

STUDYING ELEMENTS OF BIOPHYSICS

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ABSTRACT

The didactic possibilities of studying the elementary fundamentals of biophysical science by high school students of secondary schools are considered.

Keywords: Biology, physics, biophysics, synergetic approach in science.

Today, many sectors of the national economy, including the country's healthcare, are beginning to experience an increasing need for young qualified middle and junior level workers who possess elements of medical knowledge and skills, the basics of natural and mathematical sciences, and a developed worldview. Meanwhile, in secondary schools, little attention is paid to issues of medicine and hygiene, there is almost no work to orient students to medical specialties, and no such work is carried out in the process of teaching physics, based on the study of necessary issues of a biophysical orientation. Attention was drawn to this in the "Main Directions of the Reform of General Education and Vocational Schools," which states:

It is necessary for every schoolchild to acquire a minimum of knowledge in the field of hygiene and medicine, to know his body from a young age and be able to keep it in order." (7, c. 49).

Since the modern scientific and technological revolution is organically connected with successes in the development of physics and related sciences, and, in particular, biophysics, in order to prepare students for life and develop their cognitive interests, the school physics course should reflect questions accessible to students, showing the connection between these sciences, their mutual influence and enrichment. The relevance of considering biophysical material in the process of teaching physics is also determined by the fact that the study of elements of biophysics has a great influence on the understanding of physical phenomena and processes occurring in nature, in living organisms, including humans, as well as physical methods for studying natural processes and treatment patients, which is important, on the one hand, for the successful implementation of interdisciplinary connections in education, and on the other hand, for the professional orientation of students in biophysical specialties, in particular medical ones.

The study of biophysics issues enhances the educational, developmental and nurturing functions of physics teaching, and expands the possibilities of preparing students for a conscious

choice of medical professions. In addition, the study of biophysical material allows students to better understand the complex picture of relationships between various phenomena and processes of nature.

The volume of scientific and technical information is growing sharply and rapidly these days, so it is important that students not only accumulate a certain fund of knowledge, but also master the skills of independent mental work. In solving this problem, an important role is played by the formation of natural scientific thinking in schoolchildren, which is facilitated by the study of elements of border sciences, including issues of biophysics, in the high school physics course.

Among modern scientific disciplines that allow us to better understand the complex picture of connections between various natural phenomena, biophysics occupies an important place. Therefore, the study of the pedagogical effectiveness of studying its elements based on interdisciplinary connections between physics and biology represents a significant problem for improving the teaching of a physics course.

However, as an analysis of school curricula and textbooks on physics has shown, the relationship between modern medicine and physics is poorly reflected in them; the information available in textbooks and teaching aids about the role and application of physical laws in the diagnosis, treatment and prevention of human diseases is unsystematic, and there are no teaching aids and recommendations on these issues, the knowledge and skills of students in physics thus turn out to be torn from their most important practical position - medicine.

The accepted direction of research received convincing arguments in the dissertation.

The development of modern medicine is widely based on the laws and phenomena of physics (and its greatest achievements are largely related to the successes of biophysics). In modern medical practice, various physical devices are widely and variedly used, both for diagnosis and for treatment; this poses the task of training modern school personnel to work in the field of medicine with a solid command of the fundamentals of physics and biophysics.

Biophysics is a science that arose through the integration of sections of biology and mathematical physics, studies biological objects, processes and phenomena as a type of complex nonlinear physical systems.

A modern secondary school, focused on teaching the younger generation at the level of fundamental scientific achievements of the last three centuries [1], includes the following fundamentals of biophysical science in the content of student education:

- Thermodynamic foundations of biological processes.
- Laws and rules of nonequilibrium thermodynamics.

- The speed and patterns of reactions in living systems.
- Kinetics of enzymatic catalysis.
- Interaction of radiation with living organisms.
- Classification and stages of photobiological processes.
- The optical system of the eye and the phenomenon of accommodation.
- Patterns of formation and functioning of biomacromolecules.
- Spatial structure and functions of protein.
- Structure and functions of the deoxyribonucleic acid molecule.
- Principles of organization and functioning of a living cell.
- Physical model of biological membranes.
- Classification of types of transport of substances through biological membranes.
- Physical patterns of functioning of nerve and muscle cells.
- Mechanisms of information transfer in cells.
- Molecules that transmit information from the membrane into the cell and between cells.
- Passive electrical properties of biological objects.
- Types of electrical polarization in biological tissues.
- Electrical conductivity of biological objects for alternating current.
- Biophysics of electrically excitable biological tissues.
- Modern methods of recording biopotentials.
- Conduction of excitation along nerve fibers.
- Electrical and chemical synapses.
- Molecular mechanisms of muscle contraction.
- Biophysics and energetics of blood circulation.
- Modeling of breathing and the basic equation of breathing biomechanics.
- Biophysical principles and methods for studying transcellular transport.
- Biophysics of the organs of vision and hearing.
- New biophysical approaches in the diagnosis and treatment of various diseases.

A biology teacher who designs and implements an elective course in biophysics for high school students coordinates a number of his own educational topics with physics and chemistry teachers [2], establishing and developing interdisciplinary connections in a secondary school.

In physics and chemistry classes [3], teachers use relevant scientific material from the elective course in biophysics.

Pedagogical experience shows good results for graduates of secondary schools when they

pass unified state exams in biology, physics and chemistry.

Further study of selected graduates of secondary schools in higher educational institutions is accompanied by a high level of academic performance in natural and mathematical disciplines.

Analyzing and summarizing the above brief material, we can formulate the conclusion that the design and implementation of an elective course in biophysics for high school students in secondary schools leads to the establishment and development of interdisciplinary connections in the educational institution and an increase in the level of academic performance of students in natural and mathematical disciplines.

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