are not distributed evenly. Their greatest density is observed at the boundaries of the lithosphere and hydrosphere favorable for life, as well as at the contact zones in the atmosphere. The total of living organisms in the Earth's crust and the energy accumulated there forms the planet's biomass. Ancient people, by observing wild animals, birds, and fish, became fascinated by their astonishing perfection and tried to apply these features in life. Thus, by creating objects that resembled the internal or external structure of various living beings existing in the surrounding world, they made the first inventions. Today, although people possess numerous technical tools, they still benefit from nature and have achieved great success in the field of nanotechnology in the modern era. In the creation of modern technologies, similarities of such natural phenomena are reproduced:

1. Rocket jet propulsion – squid
2. Air conditioner – termite
3. Airplane – bird
4. Tweezers – bird's beak
5. Excavator bucket – strong claws of a bird
6. Radar – bat

Living organisms have acquired various adaptations in the struggle for survival. Adaptations are very diverse. The external and internal structure of animals, their instincts and behavior are also related to their adaptation to living conditions. Plants living in different natural habitats have also acquired a number of adaptations to environmental factors. In adaptation to drought, leaves are transformed into spines or scales; in adaptation to cold, the size and leaves are very small, roots are located close to the soil surface, a large amount of sugar accumulates in the cell sap, and the amount of water is low.

In general, the facts proving the adaptation of organisms to the environment are as follows: Morphological adaptation — coloration suitable to the environment, warning coloration, camouflage, etc. Physiological adaptation — hibernation, subcutaneous fat layer, dense fur covering, etc. Biochemical adaptation — the function of hemoglobin molecules in binding and transporting gases, etc. Ethological (behavioral) adaptation — mating behavior, care of offspring, protection from predators, migration, etc., in animals with a highly developed nervous system.

In the biosphere, living organisms are not distributed with the same density. Their greatest density is observed at the boundary of the lithosphere and hydrosphere, which are favorable for life, as well as at their contact boundaries with the atmosphere. The total amount of living organisms in the Earth's crust and the energy accumulated there form the planet's biomass.

Results

Changes occurring in the Earth's crust affect the life of organisms and, consequently, the proportion of biomass. These changes mainly result from human interference with nature. The establishment of large cities, cultivation of technical crops over wide areas, and construction of large industrial facilities lead to the compression and destruction of natural communities. Draining wetlands, converting natural grasslands into agricultural fields, and deforestation cause drastic climate changes. In areas where the development of fauna and flora becomes impossible, the capacity for self-regulation is lost, and the nutrient cycle does not function properly (Foley et al., 2005; Chapin et al., 2011; Steffen et al., 2015).

This makes it clear that biological knowledge is extensive. Such knowledge is particularly essential in agriculture and medicine, where it is used to solve numerous theoretical and practical problems. Without acquiring this knowledge and following its principles, it is impossible to meet the population's demand for food products. By studying the laws of heredity and variability, it becomes possible to develop highly productive plant varieties, animal breeds, and microbial strains. Recently, the use of genetic engineering to create new gene combinations has led to organisms with new hereditary traits, the production of biologically active substances on an industrial scale, the development of new biological pest control methods in agriculture, and more. This demonstrates both the continuous advancement of biology and its significance. Moreover, biological knowledge is crucial for humans in preventing many diseases, maintaining personal health, and developing methods to combat illnesses. It also highlights the importance of understanding the impact of human activities on the environment, finding ways to prevent pollution, and protecting nature, which underscores the necessity of acquiring general biological knowledge.

Discussion

Plants also constitute an important part of the living world on Earth. Over time and with changes in location, they have given rise to many plant forms with different structures. Plants differ from one another both in structure and size and are very diverse. The existence and reproduction of blue-green algae and iron bacteria in hot springs where water emerges at temperatures of 60–65 degrees, as well as the survival and reproduction of these algae in permanent glaciers colored "red" and "green," are among the most interesting and unusual phenomena in nature (Tutayuq, 1967).

Over millions of years of evolution, nature has perfected every cell and every organ of our body. Our body is the most complex creation of nature. In addition to sustaining vital activity, the organism enables humans to create, to study nature, and to uncover its secrets, the greatest of which is humanity itself. The most fundamental need of a human being is to preserve life and health (Tutayuq, 1967). The absence of diseases and bodily defects is the main condition for human happiness, the comprehensive development of personality, and full enjoyment of life (Eybatov & Mammadkhanli, 2021). Understanding the surrounding world becomes possible through the interaction of individual analyzers (Tozmer & Petrishina, 1987). In order to adapt to the changing conditions of the external environment, the human organism possesses broad biological capabilities (Farajov, 2011). As we know, among living beings, humans occupy the highest stage, having passed a long path of development like their ancestors and acquired a modern appearance (Aliyeva, 2007). Human conscious activity, the changes made in nature, social interactions, and achievements in science are the result of complex processes occurring in the brain.Biological evolution is irreversible and deals with the historical development of living organisms, changes in the genetic composition of populations, the formation of adaptations, the emergence and extinction of new species, and changes in the biosphere and biogeocenoses as a whole.

Conclusion

From all this, it becomes clear that biology, although an ancient science, is still a developing field. By using biological sciences, humans can effectively benefit from nature in every area—from following hygienic rules and maintaining proper nutrition to obtaining high-quality products in agriculture, as well as knowing the correct principles for the protection and conservation of water, soil, the atmosphere, the environment, and nature as a whole. The more educational work is carried out among people and the more biological awareness is promoted about the efficient use of natural resources, the greater the contribution will be to building a healthier and more prosperous life for future generations.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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