ISSN NO: 2771-8840
Date of Publication: 12-10-2023

Methods and Directions of Modern Biophysics

Gaybulova Gulnora Sadullaevna,
Bukhara Institute of Innovative Medicine

Annotation. The article deals with the formation of basic competencies when teaching a biophysics course. The types, functions, pedagogical and psychological qualities of the basic competencies on which they are based are substantiated.

Key words: formation of competencies, profession, pedagogical qualities, practical context, degree of universality, key competencies, educational practice, learning activities

Molecular biophysics studies the functional structure and physicochemical properties of biologically important (biologically functional) molecules, as well as the physical processes that ensure their functioning, studies the thermodynamics of biological systems, the transfer of energy and charge through biomolecules, and the quantum mechanical features of their organization. This part of molecular biophysics is gradually being separated into a new section called quantum biophysics. In general, the task of molecular biophysics is to reveal the physicochemical mechanisms of the biological functionality of molecules.

Works on cell biophysics are devoted to the physical and physicochemical properties of cellular and subcellular structures, patterns of cell division and differentiation, features of their metabolism (metabolism), as well as biophysical mechanisms of specialized cell functions (muscle contraction, secretion, nerve impulses, etc.).

Biophysics of sensory organs reveals the physical and physicochemical mechanisms of perception of specific stimuli by the receptor apparatus of sensory systems (analyzers) of humans and animals (at the quantum, molecular, cellular levels).

The task of biophysics of complex systems is to resolve general physical and biological problems (the origin of life, heredity, variability, etc.) on the basis of physical and mathematical modeling of the most important biological processes.

Many biophysicists insist on identifying another area of biophysical research - the biophysical foundations of ecology. Its content is to elucidate the mechanisms of influence of physical and chemical environmental factors on the body. There is a tendency to identify all biophysics with molecular biophysics, which is reflected in the textbook by M.V. Wolkenstein "Biophysics", published for students of biological and physics faculties of universities. Such a limitation can be allowed to determine the area of the most relevant scientific research in modern biophysics, although not everyone agrees with this.

Thus, Academician G.M. Frank, back in 1974, argued that "the center of gravity of the physicochemical consideration of the basis of life phenomena is now shifting to the field of cell biology," since "life phenomena arise only in a system called a cell," and, according to E.B. Wilson (1925), "the key to every biological problem is to be found in the cell," and modern biophysics has begun to possess methods that make it possible to make the cell the object of a precise physical experiment. This does not mean that other areas of biophysical research are given a supporting role. According to G.M. Frank, in the development of biophysics, "...the continuity of the line of research from the section that we designated as "molecular biophysics" must be observed, further through the biophysics of the cell to the biophysics of complex processes."

Biophysics is a science that studies the physical and physicochemical processes that occur in biosystems at different levels of organization and are the basis of physiological acts. The emergence of biophysics occurred as progress in physics, with contributions from mathematics, chemistry and biology.

Living organisms are an open, self-regulating, self-reproducing and developing heterogeneous system, the most important functional substances in which are biopolymers: proteins and nucleic acids of a complex atomic and molecular structure.

Objectives of biophysics:

1. Disclosure of general patterns of behavior of open nonequilibrium systems. Theoretical justification of the thermodynamic (t/d) foundations of life.

2.Scientific interpretation of the phenomena of individual and evolutionary development, self-regulation and self-reproduction.

3. Clarification of the connections between the structure and functional properties of biopolymers and other biologically active substances.

4.Creation and theoretical justification of physical and chemical methods for studying biological objects.

5.Physical interpretation of a wide range of functional phenomena (generation and distribution of nerve impulses, muscle contraction, reception, photosynthesis, etc.)

Sections of biophysics:

· Molecular – studies the structure and physicochemical properties, biophysics of molecules. The main objects of research in molecular biophysics are functionally active substances, including proteins and nucleic acids.

Cell biophysics – studies the features of the structure and functioning of cellular and tissue systems. Cell biophysics deals with the supramolecular structures of a living cell, among which a special place is occupied by the membrane structures of cells and subcellular structures.

Biophysics of complex systems – studies the kinetics of bioprocesses, the time behavior of various processes inherent in living matter and the thermodynamics of biosystems. Biophysics of complex systems considers living organisms at various levels of organization from the perspective of physical and mathematical modeling. The objects of research in this case are communities of cells, living tissues, physiological systems, and populations of organisms. Model building is one of the main stages of biophysical research. A living organism is a very complex system, not always accessible to precise physical experiments. In this case, the use of physical, analog, and mathematical models becomes fruitful. Any major discovery in biophysics is obtained through the use of models.

The representation of biomacromolecules in the form of crystals made it possible to establish the molecular structure of hemoglobin and myoglobin. The analogue electrical model of the excitable membrane played an important role in the studies of Hodgkin and Huxley. In membrane biophysics, physical models of membranes in the form of mono- and bimolecular lipid films are widely used. With the development and improvement of computer technology, modeling is gaining new development.

Sciences such as biology, medicine, and agricultural sciences are becoming more and more precise. It is difficult to overestimate in this case the role of biophysics, designed to study the phenomena of life using physical concepts and methods.

History of the development of biophysics.

Mathematical models describe a whole class of processes or phenomena that have similar properties or are isomorphic. The science of the late 20th century - synergetics - showed that similar equations describe self-organization processes of a very different nature: from the formation of galaxy clusters to the formation of plankton spots in the ocean.

Despite the diversity of living systems, they all have the following specific features that must be taken into account when constructing models.

All biological systems are complex, multicomponent, spatially structured, the elements of which have individuality. When modeling such systems, two approaches are possible. The first is aggregated, phenomenological. In accordance with this approach, the defining characteristics of the system are identified

ISSN NO: 2771-8840
Date of Publication: 12-10-2023

(for example, the total number of species) and the qualitative properties of the behavior of these quantities over time are considered (stability of a stationary state, the presence of oscillations, the existence of spatial heterogeneity). This approach is historically the most ancient and is characteristic of the dynamic theory of populations.

Another approach is a detailed consideration of the elements of the system and their interactions. The simulation model does not allow analytical research, but its parameters have a clear physical and biological meaning; with good experimental study of the fragments of the system, it can give a quantitative forecast of its behavior under various external influences.

Reproducing systems (capable of autoreproduction). This most important property of living systems determines their ability to process inorganic and organic matter for the biosynthesis of biological macromolecules, cells, and organisms. In phenomenological models, this property is expressed in the presence in the equations of autocatalytic terms that determine the possibility of growth, the possibility of instability of a stationary state in local systems and the instability of a homogeneous stationary state in spatially distributed systems.

Literature

1. Хуторской А.В. Ключевые компетенции как компонент личностно-ориентированной парадигмы образования // Народное образование. - 2003.- № 2. - С. 58-64.
2. Хуторской А.В. Личностно-ориентированный подход к обучению. - М., 2006.
3. Якиманская И.С. Технология личностно-ориентированного образования. - М., 2000.
4. Болотов В.А., Сериков В.В. "Компетентностная модель: от идеи к образовательной парадигме", Педагогика, 2003. №10
5. Ермаков Д. "Компетентность в решении проблем", Народное образование, 2005. №9
6. Дахин А.В. "Компетенция и компетентность", Народное образование, 2004. №4
7. Л.П.Алексеева, И.С. Шалыгина "Состояние и проблемы профессиональной компетентности
8. Атоева М.Ф. Периодичность обучения физике. Аспирант и соискатель. – Москва, 2010. – №6. – С. 41-43.
9. M.F. Atoyeva. Interdisciplinary relations in physics course at specialized secondary education. The Way of Science. – Volgograd, 2016. – №9 (31). – P.22-24.
10. M.F. Atoyeva. The significance of periodicity at teaching physics. The Way of Science. – Volgograd, 2016. – № 10 (32). – P.62-64.
11. Атоева М.Ф. Эффективность обучения электродинамике на основе технологии периодичности. The Way of Science. – Volgograd, 2016. – № 10 (32). – P.65-66.
12. M.F. Atoyeva. Use of Periodicity in Teaching Physics. Eastern European Scientific Journal. – Düsseldorf-Germany, 2017. № 4. –P. 35-39.
13. M.F. Atoyeva. Didactic foundations of inter-media relations in the training of university students. International Scientific Journal. **Theoretical & Applied Science. p-ISSN:** 2308-4944 (print) **e-ISSN:** 2409-0085 (online). **Year:** 2020 **Issue:** 06 **Volume:** 86, P. 124.