MINISTER OF EDUCATION, SCIENCE AND SPORT OF THE REPUBLIC OF LITHUANIA

ORDER
ON APPROVAL OF THE DESCRIPTOR OF THE GROUP OF STUDY FIELDS OF LIFE SCIENCES (EXCEPT THE STUDY FIELD OF ECOLOGY)

30 March 2021 No. V-495
Vilnius

In accordance with Paragraph 11 of Article 53 of the Law on Higher Education and Research of the Republic of Lithuania:

1. I approve the Descriptor of the Group of Study Fields of Life Sciences (except the Study Field of Ecology) (enclosed).

2. I determine that the higher education institutions have to adjust their study programmes to the Descriptor of the Group of Study Fields of Life Sciences (except the Study Field of Ecology) approved by Clause 1 hereby until 01 September 2022.

Minister of Education, Science and Sport Jurgita Šiugždinienė

APPROVED
by Order No. V-495 of the Minister of Education, Science and Sport of the Republic of Lithuania of 30 March 2021

DESCRIPTOR OF THE GROUP OF STUDY FIELDS OF LIFE SCIENCES (EXCEPT THE STUDY FIELD OF ECOLOGY)

CHAPTER I
GENERAL PROVISIONS

1. The Descriptor of the Group of Study Fields of Life Sciences (except the Study Field of Ecology) (hereinafter – Descriptor) regulates the special requirements for the study programmes in the study fields of biology (D01), genetics (D0), microbiology (D03), molecular biology (D04), biophysics (D05), and biochemistry (D06) that belong to the group of study fields of life sciences (D). The Descriptor regulates the studies in the listed fields in the scope not covered by the General Requirements for the Studies approved by Order No. V-1168 of the Minister of Education and Science of the Republic of Lithuania of 30 December 2016 "On approval of the General Requirements for the Studies."

2. The Descriptor was prepared according to the recommendations of the USA National Research Council, "A New Biology for the 21st Century", "Transforming Undergraduate Education for Future Research Biologists", and the publication "Vision and Change in Undergraduate Biology Education".

When the Descriptor was prepared, the following were taken into consideration: Order No. 5 of the Minister of Health of the Republic of Lithuania of 6 January 1999 "Regarding Approval of the Lithuanian Medical Norm MN 157:2019 "Biomedical Technologist", Order No. V-169 of the Minister of Health of the Republic of Lithuania of 4 March 2008 "Regarding Approval of the Lithuanian Medical Norm MN 68:2018 "Biomedical Biologist", Order No. V-400 of the Minister of Health of the Republic of Lithuania of 9 April 2019 "Regarding Approval of the Lithuanian Medical Norm MN 156:2019 "Biomedical Geneticist", and the European Federation of Clinical Chemistry and Laboratory Medicine syllabus for postgraduate education and training for Specialists in Laboratory Medicine: version 5 – 2018.

3. The Descriptor's requirements shall be applicable to the university study programmes of the first and second cycles that may be organised as full-time and part-time studies.

4. General goals of all the study fields in the group of life sciences:

4.1. to provide fundamental skills and knowledge necessary for work in the areas related to life sciences;

4.2. to develop broad erudition, creative and critical thinking, sense of intellectual satisfaction in the course of studies and work;

4.3. to train the need to show interest in life sciences and to apply their regularities for various circumstances;

4.4. to train the ability to maintain the professional competence through life-long learning.

5. Upon completion of the studies of life sciences, the bachelor's or master's degree in life sciences that is in conformity with the sixth/seventh level of the Lithuanian Qualifications Framework and the European Qualifications Framework for lifelong learning, attested by the diploma of the bachelor's or master's degree and diploma supplement issued by the higher education institution are awarded.

6. The studies of the first cycle in the study fields of life sciences (hereinafter – field of life sciences) may be provided as studies within the study programmes classified under two study fields organised together with the studies in the fields of life, information, technological, health, social,

humanities, educational, and agricultural sciences. In case of the studies within interdisciplinary study programmes, it is recommended to carry out a joint final work (project) that would integrate the outcomes of the respective study fields.

7. If the persons complete the university studies of the first cycle conducted within the study programmes classified under two study fields (except for two study fields in the group of life sciences), the bachelor's degree of both groups, to which the study fields are assigned, shall be awarded.

8. There are no special requirements established in the Descriptor for the persons, who want to be admitted to the study programmes of the first cycle.

9. It is recommended to admit the persons, who would have completed the studies of the first cycle of life, physical (study fields of chemistry or physics), informatics (study programmes of bioinformatics), engineering (study field of bioengineering), technological (study field of biotechnologies), health, veterinary and agricultural sciences, to the studies of the second cycle in the study fields of life sciences. The achieved learning outcomes of the first cycle have to assure the ability to study in respective study programmes of the second cycle, therefore, the higher education institutions that conduct the studies of the second cycle in the fields of life sciences have to take the character of the organised studies into consideration and to determine the links of the first and the second cycles according to the study fields with certain study programme of the second cycle. The persons, who have the professional bachelor's degree, may be admitted to the studies of the second cycle in the fields of life science after the bridging courses, the amount whereof cannot be smaller than 30 credits.

CHAPTER II
CONCEPT AND SCOPE OF THE STUDY FIELDS OF LIFE SCIENCES

10. The group of study fields of life sciences consists of the study fields of biology, genetics, microbiology, molecular biology, biophysics, biochemistry, and ecology (the requirements for the study field of ecology (D07) were established by Order No. V-1863 of the Minister of Education, Science and Sport of the Republic of Lithuania of 30 November 2020 "On Approval of the Descriptor of the Study Field of Ecology".

11. The research object of the life sciences is the following: physical and chemical principles in biological systems; flow of matter and energy in living systems, homeostasis; inheritance of information; proteins; cells as a fundamental units of living systems, cell fission; tissues, organs, systems of organs and their functions; growth and reproduction of organisms; monerae, viruses, protists, fungi, plants, animals, human; biodiversity, groups of organisms: populations, species; biological taxonomy, phylogenetic relations between species, evolution of living organisms; behaviour of living organisms; interaction between species and populations; ecosystems, flow of energy and materials between different levels of the system; human as any other species, part of the ecosystem.

12. Biology is studying general life phenomena and their specific laws, origin of life, its evolution and diversity on the Earth, structure and functions of various organisms, their interrelations and relations with non-living components of the environment.

13. The studies in the field of biology have to be focused on the studies of the organisms that belong to protists, fungi, algae, plans, and animals.

14. When the study programmes of the first cycle in the field of biology are formed, the following recommendations should be followed:

14.1. the topics of the studied subjects should cover biology of invertebrates and vertebrates, plant biology, mycology, algology, cytology, physiology, evolution and phylogenetics, developmental biology, immunology, and neurobiology. At least one third of the amount of contact work of these subjects should be attributed to exercises and laboratory works;

14.2. the fundamentals of other life sciences should be studied: biochemistry, genetics, microbiology, molecular biology, ecology, biophysics; besides the subjects of chemistry, physics

and mathematics should be taught in sufficient scope and they should be directed to more profound understanding and interpretation of natural processes;

14.3. the learning field practice of biology in the amount of at least 5 study credits is compulsory. The topics that form the basis of this practical training are the following: methods of observation of animals, fungi, algae and cormophytes in nature, material's gathering, collection, identification, and description; characteristic types of different habitations (forests, meadows, marshes, water ponds, and anthropogenic territories) of animals, fungi, algae and cormophytes; rare, protected, introduced and adventive species.

15. Genetics studies heredity and variability of organisms, their regularities, genetic factors that determine development of organisms, and endeavours at understanding molecular structure and functions of genes, gene operation within the context of cell or organism, distribution of genes, their variability and changes in the populations. The genetic research is performed in all the levels – from molecules up to ecosystems.

16. When the study programmes of the first cycle in the field of genetics are formed, the following recommendations should be followed:

16.1. the topics of the studied subjects should cover main genetic principles, population and ecological genetics, epigenetics, developmental genetics, and genetics of various organisms (microorganisms, plants, animals, humans). At least one third of the amount of contact work of these subjects should be attributed to exercises and laboratory works;

16.2. the fundamentals of other life sciences should be studied: biology, biochemistry, microbiology, molecular biology, ecology, and biophysics;

16.3. modern genetics is based on molecular, bioinformatic and statistical research methods; therefore, the sufficient scope of subjects of chemistry, physics, mathematics and informatics should be taught in the study programmes of the first cycle in the field of genetics, as well as compulsory courses of mathematical statistics (biostatistics) and bioinformatics.

17. Microbiology studies the structure, physiology, taxonomy, biochemistry, genetics, prevalence of the microorganisms (viruses, prokaryotes, archaea and microscopical fungi), and their significance for nature, agriculture, industry and medicine.

18. When the study programmes of the first cycle in the field of microbiology are formed, the following recommendations should be followed:

18.1. the topics of the studied subjects should cover structure and physiology of microorganisms, their taxonomy, genetics, ecology, and virology. It is recommended also to teach special subjects of microbiology, for example, industrial microbiology, microbiology of pathogenic organisms, etc. At least one third of the amount of contact work of these subjects should be attributed to exercises and laboratory works;

18.2. the fundamentals of other life sciences should be studied: biology, biochemistry, genetics, molecular biology, ecology, and biophysics;

18.3. modern microbiology is also closely related to biotechnology and practical use of microorganisms, so, it is recommended to teach such subjects as genetic engineering, biotechnology, immunology, etc. More profound studies of chemistry are recommended, where bigger attention would be given to organic and bioorganic chemistry.

19. Molecular biology studies biological processes on the molecular level, structure of the cell's components, their functional mechanisms and interactions.

20. When the study programmes of the first cycle in the field of molecular biology are formed, the following recommendations should be followed:

20.1. the topics of the studied subjects of the specialty should cover main principles and regularities of molecular biology (molecular biology, cell biology, molecular evolution, immunology, etc.), and application of molecular biology (genetic engineering, biotechnology, etc.). At least one third of the amount of contact work of these subjects should be attributed to exercises and laboratory works;

20.2. the fundamentals of other life sciences should be studied: biology, biochemistry, genetics, microbiology, and biophysics;

20.3. molecular biology is based on molecular, chemical, physical, bioinformatic and statistical research methods, thus, the sufficient scope of subjects of chemistry, physics, mathematics and informatics should be taught in the study programmes of the first cycle. It is recommended to study such subjects as organic chemistry, bioorganic chemistry, biostatistics and bioinformatics in the amount of at least 5 credits.

21. Biophysics studies physical phenomena and processes in the living organisms on the levels of molecules, cells, tissues, organisms and populations.

22. When the study programmes of the first cycle in the field of biophysics are formed, the following recommendations should be followed:

22.1. the topics of the studied subjects should cover main principles and regularities of biophysics (molecular biophysics, cell biophysics, biophysics of systems, etc.). At least one third of the amount of contact work of these subjects should be attributed to exercises and laboratory works;

22.2. the fundamentals of other life sciences should be studied: biology, biochemistry, genetics, microbiology, molecular biology, and ecology;

22.3. the research methods of physics, mathematics, informatics are applied in biophysics, so, the study programmes of the first cycle should include sufficient number of the subjects of physics, mathematics and informatics.

23. Biochemistry studies structure, functions, turnover and interactions of such biological molecules as proteins, nucleic acids, carbohydrates and lipids within the context of metabolism.

24. When the study programmes of the first cycle in the field of biochemistry are formed, the following recommendations should be followed:

24.1. the topics of the studied subjects should cover such topics as structure, functions and turnover of biomolecules, functioning mechanisms of enzymes, kinetics and regulation of enzyme reactions, biochemistry of co-factors, interaction of ligands, bioenergetics, biomembranes, thermodynamics of biochemical processes and their analysis methods; recombinant molecules, their application; methods of biochemical analysis and their application; and fundamentals of immunology. At least one third of the amount of contact work of these subjects should be attributed to exercises and laboratory works;

24.2. the fundamentals of other life sciences should be studied: biology, genetics, microbiology, molecular biology, and biophysics;

24.3. the research methods of chemistry, physics, biophysics, physiology, microbiology and molecular biology are applied in biochemistry, so, the studies of these subjects should get sufficient attention (at least 10 percent of total amount of the programme).

25. Life sciences integrate many biological subjects, for research whereof the physical, chemical, information, mathematic modelling and other research methods are applied. Integration of majority of scientific knowledge and methods into the life sciences allows better understanding the processes occurring in the living organisms and their systems, and finding the solutions of the challenges encountered by modern society, based on the research of life sciences. Therefore, the studies of the first cycle in the study fields of life sciences are an interdisciplinary academic field that integrates the knowledge of life, physical (physics, chemistry), mathematics and information sciences and skills necessary to solve the problems related to life sciences. The purpose is to train the specialist, who knows well the studied field and who has sufficient basic knowledge of other subjects that would enable that person to apply that knowledge in the professional work efficiently:

25.1. the recommended topics of the studied subjects of mathematics and informatics are the following: calculus; linear algebra; dynamical systems; probability and statistics; information and computation; data structures; modelling. The studies of the mathematics and informatics subjects have to focus on mathematical concepts and principles, and not on calculating. When these subjects are taught, the biological examples should be used, and the possibilities to apply mathematical methods and knowledge in biological research should be explored. It is recommended to provide the students with the possibility to learn at least one programming language;

25.2. the recommended topics of the studied subjects of physics are the following: motion, dynamics and force laws, electromagnetics; conservation laws and thermodynamics, thermal

processes on the molecular level; waves, light, optics and imaging; collective behaviors and non-equilibrium systems. When these subjects are taught, the biological examples should be used and the possibilities to apply physical methods and knowledge in biological research should be explored;

25.3. the recommended topics of the studied subjects of chemistry are the following: atoms; molecules; molecular properties; bonding models; molecular interactions; metal ions and metal complexes; resonance and electron delocalisation; water and aqueous solutions; chemical reactions; types of reactions; reactive intermediates; energetics and equilibria; reaction kinetics; biomolecules; biopolymers; molecular assemblies; analysis of molecules and reactions; materials. When these subjects are taught, the biological examples should be used and the possibilities to apply chemical methods and knowledge in biological research should be explored.

26. The subjects studied in the second cycle in the study fields of life sciences have to be of higher academic level then the subjects of the first cycle with regard to their content.

27. The studies have to be based on responsible academic and creative freedom, unity between science and studies, and create preconditions for life-long self-learning.

28. The graduates may work as specialists or managers in educational institutions, research and higher education institutions, companies of high technologies and traditional industry, research and development and manufacturing companies and other institutions, create new business companies, or continue studies in the second cycle (the graduates of the first cycle) or in the third cycle (the graduates of the second cycle). The graduates, who fulfil the requirements of certain Lithuanian Medical Norms, may work as specialists in personal health care institutions.

CHAPTER III
GENERAL AND SPECIAL LEARNING OUTCOMES

29. Upon completion of the university studies of the first cycle in the study fields of life sciences, the following learning outcomes have to be achieved:

29.1. knowledge, its application. The person:

29.1.1. knows and is able to apply knowledge about significance of the evolutional process, origin and changes of biodiversity because of mutation, selection and genetic changes;

29.1.2. knows and is able to apply knowledge about hierarchic organisation of living organisms, molecular and cellular processes, systemic relations and their significance for determination of functions of all the living organisms;

29.1.3. knows and is able to apply knowledge about growth of biological systems and their changes caused by chemical transformations in cells or organisms on the basis of the laws of thermodynamics;

29.1.4. knows and is able to apply knowledge about importance of expression of genetic information and its conveyance within certain environment for development, functions and behaviour of the organisms;

29.1.5. understands and is able to apply knowledge about relations and interactions between the living systems;

29.2. research skills. The person:

29.2.1. is able to recognise theoretically and to analyse the present problems, to plan their solution strategies based on the research methodology;

29.2.2. is able to independently collect, analyse and interpret the needed professional and scientific information in the databases and other information sources;

29.2.3. is able to interpret the data from observations and measurements with regard to their importance and explaining theory;

29.2.4. is able to communicate own research results and to cooperate with researchers from other scientific fields;

29.2.5. having completed the study programme and acquired the professional qualification governed by the normative legal acts, the person is able to apply the principles of good laboratory practice (hereinafter – GLP) in the professional work;

29.3. special abilities. The person:

29.3.1. is able to work safely with the biological and chemical substances;

29.3.2. is able to perform standard laboratory procedures with organic, bioorganic substances and living organisms;

29.3.3. is able to collect biological samples, to process and store them, and to work safely under the field conditions;

29.3.4. is able to operate standard analytical biological equipment;

29.3.5. is able to observe and measure biological features, events and changes of quantitative and qualitative character, to document them systematically and reliably;

29.3.6. having completed the study programme and acquired the professional qualification governed by the legal acts, the person is able to examine the biological or clinical sample, to process, present and store the data according to the legal acts passed by the laboratories of the institution related to health care;

29.4. social abilities. The person:

29.4.1. is able to work independently and in team, as well as in the interdisciplinary team with the workers of other specialties, in order to solve relevant problems related to life sciences, including development of bioeconomics;

29.4.2. is able to understand the social context of the performed research and understands the bioethical problems related to the research in life sciences;

29.4.3. is able to adjust the professional activities to the principles of sustainable development of the society, assumes responsibility for quality of the work and its assessment, follows the professional ethics and public spirit, as well as principles of social responsibility;

29.4.4. is able to express the thoughts smoothly and suggestively in written and orally, to communicate effectively in the professional environment, and to discuss the relevant professional issues in the official state language and in at least one foreign language;

29.5. personal abilities. The person:

29.5.1. is able to organise and plan independently and responsibly own professional and scientific activities and the learning process, and has the skills of learning culture necessary for independent pursuit of improvement;

29.5.2. is able to think analytically, to substantiate the professional activities by the latest scientific research data, to understand and act creatively in the junction between life sciences and other scientific fields;

29.5.3. is able to work in the always changing environment, to foresee and control the changes, and to plan the solutions of the tasks;

29.5.4. has skills of time planning and organisational skills that reflect ability to plan and work productively, and to implement the work purpose effectively.

30. The learning outcomes of the studies of the second cycle in the study fields of life sciences are the following: more profound knowledge and skills in the particular study field or expanded abilities in the adjacent fields are acquired, when compared to the learning outcomes of the first cycle.

31. Upon completion of the studies of the second cycle in the study fields of life sciences, the following social and personal abilities have to be achieved:

31.1. social abilities. The person:

31.1.1. is able to make responsible decisions related to the activities in studied and inter-sector areas, and to assess their impact in the conditions of the defined situation;

31.1.2. is able to communicate and to convey the science-based knowledge to specialists and society;

31.1.3. is able to use modern communication means and social networks to convey professional and other information;

31.1.4. is able to control and understand the importance of social activeness when planning and implementing personal or collective activities, and to assess their quality;

31.1.5. is able to work in the interdisciplinary groups of specialists while solving the integrated scientific problems that need knowledge in different scientific areas and new methodological solutions;

31.2. personal abilities. The person:

31.2.1. is able to define the areas of scientific and professional development;

31.2.2. is able to learn independently for the entire life, to collect new scientific and practical knowledge and skills, and to integrate into the new learning and professional environments;

31.2.3. is able to assume responsibility for quality of own work and work of the subordinate employees, to comply with professional ethics and public spirt.

32. Upon completion of the studies of the second cycle in the study field of biology, the following learning outcomes have to be achieved:

32.1. knowledge, its application. The person:

32.1.1 is able to search independently, to analyse, summarise, to assess critically and to systemise the information with various aspects of research of living organisms;

32.1.2. is able to apply the latest biological knowledge, theories, methods and technologies in practical situations, to assess alternative solutions and their consequences;

32.1.3. is able to understand the functioning of living system and interrelations between its elements, principles of formation and application of the taxonomy (species);

32.1.4. knows and is able to apply the Lithuanian and international legal acts related to research and protection of living organisms;

32.2. research skills. The person:

32.2.1. is able to apply the methods of biology and related scientific areas for research and practical work;

32.2.2. is able to formulate the scientific problems, to choose the most suitable methodology to solve the set tasks, to plan the course of research, to carry them out without prejudice to bioethical and natural protection requirements, to evaluate, analyse and summarise the received results, and to make reasoned conclusions;

32.2.3. is able to carry out the activities of the biological science and practical work that need analytical thinking and innovative solutions;

32.2.4. having completed the study programmes and acquired the professional qualification governed by the normative legal acts, the person is able to apply the GLP principles in the professional work;

32.3. special abilities. The person:

32.3.1. is able to work independently in various areas of biomedicine, agriculture and environmental protection that need continuous renewal of knowledge and qualification improvement;

32.3.2. is able to apply the obtained biological knowledge for development of new technologies, methods for research and studies, and to implant the innovations;

32.3.3. having completed the study programmes and acquired the professional qualification governed by the legal acts, the person is able to examine the biological or clinical sample, to process, present and store the data according to the legal acts passed by the laboratories of the institution related to health care.

33. Upon completion of the studies of the second cycle in the study field of genetics, the following learning outcomes have to be achieved:

33.1. knowledge, its application. The person:

33.1.1. has profound knowledge and understanding of various areas of genetics, understands the most relevant problems of the science of genetics, and their solution methods;

33.1.2. knows the genetic research methods and understands them as universal analytical instruments of problems of life sciences;

33.1.3. is able to apply the latest genetic knowledge, theories, methods and technologies in practical situations, to assess alternative solutions and their consequences;

33.2. research skills. The person:

33.2.1. is able to apply the methods of genetics and related scientific areas for research and practical work;

33.2.2. is able to formulate the scientific problems, to choose the most suitable methodology to solve the set tasks, to plan the course of research, to carry them out without prejudice to bioethical requirements, to evaluate, analyse and summarise the received results, and to make reasoned conclusions;

33.2.3. is able to carry out the activities of the science and practical work in genetics that need analytical thinking and innovative solutions;

33.2.4. having completed the study programmes and acquired the professional qualification governed by the normative legal acts, the person is able to apply the GLP principles in the professional work;

33.3. special abilities. The person:

33.3.1. is able to work independently in various genetics-related areas of biomedicine, biotechnologies, different industrial branches, medicine, agriculture and environmental protection that need continuous renewal of knowledge and qualification improvement;

33.3.2. is able to work in the interdisciplinary fields and to integrate the knowledge from various scientific areas;

33.3.3. is able to apply the bioinformatic methods and information technologies for assessment and analysis of genetic processes and phenomena;

33.3.4. having completed the study programmes and acquired the professional qualification governed by the legal acts, the person is able to examine the biological or clinical sample, to process, present and store the data according to the legal acts passed by the laboratories of the institution related to health care.

34. Upon completion of the studies of the second cycle in the study field of microbiology, the following learning outcomes have to be achieved:

34.1. knowledge, its application. The person:

34.1.1. has profound knowledge of classical and modern microbiology and is able to analyse, systemise, assess it critically and to apply it in scientific and practical activities;

34.1.2. is able to independently identify and to solve the microbiology-related problems in the areas of biotechnologiy, biomedicine, biopharmacy, environmental protection, and other areas related to microbiology;

34.1.3. is able to use the knowledge about microorganism for solution of classical and high-technology tasks;

34.1.4. is able to assess responsibly the threats caused by microorganisms and the benefits they grant;

34.1.5. is able to consult responsibly the specialists of other fields on the issues related to biology of microorganisms, biotechnology, and other issues related to microorganisms;

34.2. research skills. The person:

34.2.1. is able to apply the methods of microbiology and related scientific areas for research and practical work;

34.2.2. is able to formulate the scientific problems, to choose the most suitable methodology to solve the set tasks, to plan the course of research, to carry them out, to evaluate, analyse and summarise the received results, and to make reasonable conclusions;

34.2.3. is able to carry out the activities of the science and practical work in microbiology that need analytical thinking and innovative solutions;

34.3. special abilities. The person:

34.3.1. knows GLP and is able to apply it in the professional work of a microbiologist;

33.3.2. is able to perform independent and qualified work in various microbiology-related areas of biomedicine, biotechnology, different industrial branches, medicine, agriculture and

environmental protection that need continuous renewal of knowledge and improvement of qualification;

34.3.3. is able to select correctly and purposefully the modern methods of molecular biology, microbiology, and genetics in work with microorganisms.

35. Upon completion of the university studies of the second cycle in the study field of molecular biology, the following learning outcomes have to be achieved:

35.1. knowledge, its application. The person:

35.1.1 knows the structure and functions of various cells of the organism on the molecular level, as well as modern biological research methods of molecular cell, and is able to apply them for research of cells and their constituents;

35.1.2. is able to identify and solve independently the problems related to molecular biology in the areas of biotechnologies, biomedicine, biopharmacy, environmental protection, and other areas;

35.1.3. knows the structure of model organisms used for research in molecular biology and their application possibilities for fundamental and applied life sciences;

35.2. research skills. The person:

35.2.1. is able to apply the methods of molecular biology and related scientific areas for research and practical work;

35.2.2. is able to formulate the scientific problems, to choose the most suitable methodology to solve the set tasks, to plan the course of research, to carry them out without prejudice to bioethical and GLP requirements, to evaluate, analyse and summarise the received results, and to make reasoned conclusions;

35.2.3. is able to carry out the activities of the science and practical work in molecular biology that need analytical thinking and innovative solutions;

35.3. special abilities. The person:

35.3.1. is able to analyse, interpret, and assess critically and systematically the knowledge of the science of molecular biology, to apply it and the technologies based on that knowledge effectively in scientific and practical activities;

35.3.2. is able to create and implant the scientific innovations in the areas related to life sciences, to identify and solve independently the problems related to molecular biology in the area of biotechnologies, biomedicine, biopharmacy and other areas;

35.3.3. is able to apply the latest bioinformatic methods for analysis and modelling of the results.

36. Upon completion of the university studies of the second cycle in the study field of biophysics, the following learning outcomes have to be achieved:

36.1. knowledge, its application. The person:

36.1.1 is able to study the structure and functioning principles of the living objects (from the level of molecules up to populations) using the biophysical methods;

36.1.2. is able to independently identify and solve the complex problems related to biophysics in the areas of biomedicine, bioengineering, environmental protection, and other areas within the context of development of modern life sciences;

36.1.3. knows the application possibilities and limitations of the latest biophysical research methods, as well as planning principles of data analysis and research;

36.2. research skills. The person:

36.2.1. is able to apply modern biophysical knowledge and understanding in the areas of scientific research and practical activities;

36.2.2. is able to formulate the scientific problems and select the most suitable methodology for their solution, to plan the research implementation, to conduct research without prejudice to bioethical and GLP requirements, to evaluate, analyse and summarise the received results, and to make reasoned conclusions;

36.2.3. is able to carry out the activities of the science and practical work in biophysics that need analytical thinking and innovative solutions;

36.3. special abilities. The person:

36.3.1. is able to analyse, interpret, and assess critically and systematically the knowledge of the science of biophysics, to apply it effectively in scientific and practical activities;

36.3.2. is able to create and implant the scientific innovations in the areas related to life sciences, to identify and solve independently the problems related to biophysics in the area of biomedicine and bioengineering.

37. Upon completion of the studies of the second cycle in the study field of biochemistry, the following learning outcomes have to be achieved:

37.1. knowledge, its application. The person:

37.1.1 is able to carry out the activities of the science and practical work in biochemistry that need analytical thinking and innovative solutions;

37.1.2. understands the application boundaries, advantages and disadvantages of methods and technologies *in vitro*, *in vivo* and *in silico* of modern biochemistry and related sciences;

37.1.3. is able to integrate knowledge in different scientific areas;

37.2. research skills. The person:

37.2.1. is able to formulate the scientific problems, to choose the most suitable methodology to solve the set tasks, to plan the course of research, to carry them out, to evaluate, analyse and summarise the received results, and to make reasoned conclusions;

37.2.2. is able to select the most optimal research methods for scientific problems and to interpret the received results in the well-founded mode;

37.2.3. is able to analyse, to assess critically and to generalise the information received in the course of research and practical activities;

37.3. special abilities. The person:

37.3.1. is able to identify and solve difficult biochemical problems, and to take their links with biotechnologies, biomedicine, biopharmacy, and other areas into consideration;

37.3.2. is able to select and apply independently the complex methodological, technological and organisational means necessary to solve the wide-scope scientific and practical problems.

CHAPTER IV
TEACHING, LEARNING AND ASSESSMENT

38. The teaching content has to be updated and improved all the time, by integrating new knowledge or studying methods in conformity with the life-long learning into the process of studies. The students should be trained and encourages using the principles of this concept in the course of their studies.

39. The learning and teaching methods necessary to consolidate the practical skills have to be provided in the studies.

40. The didactic system of the programmes has to train critical thinking, creativity, analytical, metacognition and generic abilities. It is recommended to include complex tasks and research applicable in business, industry or other areas into the learning and teaching process.

41. The teachers have to know the didactic concept of the study programme and to apply various teaching methods in order to use optimally the available material resources.

42. The choice of the teaching methodology shall depend on the particular learning outcomes of the taught subject, aimed learning outcomes, and skills and knowledge granted to the student.

43. The same teaching and learning methods may be applied in different cycles of studies; however, the amount and complexity of tasks, independent input of the student, etc. must differ. In the studies of the second cycle, it is recommended to use the forms of studies' organisation that would enable the students to assume an active role in the process of studies, for example, laboratory works, seminars, exercises, individual consultations, practical training in the company or in the scientific laboratory, various projects (individual or team), case analyses, etc.

44. The studies have to be linked to the scientific research and their spread carried out in various forms. These may be scientific-practical seminars, research conducted by the students in the

scientific laboratories or accredited practical training institutions, presentation of results of the graduates' final work, joint publications of students and teachers and their reports in scientific conferences.

45. In the beginning of the studies, the students have to be introduced thoroughly with the curriculum, goals of the subject, their relations to generic goals of the study programme, expected learning outcomes, expected learning load, assessment procedure and criteria of learning achievements (influence of the examination and interim tests on final grade, examination terms, etc.).

46. The assessment system of studies has to ensure a constant feedback to the students about their learning achievements and validity of evaluation of performed works.

47. The assessment methods may be of generalising, forming and diagnostic character. The generalising assessment allows measuring the students' achievements at the end of the subject's studies, semester, course or study programme. The forming and diagnostic assessment allow the teacher and the student to observe the course of studies, to identify the difficulties, and to analyse the achievements.

48. The teachers have to be familiar with various assessment methods, their application methodology, and their input in successful acquisition of the knowledge and development of the abilities of the students. The teachers may choose the most appropriate assessment methods, depending on the aims of assessment and the taught subject, expected results, and other factors. The students' participation in the (self-)assessment process should be aimed at.

49. The procedures applied to assess the students' achievements have to be based on clearly formulated criteria that enable to reflect correctly and reliably the level of knowledge, abilities and practical skills achieved by the student in the course of studies (of the subject). The assessment criteria have to manifest, how the level of knowledge and skills obtained by the student comply with the aimed outcomes of the study programme and the aimed competences.

50. The following assessment methods may be applied: written or oral examination; testing; report on results of laboratory works and their defence; modelling works; solution of exercises; report on individual or team work; oral and stand-based presentations; colloquium; tests when questions of closed and/or open type are asked; written works (review of literature, report, essay, etc); course, final paper and its defence; and peer review of the scientific research work.

51. The students with special needs, who cannot account in the ordinary procedure, are entitled to account in the alternative modes. The alternative examination method shall be selected individually by the teacher and it shall assure assessment of the achieved learning outcomes.

52. The final work (project), its defence and assessment summarise general and special abilities that are obtained by the student and that satisfy qualification requirements for the degrees of bachelor or master.

53. The timely feedback to the students about their achievements, results and substantiation of the assessment has to be granted, as well as the timely feedback from the student that would help to improve and develop the effectiveness and quality of the teaching and learning process.

54. The appeals regarding the assessment process have to be submitted and considered in the procedure established by the higher education institution.

CHAPTER V
REQUIREMENTS FOR IMPLEMENTATION OF STUDY PROGRAMMES

55. General requirements for teachers of the study programmes in the group of study field of life sciences:

55.1. at least half of the subjects of the university studies of the first cycle have to be taught by scientists;

55.2. at least 80 percent of the teachers in the studies of the second cycle have to be scientists;

55.3. at least 10 percent of the subjects of the studies of the first cycle, and at least 20 percent of the subjects of the studies of the second cycle have to be taught by persons, who hold the position of a professor;

55.4. at least 60 percent of the subjects in the study field have be taught by teachers, whose field of scientific research corresponds to the taught subjects;

55.5. the laboratory works and other practical exercises of the study programmes of all cycles, as well as practical training of the students should be supervised by the persons, who have higher university education. It is recommended that such persons would have at least the master's degree in the study programmes of the second cycle;

55.6. the exchange of teachers and scientists with other Lithuanian or foreign higher education institutions and research centres shall be encouraged in the studies in the fields of studies of the group of life sciences;

55.7. the competence of the teachers shall be assessed according to the academic level of the taught subjects, pedagogical work experience, scientific work achievements, ability to communicate fluently in at least one foreign language used for international scientific cooperation, initiatives to create more effective learning methods, participation in refresher programmes, and skills of respectful and colleague-like communication with the students;

55.8. the teacher should be encouraged to prepare new subjects, including the ones studied online, methodical aids, and to endeavour at granting new skills and abilities to the studying persons.

56. General requirements for the process of studies:

56.1. the process of studies has to be based on consistent expansion of the student's knowledge and abilities in attempt to achieve the aimed learning outcomes of the study programme;

56.2. the process of studies shall be conducted in the procedure established by the higher education institution.

57. The studies of the first and second cycles shall end in a final work (project) prepared by the student:

57.1. the final work (project) of the studies of the first cycle has to be based on research, application of knowledge or it has to be prepared as a project that manifests the skills complying with the programme's goals. The final work (project) serves for the student to show his or her adequate level of knowledge in the studied field and initial level of performance of independent experimental or theoretical work, ability to analyse the selected topic, to take the previous works performed by other persons into consideration, to describe own research work and its results in correct and coherent language, using the accepted special terms, formulations, and to formulate clear and reasoned research conclusions;

57.2. the final work (project) of the studies of the first cycle has to be presented and defended in the procedure established by the higher education institution;

57.3. the final work (project) of the second cycle has to be based on individual research, application of acquired knowledge or it has to be prepared as a project that manifests the skills acquired during the studies. The final work (project) serves for the student to show his or her level of good understanding of the solved problem, ability to analyse the selected topic thoroughly, to take the results of earlier researchers under the same topic in consideration, to study and carry out the research independently, to describe own research work in correct and coherent language, using the accepted special terms and formulations. The student has to manifest his or her ability to summarise briefly his or her work and to formulate reasoned and generalising conclusions and recommendations on the basis of analysis of the work results;

57.4. the final work (project) of the studies of the second cycle has to be presented and defended in the procedure established by the higher education institution in the assessment commission of final works;

57.5. the assessment commission of the final work shall be formed in the procedure established by the higher education institution from competent specialists of the study field –

scientists, professional practicians and representatives of probable employers. At least one member of the commission has to be from another research and higher education institution;

57.6. the same protection of the intellectual property and/or trade secrets as applied for published scientific work shall be applied to the final work (project). Upon reasoned request of the supervisor of the final work or the institution, where the final work was prepared, the closed defence of the final work may be organised.

58. General requirements for material facilities of the studies:

58.1. the lecture halls have to satisfy the requirements of hygiene and work safety and to have the necessary audio and video demonstration tools. The lecture halls and number of places in these halls have to satisfy the students' needs;

58.2. the training laboratories have to satisfy the requirements of hygiene and work safety, and the number of places there has to satisfy the students' needs. the signs warning about potential hazard must be present in the laboratories. The evacuation schemes must be present in all the premises;

58.3. the laboratory equipment, devices, and work methodology have to be sufficient for each student to learn to use the modern research methods and equipment, to perform the experiments in the course of laboratory works, to analyse and describe the experimental results, and to prepare final works;

58.4. if unique research equipment that is available in the specialised laboratory is needed to achieve the learning outcomes, it has to be made sure that each student would have access to such an equipment when preparing the final work or performing the practical training;

58.5. if the field practical training is provided in the study programme, the appropriate stationary or mobile practical training base(s) with the necessary equipment should be used to organise it;

58.6. if professional qualification governed by the normative legal acts is granted upon completion of the study programme, the practical training should be conducted in the research laboratories that satisfy the character of profession and the level of qualification;

58.7. the students with special needs (persons with vision, hearing, movement impairments) should have possibilities to study;

58.8. the number of textbooks, summaries of lectures and other information sources of each subject of the study programme available in the libraries or methodical rooms must satisfy the students' needs, while the electronic information sources must be accessible to all participants of the study process;

58.9. the sufficient number of computers with suitable software (Internet connection, literature catalogues, search engines, connection with databases of bigger libraries) has to be present in the libraries;

58.10. the library has to satisfy the requirements of hygiene and work safety, to have appropriate sound insulation, comfortable tables and chairs, and it is recommended to have a room for discussions.

59. The material facilities have to be updated regularly, the process of studies has to be improved continuously, and the feedback with students and stakeholders has to be assured.

60. The academic support to students shall be provided in accordance with the procedure established by the higher education institution. It has to grant a possibility to the students to receive the needed consultations, including on the career issues, to receive psychological, social and financial (if possible) support. The possibilities for the students with special needs have to be created.

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