Chemistry

Degrees Offered

• Master of Science
• Doctor of Philosophy

Nature of the Program

The Department of Chemistry offers graduate studies leading to the degrees of master of science and doctor of philosophy with research concentration in the areas of analytical, biological, inorganic, organic, and physical chemistry. The master of science and doctor of philosophy degrees require completion of a research project which represents the principal component of the graduate program. The M.S. program is limited in scope and involves advanced coursework and a study of a problem in chemical research culminating in the preparation and oral defense of a M.S. thesis.

The Ph.D. program has a much wider scope than the M.S. program. Ph.D. students are expected to take a broad range of advanced coursework, both within and outside of the major area of interest. The major emphasis of the Ph.D. program is on research. A typical research problem may take several years to complete and involves many advanced techniques and concepts at the frontiers of chemical knowledge. The Ph.D. program culminates in the preparation and defense of the Ph.D. dissertation.

The program for the degree of doctor of philosophy reflects a flexible, research-oriented approach geared to develop the interests, capability, and potential of students. A program of courses is recommended to suit individual needs based on background and ability. These courses are classified as basic graduate courses, which present the essentials of a given discipline on an advanced level, and specialized graduate courses, which take one to the frontiers in a specific area of research. The course offerings are designed to provide guidelines from which students can launch their independent studies in preparation for candidacy examinations. Students are required to enroll in the departmental seminar program and attend special lectures and seminars offered by visiting scientists. Graduate students in the Ph.D. program are required to satisfactorily complete a minimum of three courses (three credits each) at the 500 to 700-level offered by the Department of Chemistry and distributed in at least two areas outside their major area of research. In addition, each major area in chemistry requires students in that area to enroll in basic graduate courses presenting the essentials of that discipline on an advanced level.

FACULTY

CHAIR

• Kung K. Wang - Ph.D. (Purdue University)
  Eberly Distinguished Professor of Chemistry, Organic Chemistry, Stereoselective Synthesis, Natural Products

ASSOCIATE CHAIR

• Jeffrey L. Petersen - Ph.D. (University of Wisconsin-Madison)
  Physical Inorganic Chemistry, Electrophillic Transition Metal Complexes, X-ray Crystallography

PROFESSORS

• Harry O. Finklea - Ph.D. (California Institute of Technology)
  Analytical/Physical Chemistry, Electron Transfer Kinetics, Solid Oxide Fuel Cells, Gas Phase Sensors

• Terry Gullion - Ph.D. (William and Mary)
  Physical Chemistry, Solid State NMR, Biological Materials, Polymers

• Lisa Holland - Ph.D. (University of North Carolina-Chapel Hill)
  Micro-separations, High Throughput Drug Screening

• Charles Jaffe - Ph.D. (University of Colorado)
  Theoretical Chemistry, Molecular Dynamics, Chaotic Systems

• Fred L. King - Ph.D. (University of Virginia)
  Analytical Chemistry, Mass Spectrometry, Trace Elements, Gas-phase Chemistry

• John H. Penn - Ph.D. (University of Wisconsin-Madison)
  Chemical Education, Online Instruction Methods in Organic Chemistry

• Kenneth Showalter - Ph.D. (University of Colorado)
  Bennett Distinguished Professor, Physical Chemistry, Chemical Kinetics, Multistability and Oscillating Systems

• Bjorn C. Soderberg - Ph.D. (Royal Institute of Technology, Sweden)
  Organic Synthesis Using Transition Metals

ASSOCIATE PROFESSOR

• Suzanne Bell - Ph.D. (New Mexico State University)
  Analytical Chemistry, Forensic Science
• Jonathan Boyd - Ph.D. (Texas Tech University)
  Analytical Biochemistry and Toxicology
• Justin Legleiter - Ph.D. (Carnegie Mellon University)
  Biophysical Chemistry, Scanning Probe Microscopy
• Michelle Richards-Babb - Ph.D. (Lehigh University)
  Chemical Education
• Alan M. Stolzenberg - Ph.D. (Stanford University)
  Inorganic Chemistry, Bioinorganic Chemistry, Organometallic Chemistry

ASSISTANT PROFESSOR
• Fabien Goulay - Ph.D. (University of Rennes, France)
  Physical Chemistry, Laser Spectroscopy
• Jessica Hoover - Ph.D. (University of Washington)
  Organometallic Chemistry, Catalysis
• Blake Mertz - Ph.D. (Iowa State University)
  Computational Biophysics and Chemistry
• Carsten Milsmann - Ph.D. (Max-Planck-Institute for Bioinorganic Chemistry)
  Inorganic and Organometallic Chemistry
• Brian Popp - Ph.D. (University of Wisconsin-Madison)
  Organic and Organometallic Chemistry, Catalysis
• Stephen Valentine - Ph.D. (Indiana University)
  Mass Spectrometric Analysis of Biomolecules

Admission
Applicants for graduate studies in chemistry must have a bachelor’s degree as a minimum requirement. Applicants must have a major or concentration in chemistry and an appropriate background in physics and mathematics. All entering graduate students in chemistry are required to take departmental guidance examinations in the major areas of chemistry. These examinations, at the undergraduate level, are administered before registration and serve to guide the faculty in recommending a course program for the beginning graduate student. Deficiencies revealed by the departmental guidance examinations need to be corrected in a manner prescribed by the faculty.

Master of Science
A research project is chosen in the area of the student’s interest and in consultation with the faculty. The thesis defense shows the ability of the student to defend scientific conclusions based on their research project.

MAJOR REQUIREMENTS
Minimum GPA of 3.0 is required.

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
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<tbody>
<tr>
<td>Chemistry Coursework (400, 500, 600, 700-level)</td>
<td>22</td>
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<tr>
<td>Research</td>
<td>6</td>
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<tr>
<td>CHEM 797 Research (Repeated)</td>
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<tr>
<td>CHEM 796 Graduate Seminar</td>
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<tr>
<td>CHEM 789 Research Seminar</td>
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<tr>
<td>Thesis</td>
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<tr>
<td>Thesis Defense</td>
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</tr>
<tr>
<td>Total Hours</td>
<td>30</td>
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Thesis/Credits
Graduate students in the M.S. program in chemistry are required to submit a research thesis. They may apply up to 6 hours of research credit toward the 30-hour requirement. The remaining 24 hours of credit must be earned in the basic graduate courses which reflect a diversified exposure to chemistry; no more than 10 hours may be elected outside the department, and coursework taken at the 500 to 700-level must include at least three 3-credit-hour courses distributed in at least two areas outside the student’s major area of research. Students are required to enroll in the departmental seminar program and are required to attend special lectures and seminars offered by visiting scientists. A final oral examination is administered after completion and submission of the thesis.
Doctor of Philosophy

Students are required to enroll in the departmental seminar program and attend special lectures and seminars offered by visiting scientists. In addition, each major area in chemistry requires students in that area to enroll in basic graduate courses presenting the essentials of that discipline on an advanced level.

MAJOR REQUIREMENTS

Minimum GPA of 3.0 is required.

<table>
<thead>
<tr>
<th>Course Description</th>
<th>Hours</th>
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<tr>
<td>Chemistry Coursework (500, 600, 700-level)</td>
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<tr>
<td>Graduate Research</td>
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<td>CHEM 789 Research Seminar (Repeated)</td>
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<td>Graduate Seminar</td>
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<td>CHEM 796 Graduate Seminar (Repeated)</td>
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<td>Comprehensive Examination</td>
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<td>Dissertation Proposal</td>
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<td>Dissertation</td>
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<td>Dissertation Defense</td>
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<tr>
<td>Total Hours</td>
<td>41</td>
</tr>
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</table>

* Graduate students in the Ph.D. program are required to satisfactorily complete a minimum of three courses (three credits each) at the 500 to 700-level offered by the Department of Chemistry and distributed in at least two areas outside their major area of research.

Research

Research, which is the major theme of graduate studies, may be initiated as early as the student and faculty feel appropriate for the individual. Normally, a student will begin laboratory work no later than the second semester. Upon successful completion of an original piece of research, the candidate will present results in a Ph.D. dissertation and, at the appropriate time, defend the work in a final oral examination.

Candidacy

Candidacy examinations contain written and oral portions. The written examinations are of the cumulative type and are offered eight times a year. After notification of successful completion of the written cumulative exams, the student will present and defend an original research proposal. The proposal must demonstrate originality and independence on the part of the student. This proposal is presented in writing to the student’s research committee and defended before that group and any other interested faculty members.

Major Learning Goals

CHEMISTRY

The graduate programs in the C. Eugene Bennett Department of Chemistry provide rigorous training in chemistry. The central mission of the Graduate Program is to train the next generation of Chemists for productive careers in the global economy.

Students earning a M.S. or Ph.D. in Chemistry will be able to:

- Explain chemical principles as they pertain to their specific field of research.
- Demonstrate the ability to understand and critically evaluate the existing literature published within their field.
- Independently design and execute new chemical experiments that can address important scientific questions.
- Understand and apply good laboratory practices (chemical hygiene, personal protective wear, etc.) and the proper handling of chemical waste streams.
- Generate quality data using a variety of experimental and/or computational techniques.
- Interpret the meaning and implication of their data.
- Effectively communicate their research in oral and written formats, including the ability to author manuscripts suitable for publication in peer reviewed scientific journals.
- Understand the ethical impact of personal and professional behavior.