

TARAS SHEVCHENKO NATIONAL UNIVERSITY OF KYIV

Educational scientific center «Institute of biology and medicine»

Department of Clinical Medicine

Department of Microbiology and Immunology

Department of Virology



EDUCATIONAL PROGRAM **CLINICAL MICROBIOLOGY, VIROLOGY AND IMMUNOLOGY**

for students

branch of knowledge 22 «Healthcare»

speciality 222 «Medicine»

educational level «Master»

educational program «Medicine»

type of discipline optional

Form of study	<u>daytime</u>
The academic years	<u>2023/2024</u>
Semester	<u>6</u>
ECTS credits	<u>3</u>
Language of teaching, learning, and evaluation	<u>English</u>
Form of the final control	<u>credit</u>

Instructors: Professor, ScD Skivka L.M., Associate Professor, PhD Korotieieva H.V., Associate Professor, PhD Rudyk M.P., Assistant Professor, PhD Siromolot A.A.

Prolonged: for 20__/20__ e.y. _____ (_____) «__» 20__
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(signature, name, date)

KYIV – 2023

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The work program of the discipline "Clinical Microbiology, virology and immunology" was considered and approved at the meeting of the Department of Microbiology and Immunology and the Department of Virology of the Educational and Scientific Center "Institute of Biology and Medicine".

Protocol № 14, «25» травня 2023
Head of the Department of Virology [Signature] Iryna BUDZANIVSKA
«25» травня 2023

Protocol № 17, «12» May 2023
Head of the Department of Microbiology and Immunology [Signature] Larysa SKIVKA
«17» 12.05 2023

Approved by scientific and methodical commission of Educational and Scientific Center "Institute of Biology and Medicine" of Taras Shevchenko National University of Kyiv.

Use of 100-point scale is approved

Protocol № 6, «20» 06 2023
Head of Scientific and Methodical Commission [Signature] Nataliia SKRYPNYK
«20» 06 2023

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1. The purpose of the discipline is to develop deep insight concerning the methodology of microbiological and virological diagnostics, as well as algorithm and methodology for the evaluation of immune reactivity in health and diseases.

The main tasks of studying the discipline "Clinical microbiology, virology and immunology" are:

- To expand knowledge on microbiological aspects of the etiology, pathogenesis, immunology of opportunistic infections and the development of methods for microbiological diagnosis, therapy and prevention of these diseases.
- To form of a system of knowledge of professional and practical skills of research work on the isolation and study of microorganisms that cause microbial complications.
- To familiarize with Vitek® Identification Cards techniques used to diagnosis of a wide range of clinically relevant organisms.
- To form a system of abilities and skills from the patterns of the infectious process caused by viruses.
- To familiarize with serological and molecular methods used to diagnose human viral infections.
- To explain the significance of immune reactivity fluctuations in the course of inflammatory diseases.
- To review in detail methodological issues in assessment of human immune function.
- To familiarize with flow cytometry techniques used to assess human immune reactivity.

2. Preliminary requirements for mastering or choosing the discipline:

1. The study of the discipline "Clinical microbiology, virology and immunology" is based on knowledge of the basic natural sciences disciplines: medical biology, medical and biological physics, biological and bioorganic chemistry, human anatomy, histology, cytology and embryology, microbiology, virology and immunology, Latin language and medical terminology, introduction to university studies and the history of medicine, philosophy with the basics of culturology and integrates with these disciplines.

2. The ability to apply knowledge of medical and general chemistry, bioorganic and biological chemistry, physiology, pathological physiology, internal diseases, bioethics, etc. educational disciplines for the solution of specific scientific and practical tasks; work with scientific and methodological literature.

3. Mastering elementary skills of system analysis.

4. Knowledge of the basic principles of general biological methods.

3. Annotation of the discipline:

The lecture topics of the discipline "Clinical Microbiology, Virology and Immunology " reveal the problematic issues of the relevant sections of microbiological, virological and immunological diagnostics approaches. Students studying the principles of microbiological and biochemical identification of *Enterobacteriaceae*, *Gram-positive Cocci*, *wound infections*, biological material sampling, collection and transportation, mechanisms of bacterial resistance to antibiotics, their clinical significance and ways to overcome, features of the clinical picture and pathogenesis of human viral infections at the cellular and organismal level,, immunogram structure in healthy persons and patients with inflammatory diseases, interpret and analyse flow cytometry histograms for the evaluation of quantitative and metabolic characteristics of immune reactivity, as well as use experiments recorded in movies, films submitted in computer programs and other educational technologies. Students are aimed to find solution of situational problems

(make up an algorithm for preanalytical and analytical stages for the diagnostics of bacterial and viral infections, evaluate patient immune status etc.) with an experimental and clinical-diagnostic orientation.

4. Course tasks (training goals):

1. Interpret the biological properties of opportunistic pathogens and patterns of their interaction with the host, the human population and the environment.
2. Master the basics methods of microbiological diagnostics and biochemical identification of opportunistic and nosocomial infections.
3. To form in the student modern ideas about the variety of forms and types of interaction of viruses and cells to determine the characteristics of cytopathic changes in viral infection;
4. To ensure the achievement of such competencies as the ability to use modern ideas about the clinical picture and features of pathogenesis to study the stages of viral infection in the human organism, the choice of diagnostic methods and differential diagnosis of viral infections;
5. To create an in-depth understanding of immune reactivity fluctuations in the course of inflammatory diseases.
6. To form a system of knowledge concerning the principles of immune reactivity evaluation for personalized, patient-tailoring monitoring, prognostication and diagnostics of inflammatory diseases.
7. To gain current concepts of the use of flow cytometry for the evaluation of patient immune status.

Competencies and study results. According to the requirements of the Standard of Higher Education of Ukraine (the second (master's) level of higher education, the branch of knowledge 22 "Healthcare", specialization 222 "Medicine") discipline ensures the acquisition of education of the following *competencies*:

integral: ability to solve complex problems, including research and innovation in the field of medicine. Ability to continue learning with a high degree of autonomy.

-general:

- GC01. The ability to think abstractly, analyze and synthesize;
- GC02. The ability to learn and master modern knowledge;
- GC03. The ability to apply knowledge in practical situations;
- GC04. Knowledge and understanding of the subject area and understanding of professional activity;
- GC05. The ability to adapt and act in a new situation;
- GC06. The ability to make informed decisions;
- GC07. The ability to work as a team;
- GC08. Interpersonal skills;
- GC09. Ability to communicate in English;
- GC10. Information and communication technology skills.
- GC11. Definition and perseverance of the tasks and responsibilities.
- GC12. Ability to act on the basis of ethical considerations.
- GC13. Awareness of equal opportunities and gender issues.

- special (professional, subject):

- SC02. Ability to determine the required list of laboratory and instrumental studies and evaluate their results;
- SC25. Adherence to professional and academic integrity, be responsible for the accuracy of scientific results.

5. Results of studying in a discipline:

Results of studying (1- Knowledge; 2- Skills; 3- Communication; 4- Autonomy and responsibility)		Forms (and /or methods and technologies) of teaching and learning	Methods of estimation	Percentage in the final evaluation of the discipline
Code	The results of education			
1	To know:			
1.1.	opportunistic pathogens, their biological characteristics, relationships with other microorganisms and host	Lectures, practical classes, Students' individual work	Written module control work №1; brief written tests, assessment of individual oral answers, written tests.	10
1.2.	pathomorphological changes and clinical picture of certain viral diseases of humans and animals. Methods of virus identification and diagnosis of human viral infections, methods of prevention and treatment of viral diseases.	Lectures, practical classes, Students' individual work	Written module control work №2; brief written tests, written tests, execution of practical work results in form of written exercises.	10
1.3	basic criteria, methodology, and interpretation of the evaluation of patient immune status	Lectures, practical classes, Students' individual work	Written module control work №3; brief written tests, written tests, execution of practical work results in form of written exercises.	10
2	To be able:			
2.1.	to use Vitek® Identification Cards for biochemical identification medically relevant Gram-positive and Gram-negative bacteria in a routine clinical laboratory practice	Lectures, practical classes, Students' individual work	Written module control work №1; assessment of individual oral answers, written tests.	20
2.2.	using serological and molecular biological assays in the laboratory identify the virus and determine the titer of the virus or specific serum.	Lectures, practical classes, Students' individual work	Written module control work №2; written tests, execution of practical work results in form of written exercises.	20
2.3	to use flow cytometry methods for the evaluation of patient immune status	Lectures, practical classes, Students' individual work	Written module control work №3; written tests, execution of practical work results in form of written exercises.	20
3	Communication			
3.1.	Discuss with expert,	Practical	Written tests, execution of	5

	describe patient immune status, identify medically relevant Gram-positive and Gram-negative bacteria, viruses, and make reasonable conclusions.	classes, Students' individual work	practical work results in form of written exercises, oral answers.	
4	Autonomy and responsibility			
4.1.	To be able to formulate assignment related with laboratory data; search, collect, analyze and apply scientific information in related area	Practical classes, Students' individual work	Written tests, execution of practical work results in form of written exercises, oral answers.	5

6. The ratio of the results of study of the discipline with the program learning outcomes

The results of study of the discipline (code)	1.1	1.2	1.3	2.1	2.2	2.3	3.1	4.1
	Program learning outcomes (name)							
PLO01. To have a thorough knowledge of the structure of professional activity. Be able to carry out professional activities that require updating and integration of knowledge. To be responsible for professional development, ability to further professional training with a high level of autonomy.	+	+	+	+	+	+	+	+
PLO02. To understanding and knowledge of basic and clinical biomedical sciences, at a level sufficient to solve professional problems in the field of health care.	+	+	+	+	+	+	+	+
PLO03. To specialized conceptual knowledge, which includes scientific achievement in the field of health care and is the basis for research, critical thinking in the field of medicine and related interdisciplinary problems.	+	+	+	+	+	+	+	+
PLO04. To select and identify the leading clinical symptoms (according to list 1); according to standard methods, using preliminary data of the patient's anamnesis, data of the patient's examination, knowledge of the person, his organs and systems, to establish a preliminary clinical diagnosis of the disease (according to list 2).	+	+	+	+	+	+	+	+
PLO05. To collect complaints, life history and disease, assess the psychomotor and physical development of the patient, the state of organs and systems of the body, based on the results of laboratory and instrumental studies to assess information about the diagnosis (list 4), taking into account the patient's age.	+	+	+	+	+	+	+	+
PLO07. To assign and analyze additional (mandatory and optional) methods of examination (laboratory, functional and/or instrumental) (according to list 4), patients with diseases of organs and systems of the body for differential diagnosis of diseases (list 2).	+	+	+	+	+	+	+	+
PLO18. To determine the state of functioning and limitations of a person's life and the duration of incapacity for work with the issuance of relevant documents in the health care institution on the basis of data on the disease and its course, features of professional activity, etc. Maintain medical records of the patient and the	+	+	+	+	+	+	+	+

population on the basis of regulatory documents.								
PLO21. To research for the necessary information in the professional literature and databases of other sources, analyze, evaluate and apply this information.				+	+	+	+	+
PLO23. To assess the impact of the environment on human health to assess the incidence of the population.	+	+	+	+	+	+	+	+
PLO25. To clearly and unambiguously communicate one's knowledge, conclusions and arguments on health issues and related issues to specialists and non-specialists.				+	+	+	+	+
PLO26. To manage health workflows that are complex, unpredictable and require new strategic approaches, organize the work and professional development of staff, taking into account the acquired skills of effective teamwork, leadership positions, good quality, accessibility and fairness, ensuring integrated health care.	+	+	+	+	+	+	+	+
PLO27. To be fluent in the State and English languages, both orally and in writing proficiency, to discuss professional activities, research and projects.	+	+	+	+	+	+	+	+
PLO28. To make effective decisions on health issues, assess the necessary resources, take into account social, economic and ethical implications.	+	+	+	+	+	+	+	+
PLO29. To plan, organize and conduct activities for the specific prevention of infectious diseases, including in accordance with the National Calendar of preventive vaccinations, both mandatory and recommended. Manage vaccine residues, organize additional vaccination campaigns, including immunoprophylaxis measures.	+	+	+	+	+	+	+	+

7. Student score and distribution scheme

7.1 Forms of examination:

- semester assessment:

1. Module control work 1 – RE 1.1, 2.1 (block of topics of Content module 1) – 10/ 5 points
2. Module control work 2 – RE 1.2, 2.2 (block of topics of Content module 2) – 10/ 5 points
3. Module control work 3 – RE 1.3, 2.3 (block of topics of Content module 3) – 10/ 5 points
4. Brief written tests – RE 1.1 - 1.3 – 10/ 5 points
5. Execution of practical work results in form of written exercises – RE 1.2,1.3, 2.2 – 4.1 – 20/ 10 points
6. Oral answers – RE 1.1, 2.1, 3.1, 4.1 – 10 / 5 points
7. Written tests – RE 1.1 - 4.1 – 30/ 15 points

- the final evaluation: in form of the credit

The total score from the educational component as a whole, the final form of examination for which the credit is established, is defined as a sum of scores (points) for all successfully evaluated learning outcomes during the semester (each grade of the educational component of the result of study below the minimum threshold 50% are not added to the final grade).

It is not allowed to retake the semester control works in order to improve the positive assessment.

In case of obtaining less than 60 points of the total final score two re-examinations are allowed. The form of the re-examination is complex test per 100 points.

7.2 Organization of evaluation:

Module control work 1, 2, 3 are carried out at the end of the thematic lectures and practical classes from Content modules 1, 2, 3, respectively. The assessments of practical work results in form of written exercises and written tests are carried out during practical classes from Content modules 1, 2, 3. The assessment of the brief tests on contemporary issues of microbiology, virology and immunology is carried out after the end of the thematic lectures and practical classes from Content modules 1, 2, 3.

The assessment of the oral answers is carried out during the semester, during practical classes on Content module 1.

7.3. Validity scale

Passed	60-100
Fail	0-59

8. The educational discipline structure.

To study the educational discipline there are 90 hours corresponding to 3 ECTS credits.

N	Title of topic	Hours		
		Lectures	Practical Classes	Self-studies
1	<u>MODULE 1. «CLINICAL MICROBIOLOGY»</u>			
2	<i>Content of the module 1. Spectrum of biological properties of microorganisms that cause microbial complications, nosocomial infections; principles of their laboratory diagnosis and study of sensitivity of clinical strains to antimicrobial drugs; basics of rational chemotherapy of bacterial complications.</i>	4	10	15
3	Lecture 1. Goals and methods of clinical microbiology. Modern algorithms for infectious diseases diagnosis. Epidemiology, etiology, clinical manifestations and features of microbiological diagnosis of nosocomial infections. Evolution of microorganisms that cause nosocomial infections	2		
4	Lecture 2. Treatment, prevention and epidemiological control of nosocomial infections. Current state and prospects of antimicrobial chemotherapy. Mechanisms of bacterial resistance to antibiotics, their clinical significance and ways to overcome. Modern methods for determining the sensitivity of microorganisms to antibacterial drugs.	2		

5	Class 1. Structure and organization of microbiological laboratories and preparation of material for research. Methods of biological material sampling and collection. <i>Lab work: Dental plaque microscopy research.</i>		2	
6	Class 2. Transportation and storage of samples for microbiological research. Types of culture transport media, carrying conditions. <i>Lab work: the impact of human skin microbiota on the exogenous culture of M.luteus with time point intervals.</i>		2	
7	Class 3. Microbiological diagnosis (biochemical identification) of intestinal infections and food poisoning (<i>Enterobacteria</i>). <i>Lab work: Description and analysis of previous lab work results (interaction of host skin flora on artificially added bacteria). Evaluation of Vitek Microbial Identification Test Card (GN) for Enterobacteria</i>		2	
8	Class 4. Microbiological diagnosis (biochemical identification) of bacteremia, sepsis, urinary tract and respiratory system infections caused by <i>Staphylococcus</i> and <i>Streptococcus</i> . <i>Lab work: Evaluation of Vitek Microbial Identification Test Card (GP) for Staphylococci and Streptococci.</i>		2	
9	Class 5. Microbiological diagnosis (biochemical identification) of wound and burn-origin infections (<i>Bacillus</i> and <i>Clostridium</i>). <i>Lab work: Evaluation of Vitek Microbial Identification Test Card (GP) for Bacillus and Clostridium</i>		1	
10	Issues for the self-instruction: Exogenous opportunistic infections. Iatrogenic infections. Oral microflora and its role in human pathology.			5
11	Issues for the self-instruction: Dysbiosis of the gut microbiota in disease: causes, consequences, methods of correction.			5
12	Issues for the self-instruction: Infectious agents of opportunistic mycoses			5
13	Module control work 1		1	
14	MODULE 2. «CLINICAL VIROLOGY»			
15	Content of the module 2. <i>Features of the clinical signs and symptoms and pathogenesis of human viral infections at the cellular and organismal level. Main syndromes of viral infection. Principles of diagnosis, prevention and chemotherapy.</i>	4	12	16
16	Lecture 3. The sequential steps in viral infection.	2		
17	Lecture 4. Viral Tropism. Virus–Host Interactions: Viral virulence. Viral persistence.	2		
18	Class 6. Viral respiratory infections. Basic pathogens, samples for testing, principles of diagnosis. Situational tests.		2	

19	Class 7. Viral infections of the gastrointestinal tract. Viral hepatitis. Basic pathogens, samples for testing, principles of diagnosis. Situational tests.		2	
20	Class 8. Viral infections of skin and mucosa. Basic pathogens, samples for testing, principles of diagnosis. Situational tests.		2	
21	Class 9. Viral infection of nervous system. Basic pathogens, samples for testing, principles of diagnosis. Situational tests.		2	
22	Class 10. Exotic and emerging viral infections. Basic pathogens, samples for testing, principles of diagnosis. Situational tests.		2	
23	Class 11. Congenital virus infection. Basic pathogens, samples for testing, principles of diagnosis. Situational tests.		1	
24	Issues for the self-instruction: Virus–Cell Interactions. Susceptibility of the host to viral diseases. Viral oncogenesis. Retroviruses. DNA-viruses.			5
25	Virus-induced immunopathology and immunosuppression. Sexually transmitted infections. HIV-infection. AIDS-associated infections.			5
26	Vector born infection. Nosocomial infection. Epidemiology, etiology, clinical manifestations and diagnosis. Problems of control, treatment and prevention of nosocomial infections.			6
27	Module control work 2		1	
28	MODULE 3. «CLINICAL IMMUNOLOGY»			
29	Content of the module 3. <i>Fluctuations of the immune reactivity in health (with age, sex-dependent, nutrition-dependent, microbiota-dependent) and diseases (infectious and inflammatory). Methodological approaches for the evaluation of general and antigen-specific immune reactivity.</i>	4	10	15
30	Lecture 5. Human immune system fluctuations in health and diseases.	2		
31	Lecture 6. Principles of the immunity to infection and antitumor immunity.	2		
32	Class 12. Algorithm of the evaluation of patient immune reactivity.		2	
33	Class 13. Basic principles of flow cytometry.		2	
34	Class 14. Flow cytometry methods for the assessment of phagocyte functions.		2	
35	Class 15. Flow cytometry methods for the assessment of lymphocyte functions.		2	
36	Class 16. Allergy testing.		1	

37	Issues for the self-instruction:			
38	Immunity to intracellular and extracellular bacteria			5
39	Antiviral and antifungal immunity			5
40	Immunity to parasites			5
41	Module control work 3		1	
42	TOTAL FOR THE DISCIPLINE	12	32	46

Total 90 hours include:

Lectures – 12 hours

Practise classes- 32 hours

Self-study – 46 hours

9. Recommended literature:

Main:

1. Yi-Wei Tang, Max Sussman, Dongyou Liu, Ian R. Poxton and Joseph D. Schwartzman. Molecular Medical Microbiology. 2nd ed. Academic Press Elsevier: Yi-Wei Tang, Andrew Sails; 2015. Volume 1-3. 2216 p. ISBN: 978-0-12-397169-2 (set)
2. F.H. Kayser, K.A. Bieiz, J.Eckert, R.M.Zinkernagel. Medical microbiology. Thieme. 2005. 724 p. ISBN:9781604061222
3. Nathanson N. 2 edition. Viral Pathogenesis and Immunity, Second Edition. 2007. - Academic Press; 280 p.
4. Clinical Virology, 4th Edition. Richman D. D., Whitley R. J., Hayden F.G. 2016. ASM Press.1489 p.
5. Clinical Immunology: Principles and Practic. Fifth ed. Edited by Robert R. Rich et all. Elsevier: 2019. 1392 p. <https://doi.org/10.1016/C2015-0-00344-6>
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Additional:

1. Rekalova O.M., Panasyukova O.R., Pogrebna M.V., Yasir S.G., Siromolot A.A., Romaniuk S.I., Kolybo D.V., Komisarenko S.V., Feshchenko Yu.I. Detection of specific antibodies using MPT83-MPT63 fusion protein in patients with destructive pulmonary tuberculosis. Proceedings of the Shevchenko Scientific Society. Medical Sciences, 2022; 69(2):40-49.

2. Siromolot A. A., Oliynyk O. S., Kolibo D. V., Komisarenko S. V. Mycobacterium tuberculosis antigens MPT63 and MPT83 increase phagocytic activity of murine peritoneal macrophages. Ukr. Biochem. J., 2016; 88(5): 62-70.
3. A.A. Siromolot, D.V. Kolibo. Putative target cells for Mycobacterium tuberculosis antigens MPT63 and MPT83. Research Journal of Pharmaceutical, Biological and Chemical Sciences, 2018; 9(2): 367-378.
4. Topley & Wilson's Principles of bacteriology, virology and immunity. – 8th ed. – Philadelphia Hamilton: B.C. Decker Inc, 1992. – Vol.3. – P.309 – 395, 437-449.
5. Dasgupta A., Wahed A. Clinical Chemistry, Immunology and Laboratory Quality Control. A Comprehensive Review for Board Preparation, Certification and Clinical Practice. 2nd ed, Elsevier: 2021. 440 p.
6. Chen B.S. Systems immunology and infection microbiology. Elsevier: 2021. 672 p.
7. Ribatti D. Immunology in the Twentieth Century. From Basic Science to Clinical Application. Elsevier: 2018. 156 p.
8. Oliynyk Z, Rudyk M, Dovbynchuk T, Dzubenko N, Tolstanova G, Skivka L. Inflammatory hallmarks in 6-OHDA- and LPS-induced Parkinson's disease in rats. Brain Behav Immun Health. 2023;30:100616. doi: 10.1016/j.bbih.2023.100616
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Web sources:

1. Microbiology and immunology on-line <http://www.microbiologybook.org/>
2. On-line microbiology note <http://www.microbiologyinfo.com/>
3. Centers for diseases control and prevention www.cdc.gov
4. Clinical Immunology Journal <https://www.sciencedirect.com/journal/clinical-immunology>
5. Introduction to Clinical Immunology https://www.youtube.com/watch?v=_oI0jVN4TTI
6. Journal of Clinical Virology <https://www.sciencedirect.com/journal/journal-of-clinical-virology>
7. International Journal of Clinical Virology <https://www.clinvirologyjournal.com/>