

MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE

SUMY STATE UNIVERSITY

Academic and Research Medical Institute

Кафедра патологічної анатомії

FUNDAMENTALS OF SCIENTIFIC RESEARCH IN MEDICINE

Higher education level	The Second
Major: study programme	222 Medicine: Medicine

Approved by Quality Council HHMI

Chairman of the Quality Council HHMI
Petrashenko Viktoriia Oleksandrivna

DATA ON APPROVAL

Author

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Considered and approved at the meeting of the work group of Study programme Медицина	Head of the work group (Head of the Study programme) Lychko Volodymyr Stanislavovych
Considered and approved at the meeting of the Кафедра патологічної анатомії	Head of the Department Moskalenko Roman Andriiovych

SYLLABUS

1. General information on the course

Full course name	Fundamentals of scientific research in medicine
Full official name of a higher education institution	Sumy State University
Full name of a structural unit	Academic and Research Medical Institute. Кафедра патологічної анатомії
Author(s)	Moskalenko Roman Andriiovych, Hyriavenko Nataliia Ivanivna, Denysenko Anastasiia
Cycle/higher education level	The Second Level Of Higher Education, National Qualifications Framework Of Ukraine – The 7th Level, QF-LLL – The 7th Level, FQ-EHEA – The Second Cycle
Duration	one semester
Workload	3 ECTS, 90 hours. For full-time course 36 hours are working hours with the lecturer (36 hours of seminars), 54 hours of the individual study.
Language(s)	English

2. Place in the study programme

Relation to curriculum	Compulsory course available for study programme "Medicine"
Prerequisites	Krok-1, Required knowledge from the integrated course “Fundamentals of Academic Writing, the integrated course “Democracy: Values, Principles, Mechanisms”. Internal medicine, including medical genetics, endocrinology, dermatology, venereology, clinical pharmacology, clinical immunology and allergology, phthisiology. Obstetrics and gynecology. Surgery, including pediatric surgery, neurosurgery; traumatology and orthopedics; emergency and urgent medical care; oncology. Infectious diseases. Epidemiology
Additional requirements	There are no specific requirements
Restrictions	There are no specific restrictions

3. Aims of the course

The goal of the educational discipline is for the learner to achieve constructive, fundamental thinking and obtain modern knowledge and professional skills in formulating a scientific hypothesis, the goal and task of scientific research, and the development of a design and plan of scientific research.

4. Contents

Topic 1 History and essence of scientific knowledge Science: concepts and functions. The history of scientific research during the development of civilization. Stages of development of scientific knowledge. Basic categories of science. The essence and features of the process of scientific knowledge. Concept of scientific idea, hypothesis, fundamental and applied sciences, applied developments.
Topic 2 The structure of scientific research Elements of scientific research. Formation of the goal of scientific research. Object and subject of scientific research as a category of scientific knowledge. The main approaches to conducting scientific research are disciplinary, interdisciplinary, multidisciplinary, and transdisciplinary.
Topic 3 Methods of scientific research Selection of research methods for hypothesis testing. Experimental and clinical research methods. Use of special research methods in experimental works and clinical studies. Peculiarities of the formation of research groups.
Topic 4 Criteria for evaluating the methodological quality of research. Types of scientific data and methods of their calculation. Concepts of evaluating the results of scientific activity. Basic principles: perspective, relevance, and consistency with the priority development directions (in science and technology, innovative activity), scientific novelty and innovative orientation, practical value, and global integration. Sequence processing, image analysis, relationship modeling, probabilistic modeling, process modeling, and graphical data.
Topic 5 Ethics of scientific medical research and academic integrity Bioethical aspects of a scientist's scientific activity. Ethical norms when working with various biological objects (cell cultures, microorganisms, animals) and patients. Violation of academic integrity in the performance of scientific research, types and fight against plagiarism. Tools for monitoring compliance with academic integrity. Provisions of "Recommendations on the status of scientific workers". Code of ethics of a Ukrainian scientist, doctor.
Topic 6 Scientific research in clinical practice. Peculiarities of involving children in clinical research, informed consent of parents (guardians). Basic principles of collecting information and clinical data in pediatric practice, ensuring confidentiality.
Topic 7 Basics of biosafety of scientific research. Biosafety rules in laboratories and rules for handling biological diagnostic material of patients. Management of laboratory waste, "green laboratories", rules for disposal of scientific research waste.
Topic 8 Basics of microscopy Types of microscopic studies: light-optical, electronic, fluorescent, new methods of high resolution. Rules for handling a light microscope. Principles of photo documentation in microscopy.

Topic 9 Basic methods of biological tissue research: histology Rules for preparing samples for research. Methodology and technique of conducting histological research. The importance of histological examination for the diagnostic process.
Topic 10 Basic methods of biological tissue research: histochemistry Rules for preparing samples for research. Peculiarities of the use of histochemical techniques in the diagnostic process. Practical demonstration of one of the histochemical methods.
Topic 11 Basic methods of biological tissue research: immunohistochemistry. Rules for preparing samples for research. Correct fixation of samples. Production of slices. Deparaffinization and unmasking of antigens. Blockade of tissue peroxidase activity. Blockade of excess antigens. Incubation with primary and secondary antibodies. Results visualization methods. Production of an immunohistochemical micropreparation. Evaluation of reaction results.
Topic 12 Basic methods of researching biological samples: cytology. Rules for preparing samples for research. Methodology and technique of conducting cytological research, necessary equipment and reagents. Diagnostic value of cytological methods. Methods and techniques of immunocytochemical research. Peculiarities of using immunocytochemical techniques in the diagnostic process.
Topic 13 General ideas about molecular biological research methods. The principle of the polymerase chain reaction method. The principle of the in situ hybridization method. Indications for conducting molecular cytogenetic studies.
Topic 14 Statistical methods in scientific research. The concept of correct and incorrect distribution of data in the studied samples. Ways to check data distribution. Parametric and non-parametric methods of statistics.
Topic 15 Publication of scientific results Types of publication of scientific data. Rules for preparation of theses of scientific research. Rules for preparation of review and research articles.
Topic 16 Funding of scientific research Search for grant and financial support. Peculiarities of preparing requests for funding of scientific research. The structure of the request for participation in the grant competition: general information.
Topic 17 Scientific career in Ukraine and the world. The system of academic degrees and titles in Ukraine and abroad. Useful tips for early stages researchers
Topic 18 Module Report on an individual scientific project.

5. Intended learning outcomes of the course

After successful study of the course, the student will be able to:

LO1	To search, select, and critically analyze scientific information from professional literary sources, scientometric databases, and other information resources to solve research problems in the field of healthcare.
LO2	Be able to solve medical problems in new or unfamiliar environments given incomplete or limited information, taking into account aspects of social and ethical responsibility.
LO3	Use basic statistical data analysis methods to interpret research results and formulate sound conclusions.
LO4	Prepare and present the results of scientific research, clearly and in a reasoned manner, presenting the obtained data to specialists and a wide audience.
LO5	The ability to carry out professional and research activities while working with scientific publications, preparing theses, reports, scientific articles, and projects, as well as effectively present and disseminate research results in a professional and academic environment.
LO6	Make informed managerial and professional decisions in health care, assessing required resources and accounting for the social, economic, and ethical implications of their implementation.

6. Role of the course in the achievement of programme learning outcomes

Programme learning outcomes achieved by the course.

For 222 Medicine:

PO21	Retrieve required information from professional literature, databases, and other sources; analyse, evaluate, and apply this information.
PO22	Utilize modern digital technologies, specialized software, and statistical data analysis methods to resolve complex healthcare challenges.
PO25	Communicate one's own knowledge, conclusions, and reasoning regarding healthcare and related issues to both specialist and non-specialist audiences clearly and unambiguously.
PO26	Manage workflow processes in the healthcare sector that are complex, unpredictable, and require novel strategic approaches; organize personnel management and professional development, incorporating acquired skills in effective teamwork, leadership, quality assurance, accessibility, equity, and the delivery of integrated medical care.
PO27	Demonstrate proficiency in communicating fluently in both the state language and English, both orally and in writing, to discuss professional activities, research, and projects.
PO28	Make effective decisions regarding healthcare challenges, evaluate required resources, and account for social, economic, and ethical consequences.

7. The role of the course in the development of program competencies

Program competencies addressed by the course:

For 222 Medicine:

PC1	GC 1. Ability to think abstractly, analyse, and synthesize.
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PC2	GC 2. Ability to learn and master modern knowledge.
PC3	GC 3. Ability to apply knowledge in practical situations.
PC4	GC 4. Knowledge and understanding of the subject area and understanding of the professional activity.
PC5	GC 6. Ability to make informed decisions.
PC6	GC 7. Ability to work in a team.
PC7	GC 8. Ability to engage in interpersonal interaction.
PC8	GC 10. Ability to use information and communication technologies.
PC9	GC 11. Ability to search, process, and analyse information from various sources.
PC10	GC 12. Determination and persistence concerning tasks and responsibilities undertaken.
PC11	GC 15. Ability to preserve and enhance moral, cultural, and scientific values and achievements of society based on an understanding of the history and patterns of development of the subject area, its place within the general system of knowledge about nature and society, and in the development of society, engineering, and technologies; to utilize various types and forms of physical activity for active recreation and leading a healthy lifestyle.
PC12	SC 11. Ability to solve medical problems in new or unfamiliar environments amidst incomplete or limited information, incorporating aspects of social and ethical responsibility, including the early intervention system.
PC13	SC 23. Ability to develop and implement scientific and applied projects in the field of healthcare.
PC14	SC 24. Adherence to ethical principles when working with patients and laboratory animals.
PC15	SC 25. Adherence to professional and academic integrity, assuming responsibility for the validity of obtained scientific results.

8. Teaching and learning activities

Topic 1. History and essence of scientific knowledge
pr.tr.1 "Historical stages and definitions of scientific research" (full-time course) CThe essence and features of the process of scientific knowledge. Structural elements of science: principles (postulates), simple abstraction (concepts, definitions), categories, axioms, regularities, laws. Scientific hypothesis. Methods empirical research, methods of theoretical knowledge and general logical methods and research techniques. Basic concepts of analysis and synthesis of information, methods of abstraction, idealization, generalization and systematic approach. The general structure of the research work: 1) formation of the topic of scientific research; 2) goal formation and research tasks; 3) theoretical studies; 4) experimental or empirical research; 5) analysis and design of scientific research; 6) implementation and effectiveness of scientific research. The use of general logical methods in medical and biological research. The study of this topic involves theoretical work in the classroom, a survey on the lesson topic, testing, and practical work in the Scientific Center for Pathomorphological Research laboratory.

Topic 2. The structure of scientific research
pr.tr.2 "The structure of scientific research" (full-time course) Elements of scientific research. Formation of the goal of scientific research. Object and subject of scientific research as a category of scientific knowledge. The main approaches to conducting scientific research: disciplinary, interdisciplinary, multidisciplinary, transdisciplinary. The study of this topic involves theoretical work in the classroom, a survey on the lesson topic, testing, and practical work in the Scientific Center for Pathomorphological Research laboratory.
Topic 3. Methods of scientific research
pr.tr.3 "Methods of scientific research" (full-time course) Selection of research methods for hypothesis testing. Experimental and clinical research methods. Use of special research methods in experimental works and clinical studies. Peculiarities of the formation of research groups. The study of this topic involves theoretical work in the classroom, a survey on the lesson topic, testing, and practical work in the Scientific Center for Pathomorphological Research laboratory.
Topic 4. Criteria for evaluating the methodological quality of research.
pr.tr.4 "Criteria for evaluating the methodological quality of research." (full-time course) Types of scientific data and methods of their calculation. Concepts of evaluating the results of scientific activity. The main principles: perspective, relevance and consistency with the priority directions of development (in the field of science and technology, innovative activity), scientific novelty and innovative orientation, practical value, global integration. Sequence processing, image analysis, relationship modeling, probabilistic modeling, process modeling, and graphical data. The study of this topic involves theoretical work in the classroom, a survey on the lesson topic, testing, and practical work in the Scientific Center for Pathomorphological Research laboratory.
Topic 5. Ethics of scientific medical research and academic integrity
pr.tr.5 "Ethics of scientific medical research and academic integrity" (full-time course) Bioethical aspects of a scientist's scientific activity. Ethical norms when working with various biological objects (cell cultures, microorganisms, animals) and patients. Violation of academic integrity in the performance of scientific research, types and fight against plagiarism. Tools for monitoring compliance with academic integrity. Provisions of "Recommendations on the status of scientific workers". Code of ethics of a Ukrainian scientist, doctor. The study of this topic involves theoretical work in the classroom, a survey on the lesson topic, testing, and practical work in the Scientific Center for Pathomorphological Research laboratory.
Topic 6. Scientific research in clinical practice.
pr.tr.6 "Scientific research in clinical practice." (full-time course) Peculiarities of involving patients in clinical research informed consent (including guardians). Basic principles of collecting information and clinical data in pediatric practice, ensuring confidentiality. The study of this topic involves theoretical work in the classroom, a survey on the lesson topic, testing, and practical work in the Scientific Center for Pathomorphological Research laboratory.
Topic 7. Basics of biosafety of scientific research.

pr.tr.7 "Basics of biosafety of scientific research." (full-time course) Biosafety rules in laboratories and rules for handling biological diagnostic material of patients. Management of laboratory waste, "green laboratories", rules for disposal of scientific research waste. The study of this topic involves theoretical work in the classroom, a survey on the lesson topic, testing, and practical work in the Scientific Center for Pathomorphological Research laboratory.
Topic 8. Basics of microscopy
pr.tr.8 "Basics of microscopy" (full-time course) Types of microscopic studies: light-optical, electronic, fluorescent, new methods of high resolution. Rules for handling a light microscope. Principles of photo documentation in microscopy. The study of this topic involves theoretical work in the classroom, a survey on the lesson topic, testing, and practical work in the Scientific Center for Pathomorphological Research laboratory.
Topic 9. Basic methods of biological tissue research: histology
pr.tr.9 "Basic methods of biological tissue research: histology" (full-time course) Rules for preparing samples for research. Methodology and technique of conducting histological research. The importance of histological examination for the diagnostic process. The study of this topic involves theoretical work in the classroom, a survey on the topic of the lesson, testing, and practical work in the pathology department of the Sumy Regional Hospital (according to the agreement on cooperation between the medical institution and the university) and the laboratory of the Scientific Center for Pathomorphological Research.
Topic 10. Basic methods of biological tissue research: histochemistry
pr.tr.10 "Basic methods of biological tissue research: histochemistry" (full-time course) Rules for preparing samples for research. Peculiarities of the use of histochemical techniques in the diagnostic process. Practical demonstration of one of the histochemical methods. The study of this topic involves theoretical work in the classroom, a survey on the lesson topic, testing, and practical work in the Scientific Center for Pathomorphological Research laboratory.
Topic 11. Basic methods of biological tissue research: immunohistochemistry.
pr.tr.11 "Basic methods of biological tissue research: immunohistochemistry." (full-time course) Rules for preparing samples for research. Correct fixation of samples. Production of slices. Deparaffinization and unmasking of antigens. Blockade of tissue peroxidase activity. Blockade of excess antigens. Incubation with primary and secondary antibodies. Results visualization methods. Production of an immunohistochemical micropreparation. Evaluation of reaction results. The study of this topic involves theoretical work in the classroom, a survey on the lesson topic, testing, and practical work in the Scientific Center for Pathomorphological Research laboratory.
Topic 12. Basic methods of researching biological samples: cytology.

pr.tr.12 "Basic methods of researching biological samples: cytology." (full-time course) Rules for preparing samples for research. Methodology and technique of conducting cytological research, necessary equipment and reagents. Diagnostic value of cytological methods. Methods and techniques of immunocytochemical research. Peculiarities of using immunocytochemical techniques in the diagnostic process. The study of this topic involves theoretical work in the classroom, a survey on the topic of the lesson, testing, and practical work in the pathology department of the Sumy Regional Hospital (according to the agreement on cooperation between the medical institution and the university) and the laboratory of the Scientific Center for Pathomorphological Research.
Topic 13. General ideas about molecular biological research methods.
pr.tr.13 "General ideas about molecular biological research methods." (full-time course) The principle of the polymerase chain reaction method. The principle of the in situ hybridization method. Indications for conducting molecular cytogenetic studies. Sample preparation for molecular biological methods. The study of this topic involves theoretical work in the classroom, a survey on the lesson topic, testing, and practical work in the Scientific Center for Pathomorphological Research laboratory.
Topic 14. Statistical methods in scientific research.
pr.tr.14 "Statistical methods in scientific research." (full-time course) The concept of correct and incorrect distribution of data in the studied samples. Ways to check data distribution. Parametric and non-parametric methods of statistics. The study of this topic involves theoretical work in the classroom, a survey on the lesson topic, testing, and practical work in the Scientific Center for Pathomorphological Research laboratory.
Topic 15. Publication of scientific results
pr.tr.15 "Publication of scientific results" (full-time course) Types of publication of scientific data. Rules for the preparation of theses of scientific research. Rules for preparation of review and research articles. The study of this topic involves theoretical work in the classroom, a survey on the lesson topic, and testing.
Topic 16. Funding of scientific research
pr.tr.16 "Funding of scientific research" (full-time course) Search for grant and financial support. Peculiarities of preparing requests for funding of scientific research. The structure of the request for participation in the grant competition: general information. The study of this topic involves theoretical work in the classroom, a survey on the lesson topic, and testing.
Topic 17. Scientific career in Ukraine and the world.
pr.tr.17 "Scientific career in Ukraine and the world." (full-time course) The system of academic degrees and titles in Ukraine and abroad. Useful tips for early-stage researchers. The study of this topic involves theoretical work in the classroom, a survey on the lesson topic, and testing.
Topic 18. Module

pr.tr.18 "Module" (full-time course)
Report on an individual scientific project.

9. Teaching methods

9.1 Teaching methods

Course involves learning through:

TM1	Practical training
TM2	Team Based Learning
TM3	Research Based Learning
TM4	Self-study
TM5	Project training

Practice-oriented training is focused on the formation of research skills sufficient for conducting scientific and applied research at the level of world achievements (RN 1). Research-based education is aimed at the formation of new knowledge and skills, and the ability to use the acquired knowledge in practical activities (RN 2,3). Team-oriented training is aimed at solving specific tasks and stimulates the skills of critical thinking and solving problems in a limited time (RN 2,3). Project training is a method of active problem-situational analysis aimed at developing the skills of forming practical solutions and algorithms for solving a given task (RN 4,5). Self-study in remote systems develops the skills to organize a search, independent selection, and high-quality processing of information from various sources (RN 2,3,4).

9.2 Learning activities

LA1	Preparation for practical classes
LA2	Performing a group practical task
LA3	Individual research project
LA4	Preparation for current control
LA5	Research-based learning

10. Methods and criteria for assessment

10.1. Assessment criteria

Definition	National scale	Rating scale
Outstanding performance without errors	5 (Excellent)	$170 \leq RD \leq 200$
Above the average standard but with minor errors	4 (Good)	$164 \leq RD < 169$
	4 (Good)	$140 \leq RD < 163$
Fair but with significant shortcomings	3 (Satisfactory)	$127 \leq RD < 139$
	3 (Satisfactory)	$120 \leq RD < 126$
Fail – some more work required before the credit can be awarded	2 (Fail)	$70 \leq RD < 119$

	2 (Fail)	$0 \leq RD < 69$
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10.2 Formative assessment

	Description	Deadline, weeks	Feedback
FA1 Diagnostic testing	The introduction of the test as a tool for measuring the educational achievements of students and the effectiveness of the educational process is aimed at identifying gaps in the knowledge, abilities, and/or skills of students and ensuring that they eliminate the corresponding deficiencies in their training. Implementation of the test as a tool for measuring applicants' educational achievements and the educational process's effectiveness.	Writing during the cycle in accordance with the calendar and thematic plan.	The maximum number of points for the test is 10 points, provided that 100% of the answers are correct. The minimum score for successfully passing the tests is 6 points (60% of correct answers).
FA2 Survey and teacher's oral comments based on his results.	Makes it possible to find out the state of educational experience acquired by students in accordance with the set goals, to find out prerequisites of the state of formation of the obtained results, reasons occurrence of difficulties, adjust the learning process, track the dynamics of the formation of learning outcomes and predict their development.	During the entire period of studying the discipline.	According to the obtained data on the results of training, on the basis of their analysis, it is proposed to determine the evaluation as an indicator of the achievements of the students' educational activities.
FA3 Review and evaluation of written assignments.	Assessment of practical work considers independence, compliance with the algorithm, correctness, completeness, and awareness.	Writing during the cycle in accordance with the calendar and thematic plan	Feedback is aimed at supporting the independent work of applicants, identifying shortcomings and assessing the level of acquired theoretical knowledge.

FA4 Peer assessment	Evaluation of each other's work results by applicants. Partnership interaction is aimed at improving the results of educational activity by comparing one's current level of success with previous indicators. Provides an opportunity to analyze one's educational activities.	During the entire period of studying the discipline.	Adjustment together with the students of learning approaches, taking into account the results of the assessment.
FA5 Providing feedback on the results of checking the performance of individual tasks by the acquirer.	Assessment of practical work taking into account independence, compliance with the algorithm, correctness, completeness, awareness.	During the cycle in accordance with the calendar and thematic plan.	Feedback is aimed at supporting the independent work of applicants, identifying shortcomings and assessing the level of acquired theoretical knowledge.

10.3 Summative assessment

	Description	Deadline, weeks	Feedback
SA1 Differentiated assessment	Differentiated assessment	At the end of studying the discipline	A student can get a maximum of 80 points. The minimum number of points for a successful defense is 48 points
SA2 Current assessment of theoretical training level	Includes oral examination, clinical individual and group case management, and ongoing testing.	During the entire period of study of the discipline	Conducted at each lesson, the results of LA implementation affect the comprehensiveness of the practical lesson
SA3 Execution of a practical case (preparation, presentation, defense)	The acquirer's ability to analyze the received information, synthesize the assessment of established knowledge, implementation, and formation of skills is determined and skill in a specific situation, modeled by verbal description or other teaching aids, and facilitates the process knowledge through observation and perception and generate ideas for solving problems based on available theoretical and practical knowledge and skills.	According to the calendar and thematic plan	The winner can get a maximum of 15 points. The minimum number of points for a successful defense is 8 points

SA4 Performing situational exercises (preparation, presentation, defense)	Assessment of correct and logical thinking, skill development observe and analyze problems arising from certain professional activity.	During of course	A student can get a maximum of 10 points. The minimum number of points for a successful defense is 6 points.
SA5 Carrying out a research task (preparation, presentation, defense)	Consolidation of theoretical knowledge and practical skills with of this educational course and the development of students' skills a practical solution to specific tasks. students, are involved in research activities and have the opportunity to present the results of own research.	According to the calendar and thematic plan	A student can get a maximum of 15 points. The minimum number of points for a successful defense is 8 points

Form of assessment:

	Points	Можливість перескладання з метою підвищення оцінки
The first semester of teaching	200 scores	
SA1. Differentiated assessment	80	
	80	Yes
SA2. Current assessment of theoretical training level	80	
	80	Yes
SA3. Execution of a practical case (preparation, presentation, defense)	15	
	15	Yes
SA4. Performing situational exercises (preparation, presentation, defense)	10	
	10	Yes
SA5. Carrying out a research task (preparation, presentation, defense)	15	
	15	Yes

The grade for the discipline is defined as the sum of points for the current educational activity (at least 72) and points for the final module control (at least 48). The number of points for a student is calculated as follows: multiply by the arithmetic average and divide by 5. The final module test is carried out at the end of the discipline study in the form of a test, with a grade of "5" corresponding to 80 points, "4" - 64 points, "3" - 48 points, "2" - 0 points. In the event of an unsatisfactory result on the final module test, the applicant has the right to retake it. Applicants who did not appear for the test without a good reason are considered to have received an unsatisfactory grade. The applicant's refusal to complete the final module task is certified as an unsatisfactory response.

11. Learning resources

11.1 Material and technical support

MTS1	Library funds
MTS2	Laboratory equipment (chemical, physical, medical, materials and preparations, etc.)
MTS3	Computers, computer systems and networks
MTS4	Multimedia, video and sound reproduction, projection equipment (projectors, screens, smart boards)
MTS5	Medical buildings/premises and equipment (Center for collective use of scientific equipment of the Medical Institute "Center for Biomedical Research", University Clinic of Sumy State University, Center for collective use of scientific equipment "Laboratory of materials science of helio-energy, sensor and nanoelectronic systems")

11.2 Information and methodical support

Essential Reading	
1	Andrew Blann. Fundamentals of Biomedical Science. 2024. pp.752 University of Liverpool. ISBN: 9780198834236
2	Aguinis, H. (2025). Research methodology: Best practices for rigorous, credible, and impactful research. Sage Publications.
3	Evidence-based Biomedicine: Methodology for Research, Standardization, and Scientific Procedural Aspects (English Edition) [Electronic resource] / R. Romero-Carazas, A. P. Espiritu-Martinez, E. R. Bazualdo-Fiorini, D. H. Bernedo-Moreira. — South American Publishing's, 2025. — 90 p. — CC BY 4.0.
4	Ferreira, R. Anatomy of a Decision: Using Grey's Anatomy to Teach Medical Ethics [Electronic resource] : bioethical guide / R. Ferreira. — 2026. — CC BY-NC-ND 4.0.
5	Bioethics [Electronic resource] : coursebook / D. Kenis, M. Mertens, F. Vulliermet etc. ; L. Meinen ; K. Hens, J. Struyf, I. Devos, I. Gordon Villafuerte. — 2025. — 164 p. — CC BY-NC 4.0.
Supplemental Reading	
1	Topical Issues of Biosafety and Biosecurity [Електронний ресурс] : lecture course for stud. of spec. 222 "Medicine", 221 "Dentistry", 229 "Public health" of full-time course of studies / V. M. Holubnycha. — Sumy : Sumy State University, 2023. — 76 p.
2	Tran, P., Mishra, P., Williams, L. G., Moskalenko, R., Sharma, S., Nilsson, A. K., Watt, D. L., Andersson, P., Bergh, A., Pursell, Z. F., & Chabes, A. (2024). Altered dNTP pools accelerate tumor formation in mice. Nucleic acids research, Vol. 52, Issue 20, 11 November 2024, Pages 12475–12486, https://doi.org/10.1093/nar/gkae843
3	R. Chyzhma, A. Piddubnyi, A. Romaniuk, R. Moskalenko, Case report: Metastasis of Merkel cell carcinoma in the small intestine. Pathology - Research and Practice. 248 (2023) 154594. https://doi.org/10.1016/j.prp.2023.154594

4	Savchenko T, Lakhtaryna R, Denysenko A, Dovbysh A, Coupland SE, Moskalenko R. An Information-Extreme Algorithm for Universal Nuclear Feature-Driven Automated Classification of Breast Cancer Cells. <i>Diagnostics</i> . 2025; 15(11):1389. https://doi.org/10.3390/diagnostics15111389
5	Kurochkin A, Moskalenko R. Diagnostic value of lymph node calcification in thyroid cancer. Theoretical and practical aspects of the development of modern scientific research: monograph / ed. Anita Jankovska. Riga : Izdevniecība "Baltija Publishing", 2022. P. 194–212. DOI: https://doi.org/10.30525/978-9934-26-195-4-23
6	Denysenko A, Danilchenko S, Stepanenko A, Chivanov V, Moskalenko R. A Comprehensive Study of Meningioma Biomineralization: Morphological, Crystallographic, and Immunohistochemical Aspects. <i>Microscopy and microanalysis : the official journal of Microscopy Society of America, Microbeam Analysis Society, Microscopical Society of Canada</i> . 2024; 30(2):392–400. https://doi.org/10.1093/mam/ozae020
7	Butsyk A, Varava Y, Moskalenko R, Husak Y, Piddubnyi A, Denysenko A, Korniienko V, Ramanaviciute A, Banasiuk R, Pogorielov M, Ramanavicius A, Korniienko V. Copper Nanoparticle Loaded Electrospun Patches for Infected Wound Treatment: From Development to In-Vivo Application. <i>Polymers</i> . 2024; 16(19):2733. https://doi.org/10.3390/polym16192733
Web-based and electronic resources	
1	https://www.abcam.com/tag/ihc%20protocols
2	https://www.sigmaaldrich.com/technical-documents/protocols/biology/immunohistochemistry-protocol.htm
3	http://www.philsci.univ.kiev.ua/biblio/Phil-science.pdf
4	https://www.eur.nl/en/media/2020-12-original-dilemma-card-game
5	https://europass.europa.eu/en/create-europass-cv
6	https://youth.europa.eu/go-abroad/working/how-write-good-cv-and-motivation-letter_en

COURSE DESCRIPTOR

№	Course Descriptor	Total hours	Classroom work, hours				Independent work of students, hours									
			Total hours	Lectures	Workshops (seminars)	Labs	Total hours	Self-study of the material	Preparation for workshops (seminars)	Preparation for labs	Preparation for assesment	Independent extracurricular tasks				
1	2					3	4	5	6	7	8	9	10	11	12	13
full-time course																
1	History and essence of scientific knowledge					2.5	2	0	2	0	0.5	0	0.5	0	0	0
2	The structure of scientific research					2.5	2	0	2	0	0.5	0	0.5	0	0	0
3	Methods of scientific research					2.5	2	0	2	0	0.5	0	0.5	0	0	0
4	Criteria for evaluating the methodological quality of research.					2.5	2	0	2	0	0.5	0	0.5	0	0	0
5	Ethics of scientific medical research and academic integrity					2.5	2	0	2	0	0.5	0	0.5	0	0	0
6	Scientific research in clinical practice.					2.5	2	0	2	0	0.5	0	0.5	0	0	0
7	Basics of biosafety of scientific research.					2.5	2	0	2	0	0.5	0	0.5	0	0	0
8	Basics of microscopy					2.5	2	0	2	0	0.5	0	0.5	0	0	0
9	Basic methods of biological tissue research: histology					2.5	2	0	2	0	0.5	0	0.5	0	0	0
10	Basic methods of biological tissue research: histochemistry					2.5	2	0	2	0	0.5	0	0.5	0	0	0
11	Basic methods of biological tissue research: immunohistochemistry.					2.5	2	0	2	0	0.5	0	0.5	0	0	0
12	Basic methods of researching biological samples: cytology.					2.5	2	0	2	0	0.5	0	0.5	0	0	0
13	General ideas about molecular biological research methods.					2.5	2	0	2	0	0.5	0	0.5	0	0	0
14	Statistical methods in scientific research.					2.5	2	0	2	0	0.5	0	0.5	0	0	0
15	Publication of scientific results					2.5	2	0	2	0	0.5	0	0.5	0	0	0
16	Funding of scientific research					2.5	2	0	2	0	0.5	0	0.5	0	0	0
17	Scientific career in Ukraine and the world.					2.5	2	0	2	0	0.5	0	0.5	0	0	0

1	2	3	4	5	6	7	8	9	10	11	12	13
18	Module	2.5	2	0	2	0	0.5	0	0.5	0	0	0
Assesment												
1	Graded Credit	6	0	0	0	0	6	0	0	0	6	0
Independent extracurricular tasks												
1	extracurricular tasks	39	0	0	0	0	39	0	0	0	0	39
<i>Total (full-time course)</i>		<i>90</i>	<i>36</i>	<i>0</i>	<i>36</i>	<i>0</i>	<i>54</i>	<i>0</i>	<i>9</i>	<i>0</i>	<i>6</i>	<i>39</i>

	UNIVERSITY POLICIES FOR THE COURSE «Fundamentals of scientific research in medicine» Higher education level The Second Level Of Higher Education, National Qualifications Framework Of Ukraine – The 7th Level, QF-LLL – The 7th Level, FQ-EHEA – The Second Cycle Major: Educational programme 222 Medicine: Medicine Form of study full-time course Language of instruction English
Teacher(s)	Moskalenko Roman Andriiovych, Hyriavenko Nataliia Ivanivna, Denysenko Anastasiia
Contact	Roman Moskalenko r.moskalenko@med.sumdu.edu.ua Anastasiia Denysenko a.denysenko@med.sumdu.edu.ua
Time and room for giving consultations	Department of Pathology, every Monday from 15:00 to 17:00. In the case of quarantine restrictions, according to the link indicated above.
Links to online educational platforms	Roman Moskalenko Join Zoom Meeting https://sumdu-edu-ua.zoom.us/j/8477545991?pwd=L2xHYjRUUi9lTEsvM1lYTtIjaFJjdz09 Meeting ID: 847 754 5991 Passcode: 3mdeXZ Anastasiia Denysenko https://meet.google.com/vjo-pyvr-ujc
Link to the syllabus in the course catalogue	https://pg.cabinet.sumdu.edu.ua/report/course/98b79437bbf9f123dedf-faa662c87c5d6090198
Communication tools	Mix.sumdu.edu.ua, e-mail, viber, WhatsApp

POLICIES

Academic integrity policy

All assignments specified in the syllabus must be completed by the student independently. Cheating during any type of assessment is prohibited. The work of a higher education student must not contain plagiarism, fabrication, falsification, or cheating. All written assignments are subject to a plagiarism check, followed by the instructor's analysis of the results in order to determine the correctness of references to textual and illustrative sources.

During the study of the course, other manifestations of academic dishonesty, as defined by the University Code of Academic Integrity, are also unacceptable.

In case of violations of academic integrity by a higher education student during the study of the course, the instructor has the right to take one of the following actions:

- reduce by up to 40% the number of points earned for a practical assignment;
- provide recommendations for revising a compulsory homework assignment with a reduction of the final score by up to 25%;
- not accept a compulsory homework assignment without granting the right to resubmit it;
- assign a retake of a written module or final assessment with a reduction of the final score by up to 15%;
- refuse to grant a retake of a written module or final assessment.

Policy on the use of artificial intelligence tools

The policy on the use of artificial intelligence tools is announced by the instructor at the beginning of the course.

The policy for the use of artificial intelligence tools (ChatGPT, Tome, etc.) is announced by the teacher at the beginning of the course.

Несанкціоноване використання інструментів штучного інтелекту є порушенням академічної

добросовісності.

Policy on the use of open access resources

When utilizing materials from open-access sources in the preparation of assignments specified in the syllabus, students must strictly adhere to the terms of the applicable Creative Commons licenses and ensure proper attribution in accordance with copyright regulations.

Attendance policy

Class attendance is mandatory. Under justified circumstances (e.g., illness, participation in academic mobility programs), studies may be conducted according to an individual schedule.

Policy on deadlines and retakes

The rescheduling of the assessment takes place in accordance with the practice schedule. With the permission of the dean's office, you can take credit during the academic year.

If the total number of points obtained as a result of all assessments corresponds to a passing grade (subject to the mandatory requirement of fulfilling all conditions specified in the syllabus and regulations), it is considered final; a passing grade may not be retaken for the purpose of improvement.

The elimination of academic debt is carried out in accordance with the Regulations on the Organization of the Educational Process of Sumy State University, taking into account the established deadlines, forms of assessment, and procedures for retaking assessment activities.

Policy on appealing assessment results

Appeals and consideration of applications from higher education students regarding the assessment of learning outcomes are carried out in accordance with the Regulations on the Organization of the Educational Process of Sumy State University.

Assessment criteria

The first semester of teaching

SA4. Performing situational exercises (preparation, presentation, defense), 10 scores	
5 (Excellent) <i>Outstanding performance without errors</i>	$170 \leq RD \leq 200$ 9-10 points
4 (Good) <i>Above the average standard but with minor errors</i>	$140 \leq RD < 169$ 7-8 points
3 (Satisfactory) <i>Fair but with significant shortcomings</i>	$120 \leq RD < 139$ 6 points
2 (Fail) <i>Fail – some more work required before the credit can be awarded</i>	$0 \leq RD < 119$ 0-5 points
SA3. Execution of a practical case (preparation, presentation, defense), 15 scores	
5 (Excellent) <i>Outstanding performance without errors</i>	$170 \leq RD \leq 200$ 13-15 points
4 (Good) <i>Above the average standard but with minor errors</i>	$140 \leq RD < 169$ 11-12 points
3 (Satisfactory) <i>Fair but with significant shortcomings</i>	$120 \leq RD < 139$ 9-10 points
2 (Fail) <i>Fail – some more work required before the credit can be awarded</i>	$0 \leq RD < 119$ 0-8 points
SA5. Carrying out a research task (preparation, presentation, defense), 15 scores	

5 (Excellent) <i>Outstanding performance without errors</i>	$170 \leq RD \leq 200$ 13-15 points
4 (Good) <i>Above the average standard but with minor errors</i>	$140 \leq RD < 169$ 11-12 points
3 (Satisfactory) <i>Fair but with significant shortcomings</i>	$120 \leq RD < 139$ 9-10 points
2 (Fail) <i>Fail – some more work required before the credit can be awarded</i>	$0 \leq RD < 119$ 0-8 points
SA1. Differentiated assessment, 80 scores	
5 (Excellent) <i>Outstanding performance without errors</i>	$170 \leq RD \leq 200$ 68-80 points
4 (Good) <i>Above the average standard but with minor errors</i>	$140 \leq RD < 169$ 56-67 points
3 (Satisfactory) <i>Fair but with significant shortcomings</i>	$120 \leq RD < 139$ 48-55 points
2 (Fail) <i>Fail – some more work required before the credit can be awarded</i>	$0 \leq RD < 119$ 0-47 points
SA2. Current assessment of theoretical training level, 80 scores	
5 (Excellent) <i>Outstanding performance without errors</i>	$170 \leq RD \leq 200$ 68-80 points
4 (Good) <i>Above the average standard but with minor errors</i>	$140 \leq RD < 169$ 56-67 points
3 (Satisfactory) <i>Fair but with significant shortcomings</i>	$120 \leq RD < 139$ 48-55 points
2 (Fail) <i>Fail – some more work required before the credit can be awarded</i>	$0 \leq RD < 119$ 0-47 points