PHARMACEUTICAL SCIENCES (MS)

The multidisciplinary field of pharmaceutical sciences has seen rapid advances that are critical to the discovery and development of drugs for chronic diseases such as cancer and diabetes, and emerging threats such as new pathogens and drug resistance. By training with our experts, you’ll be on the best track to keep up with the constantly evolving field.

The Master of Science Degree in Pharmaceutical Sciences has five different tracks to choose from. A minimum of 30 credit hours is required. A short description of each track is listed below.

CANNABIS SCIENCE and MEDICINE TRACK (CSM)

Prerequisites
B.S. or B.A. in a biological, chemical, or health/medical science
Or
Be a member of another allied health professions (the program director will individually counsel prospective students on any recommended prerequisite coursework)

Self-directed learning will be complemented by online, synchronous live, case-based discussions and/or activities guided by clinical practice experts, clinical researchers, medicinal plant chemists and pharmacologists, and legal and regulatory leaders. The only on-campus course is a 1 credit hour laboratory workshop on cannabis extraction and analytical methods that accompanies the 2 credit hour online course. Students unable to travel to Colorado for the 1 credit hour laboratory component can select an additional elective course.

CLINICAL PHARMACOKINETICS and PHARMACODYNAMICS TRACK (CPK)

An understanding of PK and PD is thus critical to every stage of drug development, from pre-clinical research through human clinical trials. Students trained in this track employ equations and models to describe drug concentrations in plasma, blood and other biological samples. The advent of new biotechnology products, combination drug products, drug delivery platforms, and nanotechnology formulations place individuals with PK-PD expertise in high demand for pharmaceutical and medical companies.

DRUG DISCOVERY TRACK (DGD)

This track offers you an opportunity to gain insight and experience in the drug discovery process. This includes computational design of molecules, high throughput/high content screening, structure-activity relationships, the selection of appropriate biomarkers for drug action, targeting drugs for personalized therapies, and the application of bioinformatics in the overall drug discovery process. Students trained in these approaches are well-positioned for jobs in the pharmaceutical industry, academia, and governmental regulatory bodies.

MOLECULAR and SYSTEMS TOXICOLOGY TRACK (MST)

This track affords you the opportunity to learn about systems toxicology and receive the training necessary to succeed in a changing research environment that is rapidly becoming focused on big data. Students graduating from this track will be sought after by employers in industry, biotechnology and government.

PHARMACEUTICAL BIOTECHNOLOGY and DRUG DELIVERY TRACK (PBT)

This track will provide you with the fundamental knowledge required for the synthesis, characterization, formulation, stabilization and delivery of these drugs. By possessing a sound understanding of how to successfully develop and deliver a biotechnology drug, students graduating from this track will be recruited by the pharmaceutical industry or new start-up biotechnology companies.

Applications for all master’s and doctoral programs are submitted electronically through the Graduate School of the University of Colorado Denver. After signing up for an account, select ‘Master’s’ under the ‘Academic Interests’ menu and scroll down to ‘Skaggs School of Pharmacy and Pharmaceutical Sciences’ and select “MS in Pharmaceutical Sciences.”

Application requirements are:

• a completed Graduate School application
• a baccalaureate degree (or equivalent) in biology, chemistry, or a related field from an accredited college or university with a minimum GPA of 3.0
• a 500- to 1,000-word written statement expressing interest or demonstrated experience, if applicable, in the field of pharmaceutical sciences and indication of the applicant’s intended specialty track (i.e., cannabis science & medicine, clinical pharmacokinetics & pharmacodynamics, drug discovery, molecular & systems toxicology, or pharmaceutical biotechnology & drug delivery)
• three (3) references from persons familiar with the applicant’s prior academic performance, potential, character, and suitability for graduate study (using a standardized template provided to prospective students)
• Additionally:
  • the GRE (Graduate Record Examination) is not required
  • the TOEFL or IELTS is required of applicants for whom English is not their first language
  • Applications will not be reviewed until all required materials have been received.

The Master of Science Degree in Pharmaceutical Sciences has five different tracks from which to choose. A minimum of 30 credit hours is required, of which non-thesis students complete a 3-credit capstone literature review (PHSC 6990), and thesis students complete two-to-three semesters of thesis research (PHSC 6950) for 6 total credits.

CANNABIS SCIENCE & MEDICINE TRACK

Year 1

<table>
<thead>
<tr>
<th>Fall</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHSC 7310</td>
<td>3</td>
</tr>
<tr>
<td>PHSC 7400</td>
<td>1</td>
</tr>
<tr>
<td>PHSC 7565</td>
<td>2</td>
</tr>
<tr>
<td>PHSC 7700</td>
<td>3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>9</td>
</tr>
</tbody>
</table>
### Clinical Pharmacokinetics & Pharmacodynamics Track

**Year 1**

**Fall**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHSC 7310</td>
<td>Fundamentals of Pharmaceutical Sciences I</td>
<td>3</td>
</tr>
<tr>
<td>PHSC 7400</td>
<td>Ethical Issues in Toxicology &amp; Pharmaceutical Sciences</td>
<td>1</td>
</tr>
<tr>
<td>PHSC 7565</td>
<td>Applied Statistics for Pharm Science and Toxicology</td>
<td>2</td>
</tr>
<tr>
<td>PHSC 6015</td>
<td>Clinical Pharmacokinetics</td>
<td>3</td>
</tr>
</tbody>
</table>

**Spring**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHSC 7310</td>
<td>Fundamentals of Pharmaceutical Sciences I</td>
<td>3</td>
</tr>
<tr>
<td>PHSC 7665</td>
<td>Pharmacokinetic Principles &amp; Applications</td>
<td>3</td>
</tr>
<tr>
<td>PHSC 7326</td>
<td>Seminar in Clinical Pharmacokinetics &amp; Pharmacodynamics</td>
<td>2</td>
</tr>
</tbody>
</table>

**Total Hours** 29

**Year 2**

**Fall**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHSC 7330</td>
<td>Development of Drugs and Biologics</td>
<td>3</td>
</tr>
<tr>
<td>PHSC 7667</td>
<td>Population Pharmacokinetic Modeling</td>
<td>3</td>
</tr>
</tbody>
</table>

**Spring**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHSC 7310</td>
<td>Fundamentals of Pharmaceutical Sciences I</td>
<td>3</td>
</tr>
<tr>
<td>PHSC 7665</td>
<td>Pharmacokinetic Principles &amp; Applications</td>
<td>3</td>
</tr>
<tr>
<td>PHSC 7326</td>
<td>Seminar in Clinical Pharmacokinetics &amp; Pharmacodynamics</td>
<td>2</td>
</tr>
</tbody>
</table>

**Total Hours** 25

### Drug Discovery Track

**Year 1**

**Fall**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHSC 7310</td>
<td>Fundamentals of Pharmaceutical Sciences I</td>
<td>3</td>
</tr>
<tr>
<td>PHSC 7400</td>
<td>Ethical Issues in Toxicology &amp; Pharmaceutical Sciences</td>
<td>1</td>
</tr>
<tr>
<td>PHSC 7565</td>
<td>Applied Statistics for Pharm Science and Toxicology</td>
<td>2</td>
</tr>
<tr>
<td>PHSC 7568</td>
<td>Seminar in the Pharmaceutical Sciences</td>
<td>2</td>
</tr>
</tbody>
</table>

**Spring**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHSC 7310</td>
<td>Fundamentals of Pharmaceutical Sciences I</td>
<td>3</td>
</tr>
<tr>
<td>PHSC 7320</td>
<td>Physical Pharmacy &amp; Pharmaceutical Sciences</td>
<td>3</td>
</tr>
</tbody>
</table>

**Total Hours** 6

**Year 2**

**Fall**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHSC 7328</td>
<td>Computational Design in Drug Discovery</td>
<td>3</td>
</tr>
<tr>
<td>PHSC 7568</td>
<td>Seminar in the Pharmaceutical Sciences</td>
<td>2</td>
</tr>
<tr>
<td>PHSC 7330</td>
<td>Development of Drugs and Biologics</td>
<td>3</td>
</tr>
</tbody>
</table>

**Spring**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHSC 6990</td>
<td>Capstone Project in Pharmaceutical Sciences</td>
<td>3</td>
</tr>
</tbody>
</table>

Students may alternatively complete a year-long research thesis (PHSC 6950 - 6 credits total), which meets the Capstone Project requirement.

**Total Hours** 3

**Total Hours** 28

### Molecular & Systems Toxicology Track

**Year 1**

**Fall**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>TXCL 7310</td>
<td>Fundamentals of Pharmaceutical Sciences I</td>
<td>3</td>
</tr>
<tr>
<td>TXCL 7400</td>
<td>Ethical Issues in Toxicology and Pharmaceutical Sciences</td>
<td>1</td>
</tr>
<tr>
<td>TXCL 7565</td>
<td>Applied Statistics for Pharm Science and Toxicology</td>
<td>2</td>
</tr>
</tbody>
</table>

**Spring**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHSC 7328</td>
<td>Seminar in Clinical Pharmacokinetics &amp; Pharmacodynamics</td>
<td>2</td>
</tr>
</tbody>
</table>

**Total Hours** 8

**Year 2**

**Fall**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHSC 7330</td>
<td>Development of Drugs and Biologics</td>
<td>3</td>
</tr>
<tr>
<td>PHSC 7667</td>
<td>Population Pharmacokinetic Modeling</td>
<td>3</td>
</tr>
</tbody>
</table>
Students may alternatively complete a year-long research thesis (PHSC 6950 - 6 credits total), which meets the Capstone Project requirement.

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHSC 6990</td>
<td>Capstone Project in Pharmaceutical Sciences</td>
<td>3</td>
</tr>
</tbody>
</table>

**ELECTIVES**

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHSC 7025</td>
<td>Pharmacogenomics</td>
<td>2</td>
</tr>
<tr>
<td>TXCL 7353</td>
<td>Immunology: Immunotoxicology and Immunopharmacology</td>
<td>2</td>
</tr>
<tr>
<td>PHSC 7660</td>
<td>Liposome-based Drug Delivery</td>
<td>2</td>
</tr>
<tr>
<td>PHSC 7345</td>
<td>Nanotechnology &amp; Drug Delivery</td>
<td>2</td>
</tr>
<tr>
<td>PHSC 7653</td>
<td>Protein Formulation</td>
<td>2</td>
</tr>
<tr>
<td>PHSC 7658</td>
<td>Advanced Topics in Pharmaceutical Sciences</td>
<td>1-5</td>
</tr>
<tr>
<td>TXCL 7750</td>
<td>Proteomics &amp; Metabolomics for Biomarker Discovery</td>
<td>3</td>
</tr>
<tr>
<td>TXCL 7751</td>
<td>Neurotoxicology</td>
<td>2</td>
</tr>
<tr>
<td>BIOS 6648</td>
<td>Design and Conduct of Clinical Research</td>
<td>3</td>
</tr>
<tr>
<td>BSBT 6802</td>
<td>Reg Env of Life Science Innovation: Drug Discovery</td>
<td>1.5</td>
</tr>
<tr>
<td>PMHW 6621</td>
<td>Mental Health and Wellbeing Promotion</td>
<td>3</td>
</tr>
<tr>
<td>CBHS 6610</td>
<td>Social and Behavioral Factors and Health</td>
<td>3</td>
</tr>
<tr>
<td>HSMP 6605</td>
<td>Health Policy</td>
<td>3</td>
</tr>
<tr>
<td>PMHW 6601</td>
<td>Mental Health</td>
<td>3</td>
</tr>
<tr>
<td>PMHW 6620</td>
<td>Mental Health Systems and Policy</td>
<td>3</td>
</tr>
<tr>
<td>PMHW 6622</td>
<td>Opioid Use, Overdose and Public Health</td>
<td>1</td>
</tr>
<tr>
<td>PMHW 6625</td>
<td>Substance Use: A Public Health Perspective</td>
<td>3</td>
</tr>
</tbody>
</table>

---

**Pharmaceutical Biotechnology & Drug Delivery Track**

**Year 1**

**Fall**

- **PHSC 7310**: Fundamentals of Pharmaceutical Sciences I
- **PHSC 7400**: Ethical Issues in Toxicology & Pharmaceutical Sciences
- **PHSC 7565**: Applied Statistics for Pharm Science and Toxicology
- **PHSC 7653**: Protein Formulation

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHSC 7310</td>
<td>Fundamentals of Pharmaceutical Sciences I</td>
<td>3</td>
</tr>
<tr>
<td>PHSC 7400</td>
<td>Ethical Issues in Toxicology &amp; Pharmaceutical Sciences</td>
<td>1</td>
</tr>
<tr>
<td>PHSC 7565</td>
<td>Applied Statistics for Pharm Science and Toxicology</td>
<td>2</td>
</tr>
<tr>
<td>PHSC 7653</td>
<td>Protein Formulation</td>
<td>2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHSC 7310</td>
<td>Fundamentals of Pharmaceutical Sciences I</td>
<td>3</td>
</tr>
<tr>
<td>PHSC 7345</td>
<td>Nanotechnology &amp; Drug Delivery</td>
<td>2</td>
</tr>
<tr>
<td>PHSC 7658</td>
<td>Seminar in the Pharmaceutical Sciences</td>
<td>2</td>
</tr>
</tbody>
</table>

**Spring**

- **PHSC 7608**: Molecular Interactions
- **PHSC 7609**: Biophysics & Spectroscopy

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHSC 7608</td>
<td>Molecular Interactions</td>
<td>3</td>
</tr>
<tr>
<td>PHSC 7609</td>
<td>Biophysics &amp; Spectroscopy</td>
<td>1.5</td>
</tr>
</tbody>
</table>

**Year 2**

**Fall**

- **PHSC 7330**: Development of Drugs and Biologics
- **PHSC 7568**: Seminar in the Pharmaceutical Sciences

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHSC 7330</td>
<td>Development of Drugs and Biologics</td>
<td>3</td>
</tr>
<tr>
<td>PHSC 7568</td>
<td>Seminar in the Pharmaceutical Sciences</td>
<td>2</td>
</tr>
</tbody>
</table>

**Spring**

- **PHSC 6990**: Capstone Project in Pharmaceutical Sciences

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHSC 6990</td>
<td>Capstone Project in Pharmaceutical Sciences</td>
<td>3</td>
</tr>
</tbody>
</table>