

MINISTRY OF HEALTH OF UKRAINE
ODESA NATIONAL MEDICAL UNIVERSITY
Department of Pharmaceutical Chemistry and Drug Technology

Syllabus of the educational discipline
"Pharmaceutical chemistry"

Scope of the educational discipline	Total hours per discipline: 390 hours, 13 credits. Semesters: V – IX. 3, 4, 5 years.
Days, time, place of the academic discipline	According to the schedule of classes. Department of Pharmaceutical Chemistry. Odesa, st. Marshal Malinovskyi, 37.
Teacher (-s)	Gelmboldt Volodymyr. doctor of chemical science, professor, head of the department. Docent, PhD. Lozhichevska Tatyana. Senior Lecturer Nikitin Oleksii. Assistants: PhD Holubchyk Khrystyna, Shyshkin Ivan, Lytvynchuk Iryna, Ulizko Igor.
Contact Information	Help by phones: Nikitin Oleksii, head teacher of the department 067-485-11-06 Klyvniak Iryna, senior laboratory assistant 0487779828 E-mail: pharmchemistry@onmedu.edu.ua Face-to-face consultations: from 2:00 p.m. to 5:00 p.m. every Thursday, from 9:00 a.m. to 2:00 p.m. every Saturday. Online consultations: from 4:00 p.m. to 6:00 p.m. every Thursday, from 9:00 a.m. to 2:00 p.m. every Saturday. The link to the online consultation is given to each group during the classes separately.

COMMUNICATION

Communication with applicants will be conducted in the classroom (face-to-face).

During distance learning, communication is carried out through the Microsoft Teams platform, as well as through e-mail correspondence, Viber messengers (through groups created in Viber for each group, separately through the head of the group), Telegram.

ABSTRACT OF THE EDUCATIONAL DISCIPLINE

Subject of discipline study – chemical structure of medicinal products, their physical and chemical properties; the relationship between chemical structure and

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action on the body, methods of quality control and changes occurring during storage and metabolism, as well as methods of obtaining and purifying medicinal products, biologically active compounds and their metabolites.

Prerequisites: to study the course, students need basic knowledge of inorganic chemistry, analytical chemistry, organic chemistry, physical and colloidal chemistry, physics with the basics of metrology, pharmacology, biological chemistry, normal physiology, pathological physiology, toxicological chemistry, pharmacognosy, drug technology, clinical pharmacy, standardization of medicinal means.

Postrequisites: lays the foundations for students to study and pass Industrial practice in pharmaceutical chemistry, as well as for passing state certification.

Goal – to provide systematic knowledge about the structure of medicinal products, methods of their extraction, identification and quantification, physical, physico-chemical and chemical properties, chemical factors of pharmacological action, patterns of relationship between structure - biological/pharmacological activity and metabolic transformations, purity research, application and storage, as well as approaches to the creation of new synthetic drugs and biologically active substances.

Tasks of the discipline: acquiring skills in the field of providing high-quality pharmaceutical care to patients, taking into account knowledge of the physical, physico-chemical and chemical properties of drugs, the main laws of structure-activity dependence, avoiding possible interaction of drugs in the process of their manufacture and use, establishing the good quality of individual drugs, their multicomponent mixtures and ensuring their proper storage, acquiring knowledge of basic methods of synthesis of medicines or extraction from natural raw materials; in the field of pharmaceutical analysis.

Expected results:

As a result of studying the educational discipline, the applicant must:

- *Know:* to know the chemical and pharmacological classification of medicines; to know the international non-proprietary names of medicinal substances and the preparations of which they are a part; to know the basic regularities of the "structure-activity" relationship, approaches to adequate replacement of medicinal products; to know the main ways of drug metabolism, the optimal conditions for the action of prodrugs; to know the most common dangers of chemical interactions of drugs with each other and with food products, which can impair bioavailability, safety and effectiveness; to know the chemical bases of the rational use of medicines; to know the state regulation of the quality of medicinal products; to know the methods of qualitative and quantitative analysis of medicinal products; to know the qualitative analysis of cations and anions; to know elemental analysis and analysis by functional groups; to know the functional analysis of organic compounds by functional groups; to know chemical titrimetric methods of analysis; to know chromatographic methods of identification, gravimetric method of analysis; to know the methods of purity research; to know methods of prevention and express determination of possible falsification of medicines.
- *Be able:* to be able to determine whether a medicinal product belongs to a

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pharmacological group, taking into account the chemical structure, to make recommendations regarding the possible replacement of a medicinal product within a pharmacological group; to be able to provide qualified pharmaceutical care to patients taking into account the physical, physico-chemical and chemical properties of medicinal products; to be able to determine the possible interaction of medicinal products when they are used together and provide recommendations on how to prevent it; to be able to provide information to the patient about the possible unwanted effect of food on the medicinal product; to be able to determine the optimal conditions for the storage of medicines; to be able to provide recommendations to the pharmacist during the manufacture of medicinal products regarding possible chemical incompatibility and ways to avoid it; be able to use analytical documentation that regulates the quality of medicinal products (State Pharmacopoeia, International Pharmacopoeia, national and regional pharmacopoeias, QCT, relevant orders and instructions); to be able to use industry standards, methodological guidelines when implementing methods of quality control of substances and medicinal products; to be able to use chemical, physical, physico-chemical methods in quality control of medicinal products; to be able to choose and perform express methods of qualitative and quantitative analysis of dosage forms of internal pharmacy production; to be able to give a qualified assessment of the quality of medicinal products according to the results of the analysis.

- *to master skills*: the ability to abstract thinking, analysis and synthesis, the ability to learn and be modernly educated; knowledge and understanding of the subject area and understanding of professional activity; ability to apply knowledge in practical situations; the ability to communicate in the state language; ability to adapt and act in a new situation; with determination and persistence in relation to assigned tasks and assumed responsibilities.

DESCRIPTION OF THE EDUCATIONAL DISCIPLINE

Forms and methods of education. The course will be taught in the form of lectures (50 hours) and practical classes (180 hours), organization of students' independent work (160 hours).

Teaching methods are used during practical classes: multimedia presentation is used in lectures; in practical classes - educational methodical materials, situational tasks, individual tasks, laboratory equipment, to test acquired knowledge and skills - test and calculation tasks, for independent work a list of necessary literary sources is provided.

Content of the education discipline

Topic 1. Subject and tasks of pharmaceutical chemistry. The system of evaluation of the quality of medicinal products.

Topic 2. Identification of medicinal substances of inorganic nature.

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Topic 3. Identification of medicinal substances of organic nature by functional groups (functional analysis).

Topic 4. Reasons for changes in the structure of the medicinal substance (influence of light, moisture, temperature and other factors. The nature and character of impurities, methods of their detection.

Topic 5. Methods of quantitative analysis of the content of medicinal products. Gravimetry.

Topic 6. Titrmetric methods of quantitative analysis of medicinal products. Determination of nitrogen in organic compounds.

Topic 7. Analysis of physico-chemical properties of medicinal products as one of the elements of quality assessment of medicinal products.

Topic 8. The use of spectroscopic and chromatographic methods in the identification of medicinal products; peculiarities of using standard samples of medicinal substances and standard spectra.

Topic 9. Chromatographic methods. Methods based on thermodynamic properties of substances. Combination of extraction, chromatographic and optical methods in the analysis of dosage forms.

Topic 10. Optical methods in the quantitative analysis of medicinal products.

Topic 11. Express analysis of medicines. Modern trends in the development of pharmaceutical analysis.

Topic 12. Express analysis of monocomponent medicines.

Topic 13. Express analysis of multicomponent medicinal products.

Topic 14. Express analysis of medicines. Analysis of an unknown medicinal product.

Topic 15. Principles of classification of medicinal products, their nomenclature. Structure-activity relationship in the creation and analysis of medicinal products. Stages of creation of medicines.

Topic 16. Main ways of drug metabolism. Chemical reactions that underlie metabolic transformations. Phases of metabolism. Factors affecting metabolic processes. Prodrugs.

Topic 17. Nonsteroidal anti-inflammatory drugs. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of obtaining, methods of analysis, application in medicine.

Topic 18. Narcotic analgesics and their analogues. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of obtaining, methods of analysis, application in medicine.

Topic 19. Sleep aids. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.

Topic 20. Means for anesthesia. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.

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Topic 21. Psychotropic drugs. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.

Topic 22. Anticonvulsant and antiepileptic drugs. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.

Topic 23. Means for the treatment of parkinsonism. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.

Topic 24. Emetics and antiemetics. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.

Topic 25. Antitussives. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.

Topic 26. Nootropic drugs. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.

Topic 27. Antihistamines. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.

Topic 28. Means affecting the afferent nervous system. Means that stimulate receptors of afferent nerve fibers. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.

Topic 29. Means that reduce the sensitivity of afferent nerve fibers. Means for local anesthesia. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.

Topic 30. Means affecting the efferent nervous system. Means acting on cholinergic processes. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.

Topic 31. Means acting mainly on adrenergic processes. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.

Topic 32. Cardiogenic means. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.

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Topic 33. Antiarrhythmic drugs. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.

Topic 34. Means that improve blood supply to organs and tissues. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.

Topic 35. Peripheral vasodilators. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.

Topic 36. Antagonists of calcium ions. Activators of potassium channels. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.

Topic 37. Means affecting the renin-angiotensin system Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.

Topic 38. Hypotensive and hypertensive drugs. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.

Topic 39. Angioprotectors. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.

Topic 40. Antioxidants. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.

Topic 41. Hypolipidemic means. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.

Topic 42. Diuretics. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.

Topic 43. Agents affecting platelet aggregation and blood coagulation. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.

Topic 44. Antiseptic and disinfectants. Characteristics, classification, mechanism of action, methods of preparation, methods of analysis, application in medicine.

Topic 45. Antibiotics of heterocyclic structure. β -lactamase inhibitors. Characteristics, classification, relationship between structure and action, mechanism of action, methods of preparation, methods of analysis, application in medicine.

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Topic 46. Tetracycline and macrolide antibiotics. Characteristics, classification, relationship between structure and action, mechanism of action, methods of preparation, methods of analysis, application in medicine.

Topic 47. Antibiotics of the aminoglycoside structure, amphenicols, other groups of antibiotics. Characteristics, classification, relationship between structure and action, mechanism of action, methods of preparation, methods of analysis, application in medicine.

Topic 48. Derivatives of 8-oxyquinoline, quinoxaline and nitrofurane. Characteristics, classification, relationship between structure and action, mechanism of action, methods of preparation, methods of analysis, application in medicine.

Topic 49. Sulfanilamides. Characteristics, classification, relationship between structure and action, mechanism of action, methods of preparation, methods of analysis, application in medicine.

Topic 50. Anti-tuberculosis drugs. Characteristics, classification, relationship between structure and action, mechanism of action, methods of preparation, methods of analysis, application in medicine.

Topic 51. Derivatives of naphthyridine and quinolone carboxylic acids. Characteristics, classification, relationship between structure and action, mechanism of action, methods of preparation, methods of analysis, application in medicine.

Topic 52. Medicines used for the treatment of oncological diseases (alkylating agents, antimetabolites, alkaloids, antibiotics, hormonal agents and their antagonists, other groups). Characteristics, classification, relationship between structure and action, mechanism of action, methods of preparation, methods of analysis, application in medicine.

Topic 53. Examples of "targeted" anticancer drugs (drugs of different chemical groups). Characteristics, classification, relationship between structure and action, mechanism of action, methods of preparation, methods of analysis, application in medicine.

Topic 54. Antiviral means. Characteristics, classification, relationship between structure and action, mechanism of action, methods of preparation, methods of analysis, application in medicine.

Topic 55. Antifungal drugs. Characteristics, classification, relationship between structure and action, mechanism of action, methods of preparation, methods of analysis, application in medicine.

Topic 56. Antimalarial drugs. Characteristics, classification, relationship between structure and action, mechanism of action, methods of preparation, methods of analysis, application in medicine.

Topic 57. Medicines for the treatment of protozoan infections. Characteristics, classification, relationship between structure and action, mechanism of action, methods of preparation, methods of analysis, application in medicine.

Topic 58. Anthelmintics. Characteristics, classification, relationship between structure and action, mechanism of action, methods of preparation, methods of analysis, application in medicine.

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Topic 59. Antipediculosis and acaricidal means. Characteristics, classification, methods of preparation, methods of analysis, application in medicine.

Topic 60. Medicinal products for thyroid hormones, antithyroid drugs. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.

Topic 61. Medicines of pancreatic hormones, characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.

Topic 62. Antidiabetic drugs. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.

Topic 63. Steroid hormones. Corticosteroids. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.

Topic 64. Androgens, anabolic steroids and their analogues. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.

Topic 65. Progestogens, estrogens. Birth control. Estrogens of nonsteroidal structure. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.

Topic 66. Water-soluble vitamins. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.

Topic 67. Fat-soluble vitamins. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.

Topic 68. Medicinal products affecting immunity processes (immunotropic agents). Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.

Topic 69. Anorexigenic means. Sorbents, antidotes and complexons. Anti-ulcer drugs. Means for the treatment of alcoholism. Characteristics, classification, relationship between structure and pharmacological action, mechanism of action, methods of preparation, methods of analysis, application in medicine.

Topic 70. Radiopaque and other diagnostic tools. Characteristics, classification, mechanism of action, methods of preparation, methods of analysis, application in medicine.

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Recommended literature list:

Basic:

1. Handbook of pharmaceutical chemistry Vol. 117 / L. Ohannesian, Antony J. Streeter. 2016. – 582 p.
2. Pharmaceutical Chemistry I – Laboratory Experiments and Commentary / Attila Almási, Zsuzsanna Rozmer, Pál Perjési. 2014. – 179 p.
3. Introduction to Pharmaceutical Chemical Analysis / S. Hansen, S. Pederson-Bjergaard, K. Rasmussen. 2012. – 496 p.
4. Chemical Analysis Modern Instrumentation Methods and Techniques 2nd Edition / F. Rouessac, A. Rouessac. 2007. – 599 p.
5. Pharmaceutical drug analysis / Addis Ababa. 2005. – 554 p.
6. Analytical Chemistry Series / John M., Chalmers, Alan J. Handley. 2003. – 384 p.
7. HANDBOOK OF MODERN PHARMACEUTICAL ANALYSIS Vol. 3 / Satinder Ahuja, Stephen Scypinski. 2001. – 587 p.
8. European Pharmacopoeia 10th. 2019. – 4255 p.

Additional:

1. Державна Фармакопея України : в 3 т. / ДП «Український науковий фармакопейний центр якості лікарських засобів». – 2-е вид. – Х. : Державне підприємство «Український науковий фармакопейний центр якості лікарських засобів», 2015. – Т. 1. – 1128 с.
2. Державна Фармакопея України : в 3 т. / ДП «Український науковий фармакопейний центр якості лікарських засобів». – 2-е вид. – Х. : Державне підприємство «Український науковий фармакопейний центр якості лікарських засобів», 2014. – Т. 2. – 724 с.
3. Державна Фармакопея України : в 3 т. / ДП «Український науковий фармакопейний центр якості лікарських засобів». – 2-е вид. – Х. : Державне підприємство «Український науковий фармакопейний центр якості лікарських засобів», 2014. – Т. 3. – 732 с.
4. Фармацевтична хімія / П.О. Безуглий, В.А. Георгіянци, І.С. Гриценко, І.В. та ін.: за ред. П.О. Безуглого. – Вінниця: Нова книга, 2017. – 456 с.
5. Фармацевтична хімія. Загальна та спеціальна фармацевтична хімія. Лікарські засоби неорганічної природи: лабораторно-практичні заняття. Навчальний посібник / Л.Г. Мішина. – Вінниця: ПП «ТД «Едельвейс і К»», 2010. – 384 с.

EVALUATING

Forms and methods of current control: oral survey, testing, evaluation of practical skills, problem solving.

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Current evaluation criteria in practical training

Evaluation	Evaluation criteria
“5”	The applicant takes an active part in the discussion of the most difficult questions on the topic of the lesson, gives at least 90% correct answers to standardized test tasks, answers written tasks without errors, performs practical work and issued a protocol.
“4”	The applicant participates in the discussion of the most difficult questions on the topic, gives at least 75% correct answers to standardized test tasks, makes some minor mistakes in the answers to written tasks, performs practical work and draws up a protocol.
“3”	The applicant participates in the discussion of the most difficult questions on the topic, gives at least 60% correct answers to standardized test tasks, makes significant mistakes in answers to written tasks, performs practical work and draws up a protocol.
“2”	The applicant does not participate in the discussion of complex questions on the topic, gives less than 60% correct answers to standardized test tasks, makes gross mistakes in answers to written tasks or does not give answers to them at all, does not perform practical work and does not draw up a protocol.

Forms and methods of final control: the applicant is admitted to the exam on the condition that the requirements of the educational program are met and if he received at least 3.00 points for the current educational activity and passed the test control of the "STEP-2" tests with at least 90% (50 tasks).

The test control is held in the Educational and Production Complex of Innovative Technologies of Learning, Informatization and Continuous Education of ONMedU in the last session on the eve of the exam.

Possibility and conditions of obtaining additional (bonus) points: not provided.

INDEPENDENT WORK OF HIGHER EDUCATION ACQUIRES

Independent work involves preparation for each practical session.

EDUCATIONAL DISCIPLINE POLICY

The policy on deadlines and rescheduling corresponds to the general rules at ONMedU. Absences of classes for non-respectable reasons will be worked out

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according to the schedule of the teacher on duty. Absences for valid reasons are worked out according to an individual schedule with the permission of the dean's office.

Observance of academic integrity by applicants is mandatory, namely: Independent performance of all types of work, tasks, forms of control provided for by the work program of this educational discipline; references to sources of information in the case of using ideas, developments, statements, information; compliance with the legislation on copyright and related rights; provision of reliable information about the results of one's own educational (scientific) activity, used research methods and sources of information.

Attendance and Tardiness Policy:

Uniform: a medical gown that completely covers the outer clothing.

Equipment: notebook, pen.

State of health: applicants suffering from acute infectious diseases, including respiratory diseases, are not allowed to attend classes.

A student who is late for a class can attend it, but if the teacher has put "nb" (absent) in the journal, he must complete it in the general order.

Use of mobile devices:

Mobile devices may be used by students with the permission of the instructor if they are needed for the assignment.

Behavior in the audience:

The behavior of applicants and teachers in the classrooms must be working and calm, strictly comply with the rules established by the Regulations on academic integrity and ethics of academic relations at Odessa National Medical University, in accordance with the Code of Academic Ethics and University Community Relations of Odessa National Medical University, Regulations on Prevention and detection of academic plagiarism in research and educational work of students of higher education, scientists and teachers of Odessa National Medical University.