



# Master of Science in Pharmaceutical Sciences



## Student Handbook 2019-2020

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## Introduction

Advances in biotechnology have significantly increased the need for pharmaceutical scientists with comprehensive knowledge and diverse skills than a typical specific subject program can provide. The Pharmaceutical Sciences Master Program (MPS) at the California Northstate University (CNU) provides rigorous background in a range of scientific disciplines that are critical to the preparation of the next generation of pharmaceutical scientists. Situated in Northern California, CNU is surrounded by over 700 biotechnology/pharmaceutical companies, with proximity to Silicon Valley – one of the world’s leading technology innovation centers. Graduates with a Master of Pharmaceutical Sciences from CNU can look forward to abundant job opportunities in a variety of public and private settings, including research and development, drug manufacturing, and regulatory affairs, or to continuing on to PhD, PharmD and MD programs.

MPS at CNU is a unique program integrated with the Colleges of Pharmacy and Medicine. With over 20 faculty members from a variety of disciplines, the MPS program prepares students with integrated pharmaceutically-relevant aspects of classical disciplines and applications in drug discovery and development with unique clinical and therapeutic perspectives. The MPS at CNU has designed a flexible Master Program to prepare students for a wider spectrum of professional career in pharmaceutical sciences fields and leadership roles in industry while also providing them with the opportunity to strengthen their fundamental knowledge and obtain a hands on skills in research.

Accepted graduate applicants commonly have strong scientific backgrounds, a passion for pharmaceutical sciences/biotechnology and in many cases ample laboratory experience. Students with undergraduate degrees in the chemistry, biological sciences, and related fields are encouraged to apply.

## Mission Statement

To advance the science of pharmaceutical research by developing future scientists trained to promote health through knowledge, research, and social responsibility

## Vision

Preeminence in pharmaceutical sciences research, drug development skills, and integrated education abilities

## Faculty Profiles

### **Dr. Catherine Yang, PhD**

Dr. Yang is a Professor of Molecular Pharmacology at the Department of Basic Science of College of Medicine of California Northstate University (CNU). Before joining CNU, Dr. Yang was a biochemistry/pharmacology Professor in the Department of Chemistry and Biochemistry at Rowan University for 23 years. She also held Professorships at Cooper Medical School of Rowan University in the Departments of Chemistry and Biochemistry and Translational Biomedical Sciences. While at Rowan, Dr. Yang served as the Chairperson for the Department of Chemistry and Biochemistry from 2007 to 2016 and the Director for the Biochemistry Program from 2000 to 2007. She has held research and faculty positions at Harvard Medical School, the American Health Foundation, Boston Biomedical Research Institute, Tokyo University of Medicine and Dentistry, University of Pennsylvania and Zhejiang University of Technology.

Dr. Yang has made strong contributions in elucidating mechanisms of tumor progression, and in the development of novel cancer drugs and antibiotics. She has led research groups studying proteolytic regulatory mechanisms in the advanced stages of prostate cancer, lung cancer and leukemia. Her in-depth research on type 2 diabetic metabolic regulation led to a dual function diabetes drug patent. Dr. Yang's immunological research resulted in an allergy vaccine development that is currently under clinical trials at affiliated clinics. The specific approach of triggering induction of immunologic tolerance to external or autologous allergens, and induction of sensitization to infectious or tumor antigens, with targeted tissue delivery of particles sized to facilitate uptake by specific cell populations, will provide unique therapeutic platform for curing advancement stage cancer. Dr. Yang's unique predictive biomarker studies have also spurred a Nano-sensor development for an early cancer diagnosis.

Dr. Yang has published more than 60 research papers, several biotechnology books, and is an inventor of several patented inventions. She has also secured numerous grants from the NIH, NSF, Research Corporation and New Jersey Health Foundation as well as funding from many corporations and health foundations. She serves on various review boards of federal, private and health foundation funding agencies.

### **Dr. Ahmed El-Shamy, D.V.M., M.S., Ph.D.**

Dr. Ahmed Elshamy is the Director of MPS program. Dr. El-Shamy is an assistant professor of virology at Dept. of Pharmaceutical and Biomedical Sciences College of Pharmacy and Dept. of Basic Sciences College of Medicine CNU. In 1999, Dr. Elshamy received a DVM from faculty of Vet. Medicine Suez Canal University, Egypt. In 2009, he received a PhD in Molecular Virology at Kobe University, Japan, where he also awarded two years post-doctoral fellowship. From Oct. 2011 to Dec. 2017, Dr. Elshamy joined Division of Liver Diseases at Mount Sinai School of Medicine, New York as a senior post-doctoral fellow. During his PhD and post-doctor studies, Dr. Elshamy published 25 publications in high impact peer-viewed journal. He is the first author

in 10 publications; three of them have been published in the highest journals of liver field (two in Hepatology and one in Journal of Hepatology). Over the course of these studies, Dr. Elshamy has established a global network with world-leading virology researchers. In 2014, Dr. Elshamy received Japan Society for the Promotion of Science (JSPS) Award; and in 2013, he received The Encouragement State Prize in Medical Sciences from the Academy of Scientific Research and Technology, Egypt. His PhD study was selected as the Medical School Excellent Paper for the 2008-2009 Academic Year from Kobe University, Japan (El-Shamy et al., Hepatology. 2008; 48:38-47).

As assistant lecturer at faculty of Vet. Medicine Suez Canal University, Egypt, Dr. Elshamy was responsible to teach the Diagnostic Virology course to post graduate students from 2001 – 2005. In 2004, he was awarded the best Teaching Assistant Trainee completing Teaching Skills Courses, Suez Canal University, Egypt. During his post-doctoral training at Kobe University and Mount Sinai School of medicine, Dr. Elshamy trained several medical, master and Ph.D students on molecular virology techniques, especially isolating the virus on tissue culture.

Liver cancer is the second leading cause of site-specific cancer-related death worldwide and the most rapidly increasing cause of cancer-related death in North America. Hepatitis B and C viruses are the leading risk factors of liver cancer development. Therefore, Dr. Elshamy's research focuses on investigating the biology underlying cellular pathways disrupted by oncogenic HBV and HCV strains using novel cell culture system that was recently established by Dr. Elshamy's team (El-Shamy et al., J. Hepatology 2016). This research plan aims eventually to identify novel viral markers for liver cancer and novel targets for liver cancer therapy. In addition, Dr. Elshamy will use the newly established cell culture-based system as an efficient platform for high throughput screening of novel therapies for liver cancer.

Dr. Elshamy's research plan will open several doors to (i) use state-of-art research techniques (including RNA-seq, Single cell sequencing, Mass cytometry-CyToF and next generation sequencing), (ii) train and mentor both undergraduate and graduate students, and (iii) collaborate with multidisciplinary teams.

#### **Dr. Simeon Kotchoni, PhD**

Dr. Kotchoni is an associate professor in the Department of Pharmaceutical and Biomedical Sciences at California Northstate University, College of Pharmacy (CNUCOP). Prior to joining CNUCOP, he was an assistant Professor at Rutgers University, Camden, New Jersey (2011-2017). He received his B.S. and MS in Biochemistry and Cell Biology from University of Abomey Calavi, Benin, and another MS in Microbiology from Obafemi Awolowo University, Ile-Ife, Nigeria. He received his Ph.D. from the University Of Bonn, Germany, where he study the role of Aldehyde Dehydrogenase (ALDH) Gene superfamily in a model plant, Arabidopsis thaliana. After his Ph.D., Dr. Kotchoni has worked as a postdoctoral researcher in Europe (Bonn, Germany), and USA (West Virginia University and Purdue University), using interdisciplinary research techniques, including molecular genetics, cell biology, proteomics, transcriptomics, metabolomics to

understand the molecular and cellular mechanisms of growth development and environmental adaptation of organisms.

The Kotchoni laboratory studies health benefits of natural products, especially, medicinal plants, and microorganisms. We focus on understanding the molecular and clinical effects of natural-derived compounds on chronic diseases and developing botanical therapeutics for health promotion and wellness. Our work extends to worldwide research collaborations on drug discovery and development. Drug discovery from natural products represents a re-visited area of active interest. In a multi-disciplinary investigator collaboration, our laboratory is currently developing small molecules from natural products against diabetes, Hepatitis B Virus, prostate, brain, breast and colon cancers with limited or no side effects.

#### **Dr. Hongbin Wang, PharmBS, MS, PhD**

Hongbin Wang is an Assistant Professor in the Department of Pharmaceutical & Biomedical Sciences at California Northstate University College of Pharmacy (CNUCOP). He received his Ph.D. from University of Pennsylvania, Department of Pharmacology. After receiving his doctoral degree, Dr. Wang worked as a Postdoctoral Researcher in the Department of Systems Pharmacology and Translational Therapeutics and a Senior Research Investigator in the Department of Pathology & Laboratory Medicine, University of Pennsylvania Perelman School of Medicine. During his time at Penn Medicine, Dr. Wang supervised multiple undergraduates, graduates and postdoctoral researchers.

Dr. Wang is interested in studying: 1), interaction of complement activation fragment C4a with protease-activated receptor (PAR) 1/4 G protein-coupled receptors (GPCRs) and their roles and signaling pathways in the initiation and progression of complement related diseases. 2), the function and regulation of protein kinase C enzymes (PKCs), the receptors for the phorbol ester tumor promoters and the second messenger diacylglycerol (DAG), an important intracellular mediator of proliferation and malignant transformation. 3), chimaerins, novel phorbol ester/DAG receptors with Rac-GAP activity toward Rac that is a small GTPase-binding protein that regulates gene expression, cell cycle progression, actin cytoskeleton organization, cell adhesion and migration.

#### **Dr. Zhuqiu (James) Jin, PhD**

Zhuqiu Jin is an Associate Professor in the Department of Pharmaceutical & Biomedical Sciences at the California Northstate University College of Pharmacy. He obtained his M.S. degree in Pharmacology from Shenyang Pharmaceutical University and a Ph.D. degree in Pharmacology from Central South University. Dr. Jin was a postdoctoral scholar at the University of California, San Francisco exploring the effects of sphingolipids in cardio protection. Prior to joining California Northstate University, Dr. Jin taught Pharmacology for Pharm.D. students and Ph.D. graduate students and carried out cardiovascular research as a faculty member at South Dakota State University.



Dr. Jin's research interest is focused on sphingolipid signaling pathway in cardiac fibrosis and remodeling. To uncover the cross-talk between immune cells and cardiac myocytes or fibroblasts in myocardial injury is the major field that Dr. Zhuqiu Jin is exploring.

#### **Dr. Ruth Vinall, PhD**

Ruth Vinall is an Associate Professor in the Department of Pharmaceutical & Biomedical Sciences at California Northstate University College of Pharmacy (CNUCOP). She received her Ph.D. from Cardiff University, U.K., Department of Anatomy. After receiving her doctoral degree, Dr. Vinall worked as a postdoctoral researcher at UC Davis Medical Center. In 2009 Dr. Vinall completed a NIH K30 program-funded M.A.S. degree in Clinical Research at UC Davis and was subsequently appointed as a research faculty in the Department of Urology. During her time at UC Davis Dr. Vinall supervised multiple undergraduate, graduate and medical students, and in 2009 and 2010 was awarded Outstanding Mentor awards for her work with the UC Davis CURE program.

Dr. Vinall's research focuses on prostate and bladder cancer research. She recently received an NIH R15 grant entitled 'Role of the AR-Nrdp-1-ErbB3 axis in mediating prostate cancer health disparities'. In addition to prostate cancer health disparities research, she is interested in determining mechanisms of chemoresistance and identifying biomarkers that can predict patient's response to chemotherapy, a primary focus is miRNA research.

#### **Dr. Valerie Gerriets, PhD**

Prior to joining the CNSU faculty, Dr. Valerie Gerriets received her PhD from the Pharmacology and Cancer Biology department at Duke University, examining T cell metabolism in the context of autoimmune and inflammatory disease. During graduate school, she also obtained a certificate in college teaching and participated in the Duke Scholars in Endocrinology and Metabolism program. Dr. Gerriets then completed a postdoctoral fellowship in the Pediatric Endocrinology division at Duke, as well as serving as the instructor of a pharmacology course at Duke. She now teaches a broad range of pharmacology topics at CNUCOM.

#### **Dr. Linh Ho, PhD**

Linh Ho is an Assistant Professor in the Department of Pharmaceutical & Biomedical Sciences at the California Northstate University College of Pharmacy. She received her B.S. in Pharmacy and M.S. in Pharmaceutical Sciences from University of Medicine and Pharmacy HCMC, and a Ph.D. in Chemistry and Chemical Biology (Pharmacology) from University of California San Francisco (UCSF). Prior to joining California Northstate University, Dr. Ho continued her post-doctoral research at UCSF in regulation of mesenchymal stem cell fate, adipogenesis, and metabolism homeostasis of mitochondrial Sirtuin-3. She has been also working on molecular mechanism of mitochondrial disease (MELAS). Dr. Ho's research focuses on mitochondrial Sirtuins and signaling pathway in metabolic abnormalities, especially type II diabetes. She is exploring Anti-diabetogenic Role of a Sirtuin-3-Adipokines (Adiponectin) Axis in Adipocytes.

### **Dr. Eugene Kreys, PharmD, PhD, BCPS**

Eugene Kreys is an Assistant Professor of Clinical & Administrative Sciences at the California Northstate University College of Pharmacy. He received his PharmD. from the University of Michigan College of Pharmacy in Ann Arbor. He went on to complete a pharmacy practice residency at the Hospital of the University of Pennsylvania in Philadelphia. He subsequently accepted a position as clinical pharmacist at the University of Pittsburgh Medical Center and then Medical University of South Carolina. After spending several years as a clinician Dr. Kreys returned to academia to further develop his research interests. He received a Ph.D. in Pharmaceutical Sciences from The University of Texas at Austin College of Pharmacy. Dr. Kreys has extensive experience assessing the effects of medication adherence on clinical outcomes and the impact evidence-based interventions on public health. Dr. Kreys aims to continue conducting pharmacoepidemiological and pharmacoeconomic studies relevant to today's healthcare system. Specifically, Dr. Kreys is interested in pragmatic comparative effectiveness research focusing on patients treated in a naturalistic setting, which incorporate cost-effectiveness analyses to promote the applicability to public policy and better informed treatment decisions.

### **Dr. Tibebe Woldemariam, PharmBS, PhD**

Tibebe Woldemariam is Associate Professor at the California Northstate University College of Pharmacy. He received his B.S. in Pharmacy and Ph.D. in Pharmaceutical Chemistry from Addis Ababa University, Ethiopia and University of Bradford, England, respectively. Before joining CNUCOP, he worked as a Senior Research Chemist at Biotechnology Companies in Massachusetts and California, where he was responsible for the isolation and characterization of bioactive molecules from diverse microbial, plants and plants tissue culture extracts. He began his academic career at King's College London, before he joined California Northstate University College of Pharmacy as an Assistant Professor in 2008. In addition to his regular duties as an associate professor, Dr. Woldemariam works as a community pharmacist to expand his knowledge beyond Medicinal Chemistry and help precept students when needed.

### **Dr. Suzanne Clark, BS Pharm, PhD**

Suzanne Clark, RPh, PhD, is an Associate Professor of Pharmacology at California Northstate University College of Pharmacy and Vice-Chair of the Department of Pharmaceutical & Biomedical Sciences. She received her B.S. from the University of Iowa, her B.S. in Pharmacy from the University of Wyoming, and her Ph.D. in Pharmacology from Duke University. Her graduate research focused on in vitro models of epilepsy, anticonvulsant drug development, and glutamatergic/GABAergic processes. Her post-doctoral research at the Durham Veterans Administration Medical Center/Duke University Medical Center focused on epilepsy and military occupational exposures to neurotoxins and their underlying neurotoxic mechanisms. After completing additional postdoctoral work on AMPA receptors and epilepsy at Colorado State University, she moved to the University Of Wyoming School Of Pharmacy, where she



taught Pathophysiology to PharmD and Nursing students for nine years. She moved to the CNU College of Pharmacy in 2014, where she teaches pharmacology and pathophysiology of the nervous system. She also worked as a hospital and community pharmacist in Colorado and as a specialist at the Duke Poison Control Center. Her interests include neuropharmacology, occupational and environmental public health, pharmacy education, and team-based learning. She was a founding member of the new Pharmacy Special Primary Interest Group in the American Public Health Association. She has included PharmD and Nursing students in many aspects her teaching, research, and service, and has facilitated opportunities for students to receive institutional, regional and national awards, as well as helping them pursue post-graduate education, academic positions, and public health opportunities.

#### **Dr. Justin Lenhard, PhD**

Justin Lenhard is an assistant professor of Clinical and Administrative Sciences at the California Northstate University College of Pharmacy. Dr. Lenhard received his PharmD from the University at Buffalo School of Pharmacy and Pharmaceutical Sciences, and subsequently completed a two-year fellowship in antimicrobial pharmacology at the University at Buffalo. Dr. Lenhard's research focusses on the in vitro suppression of antibacterial resistance and utilizing novel PK/PD strategies to combat extensively drug-resistant pathogens.

#### **Dr. Lakshmi Chaturvedi, PhD**

Dr. Lakshmi Shankar Chaturvedi (Shankar) is the Associate professor in the Department of Pharmaceutical and Biomedical Sciences-College of Pharmacy (CNUCOP) and in the Department of Basic Sciences-College of Medicine (CNUCOM) at California Northstate University (CNSU). He is a Director of Research at San Joaquin General Hospital (SJGH), French Camp, CA. Prior to joining CNSU/SJGH, he was an associate professor in the Departments of Surgery, Pathology and Biomedical Sciences at University of North Dakota School of Medicine and Health Sciences (UND-SMHS), Grand Forks, ND. He obtained his Bachelor of Science (B.Sc.) degree in Biology from University of Allahabad, Allahabad in Uttar Pradesh (UP), India and Master of Science (M.Sc.) degree in Biotechnology from Guru Nanak Dev University, Amritsar in Punjab, India. He obtained his Doctor of Philosophy (PhD) from Sanjay Gandhi Post-Graduate Institute of Medical Sciences (SGPGIMS), UP, India in Medical Genetics. His PhD thesis work is entitled "Carrier analysis, prenatal diagnosis and point mutation studies in Duchenne/Becker muscular dystrophy (D/BMD)" families. During his PhD research work, he identified of a new rare point mutation in the human dystrophin gene that has been included in the rare mutation/polymorphism category in Duchenne/Becker Muscular Dystrophy database/Leiden muscular Web page ([www.dmd.nl](http://www.dmd.nl)).

Dr. Chaturvedi has an active research group. He supervised medical students, graduate, research associates and junior faculties at Henry Ford Hospital, Wayne State University in Detroit, Michigan State University in East Lansing, MI and University of North Dakota, Grand Forks, ND on multiple research projects related cell-proliferation, apoptosis, migration,

differentiation and cell signaling in the area of breast, colon, intestine, lung, kidney, prostate, and microglial cell-culture system. He has vast experience in handling various pharmacological inhibitor/activators and short interfering RNA (siRNAs) and nanoparticles and their application in biomedical research. Dr. Chaturvedi has taught different courses of medical genetics like clinical genetics, biochemical genetics, molecular genetics, genetic counseling, mutational analysis, and cell signaling. He was co-chair of the hiring committee for Junior Faculties, research associate and post-doctoral fellow in the department of Surgery at UND-SMHS. He has served as a chair for poster session for graduate/post-graduate, medical student and research associates at UND-SMHS. He has also served as a Judge for poster sessions for annual meetings of North Dakota State Science & Engineering Fair (NDSSEF), Michigan State University-College of Human Medicine and Wayne State University-School of Medicine on Research day presentations.

#### **Dr. Uyen Minh Le, PharmBS, PhD**

Dr. Le is the chair and associate professor in the Department of Pharmaceutical and Biomedical Sciences at California Northstate University College of Pharmacy (CNUCOP). Prior to joining CNUCOP, she was an associate professor at Sullivan University College of Pharmacy (SUCOP). She got her B.S. in Pharmacy and M.S. in Pharmaceutical Sciences, both from Ho Chi Minh City University of Medicine and Pharmacy. She obtained her Ph.D. from Oregon State University College of Pharmacy, major in pharmaceutical sciences and minor in statistics. Dr. Le has taught different courses of physical pharmacy, pharmaceutics, biopharmaceutics, pharmacokinetics, and pharmaceutical compounding. Under her coaching, SUCOP team won the champion title at the 2016 National Student Pharmacist Compounding Competition.

She has served as the co-chair of the assessment committee in the AACP Laboratory Instructors Special Interest Group in 2017-2018. She was also the advisor to the AAPS student chapter and served as member of committees such as graduate, accreditation, admission, curriculum, co-curriculum, planning and assessment, promotion, and faculty development.

Dr. Le has published various peer-reviewed journal articles and book chapters as well as presented at different national/international conferences. Her laboratory research focuses on drug delivery, drug target, biomedical modeling and simulation, and data-mining in healthcare. Her pedagogical research interest includes assessment of learning and teaching.

## Learning Outcomes

### **M.S. in Pharmaceutical Sciences Graduate Program Learning Outcomes (PLOs)**

**PLO 1: Foundational Knowledge in Pharmaceutical Sciences. Demonstrates the knowledge, skills, attitudes, and ethics that are required as scientists or scientific advocates**

- 1.1. Demonstrate essential knowledge of pharmaceutical sciences needed to advance these sciences
- 1.2. Evaluate scientific literature and scientific products

**PLO 2: Exposure to research instrumentation and laboratory techniques of pharmaceutical sciences**

- 2.1. Demonstrate technical proficiency with basic laboratory techniques for pharmaceutical sciences
- 2.2. Utilize innovation in research instrumentation and laboratory techniques in basic science and drug discovery/ development

**PLO 3: Critical thinking skills and problem-solving abilities**

- 3.1. Demonstrate skillful research design and adaptation
- 3.2. Apply critical thinking and problem-solving skills to make decisions in developing, testing, and producing pharmaceutical products

**PLO 4: Critical writing skills and data presentation abilities**

- 4.1. Demonstrate writing skills needed for a career in pharmaceutical sciences and effective communication of scientific ideas in oral and visual formats appropriate for key audiences
- 4.2. Work effectively in a collaborative scientific setting and demonstrate appropriate intercommunication skills

**PLO 5: Promote scientific and technique development of pharmaceutical sciences**

- 5.1. Demonstrate ability to design mechanism-based drugs
- 5.2. Utilize scientific and technical skills needed to advance the discovery and management of new drugs and other therapeutic product

## Objectives of the program:

- Expand the students' foundation of Basic Pharmaceutical Sciences with emphasis in drug design, drug development or drug delivery.
- Expand the students' pharmaceutical research skills.
- Develop the students' ability to identify problems, formulate hypotheses, plan and execute experiments, analyze data and present results.

## Strength of the program:

- Augment the growth of CNU in the area of pharmaceutical sciences
- Bolster interactions between the clinical pharmacologists from COP and clinicians from COM
- Create a translational medical innovation center to enhance CNU programs
- Establish an interdisciplinary program for training new generations of pharmaceutical scientists and regulatory affairs specialists
- Foster scholarly interactions between faculty from different Colleges on drug discovery
- Harness the energy in innovation and translational medical sciences
- Leverage the faculty expertise from the Colleges of Health Sciences, Medicine, and Pharmacy

## Additional Scope of the program:

This program also provides advanced training in theory and laboratory-based settings to students opting for higher education in the health-related professions (M.D./Pharm.D, MD/Ph.D., and Pharm.D/Ph.D) and graduate schools (Ph.D.). In addition, this program provides a sufficient foundation in basic pharmacology, molecular biology and biochemistry to allow the students the flexibility to pursue careers in pharmaceutical and biotechnology industries, as well as regulatory affairs.

## Program Objectives

The MPS program is designed to provide fundamental knowledge and skills in the pharmaceutical sciences to students who are interested in pursuing careers in academia, the pharmaceutical industry, and government positions after graduation.

## Master's Degree Requirements

This proposed M.Sc. program will be completed within two years. There are two tracks, the Thesis-based Track and the Capstone Track (**Table 1**).

**Track A (Thesis-based Track):** To graduate from the M.Sc. program, students in this track must earn a minimum of 31 credits. In addition to the course requirements, students must pass a written prequalifying examination and complete a thesis.

**Track B (Capstone/Course Track):** Students in this track must pass a minimum of 31 credits along with successfully completing a written qualifying examination, and a capstone paper that consists of conducting a detailed literature review and analysis on a selected topic in lieu of a thesis.

**Table 1. Comparison between Thesis-based Track and Capstone Track**

	Plan A: Thesis-based Track	Plan B: Capstone Track
<b>Years</b>	2	2
<b>Total Credits</b>	31	31
<b>Core Course Credits</b>	27	27
<b>Elective Credits</b>	4	4
<b>Written Examination</b>	Yes	Yes
<b>Thesis</b>	Yes	Capstone paper

### Curriculum Design (Credits, Course Coordinator)

The course codes and course names as well as coordinators/instructors of all courses are listed in **Table 2**.

#### Track A (Thesis-based Track)

##### Core Courses (27 credits)

- MPS 501 Introduction to Pharmaceutical Sciences I (3 cr)
- MPS 511 Introduction to Pharmaceutical Sciences II (3 cr)
- MPS 502 Techniques in Pharmaceutical Sciences: Theory and Practice (3 cr)
- MPS 512 Principal of FDA Regulatory Affairs and Drug Discovery (3 cr)
- MPS 513 Biostatistics & Research Methods (3 cr)
- MPS 504 Literature & Technical Writing Skill (2 cr)
- MPS 505 Journal Club and Graduate Seminar (1 cr)
- MPS 506 Research and Thesis-I (3 cr)
- MPS 516 Research and Thesis-II (3 cr)
- MPS 526 Research and Thesis-III (3 cr)

##### Elective Courses (4 credits)

A minimum of 4 credits are required.

## Track B (Capstone/Course Track)

### Core Courses (27 credits)

- MPS 501 Introduction to Pharmaceutical Sciences I (3 cr)
- MPS 511 Introduction to Pharmaceutical Sciences II (3 cr)
- MPS 502 Techniques in Pharmaceutical Sciences: Theory and Practice (3 cr)
- MPS 512 Principal of FDA Regulatory Affairs and Drug Discovery (3 cr)
- MPS 513 Biostatistics & Research Methods (3 cr)
- MPS 504 Literature & Technical Writing Skill (2 cr)
- MPS 505 Journal Club and Graduate Seminar (1 cr)
- MPS 507 Capstone Paper-I (3 cr)
- MPS 517 Capstone Paper -II (3 cr)
- MPS 527 Capstone Paper -III (3 cr)

### Elective Courses (4 credits)

- A minimum of 4 credits are required.

#### Elective Courses (Minimum requirement: 4 credits)

- Advanced Topics in Immunology (2credits)
- Advanced Topics in Medicinal Chemistry (2 credits)
- Advanced Topics in Neuropharmacology (2 credits)
- Advanced Topics in Cardiovascular Pharmacology (2 credits)
- Advanced Topics in Physical Pharmacy (2 credits)
- Cellular and Molecular Biology (2 credits)
- Drug Discovery & Development (2 credits)
- Mechanisms of Drug Toxicity (2 credits)
- Novel Dosage Forms & Delivery (2 credits)
- Pharmacoeconomics (2 credits)
- Pharmacogenetics & Personalized Medicine (2 credits)
- Clinical Toxicology (2 Credits)



**Table 2. Courses Offered in the Master Degree in Pharmaceutical Sciences Program**

Course	Course name	Credit	Coordinator	Instructor
MPS 501	Introduction to Pharmaceutical Sciences-I	3	Dr. Wang	Dr. Wang and others
MPS 511	Introduction to Pharmaceutical Sciences -II	3	Dr. Farahat	Dr. Farahat
MPS 502	Techniques in Pharmaceutical Sciences-I	3	Dr. Wang	Dr. Wang and others
MPS 512	Principle of FDA regulatory affairs	3	Dr. Yang	Dr. Yang
MPS 513	Biostatistics & Research Methods	3	Dr. El-Shamy	Dr. El-Shamy
MPS 504	Literature & Technical Writing Skill	3	Dr. Kotchoni	Dr. Kotchoni
MPS 505	Journal Club and Graduate Seminar	1	Dr. El-Shamy	Dr. El-Shamy
MPS 506	Research and Thesis-I	3	Dr. El-Shamy	Individual faculty advisor
MPS 516	Research and Thesis-II	3	Dr. El-Shamy	Individual faculty advisor
MPS 526	Research and Thesis-III	3	Dr. El-Shamy	Individual faculty advisor

**Program Timeline**

**Tentative Schedule**

Fall	Spring	Summer
<b>Year 1</b>		
*MPS 501 Introduction to Pharmaceutical Sciences I	*MPS 511 Introduction to Pharmaceutical Sciences II	MPS 506 Research & Thesis-I
*MPS 504 Literature & Technical Writing	*MPS 512 FDA regulatory affairs	
*MPS 505 Journal Club and Graduate Seminar	*MPS 502 Techniques in Pharmaceutical Sciences	
	*MPS 505 Journal Club & Graduate Seminar	
<b>Year 2</b>		
*MPS 513 Biostatistics & Research Methods	MPS 505 Journal Club & Graduate Seminar	
MPS 516 Research & Thesis-II	MPS 526 Research & Thesis-III	
Elective	Elective	

\*Indicates core courses

## MPS to MD (2+4)-Combined Programs

The 2+4 MPS+MD (Master of Pharmaceutical Sciences + Doctor of Medicine) combined program at California Northstate University is designed to offer a unique opportunity (pathway) for students to enter into medical school. This combined program will significantly increase the chances to enter into medical school, receiving competitive clinical residencies and pursue career opportunities in advanced medicine. To enroll in this MPS-MD combined program, the students should have a minimum overall undergraduate GPA of 3.2 in a life science major. Then the progression from MPS to MD is dependent upon successfully completing certain specific admission criteria, including but not limited to earning a grade point average of at least 3.5 in the MPS Program, and an MCAT score of at least 508 which must be verified no later than the MPS graduation date.

## PharmD/MPS Combined Program

California Northstate University College of Pharmacy students in their P1 or P2 year with a minimum cumulative GPA of a 3.0 are eligible to apply for the PharmD/Masters of Pharmaceutical Sciences (MPS) combined degree program, which runs concurrently with the pharmacy program. While the MPS degree alone takes a minimum of 21-months to complete, current pharmacy students may opt to complete the PharmD/MPS combined degree program requirements within the four-year time frame of the PharmD program. This combined program will increase your chances of receiving clinical residencies. Also, students completing the PharmD/MPS combined degree may be better-situated to pursue career opportunities within the pharmaceutical industry field, regulatory affairs, academia, and other clinical research areas.

## Credit Assignment Policy

Per the Credit Assignment Policy, one unit of credit equals one hour of instruction for didactic course each week per semester; for classes containing lab work such as Techniques in Pharmaceutical Sciences (MPS 502), one unit of credit is equal to two hours each week. All courses for MPS are 100% face-to-face on-campus teaching, with the exception of one course: MPS 607: Drug Discovery and Development. This comprehensive course is designed using a hybrid teaching format, combining direct faculty-student interaction and eLearning. MPS 607 is 3-credit course and is divided into two sections: I and II. The first section is online teaching "Making Medicines" provided by a pharmaceutical company. This section is comprised of seven modules and requires approximately 15-20 hours to complete. This is equivalent to one lecture hour per week for a 16-week semester. The second section of this course is on-campus classroom teaching. Dr. Leo Fitzpatrick will instruct the relevant chapters three hours per week for 11 weeks (equivalent to two hours per week for 16 weeks).

For each 15-week semester, one (1) unit of credit is assigned per hour each week of classroom and a minimum of two (2) hours of out-of-class student work (homework). For courses that

include workshop and/or laboratory time, one (1) unit of credit is assigned per two (2) hours each week of student time spent in this activity.

## Transfer credit POLICY STATEMENT

Master of Pharmaceutical Sciences (MPS) will consider admission of qualified transfer students who have taken graduate college-level courses at other institutions. Course credits earned at other institutions will be evaluated for equivalence with MPS course offerings and articulated accordingly as substitute courses in the CNUMPS curriculum. No more than 14 course credit hours from other institutions can be transferred to CNUMPS on this basis. Potential transfer students who believe that CNUMPS may be an appropriate place to complete their graduate degree are encouraged to contact the Office of Admissions to discuss options and possible arrangements.

### Journal Club & Attendance at Seminars and Thesis Presentations

The journal club and graduate seminar are conducted mainly by students, facilitated by the course coordinator. Each week, a student presents a paper related to their research/scholarship interest. The chosen paper will be announced prior to the class and copies provided to all participants. The goal of the journal club is to create an open venue for friendly but lively scientific discussion. Students are encouraged to critically review the paper, and understand how to gauge its impact on the field. Grades will be determined primarily based on the presentation of the student during the course, as well as overall class participation.

### Assisting in Research and Teaching

Under the recommendation of faculty members and the advisory committee, research assistantship and teaching assistantship that cover tuition and other expenses are provided to outstanding graduate students with the final approval from the Dean.

### MPS Thesis Advisory Committee

This committee, which is recommended by the MPS program Director and approved by the Dean, shall consist of at least three faculty members. All members of the committee shall be members of the Graduate Program Faculty. The student's Major Advisor (Thesis Mentor) typically serves as Chair of the committee.

### Thesis Guidelines

The thesis is a vital portion of the curriculum for graduate students choosing the thesis-based track. These students will conduct hands-on, original research in CNU's state-of-the-art laboratories, mentored by faculty with experience in the biomedical and pharmaceutical sciences. Students will select their research topics after consultation with their major advisors. This course will examine student capabilities in scientific literature review, research design, research execution, statistics, result analysis & discussion, and written skills as required to produce a laudable thesis.

Lab-based thesis research starts in the summer of the 1<sup>st</sup> year and proceeds through the entire 2<sup>nd</sup> year, with 1 credit in each semester. Students will be evaluated each semester, and their progress monitored closely by their thesis advisors. The components of this course evaluation include the following comprehensive elements: literature review; experimental design; research performance; statistical analysis; result presentation and discussion, and conclusion.

- Literature review: 5%
- Research design: 20%
- Research performance: 20%
- Statistical analysis: 5%
- Result analysis and expression: 10%
- Discussion: 10%
- Thesis quality: 20%
- Oral presentation: 10%

Final grades for the student thesis will be indicated as Satisfactory (S) or Unsatisfactory (U) without any computation of grade points for the course into the semester or cumulative grade point average (GPA). A Satisfactory score in this course is granted based on the evaluation results with 70% or above. Unsatisfactory for Research & Thesis will be indicated if the net result of evaluation components is less than 70% in two semesters. Extension to the 3<sup>rd</sup> year for students with “U” grade will be reviewed by the thesis committee and approved by the Dean of College of Graduate Studies. Only one year extension is allowed for students with “U”. For details please refer to the Graduate Student Handbook.

#### Thesis Defense

Defense of thesis is the final step for graduate students on the thesis-based track. This process tests the depth and breadth of knowledge in pharmaceutical sciences, and will assess the overall understanding of scientific inquiry as it relates to the thesis. Students will be expected to justify their decisions in study design and interpretation of data. The advisory committee will make the recommendation based on the quality of thesis, answers to all questions, and other factors. The Dean of College of the Graduate Studies will make the final decision upon the recommendation of committee.

#### Requirements for Laboratory-based Research

Laboratory research is one of the essential components for graduate students in the Master’s program in Pharmaceutical Sciences at California Northstate University (CNU). Any students working in the Lab must abide by the following standards.

1. Students must complete the Collaborative Institutional Training Initiative (CITI) training and relevant biosafety training that are required for the personnel working in the Lab at CNU. CITI is an on-line service program providing research ethics and related modules to faculty, staff, and students working for research projects or courses. Students must

present completion certificates to their major advisors prior to self-directed work in the labs. Students must complete and pass the Responsible Conduct of Research course and the student Biosafety and Biosecurity Course. Additional courses may be recommended or required by their instructors.

2. Students must respect all ethical standards and must observe all federal, state, local, and institutional regulations.
3. Students must abide by all safety regulations while present in the labs, including those regarding appropriate clothing and shoes. Students must wear lab coat, gloves, and other appropriate personal protective equipment when performing procedures in the Lab.
4. Students must follow all standard operating procedures and protocols when conducting research.
5. Students must work in their designated areas. All shared equipment and instruments must be cleaned and stored in their original location after completing experiments.
6. Students must maintain original research records, catalogs, and research materials following good practices. Computer records must be consistent with the notebooks. Students are strongly encouraged to discuss the records and seek approval from the advisors.
7. All packages, containers, buffers and reagents in the Lab must have discernible, compliant labels that include name, date, identity, and sources.
8. Eating, drinking, or smoking in the Lab are strictly prohibited. Violators will be excluded from the research projects or relevant courses.
9. Hand washing with clean, running water is a good practice before leaving the Lab, and is required after certain procedures.
10. It is expected that all students will exercise professionalism and decorum while in the Labs. Horseplay, practical jokes, pranks or other inappropriate or distracting behaviors will result in a loss of Lab privileges and may impact student graduation.
11. Please report all unexpected issues to your advisors or Lab Manager.

## Academic Progression

### 1. Policy Statement

The Master of Pharmaceutical Sciences (MPS) at California Northstate University has a rigorous academic progression policy to ensure students' progression through the curriculum in a timely manner.

### 2. Purpose

The purpose of the academic progression policy is to ensure students in MPS program reach and maintain high standard of course learning and successfully complete course credits and thesis or capstone paper within required time frame.

### 3. Academic Standard

Students in MPS program must pass all courses each semester with at least a grade of C and maintain a minimum grade point average (GPA) of 3.0. A grade of D or below in a course indicates a lack of understanding of the fundamental knowledge of the course necessary for progression.

Students struggling with academic courses must complete MPS program within 3 years (2-year program) or 5 years (dual degree-MPS/Pharm.D.) from the time they registered and attended their first core course if insufficient knowledge has been identified and remediated.

#### 4. Remediation

Remediation is provided to students who earn a letter grade lower than C in any course in the MPS curriculum. The course coordinator/instructors determine the format of remediation examination that covers the course material presented throughout the course. Preparation of the remediation exam is the sole responsibility of the student. A grade of C to this course will be reported to the Registrar if the remediation examination was satisfactorily completed.

#### 5. Academic Probation

If a student fails a course or remediation is taking place for three or more courses, the student will be automatically placed on academic probation for three-year plan (2-year program) or five-year plan (dual degree-MPS/Pharm.D.) from the time they registered and attended their first core course. A academic plan for probation must be documented and approved by the Dean of the College of Graduate Studies.

#### 6. Dismissal

A student may be dismissed from MPS program if any of the following conditions occur and the Professional and Academic Standards Committee determines that dismissal is warranted:

- a. Failure to meet any terms of Remediation or Academic Probation.
- b. Conduct subject to dismissal as described in the Student Handbook.
- c. Failure to complete the degree requirements in three (two-year program) or five (dual degree) consecutive academic years from the date of the first day the student begins the program.

#### 7. Appeal of Dismissal

Students dismissed from MPS program may appeal the decision in writing within thirty calendar days of notification of dismissal to the Dean of the College. The Dean will render



a decision in writing within 15 calendar days of the receipt of the formal written appeal.  
The Dean's decision is final.

## Graduate Environment

The size of the master program of Pharmaceutical Sciences fosters a close interaction between the graduate students and the entire faculty. Every effort is made to create an environment of scholarship, creativity and learning, which is the very essence of graduate study. This enhances the quality of student-faculty communications and enriches the academic environment to benefit both learning and discovery. The College of Graduate Studies strongly supports the MPS students interacting with students from College of Pharmacy and College of Medicine.

## General Attendance Policy

The MS program will follow University guidelines in attendance policy, which requires mandatory attendance for all students. Specifically, students are expected to attend and participate in all classes, and complete all exams and assessments as scheduled (together defined as "coursework").

However, occasionally an absence from coursework will be unavoidable. The policy described below delineates the circumstances when an absence will be considered excused along with expectations for timely communication with the Course Coordinator and makeup of missed coursework.

### A. Approval of Absence

Students should seek approval for an absence from the course coordinator well in advance of the absence if possible, by completing an Excused Absence Request Form. In the case of emergency absence, students should complete and submit the Excused Absence Request Form within 3 business days of returning to campus after the absence. Regardless of whether an absence is excused or unexcused, students are expected to demonstrate professionalism and to follow procedure when requesting an absence.

### B. Duration of Absence

A student may request no more than three academic days of excused absences per semester. Absences exceeding five academic days per semester may require a student to request a Leave of Absence or a Withdrawal. Students must contact the Office of Academic Affairs (OAA) if any one absence period exceeds five days to discuss these options.

### C. Type of Excused Absence

A student may request an excused absence, from the course coordinator, only for reasons listed below:

- Medical (self or immediate family)
- Military duty
- Immigration & Naturalization
- Jury duty
- Legal
- Bereavement (first degree relative)
- Involvement in traffic accident documented by law enforcement report
- Professional Leave – conferences, invited presentations/posters, competitions, (requires verification of academic standing).

#### D. Makeup Allowances

Students are responsible for contacting the course coordinator to arrange makeup of coursework, otherwise they will receive a zero grade. A student seeking an excused absence should complete the Excused Absence Request Form and seek the Course Coordinator's signature for each course the student was absent within three business days upon return to courses or campus. The form must then be given to the Dean of Academic Affairs, who will approve or not the absence request. The OAA will notify the student and course coordinator of the outcome of the absence request.

If an absence is excused, students will be allowed the option to make up missed coursework, rotations, or missed assessments. The nature and type of makeup, makeup time, date, format, duration, and grading is at the sole discretion of the Course Coordinator, but in general Coordinators will draw the following distinction between "high" and "low" stakes assessments/coursework, and professional leave:

- A student who is absent for a "high stakes" exam or other such activity considered high stakes, provided the absence has been excused, will be required and allowed to make up the work.
- If a student is absent for a "low stakes" assessment the Course Coordinator may choose to drop the missed coursework from the gradebook or provide a makeup opportunity.
- A student requesting an absence to attend a professional meeting must demonstrate they are in good academic standing. Requests for professional leave must be submitted at least 10 business days in advance of the professional conference attendance. If attendance coincides with a high stakes exam it is highly likely that the absence will be denied.

#### Time Limit

The Master in Pharmaceutical Sciences degree is a two year (21-24 months) program. All requirements must be fulfilled within a period of two years following initial registration, although course credit is not nullified until three years after completion of a course. Any student who has

not achieved candidacy by the end of their second year will be reviewed by the Thesis Committee for placement on academic probation, regardless of grade point average, and recommendations for progress will be established.



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## Admission General Information

### Requirements for Admission to the M.S. in Pharmaceutical Sciences Program

**Critical Date:** The deadline to submit an application for Fall 2020 enrollment will be July 1, 2020. All supporting documents must be received prior to July 1, 2020 for Fall 2020 enrollment and official transcripts must be received by August 24, 2020. The online application must be completed fully.

### Educational Prerequisites

- A bachelor's degree (B.S. or B.A.) or higher in Biology, Chemistry or relevant science disciplines.
- A cumulative grade point average (GPA) of 2.8 is considered competitive. When evaluating applicants, greater emphasis will be placed on courses that are relevant to our program.
- Completion of the GRE is preferable but not required.
- Completion of an English proficiency test for international students from non-English speaking countries:
  - Minimum TOEFL paper-based test (PBT) score: 550
  - Minimum TOEFL internet-based test (IT) score: 80
  - Minimum IELTS score: 6.5
  - International applicants are exempt only if you are a native English speaker or have completed at least two years as a full-time student at a college or university where English is the primary language of instruction at the time in which you apply.

### Requirements and Materials for Applying to M.S. in Pharmaceutical Sciences:

1. Application Fee: \$100 for U.S. citizens and permanent residents; \$120 for international applicants. Applicants who demonstrate financial need can request an application fee waiver.
2. Personal Statement: Please provide a personal statement describing your professional goals as well as the characteristics you possess that make you a qualified candidate for entry into the Masters of Pharmaceutical Science Program.
3. Official Transcripts: Your academic records from each college-level institution you have attended are required and must be directly submitted from your institution or educational credential evaluators. Canadian applicants and all other foreign applicants must submit a foreign coursework evaluation; CNU accepts evaluations from ECE, IERF, WES, and Education Perspectives.
4. Official GRE General Test scores
5. Official TOEFL scores for international applicants
6. Three Letters of Recommendation: At least two letters must be submitted from faculty members who are knowledgeable about your academic capabilities and interests. You will

be asked to list the names and contact information for those references as well. They will each receive instructions for uploading their letter of recommendation.

### **Additional Admission Requirements**

Applicants are strongly encouraged to communicate with potential CNU research advisors listed in the graduate program prior to the admissions process. It is important to identify a research mentor and anticipated area of research prior to beginning the program. Formal research laboratory rotations with faculty members will be implemented after your admission. Onsite interviews are also provided to enable applicants to familiarize themselves with CNU faculty and their research areas.

### **Nondiscrimination Policy**

California Northstate University (CNU) is committed to cultivating a diverse community that recognizes and values inherent worth in individuals, fosters mutual respect, and encourages individual growth. The University believes that diversity enhances and enriches the quality of our academic program. CNU provides equal opportunity in education and employment and does not discriminate on the basis of race, color, creed, religion, national origin, ethnicity, gender identity, gender expression, age, sexual orientation, political affiliation, veteran status, or disability.

### **Payment Due Dates and Options**

All tuition and fees described on the second page of the Student Enrollment Agreement are due in full in accord with the schedule “Total Charges You Are Obligated to Pay upon Enrollment and Required Scheduled Payment Dates” set forth on the last page of the Enrollment Agreement. As an alternative to payment in cash, the student may (1) provide satisfactory written creditor approved loan documentation to the College, or (2) apply for one of the installment payment plans offered by the College, either of which the College may within its complete discretion accept as an alternative to cash payment for the above tuition and fees, excluding the enrollment confirmation fee and the student health insurance fee. If either of these options is chosen by the student, the student must make the appropriate arrangements with the College no later than thirty (30) days before the applicable due date described on the last page of the Enrollment Agreement.

Failure to make full payment, or alternative loan or installment payment arrangements, by the due dates described in the Enrollment Agreement subject the defaulting incoming student to forfeiture of the student’s seat and the defaulting returning student to dismissal or interest at the then current rate under the College’s direct pay installment program, which is presently 12% per year.