



M.Sc. Program in Medical Health Sciences of the College of Pharmacy (MS-MHS-COP)

Program Overview for 2019-2020

Disclaimer: The following information may be subject to changes

Fall Semester 2019: 08/06/2019 to 12/20/2019
Spring Semester 2020: 01/06/2020 to 05/15/2020

<p>Program Director & Chair of the Graduate Program Committee :</p> <p>Daniel Keppler, PhD Office: Bldg. H-84, Rm. 111 Phone: (707) 638-5956 E-mail: daniel.keppler@tu.edu</p>	<p>Vice-Chair of the Graduate Program Committee:</p> <p>David J. Evans, BPharm & PhD Office: Bldg. H-84, Rm. 2019 Phone: (707) 638-5240 E-mail: david.evans@tu.edu</p>
<p>Educational Technical Support: IT Department, Library Annex Phone: (707) 638-5424 E-mail: servicedesk@tu.edu</p>	<p>IT Office Hours: Mon.-Thur. 8:00 am – 7:00 pm Friday 8:00 am – 3:00 pm Sunday 9:00 am – 4:00 pm</p>
<p>MS & Residency Programs Coordinator: Ms. Christina Alvarez Office: Bldg. H-84, Rm. 216 Phone: (707) 638-5868 E-mail: christina.alvarez@tu.edu</p>	<p>Recruiter: Mr. Anthony Williams E-mail: anthony.williams@tu.edu Phone: (707) 373-4421</p> <p>Webmaster: Ms. Bridget Canfield, BSc E-mail: bridget.canfield@tu.edu</p>

Program Summary:

Under the larger umbrella of Masters in Health Sciences at Touro University California (TUC), the M.Sc. Program in Medical Health Sciences of the College of Pharmacy (MS-MHS-COP) represents a 10-months program that consists of two semesters of didactic work and intensive research training. The course of study begins August and ends in May of the following calendar year. The 19- and 18-week didactic fall and spring semesters, respectively, correspond to those in the College of Pharmacy's concurrent PharmD Program. The Program Director will arrange and oversee a successful and rewarding research experience in collaboration with the Program Coordinator and participating Faculty Advisors.

This MS Program is designed to provide students with the knowledge and tools to be effective scientific or clinical investigators. Individual interaction with Faculty Advisors on current research topics is at the core of this exciting program. Classroom coursework includes laboratory techniques, biostatistics, scientific writing, integrated pharmaceutical sciences, critical assessment and presentation of the primary scientific literature and oral scientific presentations.

This MS Program is carefully integrated. Course content is designed to be pertinent to the degree. No transfer credit, credit for experiential learning, or advanced placement can therefore be granted.

Program Strengths:

The MS-MHS-COP Program went recently (2017-2018) through a combined institutional and external review process and the following strengths of the Program were noted:

Competitiveness:

- a) Short duration (10 months)
- b) Research intensive (28/40 credits)
- c) Low tuition for degree (<\$30,000)
- d) High retention (98%) and graduation (98%) rates since inception of the MS Program in 2012
- e) Competitive career advantages when applying to positions in the pharmaceutical industry or in doctoral programs (PharmD, PhD, or other)
- f) Provides a pipeline for the COP PharmD program (61% of MS graduates)

Faculty Contributions to Program:

- a) Committed faculty members provide one-on-one student mentoring
- b) Commitment to research and scholarship
- c) Faculty is engaged in constantly improving the curriculum
- d) Use of multiple data sources in curriculum improvement
- e) Students consistently express a high degree of satisfaction with the program overall and with the individual courses and instructors

Goals of the MS Program:

The goals of this 40-credit MS Program are:

- To promote/establish sound understanding of the biomedical sciences, critical analytical skills, effective communication skills, strong work ethics, and a high level of professionalism.
- To prepare/enhance students' qualifications and competencies in pursuing careers which require the above skills, including admission to doctoral programs or appointment as Research Assistant/ Associate in the biotechnology/ pharmaceutical industry sector.

Program Student Learning Outcomes (PSLOs):

Students who complete this MS Program in Medical Health Sciences with emphasis in Pharmacy Sciences at TUC-COP will be able to....

1. Critically assess the scientific literature
2. Conduct original biomedical and related research
3. Design and implement biomedical research experiments to critically test hypotheses
4. Present scientific data in poster and seminar formats
5. Demonstrate strong verbal and written communication skills
6. Behave in a professional and ethical manner

Enrollment Target:

Fifteen (15) students will be enrolled in the program each year and matched to a participating faculty advisor. Each of the enrolled students will work with one or two TUC-COP Faculty Advisors in a given research setting either on the TUC campus, at the Buck Institute for Research on Aging or other site. For more information on the Buck Institute, click on the following URL: <https://www.buckinstitute.org/>

General Overview:

For the upcoming 2019-2020 schoolyear, the MS-MHS-COP program offers one track in Biomedical Sciences Research (BMSR). The BMSR track aims at recruiting a specific set of students as shown below:

**Biomedical Sciences Research
(BMSR) Track**

- BA/BSc graduates seeking a career in the Biotech/Pharma industry or training in a doctoral program (PharmD, PhD, or other)
- 10-month research-intensive program:
 - 28 credits research training
 - 12 credits classroom coursework
- Minimum GPA: 2.50, 2.60 preferred
- Enrollment target: 15

Course Credits:

The BMSR track will run for 19 and 18 weeks during the fall and spring semesters, respectively (*i.e.*, 37 weeks total) and have a total of 40 units of credits derived from successful completion of traditional classroom and laboratory courses.

Curriculum Overview:

Fall Semester (20 credits)

- HSPC600 Introduction to Biotechnology (1-credit classroom course)
- HSPC601 Biostatistics (2-credits classroom course)
- HSPC602 Mentored Research-1 (14-credits laboratory course)
- HSPC603 Scientific Writing-1 (2-credits classroom course)
- HSPC604 Journal Club-1 (1-credit classroom course)

Spring Semester (20 credits)

- HSPC606 Scientific Writing-2 (2-credits classroom course)
- HSPC607 Scientific Presentation (2-credits classroom course)
- HSPC608 Mentored Research-2 (14-credits laboratory course)
- HSPC609 Journal Club-2 (1-credit classroom course)
- HSPC610 Integrated Pharmaceutical Sciences (1-credit classroom course)

Approximately 70% (or 28 credits) of each student’s time will be dedicated to working on their research project (HSPC602 and HSPC608), and 30% (or 12 credits) spent in a small-group classroom learning environment.

Fall Semester 20 credits						
	Monday	Tuesday	Wednesday	Thursday	Friday	
08:00 am - 09:00 am	Preparation Time	Preparation Time	Preparation Time	Preparation Time	Preparation Time	08:00 am - 09:00 am
09:00 am - 10:00 am	HSPC602 Mentored Research-1	HSPC602 Mentored Research-1	HSPC602 Mentored Research-1 (14 Cr)	HSPC602 Mentored Research-1	HSPC602 Mentored Research-1	09:00 am - 10:00 am
10:00 am - 11:00 am						10:00 am - 11:00 am
11:00 am - 12:00 pm						11:00 am - 12:00 pm
12:00 pm - 01:00 pm						12:00 pm - 01:00 pm
						Break
01:00 pm - 02:00 pm		HSPC600 (1 Cr) Biomed Res Tech				01:00 pm - 02:00 pm
02:00 pm - 03:00 pm		HSPC603 (2 Cr) Scient. Writing-1				02:00 pm - 03:00 pm
03:00 pm - 04:00 pm		HSPC604 (1 Cr) Journal Club				03:00 pm - 04:00 pm
04:00 pm - 05:00 pm		Break				04:00 pm - 05:00 pm
05:00 pm - 06:30 pm		HSPC601 (2 Cr) Biostatistics				05:00 pm - 06:30 pm

Spring Semester 20 credits						
	Monday	Tuesday	Wednesday	Thursday	Friday	
08:00 am - 09:00 am	Preparation Time	Preparation Time	Preparation Time	Preparation Time	Preparation Time	08:00 am - 09:00 am
09:00 am - 10:00 am	HSPC608 Mentored Research-2	HSPC608 Mentored Research-2	HSPC608 Mentored Research-2 (14 Cr)	HSPC608 Mentored Research-2	HSPC608 Mentored Research-2	09:00 am - 10:00 am
10:00 am - 11:00 am						10:00 am - 11:00 am
11:00 am - 12:00 pm						11:00 am - 12:00 pm
12:00 pm - 01:00 pm						12:00 pm - 01:00 pm
	Break	Break	Break	Break	Break	
01:00 pm - 02:00 pm		HSPC607 (2 Cr) Scient. Present.				01:00 pm - 02:00 pm
02:00 pm - 03:00 pm		HSPC606 (2 Cr) Scient. Writing-2				02:00 pm - 03:00 pm
03:00 pm - 04:00 pm		HSPC609 (1 Cr) Journal Club				03:00 pm - 04:00 pm
04:00 pm - 05:00 pm		Break				04:00 pm - 05:00 pm
05:00 pm - 06:00 pm		HSPC610 (1 Cr) Integr Pharm Sci				05:00 pm - 06:00 pm

Description of the Classroom Courses:

Fall Semester 2019

HSPC600 - Introduction to Biotechnology (1 cr): This course aims at both the principles and the applications of cutting-edge biotechnology. Upon successful completion of this course, the student should be equipped with foundation knowledge of modern biotechnology including laboratory calculations, the application of stem cells in modelling diseases and their therapeutic use, the biotechnology and applications of antibody engineering, fluorescence microscopy, technology used in drug discovery and drug design, molecular biology methods including PCR, gene editing especially the use of CRISPR/Cas9 technology, as well as methodologies used in systems-level analysis of biomedical systems including RNA sequencing and mass spec-based proteomics.

HSPC601 - Biostatistics & Epidemiology (2 cr): Biostatistics and clinical epidemiology are closely intertwined disciplines that together form the foundation for conducting and interpreting clinical research. Understanding and applying the fundamental principles of these sciences will be emphasized throughout the lecture material. Critical evaluation, rather than mathematical computation, will be the primary emphasis. The topics selected for this course are intended to supplement the PharmD class in biostatistics and pharmacoepidemiology (PRMC611) which places a large emphasis on study design and evidenced based medicine. This course will begin with a survey of topics that biostatistics and epidemiology share in common before moving on to qualitative and quantitative methods that serve both the basic scientist as well as the clinical investigator. The benefits and pitfalls of employing statistical software will be demonstrated using STATA statistical software.

HSPC603 - Scientific Writing-1 (2 cr): The goal of this course is to develop clear and persuasive writing using scientific language. This is a discussion and critique-based class where we will be analyzing writing samples, identifying ways to improve our writing, and applying these insights to the composition of original pieces and the peer critique of those pieces. We will also discuss the structure and significance of the scientific paper, which is the starting format for the MS thesis. In-class participation and at-home preparation are required. Students are expected to complete all assignments

January 10, 2019

on time, and come prepared to give constructive feedback to their peers in class with annotated documents.

HSPC604 - Journal Club-1 (1 cr): In this course, students will learn to search, critically read, interpret, present, and discuss primary literature in various fields of biomedical and pharmaceutical research. The intent of this course is also to immerse students in state-of-the-art research methodologies utilized in Basic Biomedical, Clinical and Outcomes Research. Article selection is pre-approved by the faculty advisor. Each student pairs up with another student and has the opportunity to present one or two papers taken from the primary literature using 30 minutes of the designated classroom time. Fifteen minutes of classroom time is then used for questions and answers and to engage the class in a discussion. Active participation is expected. A 10-15-minute short-answer quiz is administered by the course coordinator at the end of the classroom time to assess the students' understanding of the paper.

Spring Semester 2020

HSPC606 - Scientific Writing-2 (2 cr): This course is devoted to further developing the MS students' writing skills acquired in HSPC603 Scientific Writing-1 during the fall semester. The goal of the course is the completion of the final paper required for obtaining the MS degree. Students work with their advisors to complete their research paper, which will include a title page, abstract, and introduction, materials and methods, results, discussion and references sections.

HSPC607 - Scientific Presentation (2 cr): The main objective of this course is to equip the students with essential elements of successful oral and poster presentation in their area of research. These include understanding the audience, working on the content and structure of the presentation, rehearsing presentation delivery and receiving feedback (with videotaping via Zoom), learning presentation techniques as well as guidelines to designing and producing effective scientific posters. Each student will give three presentations over the course of the semester: two oral presentations on their area of research, and a formal poster presentation at the TUC Annual Research Day. Each oral presentation will be moderated by a fellow classmate, who will be responsible for introducing the presenter and the presentation as well as initiate the question and answer session at the end of the presentation.

HSPC609 - Journal Club-2 (1 cr): The goal of this course is for attendees to become proficient in assessing primary research literature. This includes, but is not limited to identifying relevant publications, evaluating the research methods and data analyses, and presenting the findings to an audience of peers. In doing so, participants will also become acquainted with state-of-the-art methodologies used in Basic Biomedical, Clinical and Outcomes Research. This course is highly interactive. Participants should work together to analyze and critique the findings of a presented research study. Article selection should be pertinent to ongoing research interests and preapproved by a faculty advisor. Each participant is responsible for presenting one paper - using 35 minutes of the designated classroom time. The remaining 25 minutes of classroom time will be used to engage non-presenting attendees with discussion and a graded short-answer quiz, assessed by the course coordinator. Active participation is expected and will be taken into account in determining the course grade.

HSPC610 - Integrated Pharmaceutical Sciences (1 cr): This course provides MS students with a simple, integrated, coherent, introductory, yet comprehensive overview of pharmaceutical science concepts including physiology, biochemistry, medicinal chemistry, pharmacology, pharmacokinetics, and pharmacy practice. The fundamental principles that underlie all pharmaceutical science disciplines and the connection between them will be introduced and explained for their pharmaceutical and therapeutic applications. The goals are to discuss and explore pharmacodynamics, mechanisms of action,

January 10, 2019

indications, side effects/toxicities, pharmacokinetics (ADME), drug metabolism, principles of functional group chemistry, structure activity relationship (SAR), and apply these principles to clinical settings. The main topics include top 200 drugs in major therapeutic areas. MS students who understand the language of the pharmaceutical sciences, the key concepts, and links between these concepts are better able to appreciate more advanced material.

Research Training (Mentored Research):

All MS students are required to take a total of **28 units** of mentored research during their 10-month training period. These units correspond to 19 weeks of contact hours with one or two advisors in a given research setting in fall in **HSPC602 - Mentored Research-1 (14 cr)** and 18 weeks of contact hours with the same advisor(s) in spring in **HSPC608 - Mentored Research-2 (14 cr)**. In these two courses, MS students receive training in various aspects of academic research according to the expertise of their direct advisors. The course emphasizes training in oral and written scientific communication, professional behavior and work ethics, initiative and self-directed learning, as well as in designing and conducting independent research experiments.

Within the frame of Mentored Research-1 and -2, each student is paired with one or two faculty members at the very beginning of the fall semester *via* a double-blind matching process. The student then spends 30-36 hours per week for ten months in a specific academic research setting or a combination of settings (a research laboratory, an office, a field trip, the TUC library, a clinic). This research internship culminates with two important requirements for graduation:

1. Completion of a final 20-page manuscript, which is graded by the advisor and an independent reader.
2. Delivery of a final oral presentation (thesis defense) to the MS-MHS-COP faculty and students, which is evaluated by three attending faculty members including the advisor and the independent reader.

Major competencies assessed in Mentored Research:

- Communication Skills
- Professionalism
- Initiative & Self-Directed Learning
- Technical Skills

Admissions Requirements:

- **Citizenship Requirement**
All applicants, including graduates from foreign institutions, must hold either US Citizenship or Permanent Resident status at the time of application. DACA recipients and candidates with "pending" citizenship or permanent residency cannot be considered.
- **Minimum Academic Requirements**
The MS-MHS-COP program screens for interview eligibility based on the PharmGrad application process of the American Association of Colleges of Pharmacy (AACCP, <https://www.aacp.org/>) and letters of recommendation. A minimum cumulative GPA of 2.50 is required, but priority will be given to applicants with overall GPAs of 2.60 or higher. In cases where the cumulative GPA falls below a 2.50, the Admissions Committee will conduct a secondary review focusing on the applicant's previous exposure to science-related topics and extra-curricular activities. All candidates are required to have obtained a Baccalaureate degree from a regionally accredited institution of higher education prior to the first day of mandatory orientation.
- **Additional Requirement for Graduates of Foreign Institutions**

January 10, 2019

The Touro University California College of Pharmacy considers applications from graduates of foreign institutions. The College does not, however, evaluate foreign transcripts. Transcripts and coursework from foreign institutions must be evaluated by a recognized evaluation agency (<http://admissions.tu.edu/transcripteval/>)

Throughout the application process, candidates are evaluated based upon a variety of criteria, including the following:

- Academic Competence
- Personal/Professional Achievements
- Written Communication Skills
- Verbal Communication Skills
- Exposure to/Experience in the Sciences

Applicants to this program are not required to complete any specific coursework. It is expected, however, that applicants will have a foundational understanding of basic scientific principles and methods.

Many prospective PharmD students, who are interested in pursuing a clinical/research/academic career, seek to gain firm research experience before entering the PharmD Program. Therefore, students accepted into the BMSR track of the program are **guaranteed an interview** during the next application cycle for the TUC-COP PharmD Program, provided they earn a GPA of 3.0 or better in all MS coursework. **However, in no way should applicants perceive the MS Program as a preparatory program for entrance into the PharmD Program at TUC-COP.**

Admission Procedure:

Admission to the MS-MHS-COP program is conducted on a rolling basis starting on October 15, 2018 and with a deadline for receipt of applications of July 31, 2019. Applications are submitted on-line through the Admissions Office (<http://admissions.tu.edu/msmhs-ps/>).

Requirements for Graduation:

1. Satisfactory completion of all required courses, *i. e.*, a total of 40 units of credits. Satisfactory completion is a grade of at least a 2.0 (or 70%) in each course. There can be no outstanding Unsatisfactory or Incomplete grade.
2. Completion of all graded and non-graded coursework and assignments, including but not limited to:
 - a. a final report on research results, written in the form of a Master's thesis and
 - b. a final oral presentation (similar to a thesis defense)
3. Satisfactory demonstration of professional competencies
4. Recommendation by the MS-MHS-COP administration for graduation
5. Fulfillment of all legal and financial obligations to Touro University California

Accreditation:

The Master of Science in Medical Health Sciences of the College of Pharmacy (MS-MHS-COP) is offered by Touro University California, which is fully accredited by the Western Association of Schools and Colleges (<http://www.wascsenior.org/>).

Technology Competence:

Students are required to possess a laptop computer that meets the requirements as specified by the College of Pharmacy (http://cop.tu.edu/studentresources/COP_technical.html).

Academic Calendar, 2019-2020:

The duration of the MS-MHS-COP program is typically of 10 months and runs from August to May of the following year. The program runs in parallel with the College of Pharmacy curriculum, and therefore enjoys all of the breaks and holidays observed by the PharmD program. These include a fall, winter, and a spring break, as well as observance of the typical national and major Jewish holidays.

MS Workshops for 2019-2020:

- How to apply to Pharmacy School. Office of Admissions. October, 2019
- Mock Interviews with PharmD Faculty. November 2019
- Mock Interviews with PharmD Faculty. January 2020

Important Dates Near the End of the Spring Semester 2019

Wednesday, Apr 24 19th Annual TUC Research Day (presentation of a poster)
 Sunday, May 19 Graduation of the MS Class of 2019

Program and course evaluations:

Student evaluations of Orientation & Matching Day are performed shortly after the start of classes in the fall. Student evaluations of the overall program, individual courses and advisors are performed towards the end of each semester (in December and May).

MS Graduates by Career Path:

Class of	Number of Grads	COP PharmD	Other PharmD	MD or DO	PhD	Other Doctorate	Biotech/Pharma	Other/Unknown
2013	10	7	2				1	
2014	11	5	1					5
2015	15	12	2			1 (DDS)		
2016	14	8	1				3	2
2017	9	3	3	1			1	1
2018	12	8					1	3

The majority of our students chooses and manages to matriculate into a PharmD Program. From 2012-2018, a total of 52/71 (73%) of graduates chose a career path in Pharmacy and enrolled in a PharmD Program. Of those, 43/52 (83%) chose to enroll in the TUC-COP PharmD Program.

Among the six graduates who chose a career path in biotechnology/pharmaceutical industry, three got initial jobs at BioMarin and two at Genetech.

For any further information, please do not hesitate to contact any of the persons listed on the first page of this document.