Chapter 1

PHARMACEUTICAL EDUCATION IN UKRAINE AND THE EUROPEAN UNION: A COMPARATIVE PERSPECTIVE

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INTRODUCTION

The relevance of the study. It is evident that the current situation in Ukraine with regard to opportunities for obtaining pharmaceutical education is somewhat extraordinary. The training of specialists for the pharmaceutical sector of the healthcare industry is overseen by higher education institutions (HEIs) which are subordinate to both the Ministry of Health of Ukraine (MoH) and the Ministry of Education and Science of Ukraine (MES). Conventionally, training for the pharmaceutical industry is provided by higher education institutions (HEIs) that are subordinate to the Ministry of Education and Science, with the exception of the National University of Pharmacy (Kharkiv), which is subordinate to the Ministry of Health. Concurrently, other higher education institutions operating under the jurisdiction of the Ministry of Health are responsible for the training of specialists, with a predominant focus on roles within pharmacies and wholesale (intermediary) pharmaceutical companies[1]. Prior to 2022, the educational process for all applicants was conducted within a single specialty, designated 226 “Pharmacy, Industrial Pharmacy”, without the delineation of specialisations. Following the approval of the higher education standard in 2022, two distinct specialisations were introduced: 226.01 “Pharmacy” and 226.02 “Industrial Pharmacy”. Since 2025, the specialty code has also been changed to I8 “Pharmacy (by specialization)”. However, the name has remained the same for both areas of training. Simultaneously, the prevailing higher education standard (HES) has been sanctioned exclusively for the second tier of higher education, designated as the master’s level[2,3]. The standard for the third (Doctor of Philosophy) level

[1] Закон України «Про освіту». URL: http://zakon5.rada.gov.ua/laws/show/2145-19

[2] Постанова Кабінету Міністрів України «Про затвердження переліку галузей знань і спеціальностей, за якими здійснюється підготовка здобувачів вищої освіти» від 29.04.2015 р. № 266. URL: http://zakon4.rada.gov.ua/laws/show/266-2015-п

has not yet been approved, and as a result, training at this level is carried out in a single specialty without division into specializations.

Prior to the implementation of the SPE in 2022, specialists in the pharmaceutical industry in Ukraine received their training at two distinct levels: the first (bachelor's), and second (master's)[4,5].

Consequently, Ukraine is characterised by a distinctive scenario in which educational programmes for these applicant categories function concurrently:

The initial level of education, designated as the bachelor's degree, continues to be administered within the framework of the higher education institutions (HEIs) that are directly under the jurisdiction of the Ministry of Education and Science. This certification remains valid until the conclusion of the 2025/2026 academic year[6].

The second level of education is referred to as the master's level. It is intended for students who have successfully completed a bachelor's degree.

The second (master's) level of education is intended for applicants who were admitted in 2023 under the cross-cutting educational and scientific programme (CESP) following the establishment of the Higher Education Institution (HEI).

The third level of higher education is designated as the Doctor of Philosophy (PhD) programme.

The distinctiveness of the four educational models with analogous programmes in the European Union (EU) presents a potential avenue for a comparative analysis, which would allow for the exploration of regulatory requirements for pharmaceutical education across these models[7,8]. For

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[3] Постанова Кабінету Міністрів України 4 «Про затвердження Порядку здійснення єдиного державного кваліфікаційного іспиту для здобувачів освітнього ступеня магістра за спеціальностями галузі знань «Охорона здоров'я» від 28.03.2018 р. № 33. URL: https://zakon.rada.gov.ua/laws/show/212-2018-%D0%BF

[4] Постанова Кабінету Міністрів України «Про атестацію здобувачів ступеня фахової передвищої освіти та ступенів вищої освіти на першому (бакалаврському) та другому (магістерському) рівнях у формі єдиного державного кваліфікаційного іспиту» від 19.05.2021 р. № 497. URL: https://zakon.rada.gov.ua/laws/show/497-2021- %D0%BF

[5] Наказ Міністерства охорони здоров'я України «Про затвердження Переліку спеціалізацій підготовки здобувачів вищої освіти ступеня магістра за спеціальністю 226 «Фармація, промислова фармація» від 04.04.2022 р. № 621. URL: https://zakon.rada.gov.ua/laws/show/z0436-22

[6] Національний класифікатор України: Класифікатор професій ДК 003:2010. URL: https://zakon.rada.gov.ua/rada/show/va327609-10

[7] Методичні рекомендації щодо розроблення стандартів вищої освіти. Затверджені Наказ Міністерства освіти і науки України від 01.06.2017 р. № 600 (у редакції наказу Міністерства освіти і науки України від 30.04.2020 р. № 584. URL: https://mon.gov.ua/storage/app/media/vyshcha/naukovo-metodychna_rada/2020-metodrekomendacziyi.docx

[8] Fip statement of policy on good pharmacy education practice URL: https://www.fip.org/file/1518

instance, in the Republic of Poland, an applicant must first obtain a basic education in Pharmacy at a medical (pharmaceutical) university and then continue their studies for two more years at the Jagiellonian University (Krakow, Poland) to obtain a qualification as a specialist in industrial pharmacy. France is distinguished from the majority of EU countries by the existence of a bachelor's degree programme in Pharmacy. This enables a pertinent comparison to be made with Ukrainian higher education institutions (HEIs) that offer the first (bachelor's) educational level[9,10].

The objective of this study is to undertake a comparative analysis of educational programmes in the field of pharmacy at varying levels of training in higher education institutions in Ukraine and those of EU countries, according to the following criteria: the duration of the programmes, the number of ECTS credits, tuition fees, and the list of compulsory and elective components by year of study[11].

The research materials comprise the educational programmes (EPs) of Ukrainian higher education institutions (HEIs) and selected individual EU HEIs, which have been organised according to educational levels.

The research methods employed included field and desk research, observation and comparison methods.

1. Comparative analysis of educational programs in the field of pharmacy at the third (Doctor of Philosophy) educational level of Ukrainian and EU HEIs

A comparative analysis of third-level (PhD) education was conducted, given that accreditation of educational programmes in Ukraine commences at this level, and the absence of accreditation can result in the closure of a given specialty. The comparison focused on the 2024 Doctoral Education and Professional Program (EPP) in specialty 226 "Pharmacy, Industrial Pharmacy" at Lviv Polytechnic National University (HEI-1) and the Jagiellonian University in Krakow, Poland (HEI-2).

The selection of Jagiellonian University was made on the basis of its prestigious reputation and its robust pharmaceutical education system, which is in alignment with EU directives. In Poland, the pharmaceutical training programme is a structured 5.5-year integrated master's programme (330

[9] WFME Global Standards for Quality improvement: Basic Medical Education, WFME Global Standards for Quality improvement URL: https://wfme.org/wp-content/uploads/2020/12/WFME-BME-Standards-2020.pdf

[10] Standards for PhD Education in Biomedicine and Health Sciences in Europe. URL: https://orpheus-med.org/wp-content/uploads/2021/11/ORPHEUSAMSE-WFME-standards-for-PhD-education.pdf

[11] Стандарти та рекомендації щодо забезпечення якості в Європейському просторі вищої освіти (ESG). URL: https://ihed.org.ua/wpcontent/uploads/2018/10/04_2016_ESG_2015.pdf

ECTS) with theoretical and practical components, including a 6-month internship[12]. The Jagiellonian University offers a two-year postgraduate programme in industrial pharmacy, the successful completion of which leads to the award of a postgraduate qualification. The programme is designed to equip students with the applied skills required for roles within the pharmaceutical industry, including R&D, quality control, regulatory affairs and GMP production. The comparison criteria for HEI-1 and HEI-2 are outlined in Table 1.

Table 1

Criteria and Characteristics for Comparative Analysis of the Third (Doctor of Philosophy) Level of Education of HEI-1 and HEI-2

Evaluation Criteria	**HEI-1 Lviv Polytechnic National University**	**HEI-2 Jagiellonian University (Republic of Poland)**
Code, specialty name	8.226.00.00 Pharmacy, industrial pharmacy	Farmacja Przemysłowa / Nauki Farmaceutyczne
Qualifications	Doctor of Philosophy in Pharmacy, Industrial Pharmacy	Doktor nauk farmaceutycznych (PhD in Pharmaceutical Sciences)
Year of entry	2024	2024
Form of study	full-time form	full-time form
Program duration	4 years	4 years
Institute	Відділ докторантури та аспірантури	Szkoła Doktorska Uniwersytetu Jagiellońskiego
Number of credits	60 credits	144 credits
Qualification level in accordance with the National Qualifications Framework, European Qualifications Framework for Lifelong Learning	NQF Level 8 (third cycle of the EHEA, eighth level of the EQF) Educational and research program with research components	EQF Level 8 / ISCED 2011 Level 8 Doctoral research program with professional orientation
Field of expertise	Healthcare	Nauki medyczne i nauki o zdrowiu (Medical and health sciences)
Special conditions for admission	Interview, professional exam and foreign language exam	Clear specialization and structured scientific support

[12] International Standard Classification of Education (ISCED 2011): UNESCO Institute for Statistics. URL: http://uis.unesco.org/sites/default/files/documents/international-standard-classificationof-education-isced-2011-en.pdf

Table 1 (continuance)

Specific mechanisms for recognizing prior learning	Provided that the previous level was obtained in another country, nostrification is required, which is carried out by Lviv Polytechnic Support for prior learning Individual educational and scientific trajectory, taking into account prior training.	Recognition of the diploma through the procedure of qualification approval in accordance with the requirements: Ustawy Prawo o szkolnictwie wyższym i nauce (Law "On Higher Education and Science") Admission to doctoral studies is based on the analysis of an academic portfolio and an interview
Requirements and rules for obtaining a qualification, requirements for completing the curriculum	Full completion of the curriculum and public defense of the dissertation in a specialized academic council.	Completion of the curriculum (144 credits), internship, defense of the dissertation before the doctoral committee
Academic mobility	Academic mobility is regulated by the Resolution of the Cabinet of Ministers of Ukraine No. 579 of 12.08.2015 "On Approval of the Regulation on the Procedure for Exercising the Right to Academic Mobility"; participation in programs Erasmus+, NAWA	Extensive mobility opportunities (Erasmus+, CEEPUS, NAWA programs), credit and research results upon return
Other features of the program	The dissertation defense is realized in Ukrainian and/or English.	Scientific discipline: Nauki farmaceutyczne (Pharmaceutical sciences)
Cost of training	Depends on the terms of the contract and the form of financing	Free training is available for EU citizens on a competitive basis

The Educational and Scientific Program (EPP) of Lviv Polytechnic National University at the third (PhD) level is oriented towards the development of theoretical, methodological, and applied foundations of pharmaceutical chemistry. The programme places particular emphasis on contemporary trends in the design of potential medicinal agents, thus providing a solid foundation for those wishing to pursue academic and research careers. It integrates a broad spectrum of modern approaches

in pharmaceutical chemistry, forming a robust platform for scientific inquiry.

Graduates are expected to demonstrate the following:

The ability to competently execute pharmacognostic analysis methods in accordance with the stipulated analytical and regulatory documentation is paramount.

It is imperative to comprehend the Ukrainian pharmaceutical legislation that governs the development, registration, production, and quality control of medicinal products. The possession of the following competencies is requisite for the role: proficiency in the identification and development of pharmaceutical agents, encompassing the processes of screening, structure optimisation, and preclinical evaluation. The ability to apply advanced analytical methods (qualitative, quantitative, purity testing, identification), select appropriate methodologies, and critically evaluate data is paramount. The possession of practical skills in the setting up and operation of key laboratory instruments, the interpretation of results, and the comparison of analytical techniques is essential. The capacity to conduct independent scientific research and design quality control protocols for herbal raw materials and phytopreparations is essential. This includes the preparation of draft pharmacopoeial monographs. The ability to demonstrate proficiency in sophisticated organic synthesis techniques pertinent to the development of innovative therapeutic agents. The application of physicochemical research methods for the structural elucidation and analysis of pharmaceutical substances. A comprehensive understanding of the following subjects is required: pharmaceutical formulation, clinical trials, registration processes, production standards, and rational use of medicines. The programme incorporates research internships that are conducted under bilateral agreements with Ukrainian technical universities and partner institutions within the EU Erasmus+ framework. Graduates are equipped for roles in pharmaceutical research, quality assurance, regulatory affairs, and industrial drug development[13,14].

At Jagiellonian University, the domain of Medical and Health Sciences encompasses the field of Farmacja Przemyslowa, which is classified under the scientific discipline of Pharmaceutical Sciences, as delineated in the national classification system overseen by the Ministry of Science and Higher Education of Poland[15]. The system has been harmonised with the

[13] The European Qualifications Framework: Supporting Learning, Work and CrossBorder Mobility. URL: http://www.ehea.info/Upload/TPG_A_QF_RO_MK_1_EQF_Brochure.pdf

[14] QF-EHEA – Qualification Framework of the European Higher Education Area. URL:http://www.ehea.info/Upload/document/ministerial_declarations/EHEAParis2 018_Communique_AppendixIII_952778.pdf

[15] Фармація (UJ-bs-pl-Farmacja) URL: https://studyforyou.info/uk/specialities/farmacja-uj-bs-pl

European Qualifications Framework (EQF), ensuring comparability across EU member states.

As demonstrated in Table 2, a detailed comparison of the curriculum components of HEI-1 and HEI-2 EPPs at PhD level is presented, with a focus on the elements taught by semester.

Table 2

Educational components of the HEI -1 and HEI-2 by semesters of study at the third (doctoral) educational level

Semesters of study	Educational components	
	HEI-1 Lviv Polytechnic National University	**HEI-2 Jagiellonian University (Republic of Poland)**
Semester 1	Required subjects 1. Foreign language for academic purposes, part 1 (3 credits) 2. Methods of fine organic synthesis (4 credits) 3. Modern methods of identification of organic compounds (3 credits) 4. Philosophy and methodology of science (3 credits) Total per semester 13 credits	1. Academic Writing in English (3 credits) 2. Research Methodology in Pharmaceutical Sciences (4 credits) 3. Ethics in Science and Bioethics (3 credits) 4. Modern Instrumental Methods in Drug Analysis (4 credits) Total per semester 14 credits
Semester 2	Required subjects 1. Foreign language for academic purposes, part 2 (3 credits) 2. Methods of pharmacognostic analysis and quality control of medicinal plant raw materials (4 credits) 3. Professional pedagogy (3 credits) Total per semester 10 credits	1. Scientific Communication and Conference Skills (3 credits) 2. Pharmaceutical Biotechnology (4 credits) 3. Fundamentals of Academic Teaching (3 credits) 4. Advanced Pharmacognosy (3 credits) Total per semester 13 credits
Semester 3	Required disciplines 1. Academic entrepreneurship 2. Pedagogical practice Selective disciplines of the general training cycle 1. Academic integrity and quality of education 2. Open scientific practices 3. Business foreign language 3. Methodology of preparation of scientific publications Psychology of creativity and invention 4. Rhetoric	Doctoral Research Project, Publications, Mobility, Final Defence

Table 2 (continuance)

	5. Modern ingenuity in scientific research activities 6. Technology of registration of applications for grants and patent rights 7. Management of scientific projects 8. Quality of higher education (formation of internal quality assurance systems)	
Semester 4	Elective disciplines of the professional training cycle 1. Biopharmaceutical aspects of drug side effects 2. Biopharmaceutical aspects of drug side effects 3. Use of drugs in clinical practice (in-depth study of pharmacotherapy) 4. High-molecular compounds as components of pharmaceutical systems with controlled release of the active substance 5. Clinical and pharmaceutical foundations of drug development (principles of searching for new drugs, research of new drugs, implementation in medical practice) 6. Marketing tools for analyzing the pharmaceutical market 7. Pharmaceutical analysis methods 8. Good practices in pharmacy (good manufacturing practices, good clinical practices, good clinical practices, good distribution practices) 9. Regulatory support for the registration of new drugs 10. Quality assessment of medical and pharmaceutical technologies (quality of drugs, quality of treatment) 11. Pharmaceutical biochemistry Total for 3 and 4 semesters 37 credits Total for the year 60 credits	Doctoral Research Project, Publications, Mobility, Final Defence Total for 3rd and 4th semester 117 credits Total for the year 144 credits

A comparative analysis of third-level (Doctor of Philosophy) educational and scientific programmes at the National University "Lviv Polytechnic" (Ukraine) and the Jagiellonian University (Republic of Poland) reveals both shared features and distinct differences. While both programmes align with Level 8 of the National Qualifications Frameworks (NQF) and the European Qualifications Framework (EQF), they diverge in terms of structure, duration, and pedagogical approaches.

At Lviv Polytechnic, the programme is spread over four semesters and comprises 60 ECTS credits, with a primary focus on core subjects in pharmaceutical chemistry, scientific methodology, and pedagogy. A substantial proportion of the academic workload is dedicated to individual research and dissertation work, reflecting a conventional academic model.

Conversely, the Jagiellonian University offers a two-semester programme totalling 144 ECTS credits, which is structured to support international mobility and interdisciplinary research. The curriculum has been designed to include a broader array of academic disciplines, promote flexible research pathways, and emphasise integration into the European educational and research landscape.

It is evident that while the Ukrainian programme adheres to a conventional model predicated on foundational professional training and concentrated research, the Polish counterpart is indicative of a more contemporary, Europeanised framework with an augmented emphasis on academic communication, mobility, and systematic doctoral supervision. These findings suggest a potential direction for the evolution and harmonisation of Ukrainian doctoral programmes in alignment with EU best practices.

2. Comparative analysis of the second (master's) and first (bachelor's) level of education in the specialty of pharmacy in higher education institutions of Ukraine and EU countries

Prior to 2022, the Ukrainian higher education system did not formally differentiate between clinical and industrial pharmacy. Both of these subjects were encompassed within a single specialty, designated as "226 Pharmacy, Industrial Pharmacy." The introduction of distinct specialisations (226.01 – Clinical Pharmacy and 226.02 – Industrial Pharmacy) occurred only with recent reforms in higher education. In contrast, the Polish model differentiates these fields through program content, study pathways, and postgraduate education.

This structural distinction in Poland is indicative of a more flexible and labour market-oriented approach. The Polish system permits unambiguous specialisation following foundational training, thus facilitating targeted professional development in either clinical or industrial pharmacy. Ukraine, in contrast, is currently undergoing a process of transition and alignment with

European educational standards. In this context, the Jagiellonian University can be regarded as an effective model for the organisation of postgraduate pharmaceutical education, offering a framework that could inform the modernisation of Ukrainian programmes in accordance with the European Higher Education Area (EHEA) and EU pharmaceutical sector demands.

Consequently, the Jagiellonian University was selected as a reference institution for further comparative analysis. A comparative review was conducted at the second (master's) level between the EPPs of Lviv Polytechnic National University (HEI-1) and Jagiellonian University (HEI-2), both for the 2024 admission cycle (see Table 3).

Table 3

Criteria and characteristics for conducting a comparative analysis of the second (master's) level of education of HEIs-1 and HEIs-2

Evaluation criteria	**HEI-1 Lviv Polytechnic National University**	**HEI-2 Jagiellonian University (Republic of Poland)**
Code, name of specialty	3.226.00.00 Pharmacy, industrial pharmacy	Farmacja
Qualification:	Master of Pharmacy, Industrial Pharmacy	Magister farmacji
Year of enrolment	2024	2024
Form of study	full-time education	full-time education
Program duration	1 year 9 months	5.5 years (integrated master's program)
Institute	Institute of Chemistry and Chemical Technology	Faculty of Pharmacy Collegium Medicum
Number of credits	120 ECTS credits	330 ECTS credits
Qualification level according to the National Qualifications Framework, the European Qualifications Framework for Lifelong Learning	NQF level 7 (second cycle of the EHEA QF, seventh level of the EQF)	EQF level 7 (second cycle)
Discipline	Healthcare	Nauki medyczne i nauki o zdrowiu
Special admission conditions	None	Admission based on secondary education, centralized exams (Matura)

Table 3 (continuance)

Specific mechanisms for the recognition of prior learning	Provided that the previous level was obtained in another country, nostrification is required, which is carried out by Lviv Polytechnic	Diploma recognition through NAWA or according to the procedure uczelni
Requirements and rules for obtaining qualifications, requirements for completing the curriculum	Complete completion of the curriculum and public defense of the dissertation at a specialized academic council	Enrollment in all modules + passing the state exam and internship in a pharmacy
Academic mobility	None, but mobility is encouraged and recognized according to ECTS procedures	Full implementation of the curriculum, completion of professional practice, state certification
Other features of the program	MCR protection is implemented in Ukrainian and/or English	Possibility of studying some subjects in English; mandatory internship at pharmaceutical enterprises
Tuition	The contract is approximately 40,000 UAH/year for citizens of Ukraine	Free for Polish citizens; for foreigners – from 2,000 to 5,000 euros/year depending on the language and form of study.

The Master's programme in Pharmacy (specialty 226 "Pharmacy, Industrial Pharmacy") at Lviv Polytechnic National University integrates theoretical, practical, and research components. The programme encompasses the collection and analysis of Tes data, as well as the preparation of scientific publications, research reports and a master's thesis. The curriculum is comprised of 120 ECTS credits, with 79.5 ECTS credits allocated to academic courses, 3 ECTS credits allocated to coursework/ projects, 18 ECTS credits allocated to professional practice, and 19.5 ECTS credits allocated to thesis preparation and defence. The programme is designed to equip graduates with the necessary skills and knowledge to pursue careers in managerial, research and teaching roles within the fields of pharmacy and pharmaceutical technology.

Graduates are expected to have in-depth knowledge in areas such as pharmaceutical enterprise management, GMP standards, drug design, biotechnological production, dosage form technologies, and quality assurance. The practical competencies encompass a range of disciplines, including the conduct of scientific research, the management of pharmaceutical operations, the design of pharmaceutical facilities, the application of green technologies

in production, and the assurance of compliance with regulatory frameworks. Graduates are also trained in advanced therapeutic approaches, the use of nanostructures, polymers for drug delivery, and the correlation of structure-activity relationships in drug development.

The programme has been designed to cultivate competencies in professional communication (in Ukrainian and foreign languages), the utilisation of ICT tools, independent decision-making, ethical responsibility, and a commitment to lifelong learning. Students are prepared to work in uncertain environments while upholding safety and professional standards.

Although formal academic mobility is not a component of the ECTS principles, student mobility is encouraged under its auspices. The 9-credit research internship programme is designed to provide a focused learning experience in the synthesis and analysis of biologically active compounds. The programme utilises computational tools to evaluate the pharmacological potential of these compounds, fostering an understanding of modern pharmacological principles.

Graduates are awarded the qualification "Master of Pharmacy" and are prepared for employment in sectors defined under KVED DK 009:2010, including pharmaceutical production (Class 21.10, 21.20) and retail (Class 47.73, 47.74). Access to further study at the third (PhD) level is available. It is possible to defend the master's thesis in either Ukrainian or English.

The Master's programme in Pharmacy at the Jagiellonian University is a 5.5-year integrated full-time course (330 ECTS), which is in alignment with European Directives on pharmacist training. It is categorised within the domain of "Medical Sciences and Health Sciences" and is designated at Level 7 of the European Qualifications Framework (EQF).

Foreign applicants are required to undergo a process of nostrification or validation of prior education, the successful completion of which may permit entry into individual disciplines. Completion of the programme requires the successful fulfilment of the full curriculum, along with pharmaceutical and industrial internships, and the defence of a master's thesis.

The programme has been designed to incorporate international mobility through a variety of means, including Erasmus+, CEEPUS, and bilateral agreements. It is acknowledged that instruction may be delivered in part in English, and practical training in pharmaceutical institutions is emphasised.

It is important to note that tuition is waived for Polish citizens. For foreign students, the fees for this course are between €2,000 and €5,000 per year, depending on the language of instruction.

Subsequent to this, a comparative analysis was developed for the evaluation of second-level (Master's) educational programmes at the Jagiellonian University (HEI-2), the University of Freiburg (HEI-3, Germany) and the

Université Paris-Saclay (HEI-4, France). The criteria and detailed comparative data are presented in Table 4.

Table 4

Criteria and characteristics for conducting a comparative analysis of the second (master's) level of education of HEIs-2, HEIs-3 and HEIs-4

Evaluation Criteria	HEI-2 Jagiellonian University	HEI-3 Universität Freiburg Germany	HEI-4 Université Paris-Saclay France
Code, name of specialty	Farmacja	M.Sc. Pharmazeutische Wissenschaften Pharmaceutical Sciences	Pharmaceutical Science (Master's degree), Université Paris-Saclay
Qualification:	Magister farmacji	Master of Science (M.Sc.)	Master
Year of entry	2024	2023	2024
Form of study	full-time education	full-time education (Vollzeitstudium)	full-time education
Program duration	5.5 years (integrated master's program)	4 semesters (2 years)	2 years
Institute	Faculty of Pharmacy Collegium Medicum	Fakultät für Chemie und Pharmazie, Universität Freiburg	Université Paris-Saclay, Graduate School of Health and Drug Sciences
Number of credits	330 ECTS	120 ECTS	120 ECTS
Qualification level according to the National Qualifications Framework, the European Qualifications Framework for Lifelong Learning	EQF level 7 (second cycle)	EQF/NQR – level 7 (Master)	EQF Level 7 (Master's level)
Discipline	Nauki medyczne i nauki o zdrowiu	Pharmazeutische Wissenschaften	Pharmaceutical Sciences / Health Sciences
Special admission conditions	Admission based on secondary education, centralized exams (Matura)	First degree (Pharmacy, Chemistry, Biology, Biochemistry, Biotechnology, Medicine); GPA not lower than 2.5; language requirements: German C1, English B2	Candidates with a degree in pharmacy, medicine, veterinary science, biology, chemistry, biotechnology or engineering sciences

Table 4 (continuance)

Specific mechanisms for the recognition of prior learning	Diploma recognition through NAWA or according to the university procedure	The second state pharmaceutical examination (Staatsexamen) allows entry into the 3rd semester	Recognition of previous courses is possible through the selection of relevant study modules (M1 for transfer to M2)
Requirements and rules for obtaining qualifications, requirements for completing the curriculum	Enrollment in all modules + passing the state exam and internship in a pharmacy	Completion of a 120 ECTS program, including core modules, specialization and master's thesis (30 ECTS)	Successful completion of both years (M1 and M2) and all required and optional modules
Academic mobility	Full implementation of the curriculum, completion of professional practice, state certification	The opportunity to complete one of the research workshops abroad within the scope of the specialization "Drug Discovery and Delivery"	Inter-university partnerships: Sorbonne Paris Nord, Université Paris Est Créteil, Gustave Roussy, Université de Paris; international courses (International M1/M2)
Other features of the program	Possibility of studying some subjects in English; mandatory internship at pharmaceutical enterprises	Two specializations: "Drug Discovery and Delivery" or "Regulatory Affairs and Drug Development"; close collaboration with industry; emphasis on research skills	The program includes interdisciplinary courses, practical training, collaboration with industry, and availability of international tracks
Tuition fee	Free for Polish citizens; for foreigners – from 2,000 to 5,000 euros/year depending on the language and form of study.	50–350 euros/semester	243–377 €/рік

The subsequent phase of the study entailed a comparative analysis of the educational components of the Education programme at the master's level of the aforementioned higher education institutions. The programme is structured by academic semesters and the results are presented in Table 5.

Table 5

Educational components by semester of study at the second (master's) level of study at the ONP HEI-1 NU "Lviv Polytechnic" and HEI-2 Jagiellonian University (Republic of Poland)

Semesters of study	Educational components	
	HEI-1 Lviv Polytechnic National University (Ukraine)	**HEI-2 Jagiellonian University (Republic of Poland)**
Semester 1	Required subjects 1. Economics of chemical and pharmaceutical enterprises 2. Foreign language for professional orientation 3. Modeling, design and equipment of chemical and pharmaceutical enterprises according to the GMP system 4. Scientific aspects of the technology of veterinary and biomedical drugs 5. Industrial technology of pharmaceutical production, part 1 6. Occupational safety and civil security	Required subjects: 1. Pharmacognosy with elements of phytotherapy 2. Medical chemistry 3. Pharmacology 4. Physiology 5. Biostatistics 6. Practical classes in a training pharmacy
Semester 2	Required subjects: 1. Modeling, design and equipment of chemical and pharmaceutical enterprises in the GMP system (course project) 2. Industrial technology of pharmaceutical production, part 2 Elective subjects of the general training cycle: 1. Free choice Elective block Pharmacy: 1. Clinical pharmacy 2. Scientific aspects of biopharmacy 3. Quality assessment of medicines Elective block Industrial Pharmacy: Quality control of medicines Technology and application of medical cosmetics Technology of biologically active substances, biomedical polymers and nanostructures	Required subjects: 1. Technology of dosage forms 2. Quality control of medicines 3. Pharmaceutical biology 4. Pharmaceutical technology 5. Fundamentals of clinical pharmacy 6. Practice in a pharmacy under the supervision of a teacher

Table 5 (continuance)

Semester 3	Required subjects: 1. Scientific research and seminars on their topics Clinical and pharmaceutical aspects of the use of drugs (special course, part 3) Fundamentals of fine organic synthesis (special course, part 2) Fundamentals of pharmaceutical biochemistry (special course, part 1) 2. Workshop on the preparation of scientific publications, conference materials and presentations of scientific reports 3. Teaching and research practice	Required disciplines: 1. Pharmaceutical biotechnology 2. Pharmacoeconomics 3. Ethics and deontology in pharmacy
Semester 4	Required subjects: 1. Practice on the topic of the master's thesis 2. Execution of the master's thesis Defense of the master's thesis	Preparation and defense of the master's thesis

A comparative study of master's programmes in specialty 226 at the National University "Lviv Polytechnic" (HEI-1, Ukraine) and the Jagiellonian University (HEI-2, Poland) was undertaken, and both shared and distinct features were identified.

Both programmes are full-time and aim to prepare highly qualified specialists in pharmacy. It is evident that the aforementioned subjects comply with the European Qualifications Framework (EQF, Level 7). The curricula encompass theoretical and practical components, with the programme culminating in the submission of a master's thesis.

The duration of the programme is 1 year 9 months at HEI-1 and 2 years at HEI-2, with both institutions awarding approximately 120 ECTS credits. HEI-2 places significant emphasis on research and international integration, encompassing participation in the Erasmus+ programme and other mobility initiatives.

The defence of the thesis is conducted in Ukrainian/English at HEI-1 and in Polish/English at HEI-2.

It is evident that both programmes align with the standards of the European Higher Education Area (EHEA), thereby facilitating academic mobility and ensuring international recognition. It is evident that all the analysed programmes (HEI-1, HEI-2, Universität Freiburg, Université Paris-Saclay) employ ECTS, modular structures, and a competency-based approach.

A comparative analysis of the educational components of the educational programmes HEI-2, HEI-3 and HEI-4 was carried out. These programmes are arranged by academic semesters and are presented in Table 6.

Table 6

Educational components by semester of study at the second (master's) level of study for ONP HEI-2, HEI-3 and HEI-4

Semesters of study	Educational components		
	HEI-2 Jagiellonian University (Republic of Poland))	**HEI-3 Germany Universität Freiburg**	**HEI-4 France Université Paris-Saclay**
Semester 1	Required subjects: 1. Pharmacognosy with elements of phytotherapy 2. Medical chemistry 3. Pharmacology 4. Physiology 5. Biostatistics 6. Practical classes in a training pharmacy	Required disciplines: 1. Pharmaceutical chemistry 2. Pharmaceutical biology 3. Pharmaceutical technology of individual dosage forms 4. Pharmacology	Required subjects: 1. TU 05: Cancer Cell Biology Study of cancer cell biology, including lectures, practical classes and oral presentation. 2. TU 06: Pharmaceutical Engineering Introduction to the engineering aspects of pharmaceutical production. 3. Physiopathology of Major Functions Study of the physiopathology of the main functions of the body. 4. Oncology Fundamentals of oncology and modern approaches to cancer treatment
Semester 2	Required subjects: 1. Technology of dosage forms 2. Quality control of medicines 3. Pharmaceutical biology 4. Pharmaceutical technology 5. Fundamentals of clinical pharmacy 6. Practice in a pharmacy under the supervision of a teacher	Required subjects: 1. Pharmaceutical Chemistry (continued) 2. Pharmaceutical Biology (continued) 3. Biochemistry 4. Bioinformatics 5. Methodical course	Required Courses: 1. TU 07: The Medicinal Chemist's Toolbox A course covering organic synthesis, including the formation of C–C, C–O, and C–N bonds. 2. Biotechnology A study of biotechnological methods in drug development. 3. Rush: Pharmaceutical Business Game An interactive game aimed at developing skills in the pharmaceutical business.

Table 6 (continuance)

Semester 3	Required disciplines: 1. Pharmaceutical biotechnology 2. Pharmacoeconomics 3. Ethics and deontology in pharmacy.	Required subjects: One of the specializations (optional): 1. Drug discovery and delivery 2. Research practice A 3. Research practice B 4. Required elective module 5. Regulatory issues and drug development 6. Drug development and authorization issues Quality 7. Patent law and product strategy 8. Media, communications and marketing 9. Ethics and sustainable development (partially continued in the 4th semester). Required electives from the Methods course: 1. Structure discovery using NMR and mass spectrometry 2. Clinical drug trials and research analysis 3. Enzymes in pharmaceutical chemistry 4. Evidence-based pharmacy 5. TBL with summary – pharmacology 6. Preclinical methods in preventive medicine 7. Modern research in membrane biophysics 8. Biophysical chemistry of lipid membranes	Required Subjects: Immunopathology and Hematologic Dysregulations: 1. Study of immunopathologies and disorders in the blood system. 2. Pharmaceutical Engineering In-depth study of engineering processes in the pharmaceutical industry. Elective subjects of the general training cycle: 1.Biotechnology PW1: Bioreactors, Production of the Prodigiosine Pigment A practical course on bioreactors and production of the prodigiosine pigment. 2. Marketing Fundamentals of marketing in the pharmaceutical industry. 3. Pharmacology/ Toxicology Study of pharmacology and toxicology of drugs. 4. Biomolecular Modelling/Bioinformatics Modeling of biomolecules and fundamentals of bioinformatics. 5. Analytical Sciences and Data Evaluation/Environment Analytical methods and data evaluation in the context of the environment. 6. Natural Product Chemodiversity Chemodiversity of natural products and their applications.

Table 6 (continuance)

		9. Statistical methods using Python	7. Infections and Immunosuppression Study of infections and immunosuppression. 8. Therapies of Immune and Hematologic Dysregulations 9. Therapies for disorders of the immune and hematological systems.
Semester 4	Preparation and defense of the master's thesis.	Master's thesis (master's module)	Elective disciplines of the professional training cycle: 1. The Medicinal Chemist's Toolbox In-depth study of the tools of medicinal chemistry. 2. Biotechnology Extended study of biotechnological processes. 3. Pharmaceutical Engineering Engineering aspects of drug production. 4. Pharmacology/ Toxicology In-depth study of pharmacology and toxicology. 5. Biomolecular Modelling/Bioinformatics Advanced Biomolecular Modeling and Bioinformatics. 6. Analytical Sciences and Data Evaluation/Environment Analytical Sciences and Data Evaluation/Environment 7. Natural Product Chemodiversity Investigation of the chemodiversity of natural products. 8.Infections and Immunosuppression In-depth study of infections and immunosuppression.

Table 6 (continuance)

			9. Therapies of Immune and Hematologic Dysregulations Therapeutic approaches to immune and hematologic disorders. 10. Therapies in Oncology Modern therapies in oncology. 11. Internship A laboratory or company internship, culminating in a thesis defense.

The present analysis compares the first (bachelor's) level of education between HEI-1 and HEI-2 (see Table 7), as well as among HEI-2, HEI-3 (Germany), and HEI-4 (France).

Table 7

Criteria and characteristics for conducting a comparative analysis of the first (bachelor's) level of education of HEI-1 and HEI-2

Evaluation Criteria	**HEI-1 Lviv Polytechnic National University**	**HEI-2 Jagiellonian University (Republic of Poland)**
Code, name of specialty	6.226.00.00 Pharmacy, industrial pharmacy	Farmacja
Qualification:	Bachelor's degree, majoring in pharmacy	Master of Pharmacy (with integration of the bachelor's level)
Year of entry	2022	2024
Form of study	Full-time study	Full-time study
Program duration	4 years	5.5 years
Institute	Institute of Chemistry and Chemical Technology	-
Number of credits	240 ECTS credits	330 ECTS credits
Qualification level according to the National Qualifications Framework, the European Qualifications Framework for Lifelong Learning	Sixth level of NQF (first cycle of the EHEA QF, sixth level of EQF)	The graduate receives a full master's degree in pharmacy with a qualification equivalent to EQF level 7/ISCED 7, which simultaneously covers both the first cycle (bachelor's) and the second (master's) cycle

Table 7 (continuance)

Discipline	Healthcare	The programs are implemented in the field of healthcare, but at the Jagiellonian University – in closer integration with medical faculties, which allows for the formation of interdisciplinary skills adapted to EU standards.
Special admission conditions	External Test Certificates: Ukrainian Language (minimum 100 points, coefficient 0.35); Mathematics (minimum 100 points, coefficient 0.40); History of Ukraine (minimum 100 points, coefficient 0.25); Motivation letter: mandatory, but does not affect the competitive score	Online registration: via the IRK system (irk.uj.edu.pl); Required documents: Certificate of complete secondary education; Certificate of knowledge of Polish language at level B1 or B2 (depending on the program); Motivation letter; Other documents specified in the IRK system; Entrance tests: may include an interview or an exam (details specified in the IRK system)
Specific mechanisms for the recognition of prior learning	Provided that the previous level was obtained in another country, nostrification is required, which is carried out by Lviv Polytechnic	The nostrification mechanism for obtaining prior education abroad is simplified or automated within member states.
Requirements and rules for obtaining qualifications, requirements for completing the curriculum	Complete the training programs and protection of BKR	Complete completion of the curriculum
Academic mobility	Regulated by Resolution of the Cabinet of Ministers of Ukraine No. 579 “On Approval of the Regulations on the Procedure for Implementing the Right to Academic Mobility” dated August 12, 2015.	The program involves active participation in academic mobility programs (Erasmus+, NAWA) that are integrated into the curriculum.

Table 7 (continuance)

Other features of the program	BCR protection is implemented in Ukrainian and/or English.	Defense of the qualification work
Tuition fee	Contract 27400 UAH; Total cost for the training period about 109600 UAH.	For Polish and EU citizens: ≈2220 euros; For citizens of other countries: ≈14000 euros Total cost for the entire period of study: For Polish and EU citizens: ≈12210 euros; For citizens of other countries: ≈77000 euros

Lviv Polytechnic National University.

Graduates acquire fundamental knowledge and skills in a range of subjects, including modern pharmaceutical production technologies, dosage form development, chemical and physicochemical analysis, pharmaceutical equipment design, and the organisation and management of pharmaceutical enterprises. The programme places particular emphasis on the economic aspects of pharmaceuticals, marketing strategies, and research methodologies.

It is asserted that students will develop competencies to: The application of theoretical and practical knowledge in the domain of pharmacy is imperative. The organisation and management of pharmaceutical production processes is also essential. Furthermore, the assurance of quality control of raw materials and finished products is crucial. Finally, conducting scientific research in the field of pharmaceutical sciences is vital.

Graduates are granted access to the second (master's) level of education.

Subsequent analysis focused on the bachelor's programmes at the Jagiellonian University (HEI-2, Poland) and the University of Freiburg (HEI-3, Germany). The comparative criteria and programme characteristics are summarised in Table 8.

Jagiellonian University, Poland:

The Polish model is in compliance with EU Directive 2005/36/EC, which stipulates a minimum requirement of five years of pharmaceutical training.

Graduates of HEI-2 obtain an integrated Master's degree in Pharmacy (EQF level 7 / ISCED 7), encompassing both bachelor's and master's levels.

The HEI-2 model places significant emphasis on clinical training, biomedical sciences, pharmacotherapy, pharmaceutical care, and patient-centred practice.

Table 8

Criteria and characteristics for conducting a comparative analysis of the first (bachelor's) level of education of HEIs-2 and HEIs-3

Evaluation Criteria	**HEI-2 Jagiellonian University (Republic of Poland)**	**HEI-3 Universität Freiburg (Німеччина)**
Code, name of specialty	Farmacja	Bachelor of Science (B.Sc.) in Pharmazeutische Wissenschaften
Qualification:	Master of Pharmacy (with integration of bachelor's level)	Bachelor of Science (B.Sc.)
Year of entry	2022	2024
Form of study	day uniform	day uniform
Program duration	5.5 years	6 semesters (3 years)
Institute	-	Medizinische Hochschule Brandenburg Theodor Fontane (MHB)
Number of credits	330 ECTS credits	180 ECTS credits
Qualification level according to the National Qualifications Framework, the European Qualifications Framework for Lifelong Learning	The graduate receives a full master's degree in pharmacy with a qualification equivalent to EQF level 7/ISCED 7, which simultaneously covers both the first cycle (bachelor's) and the second (master's) cycle	Corresponds to the first cycle (bachelor's level) of the European Qualifications Framework for Lifelong Learning
Discipline	The programs are imple-mented in the field of healthcare, but at the Jagiellonian University – in closer integration with medical faculties, which allows for the formation of interdisciplinary skills adapted to EU standards.	Pharmaceutical Sciences
Special admission conditions	Online registration: via the IRK system (irk.uj.edu.pl); Required documents: Certificate of complete secondary education; Certificate of knowledge of Polish at level B1 or B2 (depending on the program); Motivation letter; Other documents specified in the IRK system; Entrance tests: may include an interview or an exam (details are specified in the IRK system)	General higher education (Allgemeine Hochschulreife), proof of German language proficiency (e.g. DSH 2 or TestDaF 4×4), motivation letter, interview

Table 8 (continuance)

Specific mechanisms for the recognition of prior learning	The nostrification mechanism for obtaining prior education abroad is simplified or automated within member states	Recognition is possible according to § 11 BerlHG, in case of appropriate prior education
Requirements and rules for obtaining qualifications, requirements for completing the curriculum	Complete completion of the curriculum	Successful completion of all modules, writing and defending a bachelor's thesis
Academic mobility	The program involves active participation in academic mobility programs (Erasmus+, NAWA) that are integrated into the curriculum	The program allows academic mobility within partner universities and within the framework of ECTS
Other features of the program	Defense of the qualification work	Orientation to interdisciplinarity, application of research results, practice in the pharmaceutical industry
Tuition fee	For Polish and EU citizens: ≈2220 euros; For citizens of other countries: ≈14000 euros Total cost for the entire period of study: For Polish and EU citizens: ≈12210 euros; For citizens of other countries: ≈77000 euros	

Integration with medical faculties at the Jagiellonian University has been demonstrated to promote interdisciplinary competencies aligned with EU standards.

The programme has been meticulously designed to integrate the Erasmus+ and NAWA mobility schemes into its curriculum, thereby facilitating a comprehensive and immersive learning experience.

Nostrification procedures have been streamlined, particularly within the EU, thus enhancing accessibility for international students.

The Polish integrated system has been found to foster the development of practice-oriented specialists equipped for both clinical and industrial pharmacy roles in the EU.

As illustrated in Table 9, a comparative analysis of educational components by academic semesters for HEI-1 and HEI-2 is presented.

Table 9

Ducational components by semester of study at the first (bachelor's) level of study of ONP HEI-1 and HEI-2

Semesters of study	Educational components	
	HEI-1 Lviv Polytechnic National University	**HEI-2 Jagiellonian University (Republic of Poland)**
Semester 1	Required subjects: 1. Higher Mathematics, Part 1 2. Introduction to the profession and the basics of professional hygiene 3. Professional language, Part 1 4. History of statehood and culture of Ukraine 5. Physical education, Part 1 6. Chemistry 1 (general and inorganic chemistry) 7. Chemistry 2 (organic chemistry)	Required subjects: 1. Fundamentals of Chemistry 2. Introduction to Pharmacy 3. Human Anatomy 4. Latin 5. Foreign Language (English)
Semester 2	Compulsory subjects: 1. Higher Mathematics, Part 2 2. Foreign Language for Professional Purposes, Part 2 3. Ukrainian Language (for Professional Purposes) 4. Physics 5. Physical and Colloidal Chemistry 6. Chemical Methods of Analyzing the Composition of Substances Elective Subjects: 1. Physical Education, Part 2	Required subjects: 1. Biochemistry 2. Physiology 3. Pharmaceutical botany 4. Foreign language 5. Physical education
Semester 3	Required subjects: 1. Biology and physiology with the basics of anatomy 2. Foreign language for professional purposes, part 3 3. Latin	Required subjects: 1. Pharmacognosy 2. Pharmaceutical Chemistry 3. Microbiology 4. Foreign Language 5. Physical Education

Table 9 (continuance)

	4. Methods of organic synthesis 5. Microbiology 6. Physico-chemical methods of analyzing the composition of substances	
Semester 4	Required subjects: 1. Biological chemistry and molecular biology 2. Informatics 3. Medical botany 4. Toxicological chemistry 5. Philosophy Elective subjects of the general training cycle: Free choice	Required subjects: 1. Pharmacology 2. Pharmaceutical Technology 3. Pharmacy Economics 4. Practice 5. Foreign Language
Semester 5	Required subjects: 1.Pharmaceutical technology of drugs 2.Engineering and computer graphics 3.Teaching practice in botany 4.Processes and devices of pharmaceutical production (course project) 5.Processes and devices of pharmaceutical production Selective block Pharmacy: 1. Laboratory functional diagnostics and clinical pharmacy 2. Regulatory and legal regulation of the activities of pharmaceutical enterprises Selective block Industrial Pharmacy: 1. Regulatory support of pharmaceutical production 2. Fundamentals of laboratory and functional diagnostics 3. Pharmacokinetics	Required subjects: 1. Pharmaceutical Technology 2. Clinical Pharmacy 3. Pharmacognosy 2 4. Biotechnology 5. Foreign Language

Table 9 (continuance)

Semester 6	Required subjects: 1. Pharmacy technology of drugs (coursework) 2. Fundamentals of labor protection and safety 3. harmacognosy 4. Pharmaceutical chemistry 5. Elective block Pharmacy 6. Technology of antibiotics and vitamin preparations 7. Chemistry and technology of drugs Elective block Industrial Pharmacy: 1. Chemistry and technology of medicinal substances	Required subjects: 1. Analytics 2. Pharmacoeconomics 3. Quality in Pharmacy 4. Practice 5. Foreign Language
Semester 7	Required subjects: 1. Organization and economics of pharmacy 2. Fundamentals of pharmacology 3. Pharmacognosy (coursework) Selective block Industrial pharmacy: 1. Fundamentals of clinical pharmacy 2. Fundamentals of pharmacotherapy 3. Technology of preparations from natural raw materials and phytotherapy 4. Equipment and design of pharmaceutical production 5. Equipment and design of pharmaceutical production (course project) Pharmacy elective block: 1. Design of chemical and pharmaceutical plants 2. Design of chemical and pharmaceutical plants (course project) 3. Technology of galenic preparations 4. Pharmacology 5. Chemistry of carcinogens	Required subjects: 1. Pharmaceutical law 2. Ethics 3. Informatics 4. Ecology 5. Practice

Table 9 (continuance)

Semester 8	Required subjects: 1. Completion of bachelor's qualification work 2. Defense of bachelor's qualification work 3. Organization and economics of pharmacy (coursework) 4. Internship on the topic of bachelor's qualification work 5. Technological internship Pharmacy elective block: 1.Medical and pharmaceutical commodity science 2.Management and marketing in pharmacy 3.First aid Industrial pharmacy elective block: 1. Management, marketing and pharmaceutical commodity science 2. Fundamentals of emergency first aid 3. Physical methods of drug analysis	Required subjects: 1. Logistics 2. Marketing 3. Business Management 4. Internship 5. Thesis Thesis internship Thesis defense

A comparative analysis of educational components according to the Education programs HEI-2 and HEI-3, which are arranged by academic semesters, was also carried out and presented in Table 10.

Table 10

Educational components of the ONP HEI-2 and HEI-3 by semesters of study at the first (bachelor's) educational level

Semesters of study	**Educational components**	
	HEI-2 Jagiellonian University (Republic of Poland)	**HEI-3 Universität Freiburg (Germany)**
Semester 1	Required subjects: 1. Fundamentals of Chemistry 2. Introduction to Pharmacy 3. Human Anatomy 4. Latin 5. Foreign Language (English)	Required subjects: 1. General and inorganic chemistry 2. Fundamentals of biology for pharmacists I 3. Mathematics 4. Physics and physical chemistry (submodule)

Table 10 (continuance)

Semester 2	Required subjects: 1. Biochemistry 2. Physiology 3. Pharmaceutical botany 4. Foreign language 5. Physical education	Required subjects: 1. Physical Chemistry (last module) 2. Quantitative Analysis 3. Pharmacology (beginning) 4. Fundamentals of Medicine (part 1) 5. Organic Chemistry (part 1)
Semester 3	Required subjects: 1. Pharmacognosy 2. Pharmaceutical Chemistry 3. Microbiology 4. Foreign Language 5. Physical Education	Required subjects: 1. Theory of dosage forms (final exam) 2. Fundamentals of biology for pharmacists II 3. Fundamentals of medicine (part 2) 4. Organic chemistry (final exam) Mandatory elective subjects of the general training cycle: 1. Microbiology practicum 2. Pharmaceutical and medical terminology 3. History of pharmacy 4. Basics of nutrition 5. Excursions to medicinal plants (without written exam) 6. Excursions to medicinal plants with final exam 7. Special sections of law for pharmacist students 8. English for pharmacist students
Semester 4	Required subjects: 1. Pharmacology 2. Pharmaceutical Technology 3. Pharmacy Economics 4. Practice 5. Foreign Language	Elective disciplines of the professional training cycle: 1. Instrumental analysis 2.Biochemistry (part, continued in the 5th semester) 3.Practical course on the basics of pharmaceutical biology 4.Quality assurance of medicines (part, continued in the 5th semester) 5.Detection and synthesis of medicinal substances (part, continued in the 5th semester) 6. Fundamentals of clinical chemistry 7. Biopharmaceutics

Table 10 (continuance)

		8. Bioinformatics and molecular modeling 9. Fundamentals of pharmacology (continued in the 6th semester) Biogenic drugs and molecular biology (beginning, continued in the 6th semester) 1. Industrial practice
Semester 5	Required subjects: 1. Pharmaceutical Technology 2. Clinical Pharmacy 3. Pharmacognosy 2 4. Biotechnology 5. Foreign Language	Required subjects: 1. Discovery and synthesis of drugs 2. Quality assurance of drugs 3. Biogenic drugs and molecular biology (part 1) 4. Fundamentals of pharmacology (part 1) 5. Biochemistry II (part 2)
Semester 6	Required subjects: 1. Analytics 2. Pharmacoeconomics 3. Quality in Pharmacy 4. Practice 5. Foreign Language Elective subjects of the professional training cycle: 1. Pharmaceutical Law 2. Ethics 3. Informatics 4. Ecology 5. Practice 6. Logistics 7. Marketing 8. Business Management 9. Practice 10. Thesis	Required subjects: 1. Biogenic drugs and molecular biology (part 2) 2. Fundamentals of pharmacology (part 2) 3. Bioinformatics and molecular modeling 4. Biopharmaceutics 5. Fundamentals of clinical chemistry 6. Bachelor's thesis

The Ukrainian model separates bachelor's and master's levels, while the Polish programme follows an integrated Master's format in compliance with EU Directive 2005/36/EC.

The Polish curriculum incorporates substantial practical training in clinical settings, interdisciplinary communication, and bioethics, ensuring that graduates are well-prepared to meet the standards of EU pharmaceutical practice.

The Ukrainian programme places particular emphasis on engineering and technological training, which is well-suited to meet the demands of industrial pharmacy and pharmaceutical manufacturing.

In both systems, undergraduate mobility is limited; however, Poland offers greater access to the Erasmus+ programme and related mobility programmes.

The Polish programme incorporates English-taught components, thereby enhancing its international accessibility. In contrast, the Ukrainian programme necessitates further internationalisation.

In order to align more closely with EU standards and enhance global competitiveness, it is recommended that Ukrainian programs integrate clinical training, adopt interdisciplinary approaches, and expand international cooperation and academic mobility at the undergraduate level.

CONCLUSIONS

An analysis of bachelor's programmes in Pharmacy at Lviv Polytechnic and Jagiellonian University reveals structural similarities, including core disciplines in chemistry, biology, pharmacology, and clinical pharmacy. However, the Polish programme (HEI-2) exhibits a more pronounced interdisciplinary approach, augmented English instruction, and an earlier integration of practical training. Furthermore, it is subject to more frequent updates in accordance with European Higher Education Area (EHEA) standards. Ukraine (Lviv Polytechnic): The programme places particular emphasis on the practical application of technology in the context of pharmaceutical production, entrepreneurship, and GMP compliance.

Poland (Jagiellonian University): The programme places particular emphasis on fundamental pharmaceutical sciences and phytotherapy. Germany (University of Freiburg): The programme has been developed with a foundation in experimental pharmacy and analytical disciplines, integrating these with other fields of study. France (Université Paris-Saclay): The programme is characterised by its intensive research focus, with a core emphasis on three distinct yet interconnected domains: cancer biology, physiopathology, and pharmaceutical engineering.

EU programmes offer a number of advantages over non-EU programmes. These include greater flexibility, practical training, integration with research, and the use of English. These advantages have been shown to enhance graduate mobility and global employability.

In order to comply with EU standards, it is imperative to enhance research components, expand academic mobility, introduce English-language instruction, and regularly update curricula in response to the needs of the pharmaceutical industry.

SUMMARY

A comparative analysis of the EPPs of the third (Doctor of Philosophy) level of education in 2024 in the specialty 226 “Pharmacy, Industrial Pharmacy” at Lviv Polytechnic National University (HEI-1) and Jagiellonian University in Krakow, Poland (HEI-2) was conducted. Such analysis between the EPPs was also conducted at the second (master’s) level and at the first (bachelor’s) level of Lviv Polytechnic National University (HEI-1), Jagiellonian University (HEI-2), University of Freiburg (HEI-3), Germany and University of Paris-Saclay (HEI-4), France.

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