

**National Pirogov Memorial Medical University, Vinnytsya**

"APPROVE"

Acting rector of higher education institution



Viktoriia PETRUSHENKO

"31" August 2023 year

"AGREED"

Head of Human Physiology Department



Mykhailo YOLTUKHIVSKYY

"29" August 2023 year

**SYLLABUS  
of academic discipline**

**"NEUROPHYSIOLOGY"**

|                       |                                                                                                                                                                               |
|-----------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Specialty             | 222 Medicine                                                                                                                                                                  |
| Educational level     | the second (master`s) level                                                                                                                                                   |
| Educational programme | EPP Medicine, 2022                                                                                                                                                            |
| Academic year         | 2023-2024                                                                                                                                                                     |
| Department            | Normal Physiology                                                                                                                                                             |
| Lecturer              | Prof.of HEI Mykhaylo YOLTUKHIVSKYY                                                                                                                                            |
| Contact information   | <i>physiology@vnmu.edu.ua, Normal Physiology Department, National Pirogov Memorial Medical University, Vinnytsya, Pirogov`s st, 56 (morphological building), (0432)553732</i> |
| Syllabus compiler     | Assoc. prof. of HEI Oksana OMEL`CHENKO                                                                                                                                        |

## 1. Status and structure of the discipline

|                                                                            |                                                                                                                                                                                         |
|----------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Discipline status                                                          | Elective                                                                                                                                                                                |
| Discipline code in EPP/discipline place in EPP                             | EC 2.9, discipline of general training                                                                                                                                                  |
| Course / semester                                                          | 2nd year (IV semester)                                                                                                                                                                  |
| The discipline volume (the total number of hours / number of credits ECTS) | 60 /2 credits ECTS                                                                                                                                                                      |
| The discipline structure                                                   | Lectures - 14 hours<br>Practical classes 16 hours<br>Intermediate control -<br>Independent work -30 hours<br>Totally: classroom classes – 50 %, independent extracurricular work – 50 % |
| Number of modules                                                          | 1                                                                                                                                                                                       |
| Number of content modules                                                  | 3                                                                                                                                                                                       |
| Language of study                                                          | English                                                                                                                                                                                 |
| Form of study                                                              | Full-time (or remote full-time by order)                                                                                                                                                |

## 2. Description of the discipline

### Short annotation of the course, relevance.

The program subject direction is to study the regularities of functions and processes in the holistic organism and its parts (systems, organs, tissues, cells), mechanisms and patterns of the body life at different stages of ontho- and phylogeny in interaction with the environment in the dynamics of life processes; the program is focused on obtaining knowledge of the regularities of functions and processes in the integral body and its parts, depending on the conditions of its stay, on the state of regulatory processes, depending on the load level, analysis of the causes and mechanisms of functional and metabolic deviations in the functioning of the organism organs and systems under changing the conditions of the external environment; forming practical skills: to apply natural and scientific knowledge at the patient's bed; evaluate the functioning of various organs and systems of the organism, interpret the state of regulatory processes, depending on the level of physical activity, analyze the causes and mechanisms of functional and metabolic deviations in the functioning of organs and systems of the organism under changing the environment; to provide natural and scientific substantiation of the principles of an individual approach to the patient, the main provisions of medicinal ethics and medical deontology, psychoprophylaxis and psychotherapy.

**Prerequisites.** Educational discipline "Neurophysiology" is based on studying by students of Medical Biology, Latin Language, Ethics, Philosophy, Ecology, Medical and Biological Physics, Medical Chemistry, morphological disciplines and integrates with these disciplines.

**The purpose of the course and its significance for professional activities.** The purpose of the "Neurophysiology" discipline is to study the functions of various cells, tissues, organs and systems as a whole in order to use the acquired knowledge in the study of the following medical disciplines, and in future professional activities. Physiology is the base to understand the concept of health, a healthy lifestyle and prevention of dysfunctions in the process of life.

**Postrequisites.** Physiology is the basis for studying by students of such disciplines of professional training as Pathophysiology, Pathomorphology, Deontology and Propaedeutics of clinical disciplines, which involves integrating teaching with these disciplines and the formation

of skills in the use of Physiology in the process of further education and professional activities; studying of neurophysiology is of particular importance for laying the basics of knowledge on nervous diseases; it lays the foundations of a healthy lifestyle and prevention of violations of the structure and functions in the process of life.

**3. Learning outcomes. After successful study of the discipline the applicant will be able to:**

1. formulate conclusions about the state of physiological functions of the body, its central and peripheral nervous system;
2. analyze the age characteristics of the nervous system functions and their regulation;
3. analyze adjustable parameters and draw conclusions about the mechanisms of nervous regulation of the physiological functions of the body and its systems;
4. interpret the mechanisms and patterns of functioning of the nervous system; to explain the value of sensory processes in the reflex regulation of functions;
5. analyze the mechanisms of integrative activity of the nervous system;
6. work with laboratory animals (assessment of stem reflexes);
7. perform and evaluate the reflexes of the human spinal cord;
8. perform and evaluate cerebellum testing in humans;
9. register and analyze the EEG.

**4. Content and logistic of the discipline**

|                                      |                                     |                                                                             |
|--------------------------------------|-------------------------------------|-----------------------------------------------------------------------------|
| <b>Module 1.<br/>Neurophysiology</b> | IV semester<br>60 hours / 2 credits | Lectures № 1-7<br>Practical classes №№ 1-8<br>Topics for self- study №№ 1-3 |
|--------------------------------------|-------------------------------------|-----------------------------------------------------------------------------|

The course includes 18 topics, which are divided into 3 thematic modules.

**Module 1. Neurophysiology.**

Theme 1. Subject and tasks of neurophysiology. Methods of neurophysiological research. Mechanisms of excitation transmission in chemical synapses. Electric synapses.

Theme 2. Contribution of scientists of Ukraine to the development of neurophysiology.

Theme 3. The role of the spinal cord in the regulation of motor functions. Clinically important reflexes.

Theme 4. Mechanisms of excitation and inhibition in the central nervous system.

Theme 5. Reflexes of the spinal cord in newborns.

Theme 6. The role of the brain stem in the regulation of motor functions.

Theme 7. Multilevel regulation of muscle tone. Role of different structures of CNS.

Theme 8. Functions of reticular formation.

Theme 9. The role of the strio-palidal system and the cerebellum in the regulation of motor functions.

Theme 10. Functions of thalamus relay nuclei.

Theme 11. Functions of the hypothalamus.

Theme 12. Structural and functional organization of the cerebral cortex.

Theme 13. Characteristics of motor disorders in case of damage to the cerebellum.

Theme 14. Functions of the cortex of large hemispheres. Characteristics of the projection and associative areas of the cortex. EEG analysis.

Theme 15. History of development of methods for studying the functions of the cortex of large hemispheres.

Theme 16. Modern methods of studying the functions of the cortex of large hemispheres. Study of electrical activity of the cerebral cortex. Method of the induced potentials.

Theme 17. Characteristics of the centers of speech in the cortex of large hemispheres.

Theme 18. Formation and development of language in the child.

Theme 19. Characteristics of the limbic system of the brain. The role of the structures of the limbic system in the regulation of vegetative functions and the organization of behavioral reactions.

The lecture course discovers the problematic issues of the relevant sections of Neurophysiology. Practical classes provide:

1) practical work on the study of neurophysiological functions of the human body; in particular, the study of clinically important reflexes of the spinal cord, registration and analysis of electroencephalogram (EEG); reviewing and analyzing records of the induced potentials of brain structures; demonstration of neural activity records in acute and chronic experiments performed at the department;

2) evaluation of the results of clinical and laboratory studies; solving physiological situational problems of experimental and clinical direction.

In practical classes, students write down protocols of their research in workbooks, make a summary on the topic and solve clinically-oriented situational tasks and tests.

The student's independent work involves preparation for practical classes and development of practical skills, study of topics for independent extracurricular work, preparation of presentations, tables, processing of scientific literature and writing reviews of the provided topics for individual work. Control of mastering the topics of independent extracurricular work is carried out at intermediate control classes and final control of the discipline.

Thematic plans of lectures, calendar plans of practical classes, thematic plan of independent extracurricular work, volume and directions of individual work are published on the site of the department.

The route for obtaining materials: Human Physiology Department / for students / Full-time education / medicine / 2 course / Educational materials / or through the link <https://www.vnmue.edu.ua/> Human Physiology Department#. Access to the materials is carried out through the student's corporate account [s000XXX@vnmue.edu.ua](mailto:s000XXX@vnmue.edu.ua).

### 5. Forms and methods of monitoring academic performance

|                                                                                             |                                                                                                                                                                                                                                             |
|---------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Current control in practical studies                                                        | Methods: oral or written survey, testing, electronic survey, solving situational problems, conducting laboratory studies, interpreting them and evaluating their results (drawing up a protocol in a workbook)                              |
| Control of mastering the thematic section of the discipline at intermediate control classes | Methods: oral or written questioning, electronic testing, solving situational problems, control of practical skills                                                                                                                         |
| Final semester control (credit) at the end of 3 and 4 semesters                             | According to the Regulation of the Academic process in VNMU named after M.I. Pirogov (link <a href="https://www.vnmue.edu.ua/General">https://www.vnmue.edu.ua/General</a> information)                                                     |
| Final control of the Physiology discipline - ( <i>exam</i> )                                | Methods: pre-examination testing, oral questioning (according to the Regulation of the Academic process in VNMU named after M.I. Pirogov (link <a href="https://www.vnmue.edu.ua/General">https://www.vnmue.edu.ua/General</a> information) |
| Learning success diagnostic tools                                                           | Theoretical questions, tests, clinically-oriented situational tasks, practical tasks, practical skills demonstration                                                                                                                        |

### 6. Assessment criteria

Knowledge assessment is carried out in accordance with the Regulations of the Academic process in VNMU named after M.I. Pirogov (link <https://www.vnmue.edu.ua/General> information)

|                                 |                                                                                                                                                                                                                                                                                                                                               |
|---------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Continuous assessment           | On a four point system of traditional assessments:<br>5 «excellent», 4 «good», 3 «satisfactory», 2 «unsatisfactory»                                                                                                                                                                                                                           |
| Midpoint separation assessment  | On a four-point system of traditional assessments                                                                                                                                                                                                                                                                                             |
| Control of practical skills     | According to the four-point system of traditional assessments                                                                                                                                                                                                                                                                                 |
| Pass-fail exam (credit)         | On a 200-point scale (the arithmetic average grade for the semester is converted into points)<br>Credited: 122 to 200 points<br>Not credited: less than 122 points (See Grading Scale)                                                                                                                                                        |
| Final control of the discipline | Sum of points for pre-examination testing (12-20 points) and oral questioning (38-60 points)<br>Final exam grade:<br>71-80 points - "excellent"<br>61-70 points - "good"<br>50-60 points - "satisfactory"<br>Less than 50 points - "unsatisfactory" / did not pass                                                                            |
| Discipline assessments:         | Current academic assessment - from 72 to 120 points (conversion of the average traditional assessment of practical class on a 120-point scale): 60% of the grade for the discipline<br>Final control - from 50 to 80 points: 40% of the grade for the discipline<br>Individual work - from 1 to 12 points<br>From 122 to 200 points in total. |

### Discipline Score Scale: National and ECTS

| The sum of grades for all types of educational activities | Score ECTS | Score on a national scale                                   |                                                            |
|-----------------------------------------------------------|------------|-------------------------------------------------------------|------------------------------------------------------------|
|                                                           |            | For exam, course project (work), practice                   | for credit test                                            |
| 180-200                                                   | <b>A</b>   | excellent                                                   | credited                                                   |
| 170-179,9                                                 | <b>B</b>   | good                                                        |                                                            |
| 160-169,9                                                 | <b>C</b>   |                                                             |                                                            |
| 141-159,9                                                 | <b>D</b>   | satisfactory                                                |                                                            |
| 122-140,99                                                | <b>E</b>   | satisfactory                                                |                                                            |
| 61-121,99                                                 | <b>FX</b>  | unsatisfactory with the possibility of reassembly           | is not credited with the possibility of reassembling       |
| 1-60                                                      | <b>F</b>   | unsatisfactory with a mandatory reexamination of discipline | is not credited with mandatory reexamination of discipline |

## Criteria for student knowledge assessment

### Assessment of oral / written response during the current assessment

The grade "**excellent**" is given to a student who has deeply and comprehensively mastered the theoretical material, competently and logically teaches it. He is fluent in Latin terminology, clearly answers non-standard questions on the topic of the lesson, is able to link the material of the topic with previously studied sections, which indicates knowledge of the recommended literature and the ability to analyze the material studied, and clearly demonstrates the importance of theoretical knowledge for practice medicine

The grade "**good**" is given to a student who knows and has a good theoretical material, teaches it correctly, does not allow inaccuracies in the answer, is able to reveal the topic from the standpoint of its medical significance and practical application, but the answers do not go beyond the textbook, guidelines.

A grade of "**satisfactory**" is given to a student who knows the basic concepts and definitions of the studied topic, but admits significant inaccuracies or has difficulty in formulating the answer, does not understand the medical aspects of the topic, can not relate theoretical material to practice.

The grade "**unsatisfactory**" is given to a student who does not know the theoretical foundations of the topic, makes gross mistakes in answering, does not understand the basic concepts and definitions, can not explain the importance of theoretical material for practical medicine.

### Assessment of practical skills during the current assessment

The grade "**excellent**" is given to a student who knows the course and sequence of independent practical work to perform a practical task, finds the best options for setting up a physiological experiment, demonstrates the correct implementation of the necessary practical skills, and correctly formulates generalizations and conclusions, draws up a protocol.

A grade of "**good**" is given to a student who admits inaccuracies in the performance of physiological practice, but is able to identify errors and can demonstrate the implementation of practical skills in general, carefully draws up research results in the protocol of the practical lesson.

Assessment of "**satisfactory**" is given to a student who knows the basics of the practical task, but has difficulty at performing physiological practice, can not demonstrate the correct sequence of practical skills, can not fully interpret the results of research, sloppy protocol.

The grade "**unsatisfactory**" is given to a student who cannot demonstrate the performance of practical skills, experiences significant difficulties in performing physiological practice, violates the procedure for performing practical work, does not register the progress of work in the protocol.

### Evaluation of testing during the current assessment

The grade "**excellent**" is given to the student who at carrying out test control is allowed no more than 10% of incorrect answers (volume of correct answers 90-100%). Provides correct answers to all test questions when solving clinically-oriented test tasks.

A grade of "**good**" is given to a student who makes no more than 20% of mistakes during the test (volume of correct answers 80-89%). Provides correct answers to most test questions when solving clinical-oriented test tasks.

The grade "**satisfactory**" is given to a student who makes mistakes in no more than 40% of test tasks (the amount of correct answers is 60.5-79%). When solving clinically-oriented test tasks, it provides the correct answers to only some questions to the test.

A grade of "**unsatisfactory**" is given to a student who correctly solves less than 60% of the test tasks in a test survey. When solving clinical-oriented test tasks, he cannot provide the correct answers to the test questions.

### **Assessment of intermediate control (credit)**

Intermediate control is credited if the student has mastered a certain section of the discipline in full, as evidenced by the current assessment of each practical lesson, and attended a lecture course. To assess the intermediate control, the calculation of the arithmetic average mark of the traditional assessment for the semester is performed.

The calculation of individual points is carried out on the basis of the Regulation of the Academic process in VNMU named after M.I. Pirogov (link [https://www.vnmu.edu.ua/General information](https://www.vnmu.edu.ua/General-information)).

12 points - added to the assessment of the discipline for a student who won a prize at the interuniversity competitions in the discipline or a prize at the Ukrainian competition of student research reports or a prize at the interuniversity / international scientific conference with the published work;

11 points - are added to the assessment of the discipline for a student who won the first prize at the intra-university Olympiad in the discipline or the first place at the student scientific conference with the published work, or participated in the Ukrainian competition of student research papers;

10 points - are added to the assessment of the discipline for a student who won a prize (II-III) at the intra-university Olympiad in the discipline or at the student scientific conference with the availability of printed work; or for participation (without a prize place) in interuniversity competitions in the discipline or a prize place in an interuniversity / international scientific conference with the availability of published work.

9 points - are added to the assessment of the discipline for a student who participated (without a prize) in the intra-university Olympiad in the discipline or student scientific conference with the presence of published work

8 points - are added to the assessment of the discipline for a student who actively participated in the student scientific group, published a paper with results of scientific and practical research, but did not personally participate in the student scientific conference, prepared a poster report.

6-7 points - are added to the assessment of the discipline for a student who has made at least 20 smears or at least 3 tables, or an educational video to replenish the visual support of teaching the discipline (taking into account the volume and importance of work performed).

### **7. Policy of discipline / course**

The student has the right to receive high-quality educational services, access to contemporary scientific and educational information, qualified tutoring during the study of discipline and mastering practical skills. The policy of the department during the providing of educational services is a student-centered, based on normative documents of the Ministry of Education and the Ministry of Health of Ukraine, the Statute of the University and the Procedure for the Providing of Educational Services regulated by the main principles of the organization of the

educational process in VNMU named after M.I.Pirogov and the principles of academic integrity ( link <https://www.vnmue.edu.ua/General> information).

### **Adherence to the rules of VNMU, safety techniques in practical classes, rules of conduct at the signal "AIR ALARM"**

At the "AIR ALARM" signal, students must quickly take their belongings and go down to the shelter. During the descent, behave with dignity, with endurance. Stay in the bomb shelter with the teacher during the entire time of the air raid. After its completion, return to the classroom (if the lesson time is not over).

Observance of the rules of the VNMU regulations, safety precautions at practical classes. Instruction on safety of using electrical equipment and handling chemical reagents is conducted at the first practical lesson by the teacher. The instructed students are registered in the Safety Instruction Journal.

### **Requirements for preparation for practical classes.**

The student should be prepared for a practical lesson, testing tasks for the current topic should be solved in a workbook, diagrams and tables are filled.

A student should come to class on time, without delay. A student who is more than 10 minutes late is not allowed to the practical class and must work it in the prescribed manner.

In practical classes, the student must be dressed in a work uniform (medical gown). Students who do not have a work uniform are not allowed to practice.

The student must follow the rules of safety in practical rooms and at the department.

When discussing theoretical issues, students should demonstrate tolerance, courtesy and respect for their colleagues and the teacher; when performing practical tasks, the workplace should be kept in order and be cleaned after performing practical work.

**Lectures are not held in the lecture hall.** The material of lectures (from the entire course) is presented on the website of the department.

### **Usage of mobile phones and other electronic devices.**

The use of mobile phones and other electronic devices in the classroom is allowed only during electronic testing.

**Academic integrity.** When studying the discipline, the student must be guided by the Code of Academic Integrity and Corporate Ethics of VNMU named after M.I. Pirogov (link : <https://www.vnmue.edu.ua/General> information)/ Code of Academic Integrity).. In case of violation of the norms of academic integrity during the current and final controls student receives a grade of "2" and must work it out to his teacher in the prescribed manner within two weeks after receiving an unsatisfactory assessment).

**Missed classes.** Missed classes are working out in the manner prescribed by Regulations of the Academic process in VNMU named after M.I. Pirogov (link <https://www.vnmue.edu.ua/General> information) at the time of work out schedule (published on the website of the department <https://www.vnmue.edu.ua/> Department of Physiology #) to the teacher on duty. To work out missed lesson student must provide a completed workbook protocol on the relevant topic, take a test and answer questions in writing or orally to the topic of the lesson. The reworking of missed lectures is carried out after providing a thesis of lecture material, or writing an abstract, or preparing own presentation on the topic of missed lecture.

**The procedure for admission to the discipline final control** is given in the Regulation of the Academic process in VNMU named after M.I. Pirogov (link <https://www.vnmue.edu.ua/General> information). Students who do not have missed practical classes and lectures and received an average traditional grade of at least "3" are allowed to final control.

**Additional points.** Individual points in the discipline that student can receive for individual work, is determined by the results of his individual work according to Regulation of the Academic process in VNMU named after M.I. Pirogov (link <https://www.vnmue.edu.ua/General> information) and policy of the course.

**Conflict resolution.** In case of misunderstandings and complaints to the teacher because of the quality of educational services, knowledge assessment and other conflict situations, student should submit his / her claims to the teacher. If the issue is not resolved, the student has a right to apply to the head of the department according to Complaints Consideration Procedure (<https://www.vnmue.edu.ua/> General information / Basic documents).

**Politics in terms of remote learning.** Distance learning regulated by the Regulations of the elements of remote learning in VNMU named after Pirogov M.I. (<https://www.vnmue.edu.ua/> General information). The main training platforms for studying are Microsoft Team and Google Meets. Practical classes and lectures, exercises and consultations during distance learning are published on the website of the department (<https://www.vnmue.edu.ua/> Department of Physiology / Student or [https://www.vnmue.edu.ua/Department of Physiology / News](https://www.vnmue.edu.ua/Department%20of%20Physiology%20-%20News)).

**Feedback** from teachers is via messengers (Viber, Telegram, WhatsApp) or e-mail (at the teacher's choice) during working hours.

## 8. Educational resources.

Educational and methodological support of the discipline is published on the website of the department (<https://www.vnmue.edu.ua/> Department of Normal physiology/ To students).

### 1). Recommended literature:

1. Guyton A.C., Hall J.E.: Textbook of Medical Physiology, 14th ed. Saunders.- 2021.- 1120 p.
2. Moroz V.M., Shandra O.A., Vastyanov R.S., Yoltukhivsky M.V., Omelchenko O.D. Physiology : Textbook / Edited by V.M.Moroz, O.A.Shandra. – 5th edition. – Vinnytsia: Nova Knyha Publishers, 2020. –728 p.
3. William F. Ganong Review of Medical Physiology.- 2011.- 782 p.
4. Linda S. Costando Physiology (Board Review Series).- 2018, 280 p.
5. Stuart Ira Fox Human Pysiology .- 2018, 832 p.
6. V.M.Moroz, M.V.Yoltukhovsky O.D.Omelchenko, O.V.Bogomaz, I.V.Gusakova, O.O.Nikolaenko O.V.Vlasenko PHYSIOLOGY// Study Guide of the Practical Course for the students of Medical faculty. Module 3: Physiology of the Digestion, Metabolism, Thermoregulation, Excretion. Vinnitsia – 2019.- 30p.
7. PHYSIOLOGY Handbook for the students of medical faculty, Part 1: General Physiology// Moroz V.M., Yoltukhivsky M.V., Omel'chenko O.D., Suprunov K.V., Dovgan' O.V., Shapoval O.M., Bogomaz O.V. - Vinnitsa-2014. – 60p.
8. Neurophysiology HANDBOOK for the students of medical faculty, Module-1. Vinnitsia-2022, 30p. V.M.Moroz, M.V.Yoltukhivskyy, O.V.Dovgan', O.D.Omelchenko, O.V.Bogomaz, Gusakova I.V., Rokunets I.L., Kostyuk L.V.

### 2). Electronic resources:

1. The university website: <http://www.vnmue.edu.ua>
2. The Normal Physiology department website: <http://www.vnmue.edu.ua/department> of normal physiology
3. The university library website <http://library.vsmu.edu.ua>
4. Index search engines  
<http://www.altavista.com>  
<http://www.askjeeves.com>  
<http://www.excite.com>
5. Medical thematic-subject catalogs  
<http://www.einet.net/galaxy/Medicine.html>

<http://healthweb.org>

6. Special medical information search systems

<http://www.kfinder.com>

<http://www.medwebplus.com>

In English:

Dr. Najeeb Lectures <https://www.youtube.com/channel/UCPHpx55tgrbm8FrYYCflAHw>

MEDCRAM- Medical Lectures explained clearly

<https://www.youtube.com/user/MEDCRAMvideos>

<https://pubmed.ncbi.nlm.nih.gov/>

4). Presentations of lectures, methodical recommendations for practical classes and ISWs. Consultations (twice a week in accordance with the schedule of consultations)

**9. The timetable and distribution of groups** with assigned teachers are published on the web page of the department (<https://www.vnm.edu.ua> / Department of Human physiology / To students).

**10. Questions to the intermediate and final semester control (credit) of the discipline** are published on the web page of the department (<https://www.vnm.edu.ua> / Department of Human physiology / To students).

The syllabus of the discipline "Neurophysiology" was discussed and approved at the meeting of the Normal Physiology department (record № 1, dated "29" August 2023)

Responsible for the academic discipline "Neurophysiology"



Docent Omel'chenko O.D.  
(signature)

Head of the Human Physiology department



Prof. Yoltukhivskyy M.V.  
(signature)