

PHARMACEUTICAL SCIENCES, PH.D.

The Division of Pharmaceutical Sciences (<https://pharmacy.wisc.edu/psd/>) at the School of Pharmacy offers the doctor of philosophy (Ph.D.) degree in pharmaceutical sciences. The program provides a rigorous background in a range of scientific disciplines that are critical to the success of the next generation of pharmaceutical scientists. The program's interdisciplinary training combines pharmaceutically relevant aspects of classical disciplines such as chemistry, biology, and engineering. Students earn a Ph.D. in Pharmaceutical Sciences, concentrating in one of three research cores: **Drug Discovery**, **Drug Action**, or **Drug Delivery**. Extensive communication and collaboration occur between these cores, mirroring the importance of interdisciplinary research teams in the pharmaceutical field. See our webpage (<https://pharmacy.wisc.edu/about-us/divisions/pharmaceutical-sciences/faculty-research/>) for more detailed information regarding current faculty research directions.

Research in Drug Discovery (<https://pharmacy.wisc.edu/psd/drug-discovery-core/>) focuses on areas related to medicinal chemistry, such as small molecule development, natural products isolation and characterization, organic synthesis, chemical biology, and rational drug design.

Drug Action (<https://pharmacy.wisc.edu/psd/drug-action-core/>) focuses on areas related to pharmacology, toxicology, cellular differentiation, development, and disease. Interests include the impact of drugs and toxins on biological systems, mechanisms of normal biology, and mechanisms of disease. These are studied at the cellular, genetic, molecular, and biochemical levels using diverse model systems.

Drug Delivery (<https://pharmacy.wisc.edu/psd/drug-delivery-core/>) (pharmaceutics) emphasizes principles in physical chemistry and drug transport, aiming for advances in formulation, drug targeting, and multi-modal therapy. Delivery research includes the solid-state chemistry of drugs, nano-pharmacy, biocompatibility, molecular recognition, computational chemistry, pharmacokinetics, and molecular imaging.

The UW-Madison Pharmaceutical Sciences Division has been recognized for its research productivity, extramural funding support, publication record and teaching.

UW-Madison (<https://www.youtube.com/watch?v=XTJA5alrisQ&feature=youtu.be>) is one of the nation's most prolific research universities, located on the shore of Lake Mendota in the state's vibrant capital city. The city of Madison (<https://madison.wisc.edu/>) is consistently recognized as one of the best cities in the nation in multiple categories for quality of life. Visit grad.wisc.edu (<http://grad.wisc.edu/>) to learn more about the many reasons to choose UW-Madison for graduate study.

POSTGRADUATE INFORMATION

Our students are provided many opportunities to explore different careers paths and to hone their skills in areas such as communication and leadership. Recent program graduates have found employment in a variety of settings including industry, academia, science writing, and patent law. We engage our many alumni to participate in career chats and other networking opportunities with our students. For more information on first professional placement following graduation, see employers of recent

Pharm Sci graduates (<https://pharmacy.wisc.edu/programs/pharmsci/student-outcomes/>). The School's Graduate Program Manager can be consulted for specific career information (both initial placement and longer-term employment information regarding Ph.D. alumni).

FACILITIES

The Pharmaceutical Sciences Division is housed in Rennebohm Hall (<http://www.pharmacy.wisc.edu/about-school/rennebohm-hall/>), a seven-story, state-of-the-art facility that comprises both research and teaching space. Affiliate Pharmaceutical Sciences graduate faculty and their labs are housed in other nearby campus buildings. Located on the northwest edge of campus, Rennebohm Hall is in close proximity to the Health Sciences Learning Center (home of the UW School of Medicine and Public Health, or SMPH), UW Hospital and Clinics, the UW Institute for Clinical and Translational Research (ICTR), the Waisman Center, the Wisconsin Institutes for Medical Research (WIMR), SMPH's Center for Human Genomics and Precision Medicine, the School of Veterinary Medicine, the School of Nursing, and Ebling Library for the Health Sciences.

Exceptional research facilities and equipment are available in Rennebohm Hall as highlighted by the school's Analytical Instrumentation Center (AIC) (<http://www.pharmacy.wisc.edu/aic/>), comprising mass spectrometry, nuclear magnetic resonance, spectroscopy, and spectrophotometry facilities. The division offers centralized facilities for computer-aided drug and catalyst design, real-time PCR, gene array detectors, gas chromatographs, high-pressure liquid chromatographs, cell culture, ultra-centrifuges, scintillation counters, and animal care. Additionally, many researchers leverage equipment and services available through the Carbone Comprehensive Cancer Center, Biotechnology Center, and other campus core facilities.

The School of Pharmacy's Lenor Zeeh Pharmaceutical Experiment Station (<http://www.pharmacy.wisc.edu/zstation/>) is a not-for-profit, self-sustaining center of expertise serving faculty researchers across the UW-Madison campus as well as private-sector drug product development. The station provides laboratory services related to compound physical/chemical characterization and basic formulation development to support preclinical development of promising drug candidates and other unmet pharmaceutical-related needs. Pharmaceutical Sciences graduate students are eligible to participate in summer project assistantships at the station. Pharmaceutical Sciences also houses the university's Medicinal Chemistry Center (<https://pharmacy.wisc.edu/mcc/>) (MCC), whose mission is to provide drug discovery expertise to the UW medical community and drive translational research at UW-Madison through designing and synthesizing novel small molecule-based therapeutics. Pharmaceutical Sciences faculty direct the MCC. A Nanotechnology Center for Drug Delivery (<https://pharmacy.wisc.edu/school-launches-new-nanotechnology-center-for-drug-delivery/>) began in 2018, aiming to improve the efficacy of new drug leads.

ADMISSIONS

Please consult the table below for key information about this degree program's admissions requirements. The program may have more detailed admissions requirements, which can be found below the table or on the program's website.

Graduate admissions is a two-step process between academic programs and the Graduate School. **Applicants must meet** the minimum requirements (<https://grad.wisc.edu/apply/requirements/>) **of the**

Graduate School as well as the program(s). Once you have researched the graduate program(s) you are interested in, apply online (<https://grad.wisc.edu/apply/>).

| Requirements | Detail |
|------------------------------------|--|
| Fall Deadline | December 27 |
| Spring Deadline | The program does not admit in the spring. |
| Summer Deadline | The program does not admit in the summer. |
| GRE (Graduate Record Examinations) | Not required. |
| English Proficiency Test | Please see the Graduate School's information on English proficiency testing requirements. (https://grad.wisc.edu/apply/requirements/#english-proficiency). |
| Other Test(s) (e.g., GMAT, MCAT) | n/a |
| Letters of Recommendation Required | 3 |

* GRE not required or accepted. Any submitted scores will not be used in assessing applications.

Accepted students commonly have strong scientific backgrounds and significant research experience. Students with undergraduate degrees in the physical (including chemistry) or biological sciences, engineering, pharmacy, and related fields are encouraged to apply. Students who have earned master's degrees are also welcomed to apply, but a master's degree is not a requirement. One may apply directly to the Pharmaceutical Sciences Ph.D. program with a bachelor's or PharmD degree- as long as a bachelor's or PharmD degree would be completed by the time one would begin graduate studies.

Please see admissions (<https://pharmacy.wisc.edu/programs/pharmsci/admissions/>) on the program website for the application deadline and required supplemental materials. Related links describe frequently-asked admissions questions (<https://pharmacy.wisc.edu/programs/pharmsci/admissions/faqs/>), selection criteria (<https://pharmacy.wisc.edu/programs/pharmsci/admissions/selection-criteria/>), and typical pharmaceutical research paths for various undergraduate majors (<https://pharmacy.wisc.edu/programs/pharmsci/admissions/undergraduate-research-paths/>).

FUNDING

GRADUATE SCHOOL RESOURCES

Resources to help you afford graduate study might include assistantships, fellowships, traineeships, and financial aid. Further funding information (<https://grad.wisc.edu/funding/>) is available from the Graduate School. Be sure to check with your program for individual policies and restrictions related to funding.

PROGRAM RESOURCES

Financial support is provided to all graduate students in the Pharmaceutical Sciences PhD program through a combined mechanism of fellowships, teaching assistantships, research assistantships, and project assistantships. Financial support includes a stipend, full tuition remission (waiver), and most of the cost of reasonably priced, comprehensive

health insurance; and typically extends for the full duration of a student's graduate study as long as they retain good academic standing and a faculty advisor. Funding packages for first-year students in the PhD program are provided by the School of Pharmacy and consist of fellowships and/or teaching assistant support. In addition, first-year students typically are provided \$2000 in flexible funds to aid in the transition to Madison. After the first academic year, students are supported by their thesis advisor through research or teaching assistantship appointments (some students earn funding via federally supported predoctoral fellowships or campus training grants). Additionally, the program awards travel grants to several students every year to support their attendance at scientific conferences and meetings. For more details, see this program-specific funding page (<https://pharmacy.wisc.edu/academics/pharmsci/tuition-financial-aid/>).

REQUIREMENTS

MINIMUM GRADUATE SCHOOL REQUIREMENTS

Review the Graduate School minimum academic progress and degree requirements (<http://guide.wisc.edu/graduate/#policiesandrequirements>), in addition to the program requirements listed below.

MAJOR REQUIREMENTS

MODE OF INSTRUCTION

| Face to Face | Evening/ Weekend | Online | Hybrid | Accelerated |
|--------------|---------------------|--------|--------|-------------|
| Yes | No | No | No | No |

Mode of Instruction Definitions

Accelerated: Accelerated programs are offered at a fast pace that condenses the time to completion. Students typically take enough credits aimed at completing the program in a year or two.

Evening/Weekend: Courses meet on the UW-Madison campus only in evenings and/or on weekends to accommodate typical business schedules. Students have the advantages of face-to-face courses with the flexibility to keep work and other life commitments.

Face-to-Face: Courses typically meet during weekdays on the UW-Madison Campus.

Hybrid: These programs combine face-to-face and online learning formats. Contact the program for more specific information.

Online: These programs are offered 100% online. Some programs may require an on-campus orientation or residency experience, but the courses will be facilitated in an online format.

CURRICULAR REQUIREMENTS

| Requirement Detail | |
|--------------------------------------|------------|
| Minimum Credit Requirement | 51 credits |
| Minimum Residence Credit Requirement | 32 credits |

| | |
|---|---|
| Minimum Graduate Coursework Requirement | 26 credits must be graduate-level coursework. Details can be found in the Graduate School's Minimum Graduate Coursework (50%) policy (https://policy.wisc.edu/library/UW-1244 (https://policy.wisc.edu/library/UW-1244/)). |
| Overall Graduate GPA Requirement | 3.00 GPA required. This program follows the Graduate School's policy: https://policy.wisc.edu/library/UW-1203 (https://policy.wisc.edu/library/UW-1203/). |
| Other Grade Requirements | Candidates may be dropped from the program if they receive more than 7 credits of grades at the BC level or lower. This applies to formal courses and research credits. |
| Assessments and Examinations | The preliminary examination is expected to be completed before the beginning of the third year of graduate study. For specifics regarding the preliminary examination's structure and requirements, see Preliminary Examination in the PSD Student Handbook (https://students.pharmacy.wisc.edu/pharmsci-handbook/o-preliminary-exam (https://students.pharmacy.wisc.edu/pharmsci-handbook/o-preliminary-exam/)). A final oral defense of the dissertation is required; for more on the dissertation defense, see Ph.D. Thesis Defense in the PSD Student Handbook (https://students.pharmacy.wisc.edu/pharmsci-handbook/q-phd-thesis-defense (https://students.pharmacy.wisc.edu/pharmsci-handbook/q-phd-thesis-defense/)). |
| Language Requirements | There are no language requirements in the Pharmaceutical Sciences Ph.D. program. |
| Graduate School Breadth Requirement | A doctoral minor or graduate/professional certificate is not required. |

REQUIRED COURSES

| Code | Title | Credits |
|--|--|---------|
| Foundational Content | | |
| PHM SCI 780 | Principles of Pharmaceutical Sciences | 3 |
| Select 6 credits from two Core Areas: | | |
| <i>Drug Discovery Core:</i> | | |
| PHM SCI 786 | Natural Product Synthesis, Biosynthesis and Drug Discovery | |
| <i>Drug Action Core:</i> | | |
| PATH 750 | Cellular and Molecular Biology/ Pathology | |
| PHM COL-M 781 | Molecular and Cellular Principles in Pharmacology | |
| BIOCHEM/ PHM COL-M/ ZOOLOGY 630 | Cellular Signal Transduction Mechanisms | |
| <i>Drug Delivery Core:</i> | | |
| PHM SCI/ CHEM 766 | Molecular Recognition | |
| PHM SCI 773 | Molecular Solids | |
| PHM SCI 775 | Polymeric Drug Delivery | |
| Research ethics/Responsible conduct of research | | |

| | | |
|--------------|---|---|
| PHARMACY 800 | Research Ethics: Scientific Integrity and the Responsible Conduct of Research | 2 |
|--------------|---|---|

Seminar & Research 37

| | | |
|-------------|--|--|
| PHM SCI 931 | Pharmaceutical Sciences Seminar (required every fall term during enrollment as a graduate student in the program) ¹ | |
| PHM SCI 932 | Pharmaceutical Sciences Seminar (required every spring during enrollment as a graduate student in the program) ¹ | |
| PHM SCI 990 | Research ² | |
| PHM SCI 999 | Advanced Independent Study ³ | |

Three additional credits from the Drug Action, Drug Delivery, or Drug Discovery electives. 3

Courses with the graduate attribute in the following subject listings can count toward this requirement: ANATOMY, ANAT&PHYS, BIOCHEM, BSE, BIOLOGY, BME, BMOLCHEM, BMI, BOTANY, CRB, CBE, CHEM, COMP BIO, COMP SCI, ECE, EP, FAM MED, FOOD SCI, GENETICS, H ONCOL, ISY E, MS & E, MATH, MD GENET, M M&I, MED PHYS, MED SC-M, MED SC-V, MEDICINE, MICROBIO, M&ENVTOX, MOL BIOL, NEUROL, NEURODPT, NTP, NURSING, NUTR, SCI, ONCOLOGY, PATH-BIO, PATH, PHM SCI, PHM COL-M, PHS, PHYSICS, PL PATH, PSYCH, RADIOL, SOIL SCI, SURGERY, SURG SCI, ZOOLOGY. A list of popular elective courses at this level taken by recent Pharmaceutical Sciences graduate students is maintained at <https://pharmacy.wisc.edu/programs/pharmsci/curriculum/electives> (<https://pharmacy.wisc.edu/programs/pharmsci/curriculum/electives/>).

Total Credits 51

1
Seminar is required every fall and spring semester during enrollment as a graduate student in the program.

2
Research credits are typically taken every semester in the program, beginning in the second semester. Credits will vary.

3
Research rotations in first semester of first year. At least one credit required.

To enhance a required core curriculum, an individualized course of study is planned with a faculty advisor. Faculty advisors have the option to require additional courses beyond the minimum requirements listed above.

POLICIES

GRADUATE SCHOOL POLICIES

The Graduate School's Academic Policies and Procedures (<https://grad.wisc.edu/acadpolicy/>) provide essential information regarding general university policies. Program authority to set degree policies beyond the minimum required by the Graduate School lies with the degree

program faculty. Policies set by the academic degree program can be found below.

MAJOR-SPECIFIC POLICIES

PRIOR COURSEWORK

Graduate Work from Other Institutions

With program approval, students are allowed to count no more than 15 credits of graduate coursework from other institutions (the student must have graduate student status on the other institution's transcript at the time the courses were taken). Coursework should be presented to the Pharmaceutical Sciences Director of Graduate Studies in the first semester of enrollment for consideration. Coursework earned ten years or more prior to admission to a doctoral degree is not allowed to satisfy requirements.

UW–Madison Undergraduate

With approval of the Pharmaceutical Sciences Director of Graduate Studies, students are allowed to count no more than 7 credits of UW–Madison courses numbered 500 or above (earned as a UW–Madison undergraduate) toward the Ph.D. Coursework should be presented to the Pharmaceutical Sciences Director of Graduate Studies in the first semester of enrollment for consideration. Coursework earned ten years or more prior to admission to a doctoral degree is not allowed to satisfy requirements.

UW–Madison University Special

With program approval, students are allowed to count no more than 15 credits of coursework numbered 500 or above taken as a UW–Madison special student toward the Ph.D. Coursework should be presented to the Pharmaceutical Sciences Director of Graduate Studies in the first semester of enrollment for consideration. Coursework earned ten years or more prior to admission to a doctoral degree is not allowed to satisfy requirements.

PROBATION

This program follows the Graduate School's Probation policy. (<https://policy.wisc.edu/library/UW-1217/>)

ADVISOR / COMMITTEE

All students in the Ph.D. program are required to have a major professor/advisor through the duration of their studies. Typically a permanent advisor is found by the end of one's first semester.

All students are required to conduct an annual progress meeting with their thesis committee each year. The meeting should be completed by the end of August of each consecutive academic year. In years where the preliminary exam or the Ph.D. thesis defense are scheduled, these events may substitute for the annual progress meeting. For details on the annual progress report, see the PSD Student Handbook (<https://students.pharmacy.wisc.edu/pharmsci-handbook/>). For details on the composition requirements of the Ph.D. preliminary exam/thesis committee, see Thesis Committee (<https://students.pharmacy.wisc.edu/pharmsci-handbook/l-thesis-committee/>) in the PSD Student Handbook.

CREDITS PER TERM ALLOWED

15 credits

TIME LIMITS

It is expected that Ph.D. major course requirements will be completed by the end of year two in the program.

A candidate for a doctoral degree who fails to take the final oral examination and deposit the dissertation within five years after passing the preliminary examination may be required to take another preliminary examination and to be admitted to candidacy a second time.

GRIEVANCES AND APPEALS

These resources may be helpful in addressing your concerns:

- Bias or Hate Reporting (<https://doso.students.wisc.edu/bias-or-hate-reporting/>)
- Graduate Assistantship Policies and Procedures (<https://hr.wisc.edu/policies/gapp/#grievance-procedure>)
- Hostile and Intimidating Behavior Policies and Procedures (<https://hr.wisc.edu/hib/>)
 - Office of the Provost for Faculty and Staff Affairs (<https://facstaff.provost.wisc.edu/>)
- Dean of Students Office (<https://doso.students.wisc.edu/>) (for all students to seek grievance assistance and support)
- Employee Assistance (<http://www.eao.wisc.edu/>) (for personal counseling and workplace consultation around communication and conflict involving graduate assistants and other employees, post-doctoral students, faculty and staff)
- Employee Disability Resource Office (<https://employee disabilities.wisc.edu/>) (for qualified employees or applicants with disabilities to have equal employment opportunities)
- Graduate School (<https://grad.wisc.edu/>) (for informal advice at any level of review and for official appeals of program/departmental or school/college grievance decisions)
- Office of Compliance (<https://compliance.wisc.edu/>) (for class harassment and discrimination, including sexual harassment and sexual violence)
- Office of Student Conduct and Community Standards (<https://conduct.students.wisc.edu/>) (for conflicts involving students)
- Ombuds Office for Faculty and Staff (<http://www.ombuds.wisc.edu/>) (for employed graduate students and post-docs, as well as faculty and staff)
- Title IX (<https://compliance.wisc.edu/titleix/>) (for concerns about discrimination)

Grievance Policy for Graduate Programs in the School of Pharmacy

Any student in a School of Pharmacy graduate program who feels that they have been treated unfairly by a faculty member, staff member, postdoc, or student has the right to have a complaint heard about the treatment and to receive a prompt hearing of the grievance, following these grievance procedures. Any student who discusses, inquires about, or participates in the grievance procedure may do so openly and shall not be subject to intimidation, discipline, or retaliation because of such activity. The person whom the complaint is directed against must be an employee of the School of Pharmacy. Any student or potential student may use these procedures unless the complaint is covered by other campus rules or contracts.

Exclusions

This policy does not apply to employment-related issues for Graduate Assistants in TA, PA and/or RA appointments. Graduate Assistants will utilize the Graduate Assistantship Policies and Procedures (<https://hr.wisc.edu/policies/gapp/>) (GAPP) grievance process to resolve employment-related issues.

Requirements for Programs

The School of Pharmacy requires that each director of graduate studies (DGS) serve as a grievance advisor for the school. The program must notify students of the grievance advisors, including posting the grievance advisor's names in the program handbook. The student will be able to select the grievance advisor of the student's choice and does not need to use the grievance advisor from the student's program.

A grievance advisor may be approached for possible grievances of all types. They will spearhead the grievance response process described below for issues specific to the graduate program, including but not limited to academic standing, progress to degree, professional activities, appropriate advising, and a program's community standards. They will ensure students are advised on reporting procedures for other types of possible grievances and are supported throughout the reporting process. Resources (<https://grad.wisc.edu/current-students/#reporting-incidents>) on identifying and reporting other issues have been compiled by the Graduate School.

Procedures

1. The student is advised to initiate a written record containing dates, times, persons, and description of activities, and to update this record while completing the procedures described below.
2. If the student is comfortable doing so, efforts should be made to resolve complaints informally between individuals before pursuing a formal grievance. If students would like to seek guidance at this informal step, the student can contact the Assistant Dean of Diversity, Equity, and Inclusion, the DGS for the student's program, or the UW Ombuds Office.
3. Should a satisfactory resolution not be achieved AND the complaint does not involve an academic program, the procedure outlined in Step 6 below should be followed. Should a satisfactory resolution not be achieved in step 2, the student should contact an SOP grievance advisor of one's choice to discuss the complaint. The grievance advisor should keep a record of contacts with regards to possible grievances. The first attempt is to help the student informally address the complaint prior to pursuing a formal grievance and should occur within 10 days of notifying the grievance advisor. The student is also encouraged to talk with their faculty advisor regarding concerns or difficulties.
4. If the issue is not resolved to the student's satisfaction, the student may submit a formal grievance to the grievance advisor in writing, within 60 calendar days from the date the grievant first became aware of, or should have become aware of with the exercise of reasonable diligence, the cause of the grievance. To the fullest extent possible, a grievance shall contain a clear and concise statement of the grievance and indicate the issue(s) involved including individuals, the relief sought, the date(s) the incident or violation took place, and any specific policy involved.
5. On receipt of a written grievance, the following steps will occur. The final step must be completed within 30 working days from the date the formal written grievance was received. The program must store documentation of the grievance for seven years. Significant grievances that set a precedent may be stored indefinitely.
 - a. The grievance advisor will convene a SOP faculty committee with at least 3 members to facilitate the grievance following step b, c, and d. The grievance advisor assumes the role of coordinator. Any faculty member involved in the grievance or who feels that they cannot be impartial may not participate in the committee.

Committee composition will include at least one member from outside the student's home program.

- b. The faculty committee, through the grievance advisor, will obtain a written response from the person or persons toward whom the grievance is directed. The grievance advisor will inform this person that their response will be shared with the student filing the grievance.
 - c. The grievance advisor will share the response with the student filing the grievance.
 - d. The faculty committee will make a decision regarding the grievance. The committee's review shall be fair, impartial, and timely. The grievance advisor will report on the action taken by the committee in writing to both the student and the person toward whom the grievance was directed.
6. If either party (the student or the person or persons toward whom the grievance is directed) is unsatisfied with the decision of the program's faculty committee, the party may file a written appeal to the SOP Associate Dean for Research and Graduate Education within 10 working days from the date of notification of the program's faculty committee. The following steps will occur:
 - a. The grievant will be notified in writing, within 5 business days of the written appeal, acknowledging receipt of the formal appeal and establishing a timeline for the review to be completed.
 - b. The associate dean or their designee may request additional materials and/or arrange meetings with the grievant and/or others. If meetings occur, the associate dean or their designee will meet with both the grievant and the person or persons toward whom the grievance is directed.
 - c. The associate dean or their designee will make a final decision within 20 working days of receipt of the committee's recommendation.
 - d. The SOP Associate Dean for Research and Graduate Education must store documentation of the grievance for seven years. Significant grievances that set a precedent may be stored indefinitely.
 7. The student may file an appeal of the School of Pharmacy decision with the Graduate School. See the Grievances and Appeals section of the Graduate School's Academic Policies and Procedures (<https://grad.wisc.edu/documents/grievances-and-appeals/>).

OTHER

First-year students are typically offered fellowships and School of Pharmacy teaching assistantships in their initial two semesters. Funding as research assistants is assumed by the student's principal investigator/thesis advisor in the first summer. Subsequently (year 2 and beyond), students are funded by RA-ships, TA-ships and via other extramural funding (fellowship) support.

PROFESSIONAL DEVELOPMENT

GRADUATE SCHOOL RESOURCES

Take advantage of the Graduate School's professional development resources (<https://grad.wisc.edu/pd/>) to build skills, thrive academically, and launch your career.

Professional development opportunities for Pharmaceutical Sciences graduate students include annual performance reviews by their respective thesis committee, providing feedback regarding each student's progress in coursework, research, and career development. Further, each

student, beginning in one's second year, gives an annual seminar to one's research core (Drug Discovery, Drug Action, or Drug Delivery), providing an additional community of support and feedback. Moreover, the Pharmaceutical Sciences Seminar series (<https://pharmacy.wisc.edu/psd/seminars/>) welcomes numerous academic and industrial scientists throughout the year; students have regular opportunities to meet such leaders in small settings. The division's annual poster session brings the community together and is another forum for research interaction.

The UW-Madison student chapter of the American Association of Pharmaceutical Scientists (AAPS) (<https://win.wisc.edu/organization/aaps/>) is vibrant and active, providing a wide variety of career development "workshops" and discussion "roundtable" events with scientists and faculty. AAPS also selects and hosts an annual industrial-based scientist as a speaker. Many students attend the Pharmaceutics Graduate Student Research Meeting (PGSRM) each summer, a graduate student-organized conference for graduate students across the upper Midwest. A parallel student-led medicinal chemistry-oriented conference (MIKI) is another annual opportunity.

There are a wide variety of opportunities for STEM-based graduate students to develop entrepreneurial and business skills. These include the Morgridge Entrepreneurial Bootcamp (<https://business.wisc.edu/entrepreneurship/morgridge-entrepreneurial-bootcamp/>), WiSolve Consulting Group (<https://www.wisolve.org/>), the graduate certificates (<https://wsb.wisc.edu/programs-degrees/certificates/>) in Entrepreneurship or Strategic Innovation, and many others, summarized by the School of Business' Insite Guide. (<https://apps.wsb.wisc.edu/insite-entrepreneurship-guide/>)

The program is committed to graduate students organizing an **all-day retreat every other summer**; such events typically involve career exploration and professional development themes. Informational interviews are organized with PhD alumni, either in person or via Skype, to help students understand various post-graduate opportunities. Graduate students who aspire to develop as instructors and future faculty can work with the School's Director of Graduate Studies for appropriate teaching assistant opportunities that will challenge them in this realm (complementing the ample campus resources for teaching/learning (<https://teachlearn.provost.wisc.edu/>)).

generations of scientists for challenging positions in industry, academia, and government.

LEARNING OUTCOMES

1. Demonstrate critical knowledge and in-depth understanding of principles in the student's area of expertise.
2. Identify important research questions, formulate testable hypotheses, and design experiments to test those hypotheses.
3. Conduct original research that contributes to the student's field of study.
4. Communicate scientific knowledge and research results effectively to a range of audiences.
5. Apply ethical principles in conducting scientific research.

PEOPLE

A list of **Pharmaceutical Sciences graduate faculty** and their respective areas of research specialization is available from the division website (<https://pharmacy.wisc.edu/psd/faculty-research/>) and related links. The Pharmaceutical Sciences Graduate Program has educated