CHEMISTRY, PH.D.

The mission of the Department of Chemistry at the University of Wisconsin–Madison is to conduct world-class, groundbreaking research in the chemical sciences while offering the highest quality of education to undergraduate students, graduate students, and postdoctoral associates. Our leadership in research includes the traditional areas of physical, analytical, inorganic, and organic chemistry, and has rapidly evolved to encompass environmental chemistry, chemical biology, biophysical chemistry, soft and hard materials chemistry, nanotechnology and chemistry education research. We pride ourselves on our highly interactive, diverse, and collegial scientific environment. Our emphasis on collaboration connects us to colleagues across campus, around the country, and throughout the world.

The Department of Chemistry is ranked very highly in all recent national rankings of graduate programs. We offer a doctor of philosophy in chemistry. Specializations within the program are analytical, inorganic, materials, organic, physical chemistry, chemical biology as well as chemistry education research. Breadth coursework may be taken in other departments including physics, mathematics, computer sciences, biochemistry, chemical engineering, and in fields other than the student's specialization within the Department of Chemistry.

Excellent facilities are available for research in a wide variety of specialized fields including synthetic and structural chemistry; natural product and bio-organic chemistry; molecular dynamics and photochemistry; biophysical, bioanalytical, and bioinorganic chemistry; spectroscopy (including magnetic resonance and microwave), theoretical and experimental chemical physics, chemical dynamics, quantum and statistical mechanics; macromolecular and polymer chemistry, materials science, surface and solid-state chemistry; x-ray crystallography, lasers, and light scattering; and chemical education. Programs are assisted by department computing and instrument centers and by other facilities on campus including those of the Division of Information Technology (DoIT).

Information on the research fields of faculty members is available on the chemistry website (http://www.chem.wisc.edu/).

The department offers opportunities for graduate students to obtain teaching experience. Financial assistance is available to most graduate students in the form of teaching or research assistantships, fellowships, or traineeships.

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 1
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	Every applicant whose native language is not English or whose undergraduate instruction was not in English must provide an English proficiency test score and meet the Graduate School minimum requirements (https://grad.wisc.edu/apply/requirements/#english-proficiency).
Other Test(s) (e.g., GMAT, MCAT)	n/a
Letters of Recommendation Required	3

Prospective graduate students are expected to have satisfactorily completed the equivalent in classes and labs of the fundamental courses in chemistry offered at UW–Madison, one year of physics, and mathematics through calculus. Students who have not completed all the prerequisites may be admitted in exceptional cases, but any deficiencies must be made up in the first year of graduate study.

A grade point average of 3.0 (on a 4.0 scale) in the last 60 hours of undergraduate work is the minimum required for admission to graduate studies. Students for whom English is not the native language are required to present scores from the Test of English as a Foreign Language (TOEFL) or International English Language Testing System (IELTS). Before teaching assistant appointments can be finalized, students for whom English is a second language must participate in the SPEAK Test, the institutional version of the Test of Spoken English (TSE).

Admission deadline for the fall semester is December 1. Although some recommendation letters might not have been received at that time, the application should be substantially complete by then to be considered for admission in the following fall.

Admission for the spring semester is not the norm, and applications for spring should only be submitted following discussion with a faculty member and/or the Graduate Program Office. Most summer admissions are applicants who were already admitted for the fall semester and decided to start earlier so they could serve as a teaching assistant or research assistant.

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

With few exceptions, students admitted to the Ph.D. program in the Department of Chemistry are guaranteed support for five continuous academic years. The support will be at the level of at least 50% time, and may come from a variety of sources—teaching assistantships, research assistantships, project assistantships, traineeships, and fellowships. This guarantee requires that you remain a graduate student in good

standing in the Ph.D. program in the Department of Chemistry, and that your teaching or other assigned responsibilities are satisfactory.

Currently, graduate students who have at least a 33.4% appointment for a fall or spring term are eligible to receive a full tuition (but not segregated fee) waiver.

Although serving as a teaching assistant is not a requirement of the chemistry department at this time, teaching can be an important part of the graduate training you receive. Most students will serve at least two semesters as a teaching assistant, and many will serve for two years. Whether or not an individual student will be appointed as a teaching assistant, research assistant, trainee or fellow depends on the availability of funding from the major professor, and eligibility for traineeships and fellowships from other sources.

REQUIREMENTS

MINIMUM GRADUATE SCHOOL REQUIREMENTS

Review the Graduate School minimum academic progress and degree requirements (http://guide.wisc.edu/graduate/#policiesandrequirementstext), 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 are able to complete a program with minimal disruptions to careers and other commitments.

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

Requirements	Detail
Minimum Credit Requirement	51 credits
Minimum Residence Credit Requirement	32 credits
Minimum Graduate Coursework Requirement	Half of degree coursework (26 credits out of 51 total credits) must be completed graduate-level coursework; courses with the Graduate Level Coursework attribute are identified and searchable in the university's Course Guide.
Overall Graduate GPA Requirement	3.00 GPA required.
Other Grade Requirements	The Graduate School requires an average grade of B or better in all coursework (300 or above, not including research credits) taken as a graduate student unless conditions for probationary status require higher grades. Grades of Incomplete are considered to be unsatisfactory if they are not removed during the next enrolled semester.
Assessments and Examinations	During their second year, the students complete the Thesis Background Exam (TBE). They write a paper describing the background of their research, research progress, and future research plans and orally defend their understanding and research to their mentoring committee. During the third year, the students complete the Original Research Proposal (RP) Exam. The students propose an original research project outside their area of study and write a paper describing the project. They orally defend their proposed project to their mentoring committee. At the end of their fourth year, the students complete the 4th-Year Meeting with their mentoring committee. This meeting includes an oral presentation of their research and discussion of what research needs to be completed to obtain the PhD. The students and committee discuss the students' future plans. At the end of their fifth year, if not defending their dissertation, the students complete the 5th-Year Meeting with the mentoring committee. This meeting includes an oral presentation of their research and discussion of what research needs to be completed to obtain the PhD. The students and committee discuss the students' future plans. In the 5th or 6th year, the students write, defend, and submit their dissertation.
Language Requirements	There are currently no language requirements to obtain the Ph.D. in Chemistry.
Doctoral Minor/ Breadth Requirements	Doctoral students must complete the required courses plus a minimum of 9 credits of minor courses. This requirement may be satisfied by an external minor (option A) or a distributed minor (option B). The minor, whether option A or B, is designed to represent a coherent body of work. To ensure coherence, the student must consult with their research advisor. The Ph.D. Minor Agreement Form should be submitted to the Graduate Program Office for approval at an early date, before the student is halfway through the proposed course sequence.

REQUIRED COURSES

Code	Title	Credits
CHEM 901	Seminar-Teaching of Chemistry	1
CHEM 607	Laboratory Safety	1
CHEM 964	Seminar: Molecular Dynamics	0-1

Students must complete CHEM 901 Seminar-Teaching of Chemistry in the fall of their first year and CHEM 607 Laboratory Safety in the spring of their first year. After joining a research lab, usually in the fall semester of the first year, students enroll in CHEM 964 Seminar: Molecular Dynamics in subsequent semesters.

The Department of Chemistry recognizes 7 paths to the Ph.D. in Chemistry; each path has specific required courses, called core courses, and other path-specific requirements.[1]

Analytical Chemistry Track

Code	Title	Credits
CHEM 721	Instrumental Analysis	3-4
CHEM 920	Seminar-Analytical Chemistry	0
Select two of the following:		
CHEM 622	Organic Analysis	
CHEM 623	Experimental Spectroscopy	
CHEM 624	Electrochemistry	
CHEM/ GENETICS 626	Genomic Science	
CHEM/ BMOLCHEM 627	Methods and Technologies for Protein Characterization	
CHEM 629	Atmospheric Chemical Mechanisms	
CHEM 630	Selected Topics in Analytical Chemistry	
CHEM 725	Separations in Chemical Analysis	
CHEM 728	Electronics for Chemical Instrumentation	

Chemical Biology Track

Code	Title	Credits
CHEM/ BIOCHEM 704	Chemical Biology	3
Select one of the following seminars:		0
CHEM 900	Seminar-Inorganic Chemistry	
CHEM 920	Seminar-Analytical Chemistry	
CHEM 940	Seminar-Organic Chemistry	
Select any one of the following for the maximum credits offered:		
CHEM 606	Physical Methods for Structure Determination	
CHEM 622	Organic Analysis	
CHEM/ BMOLCHEM 627	Methods and Technologies for Protein Characterization	
CHEM 630	Selected Topics in Analytical Chemistry	
CHEM/ BIOCHEM 665	Biophysical Chemistry	
CHEM 668	Biophysical Spectroscopy	
CHEM 721	Instrumental Analysis	

Chemistry Education Research Track

Code	Title	Credits
CHEM 758	Chemistry Education Research	2
CURRIC/COUN PSY/ ED POL/ED PSYCH/ ELPA/RP & SE 719	Introduction to Qualitative Research	3
ED PSYCH/ELPA 822	Introduction to Quantitative Inquiry in Education	3
The following 3 courses are recommended for the minor:		
Two chemistry courses relevant to the research project.		
One advanced methods course selected from the following:		
ED PSYCH 760	Statistical Methods Applied to Education I	
ED PSYCH 761	Statistical Methods Applied to Education II	
ED PSYCH 763	Regression Models in Education	
ED PSYCH 861	Statistical Analysis and Design in Educational Research	
ED PSYCH/ ELPA 964	Hierarchical Linear Modeling	
ED PSYCH/ COUN PSY/ CURRIC/ ED POL/ELPA/ RP & SE 788	Qualitative Research Methods in Education: Field Methods I	
ED PSYCH/ COUN PSY/ CURRIC/ ED POL/ELPA/ RP & SE 789	Qualitative Research Methods in Education: Field Methods II	

Inorganic Chemistry Track

Code	Title	Credits
CHEM 608	Symmetry, Bonding, and Molecular Shapes	1-3
CHEM 713	Inorganic and Organometallic Chemistry of the Main Group Elements	1-3
CHEM 900	Seminar-Inorganic Chemistry	0
Two of the following courses are recommended for the minor requirement:		
CHEM 606	Physical Methods for Structure Determination	
CHEM 613	Chemical Crystallography	
CHEM 714	Organometallic Chemistry of the Transition Elements	
CHEM 801	Selected Topics in Inorganic Chemistry	

Materials Chemistry Track

Code	Title	Credits
CHEM 920	Seminar-Analytical Chemistry	0
Select two of the following:		
CHEM 613	Chemical Crystallography	
CHEM 624	Electrochemistry	

CHEM 630	Selected Topics in Analytical Chemistry
CHEM 652	Chemistry of Inorganic Materials
CHEM 653	Chemistry of Nanoscale Materials
CHEM 654	Materials Chemistry of Polymers
CHEM 664	Physical Chemistry of Macromolecules
CHEM 842	Advanced Organic Chemistry
CBE 562	Special Topics in Chemical Engineering
M S & E 521	Advanced Polymeric Materials

Organic Chemistry Track

Code	Title	Credits
CHEM 641	Advanced Organic Chemistry	3
CHEM 841	Advanced Organic Chemistry	3
CHEM 940	Seminar-Organic Chemistry	0

Recommended courses, which may be taken as part of the minor:

Code	Title	Credits
CHEM 843	Advanced Organic Chemistry	1-3
CHEM 605	Spectrochemical Measurements	3
CHEM 636	Topics in Chemical Instrumentation: Introduction to NMR	2

Physical Chemistry Track

Code	Title	Credits
CHEM 661	Chemical and Statistical Thermodynamics	3
CHEM 675	Introductory Quantum Chemistry	3
CHEM 960	Seminar-Physical Chemistry	2
Complete at least 1 course from the following:		
CHEM 664	Physical Chemistry of Macromolecules	
CHEM/ BIOCHEM 665	Biophysical Chemistry	
CHEM 668	Biophysical Spectroscopy	
CHEM 762	Molecular Reaction Dynamics	
CHEM 763	Introduction to Molecular Spectroscopy	
CHEM 775	Electronic Structure of Molecules	
CHEM 777	Physical Chemistry of Surfaces	
CHEM 860	Selected Topics in Physical Chemistry	
CHEM 864	Statistical Mechanics	
CHEM/ BIOCHEM 872	Selected Topics in Macromolecular and Biophysical Chemistry	

[1] These tracks are internal to the program and represent different pathways a student can follow to earn this degree. Track names do not appear in the Graduate School admissions application, and they will not appear on the transcript.

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 12 credits of graduate coursework from other institutions. Coursework earned ten years or more prior to admission to a doctoral degree is not allowed to satisfy requirements.

UW–Madison Undergraduate

Up to 7 credits numbered 300 or above from a UW–Madison undergraduate career are allowed to count toward the minimum graduate degree credit requirement; if those 7 credits are numbered 600 or above from a UW–Madison undergraduate career, they are allowed to count toward the minimum graduate coursework requirement. **All credits so counted** must be over and above the minimum credits that were required by the original undergraduate degree. 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 300 or above taken as a UW–Madison special student toward the residence and degree credit requirements; if those 15 credits of coursework taken as a UW–Madison Special student are numbered 600 or above, they are allowed to count toward the minimum graduate coursework requirement. Coursework earned ten or more years prior to admission to a doctoral degree is not allowed to satisfy requirements.

PROBATION

The Graduate School regularly reviews the record of any student who earned grades of BC, C, D, F, or Incomplete in a graduate course (300 or above), or grade of U in research credits. This review could result in academic probation with a hold on future enrollment or in being suspended from the Graduate School.

ADVISOR / COMMITTEE

Every graduate student is required to have an advisor. An advisor is a faculty member, or sometimes a committee, from the major department responsible for providing advice regarding graduate studies. An advisor generally serves as the thesis advisor. In many cases, an advisor is assigned to incoming students. Students can be suspended from the Graduate School if they do not have an advisor.

To ensure that students are making satisfactory progress toward a degree, the Graduate School expects them to meet with their advisor on a regular basis.

A committee often accomplishes advising for the students in the early stages of their studies.

CREDITS PER TERM ALLOWED

15 credits

TIME CONSTRAINTS

Doctoral degree students who have been absent for ten or more consecutive years lose all credits that they have earned before their absence. Individual programs may count the coursework students completed prior to their absence for meeting program requirements; that coursework may not count toward Graduate School credit requirements.

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 by require 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://employeedisabilities.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)

Students should contact the department chair or program director with questions about grievances. They may also contact the L&S Academic Divisional Associate Deans, the L&S Associate Dean for Teaching and Learning Administration, or the L&S Director of Human Resources.

OTHER

All admitted Ph.D. graduate students receive tuition remission and a stipend, guaranteed for 10 semesters, as long as progress to the degree is made.

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.

LEARNING OUTCOMES

1. Articulates research problems, potentials, and limits with respect to theory, knowledge, and practice within an area of chemistry.
2. Formulates ideas, concepts, designs, and techniques beyond the current boundaries of knowledge within an area of chemistry.
3. Creates research and scholarship that makes a substantive contribution to an area of chemistry.
4. Demonstrates breadth within their learning experiences.
5. Advances the beneficial societal impacts of research in chemistry.
6. Communicates complex scientific ideas in a clear and understandable manner.
7. Fosters safe, ethical, and professional conduct.

PEOPLE

PROFESSORS

Berry, John
Bertram, Timothy
Blackwell, Helen
Boydston, AJ
Brunold, Thomas
Burstyn, Judith (Chair)
Cavagnero, Silvia
Choi, Kyoung-Shin
Coon, Joshua
Ediger, Mark
Fredrickson, Daniel
Gellman, Samuel
Hamers, Robert
Hermans, Ive
Jin, Song
Landis, Clark
McMahon, Robert
Moore, John
Nathanson, Gilbert
Record, Thomas
Schmidt, Jordan
Schomaker, Jennifer
Schwartz, David
Shakhashiri, Bassam
Sibert, Edwin (Associate Chair)
Smith, Lloyd
Stahl, Shannon
Weaver, Susanna Widicus

Weix, Daniel
Woods, Claude
Yethiraj, Arun
Yoon, Tehshik
Zanni, Martin

ASSOCIATE PROFESSORS

Boydston, Andrew
Garand, Etienne
Goldsmith, Randall

ASSISTANT PROFESSORS

Buller, Andrew
Martell, Jeffrey
Pazicni, Sam
Stowe, Ryan
Wang, Tina
Wickens, Zachary
Yang, Yang

AFFILIATE PROFESSORS

Feng, Dawei (Assistant Professor in Materials Science and Engineering)
Forest, Katrina (Professor of Bacteriology)
Ge, Ying (Professor of Cell and Regenerative Biology)
Gilbert, Pupa (Professor of Physics)
Golden, Jennifer (Assistant Professor of Pharmacy)
Gong, Shaoqin Sarah (Professor of Biomedical Engineering)
Gopalan, Padma (Professor of Materials Science and Engineering)
Hoskins, Aaron (Associate Professor of Biochemistry)
Kuech, Thomas (Professor of Chemical and Biological Engineering)
Li, Lingjun (Professor of Pharmacy)
Lynn, David (Professor of Chemical and Biological Engineering)
Mecozzi, Sandro (Professor of Pharmacy)
Middlecamp, Catherine (Professor, Nelson Institute for Environmental Studies)
Pedersen, Joel (Professor of Soil Science)
Schreier, Marcel (Assistant Professor in Chemical and Biological Engineering)
Tang, Weiping (Professor of Pharmacy)
Yu, Lian (Professor of Pharmacy)

CHEMISTRY ELECTRONICS SHOP

Thompson, Blaise (Instrument Tech)

CHEMISTRY MACHINE SHOP

Martin, Mathew (Instrument Maker–Advanced)
Mullarkey, James (Instrument Maker–Advanced)
Myers, Steven (Machine Shop Supervisor)
Schneider, Kendall (Instrument Maker–Advanced)

PAUL BENDER CHEMISTRY INSTRUMENTATION CENTER (CIC)

Clewett, Cathy (Senior Instrument Technologist)
Fry, Charles (Director of the NMR Laboratory)
Guzei, Ilia (Director of the X-Ray Laboratory)
Hofstetter, Heike (Associate Director of the NMR Laboratory)
Shanks, Robert (Senior Instrument Technologist)
Vestling, Martha (Director of the Mass Spectrometry Laboratory)

RESEARCH SUPPORT STAFF

Bates, Desiree (Computational Chemistry Leader)
Drier, Tracy (Master Glassblower)
McGuire, Paul (High Performance Computing Systems Administrator)
Silver, Alan (Computer Systems Administrator)