MASTER IN PHARMACEUTICAL AND BIOLOGICAL SCIENCES

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.
- Conduct bibliographic research, synthesize available resources, and analyze epidemiological, clinical, 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 French and English.
- Develop skills to communicate accurately, precisely, and clearly.
- Learn the rules of scientific publishing and research integrity: ethics, anti-plagiarism, accuracy, veracity, copyright.
- Discuss and defend research results.

C5
- Adapt to various socio-professional and intercultural contexts, both nationally and internationally, while collaborating in teams.
- Integrate into a versatile pharmaceutical team.
- Acquire, apply, and develop new technologies.

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 the Saint Joseph University (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.). Research Internship (Biochemistry, Molecular Biology, Microbiology, Pharmacology, Toxicology) (4 Cr.). Microbiology Research Internship (20 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 two out of four:** 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 Courses: **Choose one out of four:** 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.

004SBLGS3 Clinical Biochemistry 3 Cr.

This course equips students to:
1) Assess pathophysiological biochemical parameters, homeostasis, and the regulatory mechanisms of carbohydrate, lipid, and protein metabolism, as well as hepatic and renal functions, electrolyte balance, phosphocalcium metabolism, and blood gas levels.
2) Identify normal biochemical parameters in healthy individuals, recognize physiological variations, and detect biochemical abnormalities in the aforementioned functions.

3) Select and apply biochemical assay techniques, recognize interferences, evaluate tumor and cardiac biomarkers, interpret results, identify associated pathological disorders, and provide clinical-biochemical guidance to enhance diagnostic and preventive care.
4) Master key pathologies, their risk factors.
5) Learn diagnostic methods in clinical biochemistry, molecular biology, and laboratory medicine, focusing on disorders of carbohydrate, lipid, and protein metabolism, oncological and cardiovascular conditions, hepatic and renal dysfunctions, as well as electrolyte, phosphocalcium, and blood gas disturbances.

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.

004BICEM3 Cell Biology 2 Cr.

This course covers cell culture techniques and molecular biology methods.

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.

004BITHS1 Medical Biotechnology 2 Cr.

This course covers advanced knowledge in genetic engineering and biotechnology, focusing on pharmaceutical applications and therapeutic innovations, including gene therapy, recombinant proteins, molecular cloning, drug synthesis processes via genetic engineering, biosimilars and regulations, gene-drug interactions, and new therapeutic strategies based on innovative pharmaceutical biotechnologies.

004CHT3S3 Therapeutic Chemistry II 2 Cr.

This course aims to understand, consolidate, and expand knowledge across all therapeutic classes, including:
- Molecular structure
- Physicochemical properties and their galenic, kinetic, and metabolic implications
- Adaptability of structure to receptors and enzymes
- Structural analogies and their effects on physiological, metabolic, kinetic, and pharmacological properties
- Development opportunities from molecular structures and new design approaches
- Synthesis of these molecules

004ENLOS4 Endocrinology 2 Cr.

This course covers hormones, metabolism, hormonal dysfunctions, and the regulation of secretions.

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 and (R).

004TLCMM3 Introduction to Laboratory Work 1 Cr.

This course introduces students to laboratory work, including handling hazards, waste treatment, risk identification, and safety guidelines.

004INTES4 Drugs Interactions 2 Cr.

This course aims to:
- Analyze a prescription to identify and describe potential interactions.
- Assess the interaction and determine its severity.
- Inform the patient about possible drug interactions.
- Explain to the patient the measures to take to avoid interactions.

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 the 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.

004MRSCM3 Research Methodology 1 Cr.

This course enables students to acquire methodologies for conducting internet research, including document searches and database queries, as well as techniques for writing a scientific article.

004MIBOS3 Special Microbiology II 4 Cr.

This course introduces infectious diseases of bacterial origin in humans, including zoonotic infections. It aims to develop the following skills:

- Identify pathogenic bacteria and their clinical infection signs.
- Initiate bacterial identification and assess antibiotic sensitivity.
- Select appropriate antibiotic therapies based on infection site and patient age.
- Differentiate between bacterial and viral infections for effective patient counseling.

004GEAMM1 Genomics and Medical Applications 2 Cr.

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

1) Recognize various genome methods and sequencing techniques.
2) Apply exomic, genomic, and genetic analyses in medicine and pharmacy.
3) Integrate methods for analyzing and quantifying gene expression, including their research and diagnostic applications.
4) Understand transgenic animal models and their use in studying genes and therapeutic targets.

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

This course provides an in-depth understanding of Clinical and Experimental Toxicology.
Students will be able to:

- Describe the fate of toxic substances in the body (toxicokinetics, biotransformations, cellular and molecular toxic mechanisms).
- Apply principles of cell culture.
- Identify necessary toxicity studies and tests for obtaining marketing authorization of new drugs.
- Determine the basis of carcinogenesis, mutagenesis, teratogenesis, and immunotoxicity.
- Recognize the fundamentals of pharmacovigilance.
- Apply principles of analyzing a scientific article.

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

This course serves as an introduction to research in neuropharmacology. It aims to provide future graduates with the latest ideas for studying common neurological disorders and developing new ways to treat them. The course is divided into four parts for each disorder.

- A review of the causes of diseases and how they are treated with medicines.
- Finding new ways to target drugs and identify biological markers.
- Presentation of current treatment options being studied in research labs.
- A detailed explanation of the animal models and evaluation tests used in preclinical studies of these disorders.

004PHMBM1 Molecular Pharmacology and Biostatistics 2 Cr.

This course aims to enable M1 students to:

1) Recall the main statistical methods for analyzing clinical data.
2) Understand the principles of clinical intervention studies and pharmacoepidemiology.

3) Critique the statistical methodology and study protocols in scientific articles.
4) Analyze survival data.
5) Grasp the principles of regression models.
6) Understand the principles of systematic reviews and meta-analysis.
7) Construct a database for statistical analysis within the context of a study (e.g., thesis).
8) Utilize IBM SPSS for standard statistical data analyses.

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

This internship provides students with foundational training and experience in pharmaceutical firms or industries.

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

This course introduces fundamental and clinical research in the fields of clinical biochemistry, genetics, molecular biology, microbiology, pharmacology, and toxicology.
By the end of the course, students will be able to:
- Integrate fundamental research developments in pharmaceutical and biological fields.
- Use molecular biology and genetics techniques (DNA extraction, PCR, electrophoretic migration, sequencing, etc.).
- Learn about cell culture methods.
- Process cell stimulation and recognize techniques for evaluating target gene expression (RNA extraction, PCR, real-time PCR, electrophoretic migration, etc.).
- Use analytical separation techniques (GC-MS).
- Use bioinformatics software and familiarize yourself with various genetic databases and sequence analysis software.
- Prepare a poster or present research results.
- Apply microbiology techniques, particularly molecular microbiology and microbiota analysis.
- Apply methods for mutation research, sequencing, and pharmacogenetics.

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

By the end of this course, students will be able to:
- Recognize different cellular signaling pathways, their pathophysiological and therapeutic applications, chemical messengers, receptors, and signaling pathway modules and their regulation.
- Master the molecular, cellular, diagnostic, and therapeutic approaches to major metabolic and cardiovascular pathologies, as well as the latest advances in research on diabetes, dyslipidemias, hypercholesterolemia, and cardiovascular complications, and in nutrigenetics and nutrigenomics.
- Describe the different types of cell death.
- Recognize the signaling pathways activated by xenobiotics.
- Identify adverse effects induced by monoclonal antibodies and tyrosine kinase inhibitors.
- Recognize the fundamentals of animal experimentation.
- Explain the basis of toxicogenomics.
- Integrate the development of fundamental research in the pharmaceutical and biological domains.

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

This course explains pharmaceutical law and regulations at the international, regional, and local levels. This includes the stages of research and development, pre-launch, and product launch. The course also provides practical experience. This training offers a theoretical overview, along with an internship to help students learn more about how the pharmaceutical industry works. This experience will help them understand how important pharmacists are in the industry and the many opportunities that are available to newcomers and professionals interested in the pharmaceutical sector.

004TCEXM1 Clinical and Experimental Toxicology 2 Cr.

This course provides an in-depth understanding of clinical and experimental toxicology. Upon completion, students will be able to describe the toxic effects of:

- Toxic agents affecting the liver.
- Toxic agents affecting the kidneys.
- Toxic substances in the central nervous system (CNS).
- Mycotoxins.
- Phycotoxins.
- Pesticides.

004NUTRS4 Nutrition 3 Cr.

This course introduces the concepts of nutrition and defines key terms. It covers the following topics:

- Nutritional status of individuals.
- Human nutritional behavior.
- Fundamentals of nutrition.
- Obesity and its therapeutic approaches.

004PECLS3 Clinical Pharmacy I 3 Cr.

This course provides students with essential knowledge to understand major pathologies, their complications, and relevant biological tests for diagnosis and monitoring. Students will actively participate in therapeutic decision-making and selecting optimal treatments, including treatment selection, dosage adjustment, dosage form choice, and awareness of precautions, contraindications, and potential side effects.

004TEQES4 Clinical Pharmacy II 3 Cr.

This course aims to deepen students' knowledge and consolidate their understanding of infectious diseases and neurology, enabling them to enhance their analysis of optimal patient management, follow-up, and the optimization of pharmaceutical care plans.

004PHAGS3 Pharmaceutics III 4 Cr.

This course aims to formulate and manufacture unconventional pharmaceutical forms, innovative formulations, and develop forms for various routes of administration. It also covers biopharmaceuticals.
Connections to Program Learning Outcomes (PLO):

- Develop a pharmaceutical product within a team.
- Participate in the manufacturing of a pharmaceutical product.
- Ensure quality control of pharmaceutical products according to standards.
- Inform, promote, and respond to healthcare professionals' inquiries within marketing and regulatory affairs teams.

004PHSPS3 Special Pharmacology I 4 Cr.

This course deepens students' understanding of the hormonal and endocrine systems, the mechanisms of action of antibiotics, their practical uses, potential patient issues, and strategies for providing effective advice.
By the end of this course, students will be able to:

- Explain the main mechanisms of action of the medications discussed.
- Identify potential side effects associated with the studied drug class.
- Understand the implications of these side effects and how to mitigate them.
- Define the specific therapeutic indications for the medications covered.

004PHSOS4 Special Pharmacology II + Oncology 4 Cr.

This course equips students with essential knowledge in pharmacology, focusing on mediators, receptors, transporters, and targets related to cancer and its treatments, including platelet aggregation. By understanding both the intended therapeutic effects and potential side effects, students will be equipped to develop effective care and counseling strategies in hospital environments, especially in oncology.

This course is vital for preparing students for the clinical pharmacy course in their fifth year and for their practical internship in hospitals. Ultimately, the goal is to "deliver pharmaceutical care by safely dispensing medications and health products in hospital and pharmacy settings."

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.

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.

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.

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.

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.

004TOXIS3 Toxicology 4 Cr.

This required course contributes to the development of the following competencies and Program Learning Outcomes (PLO):

- Prepare and dispense medications and health products.
- Address the needs of patients seeking pharmaceutical care for treatment or guidance.
- Inform patients about potential toxic effects of medications and other toxic products.
- Analyze an intoxication, assess its severity, and determine appropriate actions.

004TODUS4 Emergency Toxicology 3 Cr.

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

- Inform patients about potential toxic effects of medications and other toxic products.
- Analyze an intoxication, assess its severity, and determine appropriate actions.

004PHAPS3 Special Pharmacology Practical Work 1 Cr.

This course studies tests related to analgesics and muscle relaxants.

004VIROS4 Virology 2 Cr.

This course introduces students to viral infectious pathologies in humans, whether strictly human or zoonotic. It aims to:

- Recognize various pathogenic viruses in humans and the clinical signs of associated infections.
- Initiate diagnostic processes for viral infections.
- Identify appropriate antiviral treatments for each infection.
- Acquire essential knowledge for differential diagnosis with bacterial infections.