ANNOTATION

Dissertation on the topic "Methodology for the formation of research competence of students on the basis of molecular genetic characteristics and identification of viruses" for the degree of Doctor of Philosophy (PhD) in the specialty 6D011300-"Biology"

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Research topic: Methodology for the formation of students' research competence based on the molecular and genetic characteristics and identification of viruses.

The aim of the research: Theoretical substantiation of the formation of research competence of students on the basis of molecular - genetic characterization and identification of viruses, the development of methods and its experimental testing.

Research objectives:

- scientific and theoretical substantiation of the formation of students' research competence based on the molecular genetic characteristics and identification of viruses;
- identification and bioinformatics analysis of new viruses that can harm human health and lead to economic losses in animal husbandry and agriculture;
- to propose the content of the methodology for the formation of students' research competence based on the molecular genetic characteristics and identification of viruses;
- experimental verification of the effectiveness of the methodology for the formation of students' research competence based on the molecular genetic description and identification of viruses, introduction into the educational process.

Research methods: While providing the research work in a complex, the following methods were used:

- theoretical (analysis and synthesis, generalization and comparison, abstraction and clarification, modeling the prediction of research and design of results);
- empirical (questioning, interviewing, observation, analysis of educational and methodical documentation, solving pedagogical problems, consulting, conducting tests, experimental work);
- laboratory (research methods of works on molecular-genetic characterization and identification of viruses in laboratory conditions);
- statistical (mathematical and statistical processing of research results).

Basic principles proposed for thesis defense (proven scientific assumptions and other conclusions that are new knowledge):

- the result of the analysis of scientific-theoretical foundations for the formation of research competence of biology students on the basis of molecular-genetic characterization and identification of viruses became the scientific rationale of the experimental works;
- on the basis of molecular-genetic characterization of viruses and the presentation of the results of identification implies the definition of effective content of the methodology of formation of research competence of students;
- the effectiveness of the methodology of research competence formation on the basis of molecular-genetic characterization and identification of viruses is provided by such conditions as actualization of integration of science and education, application of practice-oriented active forms of learning, application in the training of future biologists;

- the conclusion and the results of the experimental evidence showing the effectiveness of the methodology for the formation of research competence on the basis of molecular-genetic characterization and identification of viruses confirm the validity of the principles proposed for protection.

Main results of the research:

- the theoretical foundations for the formation of research competence of students on the basis of molecular genetic characterization and identification of viruses were determined;
- the content of the formation of research competence based on the results of molecular genetic study of viruses was determined;
- the methodology of forming research competence on the basis of molecular-genetic characteristic and identification of viruses was developed;
- the effectiveness of the method of forming the research competence on the basis of molecular-genetic characteristic and virus identification was tested and introduced into the teaching process.

Novelty and significance of the results:

- *the theoretical foundations of the formation of students' research competence* based on the molecular genetic characteristics and identification of viruses are determined. The necessity of monitoring environmental objects due to the presence of fragments of genomes of pathogens of a number of diseases has been revealed;
- *the novelty of the second conclusion* is that the content of the establishment of research competency is determined based on the results of the molecular genetic study of viruses. The whole genome sequence of Acheta domesticus densovirus (AdKaz18) was registered in GenBank as MT823474, and the complete genome sequence of Invertebrate iridescent virus (Kaz2018) was registered as MT862761.1.
- *the novelty of the third result* is that a methodology for developing students' research competency based on molecular genetic characteristics and virus detection has been devised. A patent on the topic "Method of lysis of *E.coli* strains causing nosocomial infections," which is integrated into the educational process, was established.
- *the fourth finding in this study* is distinguished by its innovation, as it involves the empirical assessment and implementation of a methodology aimed at enhancing students' research competence through the analysis of molecular genetic characteristics and viral identification. Specifically, this research has led to the development and publication of the instructional resource titled "Fundamentals of Virology," which has been seamlessly integrated into the educational curriculum. Furthermore, the outcomes of this investigation have been seamlessly integrated into the educational framework of the comprehensive course on "Microbiology and Biotechnology." These findings hold considerable promise for application in the pedagogical training of biology students at institutions of higher education and within teacher training programs.

Compliance with the directions of science development or state programs:

The main idea of the research work corresponds to the state program of development of education and science of the Republic of Kazakhstan for 2020-2025, the generally binding standard of education, the annual messages of the President of the Republic of Kazakhstan Kassym-Jomart Kemelevich Tokayev to the people of Kazakhstan.

The contribution of the doctoral student in the preparation of each publication (indicate the share of the author of the dissertation, measured as a percentage of the total volume of the publication):

On the content of the research work published 17 scientific papers, including:

5 articles were published in a scientific journal indexed on the Scopus and Web of Science databases;

2 articles was published in the publication, listed by the Committee for Quality Assurance in the field of science and higher education of the Ministry of Science and Higher Education of the Republic of Kazakhstan;

1 paper was published in the foreign ranking (foreign expert) scientific journals;

1 article published in the scientific journals of Kazakhstan;

7 articles published in the proceedings of the international practical conference held in the near and far abroad countries.

1 textbook (Minutes № 17 of 25.06.2021, presented by the Academic council of KazNPU named after Abai, Institute of Natural sciences and Geography). All publications were published during the study.

In a scientific journals indexed by Scopus and Web of Science databases:

1. Complete Genome Sequence of Escherichia-Infecting Phage CEC_KAZ_2018, Isolated from Soil // Microbiology Resource Announcements, E-ISSN:2576-098X, Vol. 8. No. 36., P. 00540- 00540, September, 2019 https://journals.asm.org/doi/10.1128/MRA. (Co-authored by: Y. Moldakhanov, M. Alexyuk, A.Bogoyavlenskiy, P. Alexyuk, A.Turmagambetova, I. Zaitseva, N. Sokolova, K. Akanova E. Omirtaeva, V. Berezin 50%) doctoral student's contribution to the publication is 50%. This article presents the complete genome sequence of the infecting Escherichia phage CEC_KAZ_2018 isolated from soil.

2. Complete Genome Sequence of vB_EcoP_PR_Kaz2018, aT7-Like Bacteriophage // Microbiology Resource Announcements, E-ISSN:2576-098X, Vol. 8. No. 49. December, 2019 https://journals.asm.org/doi/10.1128/MRA.01323-19 (Co-authored by: M. Alexyuk, A.Bogoyavlenskiy, P. Alexyuk, Y.Moldakhanov, A.Turmagambetova, V. Berezin 30%) doctoral student's contribution to the publication is 70%. The full genome sequence of VB_ECOP_PR_KAZ2018, a T7-like bacteriophage, is presented in the article.

3. Virome Structure of the Small Aral Sea // Microbiology Resource Announcements, E-ISSN:2576-098X, Vol. 9. No. 41. October, 2020 https://journals.asm.org/doi/10.1128/MRA.01023-20 (Co-authored by: M. Alexyuk, A. Bogoyavlenskiy, M. Amanbayeva, P. Alexyuk, Y. Moldakhanov, A. Imangazy, V. Berezin 35%) doctoral student's contribution to the publication is 65%. The article presents the viral structure of the Small Aral Sea.

4. Metagenomic Exploration of Atelerix albiventris Gut Microbiome//Microbiology Resource Announcements, E-ISSN:2576-098X, Vol. 10. No. 1. January, 2021 https://journals.asm.org/doi/10.1128/MRA.01342-20 (Co-authored by: M. Amanbayeva, A. Bogoyavlenskiy, M. Alexyuk, A. Imangazy, V. Berezin 25%) doctoral student's contribution to the publication is 75%. This article presents a metagenomic study of the gut microbiome of atelerix albiventris.

5. Metagenomic Exploration of Koumiss from Kazakhstan // Microbiology Resource Announcements, E-ISSN:2576-098X, Vol. 11. No. 1. January 2022 https://journals.asm.org/doi/10.1128/mra.01082-21 (Co-authored by: A. Bogoyavlenskiy, M.

Alexyuk, P. Alexyuk, M. Amanbayeva, A. Imangazy, A. Bektuganova, V. Berezin 35%) doctoral student's contribution to the publication is 65%. The article presents a metagenomic study of koumiss from Kazakhstan.

In publications recommended by the Committee on Quality Assurance in Science and Higher Education of the Ministry of Science and Higher Education of the Republic of Kazakhstan:

1. Formation of research competencies of students Biologists // KazNPU named after Abay, Vestnik, Series № 1 (65) "Pedagogical sciences", ISSN 1728 -5496 - Almaty, 2020. - C. 111 - 115. (Co-authors: M. B. Amanbaeva, A. P. Bogoyavlenskiy 30%) doctoral student's contribution to the publication 70%. The article presents a methodological rationale for the formation of research competencies of biology students.

2. Double-stranded DNA virome of the small aral sea // "NAS RK Proceedings, Biological and Medical Series." No 4 (334), ISSN 2518-1629 (Online), ISSN 2224-5308 (Print) - Almaty, 2019 B. 17 - 26. (Co-authored by: M. Alexyuk, A. Bogoyavlenskiy, P. Alexyuk, Y. Moldakhanov, K. Akanova, V. Berezin 30%) doctoral student's contribution to the publication 70%. The taxonomic diversity of double-stranded DNA (dsDNA) virome in the Aral Sea is considered in the article.

Scientific papers published in scientific journals:

1. Massive parallel sequencing as a basis for forming competence of a specialist in biology // Scientific-methodical journal "Biology at school". NO. 4, ISSN 0320-9660. - Moscow, 2019. P. 3 - 10. (Co-authored by: M. S. Alexyuk, E. S. Moldakhanov, A. S. Turmagambetova, P. G. Aleksyuk, M. B. Amanbaeva, A. P. Bogoyavlenskiy 30%) doctoral candidate contribution to the publication 70%. The article presents parallel sequencing as a basis for formation of scientific competence of biology students.

2. Massive parallel DNA sequencing - a step into the future // Science journal "Microbiology and Virology". No.4 (31), ISSN 2304-585 X.- Almaty 2020. C. 4-13. (Co-authored by: M. B. Amanbaeva, A. S. Imangazy, A. P. Bogoyavlenskiy 30%) doctoral student's contribution to the publication 70%. The article presents the multiparallel sequencing or high throughput parallel sequencing (NGS) is a new step in improving nucleotide sequence detection technology.

Materials of the international scientific and practical conference

1. On the problem of research competence formation in preparing of future specialists of biologists in Kazakhstan / International scientific - practical conference "Perspective directions of research in the methodology of teaching biology and ecology" of Russian State Pedagogical University named after A. I. Herzen. - Saint - Petersburg, 2018. C. 208 - 212. ISBN 978-5-4386-1175-2. (Co-authored by: M. B. Amanbaeva, A. P. Bogoyavlenskiy 20%) doctoral student's contribution to the publication 80%. The article presents the problems of formation of scientific competence in the training of future specialists in biology.

2. Research competence of biology teachers as a condition for improving the quality of pedagogical education in Kazakhstan / International scientific and practical conference "Perspective areas of research in the methodology of teaching biology and ecology" Russian State Pedagogical University named after A. I. Herzen. - St. Petersburg, 2019. C. 269 - 271. ISBN 978-5-4386-1175-2. (Co-authored by: M. B. Amanbaeva, 20%) doctoral student's contribution to the publication 80%. The article presents the research competence of biology teachers as a condition for improving the quality of teacher education in Kazakhstan.

3. Massive parallel sequencing as a learning tool diversity and distribution of bee viruses / International scientific and practical conference "Prospects for the development of university science, Russia". Collection Modern problems of science and education. - Moscow, 2021. - No. 21. ISBN 978-5-91327-650-6 P. 12. (Co-authored by: M. B. Amanbayeva, A. S. Imangazy, A. P. Bogoyavlenskiy 20%) publication 80%. The article presents multiparallel sequencing as a tool for studying the diversity and distribution of bee viruses.

4. Microbiome of bees of eastern Kazakhstan / International scientific practical conference "Prospects for the development of university science, Russia." Collection Modern problems of science and education. - Moscow, 2021. - No. 21. ISBN 978-5-91327-650-6 P. 12 - 13. (Co-authored by: M. B. Amanbayeva, A. S. Imangazy, A. P. Bogoyavlenskiy 30%) contribution doctoral candidate for publication 70%. The article presents the microbiome of bees in East Kazakhstan.

5. Virome analysis of surface waters of the artificial reservoir in Central Asia / OpenBio 2021: Collection of Abstracts VIII International Scientific and Practical Conference of Young Scientists: Biophysicists, Biotechnologists, Molecular Biologists and Virologists - Novosibirsk, 2021 - P. 236. (Co-authored by: M. Alexyuk, Y. Moldakhanov, K. Akanova 30%) contribution of the doctoral student to the publication 70%. The article presents a metagenomic analysis of the Aidarkol reservoir.

6. Monitoring of Lactococcus lactis phages by the massive parallel sequencing / Proceedings of the international congress Biotechnology: state and development prospects. ISBN: 978-5-6045396-1-3. Volume. Issue 19-Moscow, 2021. P. 11 - 13. (Co-authored by: A. Bektuganova, M. Aleksyuk, M. Amanbaeva, A. Bogoyavlenskiy, V. Berezin 25%) contribution of the doctoral candidate to the publication 75%. The article presents the presence of phages of lactic acid bacteria in milk samples.

7. Virome of water samples of the aral sea / Journal of Biotechnology. (Impact Factor 3.163) WoS ISSN 0168-1656, https://doi.org/10.1016/j.jbiotec.2019.05.132. Vol.305, Supplement, 2019, Pp. 36-37. (Co-authored by: Alexyuk M. S., Bogoyavlenskiy A. P., Alexyuk P. G., Moldakhanov Y. S., Zhumanov Zh. Zh., Turmagambetova A. S., Berezin V. E 30%) contribution of the doctoral student to the publication 70%. The article presents a metagenomic analysis of the biodiversity of the Aral Sea viruses.

Educational-methodical, teaching aids:

1. Fundamentals of virology. Textbook, - Nur-Sultan: LCD "Profi Polygraph", 2021. - 98p. Recommended for publication by the Academic Council of the Kazakh National Pedagogical University named after Abay. Protocol No. 17, date 06/25/2021 Almaty, 2021 ISBN 978-601-353-031-4. (Co-authors: A. P. Bogoyavlensky, M. B. Amanbayeva 20%) the contribution of the doctoral student to the preparation of the textbook is 60%.

These publications and teaching aids are related to the content of the dissertation, according to the results of the research obtained, they are independent works of the doctoral student.