

AL FARABI KAZAKH NATIONAL UNIVERSITY

Approved
by at a meeting of the scientific and
methodological Council of KazNU al-Farabi
Vice Rector for academic affairs

_____A. K. Khikmetov
Protocol No. __ from “__” ____ 2020

PROGRAM

SPECIALTY ENTRANCE EXAM
FOR ENTRY INTO PHD COURSE SOFTWARE
SPECIALTIES "8D05103 - BIOPHYSICS"

ALMATY 2020

The program is compiled in accordance with the State educational standard in the specialty "8D05103 - BIOPHYSICS"

The program was considered at a meeting of the Department of Biophysics and Biomedicine

Minutes No. _____ of _____ 2020

Head Department _____ Tuleukhanov S.T.

Approved at a meeting of the Methodological Bureau of the Faculty of Biology and Biotechnology

Minutes No. _____ dated _____ 2020

Chairman of the method bureau _____ Yurikova O.Yu.

Approved at a meeting of the Academic Council of the faculty

Protocol No. _____ of _____ 2020

Chairman of the Scientific Council

Dean of the Faculty _____ Zayadan B.K.

Scientific Secretary _____ Bauenova M.Θ.

CONTENT

1. The goals and objectives of the entrance examination for doctoral studies in the specialty "8D05103 - BIOFYSICS" - to identify the level of theoretical preparedness for the various fields of biological science, the ability to navigate the dialectical relationship of different levels of organization of living, to have an idea of the basic fundamental, classical branches of biology, as well as methods, tasks and achievements of modern innovative branches of biological science, to evaluate the extent to which they master the program material and the formations developed during their studies in undergraduate and graduate programs, and the necessary skills for carrying out professional activities.

2. Requirements for the level of training of people entering PhD doctoral studies
The doctoral program in the specialty "8D05103 - BIOFYSICS" provides for the preparation of doctors of philosophy for work in the field of studying wildlife, diversifying the use of biological systems for practical and research purposes, preserving biodiversity and the environment, capable of carrying out qualified scientific research and practical development in this direction.

3. Prerequisites of the educational program

Cell Biology - 3 credits

Theoretical Biology - 3 credits

Environmental protection and conservation of biological diversity - 3 credits

Organization and planning of research - 3 credits

The discipline "Cell Biology"

Exam Topics

Ways of cell evolution and the formation of multicellular organisms. The formation of various cellular phenotypes. The main types and variety of cells. Separation of cell functions in a multicellular organism, totipotency and differentiation of cells. Phenotypes of mammalian cells. Molecular structure and functional components of cell membranes. Types and functions of membrane lipids. Membrane proteins: physical and chemical properties. Molecular organization of membrane transport systems (mobile carriers, ion channels, transport ATPases). The structure and function of intracellular organelles. Organelles and vesicular transport. Change in the shape of cells, endo - and exocytosis. Mitochondria and cellular energy. Cell cycle cell division. Vegetative and sexual reproduction of cells. Cell death. Non-programmable and programmable cell death paths. Apoptosis The system of degradation and utilization of intracellular structures. Cytoskeleton. The structure and conformational rearrangements of the cytoskeleton. The main types, molecular organization and actuators of systems that provide movement. Motion systems based on polymerization (depolymerization) and the interaction of microtubules and actin filaments. Cellular contacts, intercellular adhesion and extracellular matrix. Molecular mechanisms of signal transmission: the main pathways of intercellular signaling. Phosphorylation and cell signaling. Cell pathology and aging. Carcinogenesis.

References

Main literature:

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2. Альбертс Б., Брей Д., Льюис Дж., Рэфф М., Робертс К., Уотсон Дж., 1994. Молекулярная биология клетки. 1-5 т. М: Мир, 1994.
3. Геннис Р. Биомембраны: Молекулярная структура и функции: Пер. с англ. – М.: Мир, 1997,-624с.

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6. Елифанова О.Н. Лекции о клеточном цикле. КМК Scientific press , 1997.

Additional literature:

1. Свенсен К., Уэбстер П. Клетка. М.: Мир, 1980.
2. Заварзин А.А., Харазова А.Д., Молитвин М.Н. Биология клетки: общая цитология. СПб.: Изд-во СПб. ун-та, 1992.
3. Скулачев В.П. Энергетика биологических мембран. Москва, Наука, 1989 г
4. Мецлер Д. Биохимия. Химические реакции в живой клетке. Москва, Мир, 1980 г., т.т. 1-3
5. Спирин А.С. Молекулярная биология. Структура рибосомы и биосинтез белка. Москва, Высшая школа, 1986 г.
6. Alberts B., Bray D., Lewis J., Raff M., Roberts K., Watson J. D. Molecular biology at the cell. 4th ed. N.Y.; L.: Garland Publ., 2001.
7. Karp G. Cell and molecular biology. 2nd ed. N.Y. etc.: John Wiley and Sons, 1996.
8. Lodish H., Berk A., Zipursky S.L., Matsudaira P., Baltimore D., Darnell J. Molecular cell biology. 4th ed. L.: Freeman, 2000.
9. Tobin A.J., Murel R.E. Asking about cells. Saunders college publ., 1997.

Discipline "Theoretical Biology"

Exam Topics

The system of the organic world. The law of the unity and diversity of life, or the law of St. Hilaire. The law of the global life, or the first law of Vernadsky. Biological evolution. The law of organic expediency, or the law of Aristotle. The law of natural selection, or the law of Darwin. Individual development of the body. The law of ontogenetic aging and renewal, or the Krenke law. The law of integrity of ontogenesis, or the Drish law. Physiological and biochemical essence of life. The law of the chemical composition of living matter, or the first law of Engels. The law of the systematic organization of biochemical processes, or the Bertalanffy law. Genetic-cybernetic essence of life. The law of information linguistic biological systems, or Waldington's law. The law of discreteness and continuity of biological information, or the law of Morgan-Efrussia. Man and the life of the planet. The law of the leading role of labor in the formation and development of man, or the second law of Engels. The law of the biospheric role of reason, or the second law of Vernadsky. Steps of ascent.

References

Main literature:

1. Бауэр Э.С. Теоретическая биология. - М.- Л.: Наука, 2005г.
2. Пригожин И. От существующего к возникающему: Время и сложность в физических науках: пер. С англ. / Под ред. Ю.Л.Климонтовича. – Изд. 2-е, доп. – м.: Едиториал УРСС, 2002. – 288 с.
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4. Грант В. Эволюционный процесс. - М.: Мир, 1991.
5. Заренков Н.А. Теоретическая биология (Введение). - М.: МГУ, 1988.
6. Смирнов А.Н. Эндокринная регуляция / Под ред. В.А.Ткачука, - М: «Гэотар Медия», 2009. – 135 с.
7. Медников Б.М. Аксиомы биологии. - М.: Знание, 1982.

Additional literature:

1. Пригожин И., Стенгерс И. Время, хаос, квант. - М.: Прогресс, 1994.
2. Ланге К.А. Организация управления научными исследованиями. Лекция 11 биологическая эволюция. – М.: Наука, 2009
3. Фролов И.Т. Методологические проблемы теоретической биологии. - Пущино, 1982.
4. Хазен А.М. Законы эволюции жизни и «справедливое общество».- М., 1997.
5. Хакен Г. Информация и самоорганизация.- М.: Мир, 1991.
6. Шустер Х. Детерминированный хаос. - М.: Мир, 1990.

Discipline: "Environmental protection and conservation of biological diversity"**Exam Topics**

The doctrine of biogeocenoses is a scientific and theoretical basis for studying the sustainability of ecosystems and preserving biodiversity. Vegetation as a component of an ecosystem (biogeocenosis). Autotrophic part of biota in biogeocenoses. Phototrophs, their functions and features. A variety of ecosystems. Environmental factors that disrupt the course of the population cycle and lead to a narrowing of biological diversity. Environmental assessment of the current state of biodiversity. Carrying out an inventory of the flora and fauna of a particular region and protected areas. Principles of compiling a general and regional inventory of flora and fauna; preparation of the publication of the Red Book. Human activities and biodiversity. An inventory of the flora and fauna of a particular region and specially protected areas.

Priorities for the conservation of biological diversity. Long-term monitoring of the state of biosystems. Forecasting ecosystem changes. Goals and objectives of the strategy; strategic directions for the conservation and balanced use of biological diversity. Development of regulatory frameworks for the conservation and balanced use of biological diversity. Organization of a biological monitoring system. Protected areas and biodiversity. Priority actions for the near term and completion of the biodiversity inventory. Inventory of forest ecosystems. Complete inventory of moss flora. Inventory and publication of a list of algae flora. Key ornithological territories as the basis for the conservation and balanced use of birds. Invertebrate Inventory; Handbook on the biodiversity of insects and arachnids of Kazakhstan. Development of a scheme for the development of a network of specially protected areas and the creation of reserves, national parks and botanical gardens. Conservation of forest ecosystems and balanced use of their components. In-situ conservation of mountain fruit forests in Kazakhstan. Creation of a network of specially protected wetlands of international importance, in accordance with the Ramsar Convention. Principles, jurisdiction, international cooperation in the conservation of biodiversity. Improving the legislative framework for the conservation and rational use of biological diversity. Improving the economic system for stimulating the conservation of biological diversity and developing the foundations of an economic assessment of biological resources and standards for their balanced use. Strengthening regional cooperation and international cooperation on biological diversity. Relationship with other National Programs, Conventions and international agreements. The purpose of the Rio de Janeiro Convention on Biological Diversity. Tasks of the Republic of Kazakhstan as a member of the convention in Rio de Janeiro. Inventory of flora and fauna of Kazakhstan. Identification of specially protected natural areas, drawing up a development plan, organization of nature reserves, national parks and botanical gardens. Biodiversity conservation, conservation priorities. Preservation of agro-diversity of mountain ecosystems in the context of a situation. Bringing to optimal conditions the biodiversity of ecosystems degraded under the influence of natural and anthropogenic factors. Security categories. Rational use of bioresources of Balkhash and Alakol lakes, conservation of biodiversity in them, conservation from desertification. Conservation of the biodiversity of the Caspian.

National biodiversity conservation strategy, conservation and sustainable use. Production of germplasm of endangered plants and endemic species of Kazakhstan, conservation in ex situ conditions. Stability and dynamics of natural ecosystems. National Strategy for the Balanced Use of Biological Diversity. Legislative framework for the conservation of biodiversity. Prospects for the development of biosphere and environmental studies.

References

Main literature:

1. Бигалиев А.Б. Проблемы окружающей среды и сохранения биологического разнообразия. Учебное пособие. Алматы. 2005.
2. «Проблемы окружающей среды и сохранения биологического разнообразия» на русском языке, Издательство NURPRESS, 2009г, 260 стр
3. Учебник «Общая экология», Издательство NURPRESS, 2011г, 150 стр.
4. Миркин Б.М., Наумова Л.Г. Биологическое разнообразие и принципы его сохранения. Учебное пособие. - Уфа, РИО БашГУ, 2004. - 124 с.
5. Национальный доклад Республики Казахстан об осуществлении конвенции ООН по борьбе с опустыниванием. - Кокшетау, 2000.
6. Гиляров М.М. Популяционная экология М. МГУ, 1990.
7. Красилов В.А. Охрана природы: принципы, проблемы, приоритеты. М. 1992.
8. Национальная программа действий по борьбе с опустыниванием в Республике Казахстан. МЭПР, ЭНЕП, Алматы, 1997.
9. Сохранение биоразнообразия Центральной Азии. Казахстан. Под Ред. Брагиной Т.М., Переладовой О.Б. Алматы, 1997.
10. Фурсов В.И. Экологические проблемы окружающей среды. Алма-Ата. 1991.

Additional literature:

1. Еськов К.Ю. История земли и жизни на ней. М.: МИРОС-МАИК "Наука/Интерпериодика" 2000.
2. Перечень редких и находящихся под угрозой исчезновения видов растений. Утвержден Постановлением Правительства РК от 31 октября 2006 г., №1034. – Астана, 2006. – 9 с.
3. Перечень объектов охраны окружающей среды, имеющих особое экологическое, научное и культурное значение. Утвержден Постановлением Правительства РК от 21 июня 2007 года № 521. – Астана, 2007. -27 с.
4. Колчинский Э.Н. Эволюция биосферы. Ленинград, "Наука", 1990,236 с.
5. Проблемы, приоритеты и партнёрство национального плана действий по охране окружающей среды для устойчивого развития Республики Казахстан. Алматы, 1996.
6. Розанов А.Ю. (ред.). Проблемы доантропогенной эволюции биосферы. М. 1993.
7. Дебело Т.В., Левыкин С.В., Чибилев А.А. Стратегия сохранения ландшафтного и биологического разнообразия в западном секторе Российско-казахстанской границы. Интернет <http://www.mininform.org.ru/books.prigr/deb.nin>.

Discipline "Organization and planning of scientific research"

Exam Topics

Scientific research as an activity aimed at a comprehensive study of an object, process or phenomenon, their structure and relationships, as well as obtaining and putting into practice useful results for humans. Objects of scientific research: material, ideal systems. The subject

of scientific research is the structure of the system, the interaction of its elements, various properties and patterns of development. Research Methodology. The history of the formation of natural science, key stages and aspects. The value of scientific planning in the modern world. Models and technologies of scientific planning. Thesis as an independent creative work of students, summarizing the experimental data obtained by them in the course of research work, systematizing the theoretical knowledge they acquired earlier and representing a platform for mastering professional presentation skills, testing their competence in the chosen profile of the specialty, key elements and requirements for presented to her. The need to use bibliographic references in scientific works, its rules governing. The concept of copyright and licensing, academic etiquette. Mechanisms for implementing the results of scientific research. The relevance of the formation of professional and key competencies, subject-specific competencies: research (search), organizational and managerial, communicative, reflective, skills in teamwork. Speech communication as an instrument of professional activity. Work with scientific information, its processing and presentation. Technical, graphic, stylistic, grammatical criteria for the design and presentation of the poster, information load. Definition and designation of scientific novelty, relevance, scope of the results of scientific research. Ways and tasks of the development of innovative and strategically important scientific technologies. The main stages of the development of science in Kazakhstan, the Kazakhstan-2050 strategy, state and international programs for financing basic and applied research.

References

Main literature:

1. Aytasheva Z.G. Concise Guidance for Biologists: Preparation of Scientific Publications and Grant Proposals. Kazakh University, 2005, 47 p. (Rus.). and later editions of this guidebook.

Additional literature:

1. Day R.A. How to write and publish a scientific paper. 4th Edition. Phoenix, Oryx Press AZ, 1994.

2. Woosley J.D. Combating poster fatigue: How to use visual grammar and analysis to effect better visual communications. Trends Neurosci. 12, 325-332, 1989.

3. Dawkins R. The Oxford book of modern writing. 1st paper edition. Oxford University Press, 2009, 419 pp.

4. Issever C., Peach K. Presenting Science. A practical guide to giving a good talk. Oxford University, Press, 2010, 120 pp.

Internet resources:

1. http://highered.mcgraw-hill.com/sites/0767417399/student_view0/chapter1/web_links.html
2. http://wps.ablongman.com/long_aaron_lbb_2/22/5789/1482143.cw/index.html
3. http://college.cengage.com/english/chaffee/critical_thinking/2e/students/links/chap10.html
4. <http://bmj.bmjournals.com/collections/read.htm> (how to read scientific papers)
5. <http://modeling.asu.edu/modeling/weblinks.html> (weblink for the modelers)

**SPECIALTY OF ENTRANCE EXAMINATION EVALUATION SCALE
FOR APPLICANTS TO PHD
BY SPECIALTY »" 8D05103 - BIOPHYSICS "**

Rating	Kriteria for evaluation:
Fine	<ol style="list-style-type: none"> 1. Given competent, reasonable and complete answers to all theoretical questions 2. The practical task is completed in full. 3. Horizon and creativity demonstrated student 4. Theoretical postulates are supported by examples.
Good	<ol style="list-style-type: none"> 1. The answers to all theoretical questions are competent and correct, there are minor inaccuracies, or not backed up by examples 2. The practical task is completed but may be technical errors in the calculations.
Satisfactorily	<ol style="list-style-type: none"> 1. Essentially correct answers are given to all theoretical questions, but or with inaccuracies in the logical sequence facts, without examples and with wording errors 2. The practical task was completed with errors or not in full volume.
Unsatisfactory	<ol style="list-style-type: none"> 1. The answer is not given, or contains gross errors. 2. The logical sequence is broken. 3. The practical task is not done.

Maximum -100 points, minimum (passing) - 51 points.

1 question (theoretical) is evaluated as follows:

Excellent - 30 points (maximum)

Good - 26 points (maximum)

Satisfactory - 23 points (maximum)

Unsatisfactory - 15 points (maximum)

Question 2 (theoretical) is evaluated as follows:

Excellent - 30 points (maximum)

Good - 26 points (maximum)

Satisfactory - 23 points (maximum)

Unsatisfactory - 15 points (maximum)

Question 3 (practical) is evaluated as follows:

Excellent - 40 points (maximum)

Good - 35 points (maximum)

Satisfactory - 30 points (maximum)

Poor - 20 points (maximum)