

*Federal State Autonomous Educational Institution of Higher Education
"Peoples' Friendship University of Russia"*

Institute of Medicine

Recommended by MSSN

THE WORKING PROGRAM OF THE DISCIPLINE

Discipline: Methodology of Scientific Research

Recommended for the direction of training / specialty:

06.06.01 Biological science

1. Goal and objectives of the discipline:

Goal of the discipline:

training of a specialist who possesses the fundamental theoretical knowledge and practical skills necessary for carrying out scientific work, who is able to successfully and timely complete a dissertation research.

Objectives of the discipline:

- study of methods and techniques to acquired and substantiated new scientific knowledge.
- study of the organization and planning of scientific research by mathematics and informatics methods, collection and processing of experimental data, solution of scientific problems of fundamental and applied importance.
- study of the basic principles of scientific research and scientific knowledge, its place in social organization, its functions and features in modern conditions;
- studying the ways of writing the main types of scientific research: a scientific report for a seminar, conference, international seminar, Ph.D. thesis;
- training in the basic principles of planning own clinical trials, the principles of collection, storage, processing and analysis of scientific data;
- training in the principles of presentation of research results, and their preparation for publication and presentation.

2. Place of discipline in the structure of high education program:

The discipline "*Methodology of scientific research*" refers to the variable part of block 1 of the curriculum.

The following are the preceding and subsequent disciplines aimed at forming the competencies of the discipline in accordance with the competence matrix.

The discipline "*Methodology of scientific research*" is based on the knowledge available to postgraduate students after receiving higher professional education.

For a high-quality development of the discipline, a graduate student must know philosophy, a foreign language, bioethics, computer science within the scope of a specialist's course, and be able to use scientific literature.

The discipline "*Methodology of scientific research*" is the base for the block "Scientific research", preparation and passing of the candidate exam in a special discipline, teaching practice.

3. Requirements for the results of the discipline:

The discipline program is designed to form the following competencies:

UC-1. the ability to analyze and evaluate current scientific achievements, generate new ideas and solve the research and practical problems;

UC-2. the ability to design and perform integrated research, including interdisciplinary research, based on a holistic systemic scientific worldview and knowledge in the field of history and philosophy of science;

UC-3. the readiness to participate in the work of Russian and international research teams;

PC-5. the ability to use modern computer technologies in the collection, storage, processing, analysis and transmission of biological information;

PC-6. the ability to present and report the results of scientific research;

PC-7. the ability to apply the methodological principles of design and performance of laboratory research using modern equipment;

PC-8. the knowledge of normative documents regulating the organization and methodology of the research, the ability to ensure safety;

PC-9. the readiness to teach in higher education and manage student research projects, the ability to provide teaching material in oral, written and graphic forms for different students.

As a result of studying the discipline, the post-graduate must:

know:

- basic methods of research activities (UC-1);
- theoretical, methodological and organizational aspects of the implementation of research activities in medicine (UC-2);
- methods of critical analysis and assessment of modern scientific achievements, methods of generating new ideas in solving research and practical problems, including in interdisciplinary fields (UC-3);
- applied programs for modeling in biology and medicine (PC-5)
- concepts and objects of intellectual property, methods of their protection, objects of industrial property in the field of natural sciences; rules for drawing up and filing an application for the grant of a patent for an invention (PC-6);
- the main stages of scientific biomedical research (PC-7);
- principles and criteria for the selection of patients in a clinical trial (PC-8);
- format for preparing a scientific publication (PC-9);

be able to:

- carry out information searches and compile a list of analogs in accordance with the annotation (plan) of performing own research (UC-1);
- select patients for the study according to inclusion and exclusion criteria, critically analyze and generalize the obtained clinical data, objectively evaluate the effectiveness of the studied methods of diagnosis, prevention, treatment, rehabilitation, to determine the ratio of risk and benefit from the studied methods of intervention in accordance with the profile of interventions (UC- 2);
- analyze alternative options for solving research problems and assess the potential gains / losses of the implementation of these options (UC-3)
- receive new information by analyzing data from scientific sources (PC-5)
- fill out an application for an invention, utility model, database; to formulate practical significance and practical recommendations based on the results of scientific research; draw up guidelines for the use of new methods of prevention and treatment of human diseases (PC-6)
- form the main and control groups according to the inclusion and exclusion criteria, apply the planned research methods, organize the collection of material, record and systematize the data obtained (PC-7)
- determine promising directions of scientific research in the subject area of professional activity, the composition of research works, which determine their factors; to study scientific and medical literature, domestic and foreign experience on the research topic; work with sources of patent information; use the indexes of the International Patent Classification to determine the heading index; conduct information and patent search; carry out bibliographic search processes (PC-8)
- form a research plan and distribute team work (PC-9)

have skills:

- of information search (UK-1)
- in drawing up a research plan, writing an abstract of a scientific research (UK-2)
- of analyzing the main worldview and methodological problems, incl. interdisciplinary character arising in science at the present stage of its development, ways of organizing interaction with colleagues and social partners (UK-3)
- of collecting, processing, analyzing and organizing information on the research topic; the skills of choosing methods and means of solving research problems (PC-5)
- of preparing a scientific publication (PC-6)
- of working with modern software for laboratory research (UK-7)
- of conducting scientific biomedical research (PC-8)

- of independent acquisition of knowledge and skills necessary for conducting research activities (PC-9)

4. The scope of the discipline and types of educational work

The total workload of the course is 3 credit units.

4.1 Full-time education

| Type of educational work | Total hours | Semesters | | | |
|---------------------------------|--------------|-----------|-----|---|---|
| | | 2 | | | |
| Class hours (total) | 74 | 74 | | | |
| Including: | - | - | - | - | - |
| <i>Lectures</i> | 54 | 54 | | | |
| <i>Practice work (PW)</i> | 20 | 20 | | | |
| <i>Seminars (S)</i> | | | | | |
| <i>Laboratory work (LW)</i> | | | | | |
| Self study + examination | 34 | 34 | | | |
| Total workload | hours | 108 | 108 | | |
| | credit units | 3 | 3 | | |
| | | | | | |

4.2 Distance learning

| Type of educational work | Total hours | Semesters | | | |
|---------------------------------|--------------|-----------|-----|---|---|
| | | 2 | | | |
| Class hours (total) | 6 | 6 | | | |
| Including: | - | - | - | - | - |
| <i>Lectures</i> | 6 | 6 | | | |
| <i>Practice work (PW)</i> | | | | | |
| <i>Seminars (S)</i> | | | | | |
| <i>Laboratory work (LW)</i> | | | | | |
| Self study + examination | 102 | 102 | | | |
| Total workload | hours | 108 | 108 | | |
| | credit units | 3 | 3 | | |

5. Content of the discipline

5.1. Content of the discipline's sections

| № п/п | Discipline sections | Section content (topics) |
|-------|--|---|
| 1. | General methodological issues | Scientific knowledge concept. General characteristics of the process of scientific knowledge. Methodology as a philosophical teaching on the methods of cognition and transformation of reality, the application of the principles of worldview to the process of cognition, spiritual creativity and practice. |
| 2. | Methodological foundations of scientific knowledge | Science as a specific form of activity. The method of scientific knowledge: essence, content, main characteristics. |
| 3. | General research questions | Basic concepts of science characteristic features of modern science classification of scientific research |

| | | |
|-----|--|--|
| 4. | Means and methods of scientific research | Classification of general scientific methods, general logical methods, theoretical methods, empirical methods. System analysis. Scientific and technical creativity as a search and solution of problems in the field of technology based on the use of scientific achievements. Methods of psychological activation of collective creative activity: "brainstorming", an algorithm for solving inventive problems. |
| 5. | Good Scientific Practice | Basic principles of good scientific practice. Research protocol. Individual patient record. Experimental research protocols. Methods for collecting information. Classification of experiments. Research program plan. Sources of reliable information. |
| 6. | Ethical aspects of scientific research. | Basic principles of biomedical research. Basic ethical principles of scientific research. Ethical aspects of laboratory and clinical research. People as a source of scientific information. Patient informed consent. |
| 7. | Research progress chart | Justification of the relevance of the selected topic. Setting the goal and specific objectives of the study. Determination of the object and subject of research. The choice of methods (techniques) of the study. Description of the research process. Discussion of the research results. Formation of conclusions and assessment of the results obtained. Practical relevance, Research work plan |
| 8. | Study design. Processing and analysis of scientific research results | Fundamentals of Biomedical Statistics. Sample size calculation. Descriptive statistics. Statistical analysis methods. |
| 9. | Registration of scientific research. | Presentation of research results. Principles of writing scientific articles, reports. |
| 10. | Preparation of a scientific publication | What is a scientific publication for? Types of publications: conference materials, thesis, short message, letter, original scientific article, review article, monograph. Types of magazines. Requirements for the structure of a scientific publication. Reviewing. Indexing of scientific publications (SCOPUS, WoS, RSCI). Violations of scientific ethics. Copyright for the article. Creative Commons licenses. Impact factor. Tools for selecting a magazine for the relevant topic. |
| 11. | Methodology of dissertation research. | The structure of a scientific dissertation research. Stages of dissertation research. Requirements for the structure, content and design of the thesis. |
| 12. | Search, accumulation and processing of scientific information | Classifications of information, methods of structuring, systems of information standards. Types and standards of information: HL7 standard, DICOM standard, standards in genomics, proteomics, metabolomics. Databases for systematizing scientific material. The main elements of the database: tables, forms, queries, reports. Data types. Database structure. ... |
| 13. | Basics of information biological processes | Methods for describing and modeling information processes in medical and diagnostic tasks, in classification problems, in the study of population interactions, in the study and prediction of the behavior of the environment of living systems by means of modern information technologies |

| | | |
|-----|--|--|
| 14. | Mathematical modeling in biology and medicine | The concept of a model, types of models, implementation of mathematical models in silico. Population modeling, growth models, models of ecological processes, simulation modeling, models of elements and systems of an animal organism. Simulation object. Formalization of the task. Difficult to formalize tasks. Models in diagnostics of human condition, prognostic models, models of outcomes of conditions, treatment course, disease remissions, epidemiological models, etc. Application programs for modeling in biology and medicine (interface, help system, built-in programming languages (macros)). Modern software for automation of experimental data processing: MathLab, Statistica, R, SAS. |
| 15. | Introduction to Bioinformatics | Biological classifications and nomenclatures; using sequences to determine phylogenetic relationships; determination of the similarity of sequences using network databases; introduction of protein into the structure; classification of proteins; development and prediction of protein structure; the concept of proteomics, genomics, metabolomics, polymorphism, amplification, sequencing; exercises, problems, web-lems. |
| 16. | Electronic archives, accumulation, storage and retrieval of genetic information. | DNA sequences database; genomic databases and genomic navigators; DB of protein sequences; DB of related proteins, DB of protein structures, classification of protein structures, problems of determining protein structures; |
| 17. | Organization and evolution of the genome | genome and proteome, genome sequence projects; the relationship of the genome with the type of cell; the human genome; development of the genome, comparison of genomes. |
| 18. | Genome analysis and modeling methods | programming languages and tools: traditional algorithmic languages, scripting languages, specialized libraries for programming in molecular biology; Java is an applet language for the Web; hypertext markup languages. |

5.2. Discipline's sections and types of classes

5.2.1 Full-time education

| № п/п | Discipline sections | Lec.. | Pract. | Lab. | Sem. | Self | Total (hours). |
|-------|--|-------|--------|------|------|------|----------------|
| 1 | General methodological issues | 1 | | | | 1 | 2 |
| 2 | Methodological foundations of scientific knowledge | 2 | | | | 1 | 3 |
| 3 | General research questions | 1 | | | | 1 | 2 |
| 4 | Means and methods of scientific research | 2 | | | | 1 | 3 |
| 5 | Good Scientific Practice | 1 | | | | 1 | 2 |
| 6 | Ethical aspects of scientific research. | 1 | | | | 1 | 2 |
| 7 | Research progress chart | 1 | | | | 1 | 2 |
| 8 | Study design. Processing and analysis of scientific research results | 12 | 6 | | | 6 | 24 |
| 9 | Registration of scientific research. | 1 | | | | 1 | 2 |
| 10 | Preparation of a scientific publication | 2 | 1 | | | 2 | 5 |
| 11 | Methodology of dissertation research. | 3 | 1 | | | 2 | 6 |
| 12 | Search, accumulation and processing of scientific information | 3 | 3 | | | 3 | 9 |

| | | | | | | | |
|----|--|---|---|--|--|---|----|
| 13 | Basics of information biological processes | 3 | | | | 1 | 4 |
| 14 | Mathematical modeling in biology and medicine | 9 | | | | 1 | 10 |
| 15 | Introduction to Bioinformatics | 6 | | | | 1 | 7 |
| 16 | Electronic archives, accumulation, storage and retrieval of genetic information. | 3 | 3 | | | 3 | 9 |
| 17 | Organization and evolution of the genome | 3 | | | | 1 | 4 |
| 18 | Genome analysis and modeling methods | 3 | 6 | | | 6 | 15 |

5.2.2 Distance learning

| № п/п | Discipline sections | Lec.. | Pract. | Lab. | Sem. | Self | Total (hours). |
|----------|--|-------|--------|------|------|-------|-------------------|
| 1 | General methodological issues | 0,25 | | | | 1,75 | 2 |
| 2 | Methodological foundations of scientific knowledge | 0,25 | | | | 2,75 | 3 |
| 3 | General research questions | 0,25 | | | | 1,75 | 2 |
| 4 | Means and methods of scientific research | 0,25 | | | | 2,75 | 3 |
| 5 | Good Scientific Practice | 0,25 | | | | 1,75 | 2 |
| 6 | Ethical aspects of scientific research. | 0,25 | | | | 1,75 | 2 |
| 7 | Research progress chart | 0,25 | | | | 1,75 | 2 |
| 8 | Study planning. Processing and analysis of scientific research results | 1 | | | | 23 | 24 |
| 9 | Registration of scientific research. | 0,25 | | | | 1,75 | 2 |
| 10 | Preparation of a scientific publication | 0,25 | | | | 4,75 | 5 |
| 11 | Methodology of dissertation research. | 0,25 | | | | 5,75 | 6 |
| 12 | Search, accumulation and processing of scientific information | 0,25 | | | | 8,75 | 9 |
| 13 | Basics of information biological processes | 0,25 | | | | 3,75 | 4 |
| 14 | Mathematical modeling in biology and medicine | 0,50 | | | | 9,50 | 10 |
| 15 | Introduction to Bioinformatics | 0,75 | | | | 6,25 | 7 |
| 16 | Electronic archives, accumulation, storage and retrieval of genetic information. | 0,25 | | | | 8,75 | 9 |
| 17 | Organization and evolution of the genome | 0,25 | | | | 3,75 | 4 |
| 18 | Genome analysis and modeling methods | 0,25 | | | | 14,75 | 15 |

6. Laboratory workshop is not provided

7. Practical workshop

7.1 Full-time education

| № п/п | Discipline sections | Topics of practical classes | Hours |
|----------|---|---|-------|
| 1. | Study design. Processing and analysis of scientific research results | Fundamentals of Biomedical Statistics. Sample size calculation. Descriptive statistics. Statistical analysis methods. | 6 |
| 2. | Preparation of a scientific publication | What is a scientific publication for? Types of publications: conference materials, thesis, short message, letter, original scientific article, review article, monograph. Types of magazines. Requirements for the structure of a scientific publication. Reviewing. Indexing of scientific publications (SCOPUS, WoS, RSCI). | 1 |

| | | | |
|---|--|---|---|
| | | Violations of scientific ethics. Copyright for the article. Creative Commons licenses. Impact factor. Tools for selecting a magazine for the relevant topic. | |
| 3 | Methodology of dissertation research. | The structure of a scientific dissertation research. Stages of dissertation research. Requirements for the structure, content and design of the thesis. | 1 |
| 4 | Search, accumulation and processing of scientific information | Classifications of information, methods of structuring, systems of information standards. Types and standards of information: HL7 standard, DICOM standard, standards in genomics, proteomics, metabolomics. Databases for systematizing scientific material. The main elements of the database: tables, forms, queries, reports. Data types. Database structure. | 3 |
| 5 | Electronic archives, accumulation, storage and retrieval of genetic information. | DNA sequences database; genomic databases and genomic navigators; DB of protein sequences; DB of related proteins, DB of protein structures, classification of protein structures, problems of determining protein structures; | 3 |
| 6 | Genome analysis and modeling methods | programming languages and tools: traditional algorithmic languages, scripting languages, specialized libraries for programming in molecular biology; Java is an applet language for the Web; hypertext markup languages. | 6 |

7.2 Distance learning

Practical workshop is not provided

8. Material and technical support of the discipline:

For classes, group and individual consultations, monitoring and intermediate certification, computer classes 452 and 453 are used located at the address: Moscow, st. Miklukho-Maklaya, 10, building 2. and a lecture hall located at the address: Moscow, st. Miklukho-Maclay, 8.

A set of workstations consisting of computer tables, chairs, marker board; technical means: interactive whiteboard, projection screen, multimedia projector, teacher's laptop, monoblocks.

Computing server HP ProLiant ML350 Gen 10, Monoblock Acer Aspire C24-865 - 16 pcs., Monoblock Lenovo V30a-24IML All-In-One 23.8 "- 19 pcs., Monoblock Acer Z3-615 - 12 pcs., Workplace as part of the Dell Optiplex 3010MT system unit and Dell S2240L monitor - 6 pcs., Gladius 210XT0808R-21064 server - 3 pcs.

9. Information support of the discipline

a) software:

Microsoft Subscription Enrollment for Education Solutions (EES) No. 56278518 dated 04/23/2019 (renewed annually, the program is assigned a new number).

б) databases, reference and search systems:

1. EBS of RUDN University and third-party EBS to which students have access on the basis of concluded agreements:

- RUDN University Electronic Library System - RUDN University Library System <http://lib.rudn.ru/MegaPro/Web>
- EBS "University Library Online" <http://www.biblioclub.ru>
- EBS Yurayt <http://www.biblio-online.ru>
- EBS "Student Consultant" www.studentlibrary.ru
- EBS "Doe" <http://e.lanbook.com/>
- TUIS: <http://esystem.pfur.ru/course/view.php?id=46>

- All-Russian Institute for Scientific and Technical Information of the Russian Academy of Sciences (VINITI RAS) <http://www2.viniti.ru/>
- 2. Database of medical and biological publications:
 - NCBI: <https://p.360pubmed.com/pubmed/>
 - RUDN University Bulletin: access mode from the RUDN University territory and remotely <http://journals.rudn.ru/>
 - Scientific library Elibrary.ru: access by IP-addresses of RUDN University at: <http://www.elibrary.ru/defaultx.asp>
 - ScienceDirect (ESD), "FreedomCollection", "Cell Press" ID "Elsevier". There is remote access to the database, access by IP-addresses of RUDN University (or remotely by individual login and password).
 - Google Academy (eng. Google Scholar) - a free search engine for full texts of scientific publications of all formats and disciplines. Indexes full texts of scientific publications. Access mode: <https://scholar.google.ru/>
 - Scopus - scientometric database of the publishing house "Elsevier". There is remote access to the database.
Access by IP-addresses of RUDN University and remotely by login and password (Grant of the Ministry of Education and Science). Access mode: <http://www.scopus.com/>
 - Web of Science. There is remote access to the database. Access to the platform is carried out by IP-addresses of the RUDN University or remotely. Remote access to WOS is activated without administrator intervention after registering on the platform from RUDN University <http://login.webofknowledge.com/>

10. Educational and methodological support of the discipline:

a) Basic literature

1. Methodology of scientific research [Electronic resource]: Textbook / N.A. Slesarenko [et. all]. - 2nd ed., Erased. - SPb. : Publishing house "Lan", 2018. - 268 p.
2. Methodology of scientific research [Electronic resource]: Textbook / N.A. Slesarenko [et. all]; ed. ON THE. Slesarenko. - SPb. : Publishing house "Lan", 2017. - 268 p.

b) Further reading

1. Ruzavin GI Methodology of scientific knowledge [Text]: Textbook for universities / GI. Ruzavin. - M.: UNITY-DANA, 2013.-- 287 p.
2. Ivanova T.B. Methodology of Scientific Research [Text / electronic resource] = Methodology of scientific research: Education and Methodical Complex / T.B. Ivanova. - The book is in English; Electronic text data. - M.: PFUR, 2013.-- 117 p.
3. Ivanova TB Methodology of Scientific Research (Methodology of scientific research) [Text / electronic resource]: Textbook / T.B. Ivanova, A.A. Kozlov. - Electronic text data. - M.: Publishing house of RUDN University, 2012.-- 76 p.
6. Dreshchinsky V.A. "Methodology of scientific research" - Electronic text data - Moscow - Yurayt, 2019.
7. N.V. Lipchii, K.I. Lipchii "Methodology of scientific research: textbook", Krasnodar, 2013 - 290s.

11. Methodical instructions for students on mastering the discipline (module)

For each practical lesson and seminar, there are:

- topic and questions for study;
- a specific list of skills and abilities that a graduate student must master;
- control questions and tasks that allow you to determine the success of the assimilation of the studied material;
- questions for self-examination and tasks for independent work on topics are presented in the methodological developments for each section and posted on the TUIS platform: <http://esystem.pfur.ru/>

Detailed information, including theoretical material, a glossary and a list of recommended literature for those wishing to learn more about the topic under study, can be found on the TUIS platform: <http://esystem.pfur.ru>.

At the end of each lesson, it is planned to fill out a report on the TUIS platform. The report can be in the form of answers to questions on the topic covered or in the form of attaching a file with the completed task.

Passage of each section ends with midterm knowledge control in the form of control work and computer testing. In the process of midterm control, a graduate student must show his knowledge and skills on the topic covered.

The study of the discipline "Methodology of scientific research" ends with the passing of the final computer test, which includes questions on all topics covered.

In the process of mastering the discipline within the framework of independent work, the graduate student works with literature in the RUDN University library and uses the resources of the information and communication network "Internet".

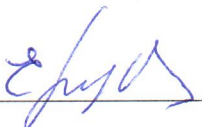
12. Fund of assessment tools for intermediate certification of students in the discipline

Materials for assessing the level of mastering the educational material of the discipline "Methodology of scientific research" (evaluation materials), including a list of competencies with an indication of the stages of their formation, a description of indicators and criteria for evaluating competencies at various stages of their formation, a description of the assessment scales, typical control tasks or other materials necessary for assessing knowledge, skills, skills and (or) experience of activity, characterizing the stages of the formation of competencies in the process of mastering the educational program, methodological materials that determine the procedures for assessing knowledge, skills, skills and (or) experience of activities that characterize the stages of formation of competencies, developed in full and available for students on the discipline page at TUIS RUDN.

The program has been drawn up in accordance with the requirements of the ES HE RUDN.

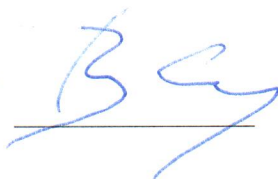
Developers:

Associate professor,
Department of Medical Informatics
and telemedicine



____ E.A. Lukianova ____

Head of the Department
Department of Medical Informatics
and telemedicine



____ V.L. Stolyar ____