



Problems in improving the methodology of teaching subjects in the department of genetics and their solutions

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Abstract: This article is devoted to highlighting the problems and solutions in improving the methodology of teaching genetics in higher education institutions. Also, the results of research and practical recommendations on improving the teaching process of genetics are presented.

Keywords: Quality of education, genetic variability, heredity, variability, allelic and non-allelic genes, codominant, complementary, epistasis, polymer, double crossover.

Introduction: Genetics is one of the most important branches of biology, studying the hereditary characteristics of organisms, their genetic information, the structure of genes and chromosomes, and evolution. In the second half of the 20th century, genetics became a rapidly developing and expanding branch of biology, and was used in the research of physics, chemistry, molecular biology, biophysics, cybernetics, and mathematics. Scientific research in the field of genetics contributes not only to the development of biology, but also to the formation of research skills of students, as well as to the preservation of human life and their health.

Main part. As we all know, the healthy birth of our children is largely directly related to the dissemination of genetic knowledge and increasing genetic literacy among the general population, especially among young people. Therefore, it is of practical importance to provide the younger generation with knowledge of the basics of genetics, as well as all sciences, to form their scientific worldview, conduct genetic analyses, and achieve important results in meeting the needs of

people in their lives. However, the results of our research in this area revealed that there are a number of problems of a theoretical and practical nature in the process of teaching this section, and in order to eliminate these problems, it is required of specialists engaged in pedagogical activities in this area to develop clear and correct methodological solutions and apply them in pedagogical activities.

To eliminate these problems, it is considered appropriate for students to be active in mastering knowledge of genetic content, to be able to apply theoretical information in practice, to apply integrative knowledge, and to develop creative thinking in the process of solving problems that reflect genetic laws. This is an important pedagogical approach in the process of further deepening the knowledge of students in the field of genetics and preparing them to solve real-life problems.

Studying the content of the topics of the genetics department is complex, due to the breadth of its theoretical and practical aspects, the depth of scientific concepts and ideas, and requires great attention and analytical, independent, logical and creative thinking from students during their mastery of the topics of this department.

One of the first problems in improving the methodology for teaching the topics of the genetics department is the presentation of scientific information in the genetic literature from different points of view. For example, in the textbook "Fundamentals of Genetics and Selection", published under the co-authorship of Academician J.M. Musayev and others, "Types of interaction of non-allelic genes" are divided into 6 types: complementary type of genes; epistatic type of genes; polymer type of genes; combined type of genes; The inheritance of traits under the multifaceted influence of genes is called pleiotropy (the influence of an allelic gene or a non-allelic gene or a separate influence); the mutual modification effect of genes is given. The textbook "Genetics" published by Professor A.T. Gofurov and others, or the textbook "Biology" intended for students of general education schools, states that there are 3 types of "types of interaction of non-allelic genes", which are complementary, epistasis, and polymerization. The textbook "Genetics" published by P.S. Sobirrov and other scientists, states that there are 4 types of "types of interaction of non-allelic genes", which are complementary, epistasis, heterostasis, polymerization, and other types.

The different interpretations of many of the terms given in genetics textbooks in different literatures are considered one of the problems that arise in the

teaching process. In particular, thalassemia disease (a disorder of normal hemoglobin synthesis) is interpreted as partially dominant in some literatures and as completely dominant in some textbooks and manuals (there are also such ambiguities in many other character waves), or another example, the specific features of codominance and partial dominance are not fully explained. Similarly, the interpretation of the stages of mitosis in most literatures as consisting of 5 phases and in some literatures as 6 phases, the inheritance of wool in mice as an epistatic effect in some literatures and a complementary effect in most literatures, of course, leads to a number of confusions in the process of assimilation of genetic knowledge by teachers and students.

We believe that our scientists should come to a unanimous opinion on the solution of the above problems based on genetic research. And it is appropriate to present the types of gene interaction in textbooks as complementary, epistasis, polymer types, and the remaining types as separate types of gene effects (foreign literature, in particular, in the textbook "Genetics" published in 2020 by the Moscow geneticist V.I. Ivanov, the types of non-allelic genes are interpreted in this way). Genetic traits should be clearly given in terms of dominant and recessive states and the stages of the processes should be presented in a clear order.

Another important problem in improving the methodology for teaching topics in the Genetics department is the shortcomings in covering the content of these topics.

In particular, in covering the content of epistasis inheritance, unidirectional and bidirectional epistasis types are given, but bidirectional epistasis is not described in the content of the topic based on examples. On the Internet, this information is presented with the unfounded opinions of each researcher. No one can guarantee the accuracy of this information. Also, the phenomenon of multiple allelism of genes, codominant, mechanisms that cause intermediate inheritance, the causes of forward and reverse mutations in types of variability, and other information can be cited as examples.

The solution to this problem is to provide sources based on the process of comprehensively clarifying genetic information, to describe the mechanisms of occurrence of each process, to collaborate with scientific research and institutions engaged in genetics and selection processes, as well as to compare foreign sources and include information that has a solid basis. Information provided based on errors or misinterpretations will lead to genetic doubts in the minds of future youth. This will

directly undermine the quality of genetic literacy.

One of the most important problems in improving the methodology of teaching topics in the Department of Genetics is the lack of qualifications and methodological knowledge of teachers. In the process of designing lectures, practical, and laboratory exercises in the effective teaching of genetics, the scientific and methodological skills and fundamental knowledge of professors and teachers play an important role. However, today, many young professors and teachers cannot fully apply advanced technologies, methodological approaches, and interactive teaching methods in their pedagogical activities during classes on topics in the Department of Genetics. This, in turn, leads to a decrease in the interest of students in mastering topics related to the Department of Genetics. For example, it was found that the level of knowledge of topics such as multiple allelism, codominant, molecular basis of heredity, double crossover, genetic mapping, interference, coinciding, one- and two-way epistasis, 3 types of complementary inheritance, and population genetics is low.

In our opinion, the solution to the above problems lies in the following aspects: It is advisable to include topics in the content of the qualification requirements on a consistent basis and increase its volume; to improve the coherence of theory and practice throughout the specialist's career; to use innovative methods of solving problems and exercises as much as possible in the gaps identified above; to organize regular methodological seminars, trainings and scientific conferences to develop the pedagogical and scientific knowledge of professors and teachers; to teach future teachers new pedagogical teaching methods, including the introduction of approaches that include interactive lessons, laboratory work and virtual simulations; creating platforms for professors and teachers to learn from their experiences and help each other.

Another problem in improving the methodology of teaching topics in the Department of Genetics is the insufficient previous knowledge of biology of specialist teachers.

As is known, biology is a theoretical basis for studying topics from the Department of Genetics. When teaching the Department of Genetics, knowledge acquired from other related disciplines included in the curriculum (botany, zoology, developmental biology, biochemistry, molecular biology) is considered a foundation. If teachers have not thoroughly studied the basic concepts of biology, then difficulties arise in accepting and mastering deep knowledge in genetics. This creates problems in teaching topics related to

genetics.

Heredity and variability are closely related to the reproduction of organisms. Reproduction involves complex biochemical and physiological processes based on heredity and variability. Therefore, the study of genetics is closely related to biochemistry and physiology. The individual development of organisms is mainly determined by hereditary factors - that is, the activity of genes. The influence of genes cannot be explained in isolation from the general laws of ontogenesis, since this fact indicates the connection of genetics with embryology. Also, the connection with the science of ecology in the study of the concepts of genetics is very extensive. First of all, environmental pollution has a negative effect on the heredity of plants, animals and humans. In order to prevent hereditary diseases that arise as a result of such effects, one must know the laws of ecology.

In our opinion, in order to achieve positive results in this problem: it is advisable to develop the skills of applying previously acquired knowledge in practical situations in the process of studying topics related to the genetics department. To do this, it is necessary to recall and repeat the basic concepts of biology, which will help students better master the basic concepts and terminology; it is important to improve the quality of knowledge of genetics and ensure integration by giving students examples related to other departments of biology; in the process of organizing classes, it is necessary to provide students with auxiliary materials and manuals, taking into account the individual learning needs of students.

Another important problem in improving the methodology of teaching topics in the genetics department is the difficulty of connecting theoretical knowledge with practice.

The genetics department has a theoretical basis and requires the understanding of many laws, theories, concepts and principles. However, students face a number of difficulties in applying this theoretical knowledge to practice, especially in laboratory work or in understanding examples that arise in real life. For example, the legal prohibition of conducting genetic research related to the inheritance of human traits, the lack of genetic laboratories and equipment, and facilities are among them.

Based on our research, it was suggested that this problem should be solved based on the following solutions: teaching students to connect theoretical knowledge with practice through computer simulations of genetic experiments conducted during lectures, practical, laboratory and independent learning; further clarifying students' concepts by presenting real-life

examples of genetics (for example, genetic diseases, hereditary traits); introducing modern laboratory equipment, virtual laboratories and interactive educational platforms into the teaching process; It is recommended to achieve this through the effective use of 3D animations and artificial intelligence capabilities.

Of particular importance are the difficulties in integrating modern technologies into the teaching process of genetics. Today, the development of genetics and related research is based mainly on high technologies and scientific methods at the molecular level. However, the technical capabilities of most higher educational institutions and general secondary schools are somewhat limited, which reduces the opportunities for the effective use of modern technologies. This reduces the effectiveness of teaching genetics.

The ways to overcome these problems are as follows: providing higher education institutions and general secondary schools with modern technical means and laboratory equipment, as well as expanding access to high-speed Internet; training teachers in the use of modern computer technologies and programs, including the creation of interactive learning platforms; directing students to participate in online resources and virtual laboratories.

Another problem in improving the methodology of teaching topics in the Genetics Department is the difficulty in organizing the educational process and increasing the motivation of students.

Complex and sometimes difficult-to-understand topics in the Genetics Department can reduce student interest. It is important to present genetics topics to students in an interesting and relevant way and increase their motivation. To do this, it is necessary to introduce students to advanced and relevant topics related to genetics, such as hereditary diseases, evolutionary processes or genome editing technologies, marker-based technologies, the importance of the polyploidy phenomenon in meeting human needs, sequence-based research, and the possibilities of gene knockout methods; to increase students' interest in this area by showing them scientific research and practice; to explain the importance of genetics in everyday life based on real-life examples, for example, plant breeding, the consequences of inbreeding, medical genetic issues, or examples of biologically diverse forms of life. Also, finding ways to effectively use non-standard tasks in the process of increasing students' genetic literacy and increasing motivation is an urgent solution to the problem. In the process of improving the methodology for teaching topics in the genetics department, the regular use of non-standard tasks during the lesson directly contributes to increasing genetic literacy. In particular, in the process of thoroughly mastering genetic discoveries, genetic terms and laws, it is considered appropriate to use the following non-standard tasks. As a result, we will eliminate students' problems in learning the basics of this science, develop their research skills, and consolidate the acquired knowledge.

1.	G.Mendel	A	carried out the synthesis of the gene of a yeast cell in the laboratory.
2.	X.De Friz, E.Chermak, K.Korrens	B	Determined the composition of the nucleotide triplet for 20 amino acids, and as a result, the genetic code became known.
3.	U.Betson	V	Published a model of the structure of the DNA molecule.
4.	V.Iogansen	G	Together with his students, he proved that nucleic acids are the material basis of heredity.
5.	T.Morgan	D	Conducted research on neurospores of ascomycetes
6.	G.Nadson, G.Filippov	E	proved that processes in populations can be studied using mathematical methods
7.	S.Rayt, R.Fisher	K	succeeded in obtaining mutations in yeast under the influence of radium rays
8.	D.Bidl, E.Tatum	L	discovered chromosome theory with his students
9.	O.Eyveri	M	introduced concepts such as gene, genotype, phenotype into science
10.	Dj.Uotson, F.Krik,	N	introduced the term genetics into science

	M.Uilkins, R.Franklin											
11.	M.Nirenberg, G.Matthey, F.Krik	S	rediscovered the laws of heredity in 1900									
12.	X.Korrorna	R	discovered the laws of heredity.									
Answers:	1-	2-	3-	4-	5-	6-	7-	8-	9-	10-	11-	12-

CONCLUSION

Improving the methodology of teaching topics in the genetics department is relevant in the process of developing the scientific worldview of students, increasing their interest in genetics, and introducing them to modern scientific approaches. In this regard, the qualifications of professors and teachers, the level of knowledge of students, the effectiveness of methodological approaches, and the quality of technical capabilities are important factors. The teacher prepares the ground for improving the methodology of teaching genetics and ensuring its quality by correctly designing genetic problems in the lesson process and analyzing them and implementing appropriate solutions.

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