

Main Language of Instruction:French ☒ English ☐ Arabic ☐**Campus Where the Program Is Offered:** CSM**OBJECTIVES**

The Master in Pharmaceutical and Biological Sciences aims to train students for careers in research related to pharmaceuticals, new therapeutic targets, and biological diagnostics. It equips them with both essential and applied knowledge, alongside recent advancements in pharmacology, toxicology, biochemistry, and microbiology. By emphasizing a research-driven approach, the program provides students with classical and innovative research methodologies, establishing a robust foundation for those wishing to pursue doctoral studies in Lebanon or internationally.

Furthermore, this program offers professional training beneficial for aspiring instructors-researchers and pharmacists aiming to enhance their skills in pharmacology and clinical practice, thereby improving the quality of pharmaceutical and biological care they provide to patients.

PROGRAM LEARNING OUTCOMES (COMPETENCIES)

C1 - Participate in a research project in the biological or pharmaceutical fields with perseverance, adhering to ethical standards and integrity.

- Analyze literature, define the problem, and formulate hypotheses.
- Contribute to the project with scientific rigor, critical thinking, and discernment.
- Uphold ethics, integrity, and respect for anonymity, confidentiality, and human values.
- Learn responsible work practices, particularly in health and safety.

C2 - Analyze bibliographic resources, evaluate problems, and acquire techniques to develop innovative scientific work in pharmaceutical and biological sciences.

- Contribute to bibliographic research, synthesize available resources, and analyze epidemiological, clinical, and biological data, and molecular mechanisms.
- Investigate with scientific curiosity and pose relevant questions.
- Apply research methods and analytical techniques pertinent to your field.
- Acquire cutting-edge technologies in research.
- Analyze, synthesize, and interpret results with rigor and critical insight.

C3 - Contribute to high-quality research aimed at improving biological diagnostics, treatments, and patient care, as well as discovering new therapeutic targets.

- Engage in innovative and ambitious projects.
- Adopt an appropriate, original, rigorous, and comprehensive scientific approach.

C4 - Communicate scientific information effectively, both orally and in writing.

- Master the French and English languages.
- Develop the ability to communicate accurately, precisely, and clearly in writing or orally.
- Learn the rules of scientific publishing and research integrity: ethics, anti-plagiarism, accuracy, veracity, copyright.
- Discuss and defend the results.

C5 - Adapt to various socio-professional and intercultural contexts, both nationally and internationally, while collaborating in teams.

- Integrate into a polyvalent pharmaceutical team.
- Acquire new technologies, apply them and develop them.



C6 - Continuously update knowledge and manage a career as a researcher or expert in biochemistry, molecular biology, genetics, pharmacology, toxicology, and microbiology, considering preventive, diagnostic, pharmaceutical, medical, and public health aspects.

- Ensure timely updates of received information and acquire new skills through continuing education or pursuing a PhD.
- Participate in national and international conferences.
- Develop expertise in biological and pharmaceutical fields.

ADMISSION REQUIREMENTS

Candidates must hold a degree in Pharmacy from Saint Joseph University of Beirut (USJ) or any recognized equivalent.

Pharmacy students currently enrolled at USJ may register starting from the 6th semester of their program.

Upon obtaining their Doctor of Pharmacy degree, they will be allowed to enroll in the second year of a Master's program in one of the previously mentioned specialties.

COURSES/CREDITS GRANTED BY EQUIVALENCE

46 credits are granted by equivalence during the 4th year of the pharmacy program.

PROGRAM REQUIREMENTS

120 credits: Required courses (92 credits), Institution's elective courses (28 credits).

Duration: At least 4 semesters (60 credits for each year of the Master's program)

The 60 credits for the first year (M1) can be completed during the 4th and 5th years of the pharmacy program for students from the Faculty of Pharmacy of USJ.

Required Courses (92 Cr.)

Analysis of Specialized Articles in Molecular Biochemistry, Microbiology, Pharmacology, and Toxicology (10 Cr.). Bioinformatics (2 Cr.). Biotechnology (2 Cr.). Cell Biology (2 Cr.). Clinical Biochemistry (3 Cr.). Clinical Pharmacy I (3 Cr.). Clinical Pharmacy II (3 Cr.). Drugs Interactions (2 Cr.). Emergency Toxicology (3 Cr.). Endocrinology (2 Cr.). Epidemiology and Statistics (2 Cr.). Genomics and Medical Applications (2 Cr.). Introduction to Laboratory Work (1 Cr.). Master Thesis (10 Cr.). Mechanisms of Toxicity, Carcinogenesis, and Regulations (2 Cr.). Medical Biotechnology (2 Cr.). Molecular Pharmacology and Biostatistics (2 Cr.). Nutrition (3 Cr.). Pharmaceutics III (4 Cr.). Research Methodology (1 Cr.). Special Microbiology II (4 Cr.). Special Pharmacology I (4 Cr.). Special Pharmacology II + Oncology (4 Cr.). Special Pharmacology Practical Work (1 Cr.). Specialized Research in Pharmaceutical and Biological Sciences (Pharmacology, Toxicology, Infectious Diseases, and Clinical Biochemistry) (10 Cr.). Therapeutic Chemistry II (2 Cr.). Toxicology (4 Cr.). Virology (2 Cr.).

Institution's Elective Courses (28 Cr.), to be chosen from the list below:

Clinical Biochemistry and Molecular Biology Research Internship (20 Cr.). Clinical Pharmacology Research Internship (20 Cr.). Clinical Toxicology Research Internship (20 Cr.). Cellular and Integrated Pharmacology in Neurosciences and Infectiology (2 Cr.). Cellular Signaling, Therapeutic Targets in Metabolic, Cardiovascular, and Immunotoxicology Disorders (2 Cr.). Clinical and Experimental Toxicology (2 Cr.). Innovative Therapies: From Patent to Commercialization (2 Cr.). Internship in Pharmaceutical Firms or Industries (4 Cr.). Microbiology Research Internship (20 Cr.). Research Internship (Biochemistry, Molecular Biology, Microbiology, Pharmacology, Toxicology) (4 Cr.).



SUGGESTED STUDY PLAN

Semester 1

Code	Course Name	Credits
004SBLGS3	Clinical Biochemistry	3
004PECLS3	Clinical Pharmacy I	3
004TEQES4	Clinical Pharmacy II	3
004TODUS4	Emergency Toxicology	3
004ENLOS4	Endocrinology	2
004PHAGS3	Pharmaceutics III	4
004INTES4	Drugs Interactions	2
004BITHS1	Medical Biotechnology	2
004CHT3S3	Therapeutic Chemistry II	2
004NUTRS4	Nutrition	3
004MIBOS3	Special Microbiology II	4
004PHSPS3	Special Pharmacology I	4
004PHSOS4	Special Pharmacology II + Oncology	4
004PHAPS3	Special Pharmacology Practical Work	1
004TOXIS3	Toxicology	4
004VIROS4	Virology	2
	Total	46

Semester 2

Code	Course Name	Credits
004GEAMM1	Genomics and Medical Applications	2
004MATCM1	Mechanisms of Toxicity, Carcinogenesis, and Regulations	2
004PHMBM1	Molecular Pharmacology and Biostatistics	2
004SCCTM1 or 004TIBCM1 or 004TCEXM1 or 004PCINM1	Institution's Elective Courses, choose 2: Cellular Signaling, Therapeutic Targets in Metabolic, Cardiovascular, and Immunotoxicology Disorders (2 Cr.) or Innovative Therapies: From Patent to Commercialization (2 Cr.) or Clinical and Experimental Toxicology (2 Cr.) or Cellular and Integrated Pharmacology in Neurosciences and Infectiology (2 Cr.)	4
004STDEM1 or 004STPHM1	Institution's Elective Courses: Research Internship (Biochemistry, Molecular Biology, Microbiology, Pharmacology, Toxicology) (4 Cr.) or Internship in Pharmaceutical Firms or Industries (4 Cr.)	4
	Total	14

Semester 3

Code	Course Name	Credits
004ANASM3	Analysis of Specialized Articles in Molecular Biochemistry, Microbiology, Pharmacology, and Toxicology	10
004BIFCM3	Bioinformatics	2
004BICEM3	Cell Biology	2
004BITCM3	Biotechnology	2
004EPBCM3	Epidemiology and Statistics	2
004TLCMM3	Introduction to Laboratory Work	1
004MRSCM3	Research Methodology	1
004RSSPM3	Specialized Research in Pharmaceutical and Biological Sciences (Pharmacology, Toxicology, Infectious Diseases, and Clinical Biochemistry)	10
	Total	30

Semester 4

Code	Course Name	Credits
004MFMSM4	Master Thesis	10
004SRTCM4 or 004SRPCM4 or 004SRBCM4 or 004SRMIM4	Institution's Elective Course, choose 1: Clinical Toxicology Research Internship or Clinical Pharmacology Research Internship or Clinical Biochemistry and Molecular Biology Research Internship or Microbiology Research Internship	20
	Total	30

COURSE DESCRIPTION

004ANASM3	Analysis of Specialized Articles in Molecular Biochemistry, Microbiology, Pharmacology, and Toxicology	10 Cr.
------------------	---	---------------

This course enables students to:

- Analyze specialized articles in molecular biochemistry, microbiology, pharmacology, and toxicology.
- Learn to recognize the different steps needed to set up a research project and prepare a publication.
- Understand the methodology of scientific publications, writing scientific articles, and preparing scientific posters in these fields.
- Analyze original scientific articles and reviews.
- Formulate a research hypothesis and support it by conducting a bibliographic reference search.

004BIFCM3	Bioinformatics	2 Cr.
------------------	-----------------------	--------------

This course introduces students to various databases and computational tools available online, enabling *in silico* analyses and retrieval of information from genome sequencing projects accessible through web resources.

004BITCM3	Biotechnology	2 Cr.
------------------	----------------------	--------------

This course equips students with the skills to develop new products for human health, food quality and safety, and environmental protection.

004BICEM3	Cell Biology	2 Cr.
------------------	---------------------	--------------

This course enables students to deepen their knowledge of cell culture techniques and molecular biology methods.

004PCINM1	Cellular and Integrated Pharmacology in Neurosciences and Infectiology	2 Cr.
------------------	---	--------------

This course offers an integrated two-part approach aimed at introducing students to research in neuropharmacology and infectious diseases.

The neuropharmacology component aims to provide future graduates with the most up-to-date conceptual foundations for studying certain common neurological diseases and for developing new therapeutic targets. For each disease, the course is structured in five stages:

- 1- Review of pathophysiology and pharmacotherapy;
- 2- Identification of potential new pharmacological targets and biological markers;
- 3- Presentation of current therapies being developed in research laboratories;
- 4- In-depth description of animal models and evaluation tests used in preclinical studies of these conditions;
- 5- Analysis of selected preclinical studies along with a discussion of their results.

The infectious diseases component is designed as an advanced integrative course at the interface of clinical microbiology, anti-infective pharmacology, immunology, molecular biology, neuroscience, and public health.

It is organized around three complementary modules:

- (1) microbiota, inflammation and systemic interactions;
- (2) anti-infective pharmacology, resistance, molecular diagnostics and innovative alternatives;
- (3) immunopharmacology, vaccines and targeted therapies.

The objective of this course is to develop Master's (M1)-level scientific and pharmaceutical reasoning capable of integrating molecular mechanisms, data interpretation, methodological choices, therapeutic innovation, patient safety, and clinical relevance.

004SCCTM1	Cellular Signaling, Therapeutic Targets in Metabolic, Cardiovascular, and Immunotoxicology Disorders	2 Cr.
------------------	---	--------------

This course aims to:

- Identify the different cellular signaling pathways and their physiopathological and therapeutic applications, particularly their involvement in the toxic mechanisms of xenobiotics.
- Understand how signaling pathways regulate cell survival and death, and how their disruption by toxic substances or drugs can lead to immunotoxic effects.
- Explore molecular, cellular, and preclinical approaches in the discovery of new therapeutic targets, particularly in metabolic and cardiovascular diseases.

004TCEXM1	Clinical and Experimental Toxicology	2 Cr.
------------------	---	--------------

This course will provide a deeper understanding of clinical and experimental toxicology. Upon completion of this course, students will be able to:

- Describe the toxic effects and substances affecting the liver.
- Describe the toxic effects and substances affecting the kidneys.
- Describe the toxic effects and substances affecting the central nervous system (CNS).
- Describe the toxic effects of mycotoxins.
- Describe the toxic effects of phycotoxins.

004SBLGS3	Clinical Biochemistry	3 Cr.
------------------	------------------------------	--------------

This course enables students to:

- Evaluate physiological and pathological biochemical parameters, including metabolic regulation (carbohydrates, lipids, proteins), liver and kidney function, electrolyte and calcium balance, and blood gases.
- Identify normal biochemical values, physiological variations, and major abnormalities.
- Select and apply biochemical assays, recognize interferences, interpret results, assess key biomarkers (including cardiac and tumor markers), and provide clinical-biological guidance for diagnosis and prevention.
- Understand major diseases, their risk factors, and diagnostic approaches (biochemical, biological, and molecular), including metabolic, cardiovascular, hepatic, renal, oncological disorders, and electrolyte and acid-base imbalances.

004SRBCM4	Clinical Biochemistry and Molecular Biology Research Internship	20 Cr.
------------------	--	---------------

This internship provides students with hands-on experience in laboratory research, allowing them to acquire fundamental research methods and apply them to their specific research topics under their Master's program.

004SRPCM4	Clinical Pharmacology Research Internship	20 Cr.
------------------	--	---------------

This internship provides students with hands-on experience in laboratory research, allowing them to acquire fundamental research methods and apply them to their specific research topics under their Master's program.

004PECLS3	Clinical Pharmacy I	3 Cr.
------------------	----------------------------	--------------

This clinical pharmacy course focuses on the major neurological and psychiatric disorders. It aims to train students in optimizing patient medication management by providing them with the knowledge necessary to understand the pathophysiological and etiological mechanisms, clinical manifestations, and diagnostic tools associated with these conditions.

The course also addresses the principles of therapeutic management based on the most recent international treatment guidelines that inform the selection of therapeutic strategies. This enables students to understand the foundations of clinical reasoning as applied to the optimization of pharmacological care and the effective medication management of patients.

004TEQES4	Clinical Pharmacy II	3 Cr.
------------------	-----------------------------	--------------

By the end of this course, students will be able to:

Clinical Antibiotic Therapy

Systematically analyze infectious clinical cases and design, justify, and optimize appropriate antibiotic therapy by integrating microbiological data, including suspected or identified pathogens, antimicrobial susceptibility testing results, and local epidemiology.

Apply pharmacological principles, including mechanisms of action, spectrum of activity, pharmacokinetics/pharmacodynamics (PK/PD), and safety profiles, to antibiotic selection and use.

Integrate clinical parameters, including the site and severity of infection and patient-specific factors such as age, comorbidities, renal and hepatic function, and immune status, in accordance with clinical guidelines and evidence-based practice.

Reassess and adjust antibiotic therapy based on clinical response and microbiological results, including de-escalation or escalation when appropriate.

Individualize therapeutic regimens by selecting the appropriate drug, dose, route of administration, and duration according to PK/PD principles and patient-specific characteristics.

Apply antimicrobial stewardship principles to limit the emergence of bacterial resistance and improve the quality of care.

Contribute to therapeutic decision-making in infectious diseases and promote the safe, effective, and responsible use of antibiotics in hospital and community pharmacy practice.

Gastroenterology, Nephrology, and Pulmonology

Understand and analyze the major digestive, respiratory, and renal diseases by integrating pathophysiological, clinical, and pharmacological data.

Contribute to appropriate therapeutic decision-making, ensure medication safety, and optimize patient outcomes in hospital and community pharmacy practice.

004SRTCM4	Clinical Toxicology Research Internship	20 Cr.
------------------	--	---------------

This internship provides students with hands-on experience in laboratory research, allowing them to acquire fundamental research methods and apply them to their specific research topics under their Master's program.

004INTES4	Drugs Interactions	2 Cr.
------------------	---------------------------	--------------

This course provides a fundamental foundation for the training of pharmacists. It is offered to fourth-year Pharmacy students and is a compulsory course.

Upon completion of this course, students will be able to:

- Analyze a prescription and identify and describe any potential drug interactions.

- Analyze a drug interaction and determine its severity.
- Inform patients about potential drug interactions.
- Explain to patients the measures that should be taken to prevent drug interactions.
- Understand the operation of pharmacovigilance systems worldwide.

004TODUS4	Emergency Toxicology	3 Cr.
------------------	-----------------------------	--------------

This course provides a fundamental basis for the training of future pharmacists. It is delivered to fourth-year Pharmacy students and is part of both the undergraduate (Bachelor's) and graduate (Master's) program. This is a compulsory course.

Upon completion of this course, students will be able to:

- Provide patients with information regarding potential toxic effects of medications and other toxic substances.
- Analyze cases of intoxication, assess their severity, and determine the appropriate management measures.

004ENLOS4	Endocrinology	2 Cr.
------------------	----------------------	--------------

This course covers the main endocrine disorders. It begins with a general introduction addressing hormonal signaling, and is then organized by endocrine gland, covering the hypothalamic–pituitary axis, the thyroid, the adrenal glands, the gonads, as well as osteoporosis and calcium–phosphate metabolism. Each chapter includes a physiological review, the clinical presentation of major disorders, and their corresponding therapeutic approaches. Except for osteoporosis, metabolic diseases are not included in this course.

004EPBCM3	Epidemiology and Statistics	2 Cr.
------------------	------------------------------------	--------------

This course covers common statistical methods used in biomedical research through case studies and practical workshops, utilizing the statistical functions of Microsoft Excel ^(R).

004GEAMM1	Genomics and Medical Applications	2 Cr.
------------------	--	--------------

This course provides in-depth knowledge and enables students to understand how genomics guides the development of personalized therapies, optimizes their effectiveness, and improves patient safety.

Upon completion of this course, students will be able to:

- Recognize the different methods used for sequencing genomes.
- Understand exomic, genomic, and genetic analyses in medicine and pharmacy.
- Integrate methods for analyzing and quantifying gene expression, as well as their applications in research and diagnostics.
- Understand the different transgenic animal models and their applications in the study of genes and therapeutic targets.
- Understand the applications of monoclonal antibodies, bispecific antibodies and immunotherapy in personalized medicine, particularly in the identification of therapeutic targets, the evaluation of treatment response, and the prediction of adverse effects.
- Interpret the results of genomic techniques used to analyze genetic signatures involved in treatment toxicity (toxicogenomics).

004TIBCM1	Innovative Therapies: From Patent to Commercialization	2 Cr.
------------------	---	--------------

This course covers the regulations and strategies governing the pre-launch phase of medicinal products at the international, regional, and local levels, evaluates them, and explains how to apply the most appropriate ones within the pharmaceutical industry.

This course is part of the master's program in Innovative Therapies and is a mandatory course.

004STPHM1	Internship in Pharmaceutical Firms or Industries	4 Cr.
------------------	---	--------------

The objective of the internship is to enable pharmacy students to complement their theoretical training and gain concrete professional experience within the pharmaceutical industry. This includes, on the one hand, obtaining an overview of how the different departments operate and collaborate, and on the other hand understanding local regulations, the application of ethical charters, standards and good practices, as well as the specificities of the specialized department in which the student will carry out the internship.

At the end of the internship, the student will be able to:

- Understand the different professions within the sector.
- Learn to work in a team and communicate in a professional environment.
- Become familiar with professional practices, pharmaceutical regulations, and standards to ensure product compliance throughout their lifecycle, while guaranteeing consumer safety.
- Manage a project within the specialized host department by applying their knowledge.
- Interpret and analyze pharmaceutical regulations as well as the local or regional market context and dynamics.
- Anticipate legislative and/or commercial developments.

004TLCMM3	Introduction to Laboratory Work	1 Cr.
------------------	--	--------------

This course introduces students to laboratory work, the study of risks associated with handling chemical and biological products, waste management, as well as hazard identification and safety precautions.

004MFMSM4	Master Thesis	10 Cr.
------------------	----------------------	---------------

The Master Thesis consists of a comprehensive research project that explores and analyzes a specific topic within pharmaceutical and biological sciences. Students may focus on areas such as clinical biochemistry, molecular biology, microbiology, toxicology, or pharmacology, based on the theme and specialization of the laboratory where research and internship are conducted. This project highlights the mastery of knowledge gained throughout the program and during the laboratory internship, demonstrating the ability to conduct thorough scientific research and generate innovative, applicable solutions.

004MATCM1	Mechanisms of Toxicity, Carcinogenesis, and Regulations	2 Cr.
------------------	--	--------------

This course covers clinical and experimental toxicology. Upon completion of this course, students will be able to:

- Describe the evolution of toxic substances in the body (toxicokinetics, biotransformations, and cellular and molecular mechanisms of toxic action).
- Apply the principles of cell culture.
- Identify the different toxicity studies and tests required for obtaining marketing authorization (MA) for new drugs.
- Explain the foundations of carcinogenesis, mutagenesis, teratogenesis, and immunotoxicity.
- Recognize the basic principles of pharmacovigilance.
- Apply the principles for analyzing a scientific article.

004BITHS1	Medical Biotechnology	2 Cr.
------------------	------------------------------	--------------

This course covers advanced knowledge in genetic engineering and biotechnology, including their pharmaceutical applications and therapeutic innovations. Key topics include gene therapy, recombinant proteins, and molecular cloning; methods for drug synthesis using genetic engineering; biosimilars and their regulatory frameworks; gene-drug interactions; regulation of gene expression; and emerging therapeutic strategies based on innovative pharmaceutical biotechnologies, such as RNA interference (RNAi).

004SRMIM4	Microbiology Research Internship	20 Cr.
------------------	---	---------------

This internship provides students with hands-on experience in laboratory research, allowing them to acquire fundamental research methods and apply them to their specific research topics under their master's program.

004PHMBM1	Molecular Pharmacology and Biostatistics	2 Cr.
------------------	---	--------------

This course aims to enable students enrolled in the Master 1 (M1) Research in Pharmaceutical and Biological Sciences program to:

- Recall the main statistical methods used for the analysis of clinical data.
- Understand the principles of clinical interventional studies and pharmacoepidemiologic studies.
- Critically appraise statistical methodologies and study protocols presented in scientific articles.
- Analyze survival data.
- Understand the principles of regression models.
- Understand the principles of systematic reviews and meta-analyses.

- Develop and organize a database for statistical analysis within the framework of a research study (e.g., a master's thesis).
- Use IBM SPSS to perform standard statistical analyses of data.

004NUTRS4	Nutrition	3 Cr.
------------------	------------------	--------------

This course complements the previous modules and focuses on obesity, a chronic disease commonly encountered by community pharmacists. As healthcare advisors, pharmacists must understand this condition, especially since it is a major risk factor for chronic non-communicable diseases.

There are two main types of obesity: android and gynoid. Android obesity is particularly associated with higher risks of diabetes, hypertension, cardiovascular and cerebrovascular diseases, and certain cancers. Obesity is defined as an excess of body fat, not simply excess weight.

Its study requires understanding:

- Causes of weight gain (diet vs. lack of physical activity)
- Behavior of adipose tissue
- Type of obesity
- Methods of patient assessment
- Management strategies

Management relies on a comprehensive approach combining a hypocaloric diet, increased physical activity, and lifestyle changes.

This course provides the essential knowledge needed to effectively manage patients with obesity.

004PHAGS3	Pharmaceutics III	4 Cr.
------------------	--------------------------	--------------

This course explores in detail “non-conventional” pharmaceutical dosage forms, along with innovative formulations and those currently under development for various routes of administration. It also covers biologically derived medicinal products, with a particular focus on human insulin and its analogues, as well as vaccines.

004STDEM1	Research Internship (Biochemistry, Molecular Biology, Microbiology, Pharmacology, Toxicology)	4 Cr.
------------------	--	--------------

This internship provides an introduction to fundamental and clinical research applied to toxicology, immunotoxicology, clinical biochemistry, molecular biology, pharmacology, and microbiology. This course enables students to become familiar with key experimental techniques, including cell culture (notably the isolation of mononuclear cells by Ficoll density gradient centrifugation) and cell stimulation; DNA and RNA extraction; conventional PCR and real-time PCR; electrophoretic migration; Sanger sequencing; evaluation of the anti-inflammatory activity of a substance; and protein quantification using ELISA.

It also develops skills in analytical separation methods, including thin-layer chromatography (TLC) and gas chromatography coupled with mass spectrometry (GC-MS), the latter applied to the detection of urinary toxic substances.

In addition, students will gain an understanding of the principles of high-performance liquid chromatography (HPLC), as well as of disintegration and dissolution testing apparatus used in the quality control of pharmaceutical dosage forms.

Students will also be introduced to bioinformatics tools for sequence analysis, identification of genetic variations, and primer design. In the microbiology component, students will participate in the identification of microorganisms, the study of their antimicrobial susceptibility, and the understanding of resistance mechanisms, while also exploring molecular detection techniques and microbiome analysis. Furthermore, students will develop scientific analysis and communication skills by critically evaluating research articles in toxicology, biochemistry, pharmacology, and microbiology, and by presenting their work through posters or internship reports.

Overall, the placement aims to instill a rigorous scientific approach based on observation, critical analysis, quality assurance, traceability, biosafety, and clinical relevance, in alignment with the objectives of the Master 1 program.

004MRSCM3	Research Methodology	1 Cr.
------------------	-----------------------------	--------------

This course enables students to acquire skills in research methodology, literature searching and querying bibliographic databases.

004MIBOS3	Special Microbiology II	4 Cr.
------------------	--------------------------------	--------------

This Medical Bacteriology course is offered to students enrolled in the 4th year of the Doctor of Pharmacy program (professional doctorate). It is a mandatory course. This course provides an introduction to bacterial infectious diseases in humans, whether they are exclusively of human origin or are zoonotic infections (transmitted from animals to humans).

It contributes to the development of the following competencies:

- Recognize the different pathogenic bacteria affecting humans and the clinical signs of the infections they cause.
- Understand the principles of identifying bacteria responsible for infections and assessing their susceptibility to antibiotics.
- Recognize the different antibiotic therapies appropriate for each infection according to factors such as the site of infection, the patient's age, and other relevant considerations.
- Acquire the fundamental knowledge necessary to differentiate bacterial infections from viral infections, enabling appropriate patient counseling and guidance.

004PHSPS3	Special Pharmacology I	4 Cr.
------------------	-------------------------------	--------------

This course constitutes the second part of a three-course series in specialized pharmacology delivered over three semesters. It provides the rational foundations and general principles of pharmacotherapy.

The course integrates the pathophysiological mechanisms of diseases with the pharmacological properties, clinical pharmacokinetics, and pharmaceutical formulations of drugs used in the treatment of inflammatory, endocrine, and gynecological disorders.

004PHSOS4	Special Pharmacology II + Oncology	4 Cr.
------------------	---	--------------

This course covers cardiovascular pharmacology, focusing on the major cardiovascular diseases and the pharmacological management strategies used in their treatment. Emphasis is placed on the mechanisms of action, therapeutic indications, adverse effects, drug interactions, and appropriate use of cardiovascular medications. In addition, this course addresses the full range of oncology therapeutics, including conventional anticancer agents, targeted therapies, immunotherapies, and supportive treatments. Attention is given to their mechanisms of action, clinical indications, adverse effects, drug interactions, and safe and effective use. The course also highlights the latest evidence-based guidelines and current standards of care in oncology, ensuring that students are familiar with recent advances and best practices in cancer treatment.

004PHAPS3	Special Pharmacology Practical Work	1 Cr.
------------------	--	--------------

This course focuses on experimental pharmacology through virtual simulation platforms, including isolated organ models (OBSim) and the rat cardiovascular system (RatCVS). Students will apply theoretical concepts from lectures to analyze dose-response relationships, interpret the effects of agonists and antagonists, identify the receptors involved, and present their findings in the form of tables, graphs, and a structured scientific report.

004RSSPM3	Specialized Research in Pharmaceutical and Biological Sciences (Pharmacology, Toxicology, Infectious Diseases, and Clinical Biochemistry)	10 Cr.
------------------	--	---------------

This course promotes a multidisciplinary perspective on research within the pharmaceutical and biological sciences, covering areas such as clinical biochemistry, molecular genetics, pharmacology, toxicology, immunotoxicology, and microbiology. It deepens and hones the expertise of healthcare professionals in these fields, equipping them for research initiatives and therapeutic innovations.

004CHT3S3	Therapeutic Chemistry II	2 Cr.
------------------	---------------------------------	--------------

This course covers:

- The structure of molecules.
- The physicochemical properties of these molecules and their pharmaceutical, kinetic, and metabolic implications.
- The properties conferred by their structure regarding their ability to interact with receptors and enzymes.
- The similarities between different structures and the consequences of these similarities in terms of physiological, metabolic, kinetic, and pharmacological properties, as well as their therapeutic implications.
- The development opportunities offered by these structures and the new approaches to molecular design.
- The synthetic pathways used to obtain these molecules.

004TOXIS3**Toxicology****4 Cr.**

This course provides a foundational component of pharmacy training. It is delivered to fourth-year pharmacy students and is part of both the Bachelor's and Master's programs. It is a compulsory course. The course introduces the basic principles of toxicology.

By the end of this course, the student will be able to:

- Advise patients on the potential toxic effects of medications and other toxic substances.
- Assess a case of poisoning, determine its severity, and decide on appropriate management.

004VIROS4**Virology****2 Cr.**

This course enables students to:

- Identify the major human pathogenic viruses.
- Describe their structure and their interactions with host cells.
- Recognize the diseases caused by viral infections.
- Understand the mechanisms underlying viral latency and virus-induced carcinogenesis.
- Identify the diagnostic methods used for viral infections.
- Describe the strategies for prevention and control of viral diseases, including prophylaxis, treatment, and vaccination.