

The Content and Development of Biochemical Concepts in Biology

Axrrova Feruza Aliyevna

Teacher of biology subject at academic Lyceum of Jizzakh state pedagogical university

Kenjayeva Sevara Nuritdinovna

Teacher of chemistry subject at academic Lyceum of Jizzakh state pedagogical university

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ABSTRACT

The central core of the system of scientific knowledge is scientific concepts. The school course "Biology" is a system of basic biological concepts that develop in a logical sequence. The system of concepts is determined by the fundamentals of biological sciences that make up the academic subject: botany, zoology, anatomy, physiology, cytology, ecology, biochemistry, etc. Therefore, the development of biological knowledge is operating with appropriate concepts.

The theory of the development of concepts is one of the main ones in the methodology of teaching biology. The theory of the development of concepts is based on the philosophical doctrine of cognition, in which empirical and theoretical levels of cognition are distinguished, expressed in the corresponding concepts. Empirical concepts are knowledge that is formed on the basis of sensory experience. Theoretical concepts are the result of generalization of various representations.

There are several approaches to the classification of concepts. According to the volume of content, the concepts are divided into simple and complex. According to the degree of generality, special and general biological concepts are distinguished. Biochemical concepts can be classified according to the essence of the content, along with morphological, anatomical, ecological, systematic, cytological, embryological, hygienic, etc. concepts.

Let's consider the content and development of biochemical concepts in the process of studying biology. Biochemistry (biological chemistry or physiological chemistry) is a biological science that is located at the junction of exact sciences that study physical and chemical phenomena and a number of biological disciplines. Biochemistry studies the chemical composition of cells, organs, tissues, fluids and the whole organism, chemical reactions taking place in the body, metabolism and their manifestation in biological functions. Biochemistry also uses concepts formed in the course of general chemistry (for example, "reaction", "qualitative reaction", "precipitation reactions", "mineral (inorganic) and organic substances", etc.).

Some biochemical concepts belong to a group of general biological concepts, i.e. concepts of

biological laws relating to the whole of nature, to all living organisms. These are the concepts: "metabolism and energy", "catabolism (dissimilation)", "anabolism (assimilation)", "nutrition", "respiration", "excretion", "photosynthesis". Other biochemical concepts: "bioorganic substances of the cell: proteins, carbohydrates, lipids, vitamins, enzymes, hormones", "macroergic substances", "glycolysis", "Krebs cycle", "essential amino acids", "glycogen", "urea", "catalase", "ptyalin", "lipase" and others are special, as they are studied within a certain section.

The fundamental factors influencing the formation of the system of conceptual apparatus are textbooks, according to which students study disciplines, organizational conditions of educational activity, the natural and socio-cultural environment in which the student develops.

For example, the processes of nutrition, respiration, and metabolism are initially interpreted as physiological processes taking place in a plant organism. The concepts are formed in interrelation and interpreted as follows: "In the process of nutrition, the body absorbs the substances and energy it needs from the external environment, assimilates them, thanks to which it lives and increases in size. Plants in the process of nutrition absorb water and dissolved minerals from the soil, and carbon dioxide from the air, from which organic substances are formed with the help of light energy and use them to build their bodies, growth and development. In the process of respiration, the plant organism consumes oxygen. At the same time, carbon dioxide is released, substances harmful to the body are formed. Each organism has its own metabolism. At the same time, the transformations of substances received in the process of nutrition and respiration occurring in the body ensure its vital activity and constant communication with the environment".

The comparison of respiration and photosynthesis processes is carried out using physiological and biochemical processes occurring at the cell level of the green leaf of the plant. The concept of "metabolism" in the study of plants, bacteria and fungi is defined "as a set of various chemical transformations occurring in the body that ensure the growth and development of the organism, its reproduction and constant contact with the environment".

When studying animals, the concepts of "nutrition" and "respiration" are considered as physiological processes related to the functioning of the entire surface of the body or specialized respiratory and nutrition organs. In animals, the study of respiration begins with the example of unicellular organisms, in which it occurs by diffusion. When studying coelenterate animals and types of worms that do not have special respiratory organs, we are talking about breathing that occurs through the surface of the body. During the subsequent study of the section, students get acquainted with the peculiarities of the structure of the respiratory system of various representatives of the animal world, the complication of the breathing process (gill, tracheal, pulmonary respiration). Considering the process of respiration, the role of oxygen in the air is emphasized, which is necessary for the oxidation of substances with the formation of energy necessary for the passage of vital processes. The resulting substances: water, carbon dioxide and some others must be removed from the body.

It should be noted that it is in the section "Man" that practical methods are added to the verbal and visual methods of forming biochemical concepts, which are implemented in the form of laboratory work and assume active research activities of students. "The research activity of students in the study of biology is the activity of mastering the methods of studying objects of wildlife in order to develop cognitive interest, independence, intellectual and practical skills. It reflects the methodological level of the content of the subject and helps students to get acquainted with the methods and forms of scientific knowledge". The research activities of schoolchildren in the study of biology can be carried out in various directions. As part of this type of activity, you can organize an observation or experiment. The introduction of an experiment into the teaching of biology contributes not only to the establishment of cause-and-

effect relationships between the phenomena studied, but also to the formation of elementary and complex experimental skills belonging to the group of practical ones. If we are talking about the formation of biochemical concepts, then they will correspond to the ability to conduct biochemical reactions, put forward a hypothesis, explain the results obtained, choose the equipment necessary for conducting experiments. Students' research activities can take place individually or collectively. Moreover, the latter form of organization allows you to form not only universal learning activities, but also met subject learning outcomes - the ability to work in a group as an activity partner and as a leader. Such research collective activity should proceed under a number of methodological conditions.

The formation of biochemical concepts is completed in the school biology course on the topic "Molecular standard of living". There is a repetition and some clarification of biochemical concepts: "macro- and microelements", "carbohydrates", "lipids", "proteins", "enzymes", "nucleic acids", "biosynthesis", "photosynthesis", "glycolysis", "oxygen stage of aerobic cleavage", "vitamins", "hormones". New biochemical terms and concepts "pyruvate (lactic acid)", "repressor protein", "coenzyme", "vasopressin", "oxytocin", "corticotropin", "prostaglandins" are included, which are found only in one or two paragraphs of the textbook, i.e. they are local. No laboratory work as a way of forming biochemical concepts is provided.

There is continuity in the formation and development of these concepts: at first, they are special and are studied as processes characterizing the vital activity of a plant; when considering the processes occurring in animal organisms, biochemical concepts become general biological. In the section "General Biology" they become special again. This pattern is justified by the logic of the construction of biological material.

The problem of the development of concepts, both in the theory of methodology and in the practice of teaching biological subjects, is one of the most urgent and complex. The teaching of biology has undergone a significant restructuring in recent years, the programs have been supplemented and reduced so much that there is a real need to determine the system of knowledge, the most essential concepts of the fundamentals of sciences that should be studied at school. It is necessary to apply an activity-based approach in the formation of concepts, because one of the conditions for the correct formation of a concept is the application of knowledge in practice. The skills and abilities acquired by students are an indicator of the effectiveness of learning, along with the sum of subject knowledge.

The experimental methodology provides for the gradual formation and development of general biological concepts: isolation of the system of general biological concepts of the school course "General Biology" from the system of biological concepts; definition of the term general biological concept; definition of the primary content and scope of the concept through the establishment of essential features in the process of mobilizing students' knowledge; deepening the content of the concept, generalization at the level of the detailed scope of the concept; establishing the relationship of a concept with other concepts and their generalization to a system.

Thus, the results of the study revealed that the content of the course "General Biology" has great opportunities in the formation and development of general biological concepts. Despite the urgency of this problem, there is currently insufficient research devoted to the formation of general biological concepts that play a huge role in the development of ideological knowledge, views and beliefs.

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