

DOCTOR OF PHILOSOPHY IN CHEMISTRY

The Chemistry Department engages students in the science of the molecules—what they are, how they are made, and what they do—studying important chemical problems in both the classroom and the research laboratory. Research in the department spans organic and inorganic nanomaterials, new recyclable polymers, the molecular basis of neurodegenerative diseases, understanding the structures and dynamics of proteins, the development of biofuels, the development of new therapeutic and diagnostic drugs, and computational approaches to complex chemical systems.

The Department of Chemistry offers a graduate program leading to a Doctor of Philosophy in Chemistry. The program offers a breadth of research opportunities and course offerings, providing PhD students with exposure to many subfields of chemistry. Students develop close working relationships with faculty mentors, who help them design and follow their own customized program of study. PhD candidates acquire the skills to be independent chemical researchers and are qualified to design, carry out, interpret, and communicate the results of significant research projects.

Students pursuing the PhD in Chemistry are expected to write two research proposals, one during the second year related to the student's dissertation and a second in the fourth year, on a novel idea not directly related to the student's current work. PhD candidates may also choose a concentration in the interdisciplinary studies of either Chemical Physics or Molecular Biophysics. Students must complete at least two semesters as a teaching assistant as a means of developing communication and teaching skills. To earn their degree, the PhD candidate must complete a significant body of original research and defend their dissertation to their faculty advisory committee, the department, and the broader community.

COURSES

All degree-seeking graduate students are required to register for at least one credit in each semester that they are enrolled at the University.

Course requirements are designed to achieve two basic goals:

1. **Acquisition of background knowledge.** A central common core of material is expected for all chemists. Graduate students take appropriate one-semester core courses in the areas of organic chemistry, inorganic chemistry, biochemistry, physical chemistry, and quantum chemistry. Students with previous equivalent coursework may be exempted from one core course not in their primary field of study by petition.
2. **Continued scholarly growth.** Graduate students are required to take at least one course every semester. This may be a regular advanced course in chemistry or a related discipline, a weekly seminar, or a research tutorial.

LANGUAGE REQUIREMENT

There is no language requirement associated with this program.

PROGRESS AND QUALIFYING EXAMS

Progress examinations are open-book, take-home exercises that are offered approximately monthly during the academic year. These examinations are based on articles in the current literature and are designed to assist graduate students in keeping up with recent developments in chemistry. They also provide valuable training in reading the chemical literature critically and for suggesting areas in which the student may benefit from additional study. PhD students are required to pass 15 elementary and seven advanced progress exams, which is typically completed by the end of the second or early in the third year of the program.

TEACHING

Completion of at least two semesters as a teaching assistant is generally required for the PhD degree. These assignments are provided as a means of developing communication and teaching skills. Graduate students may be given more advanced teaching responsibilities as appropriate.

RESEARCH

Writing research proposals is an important part of the PhD program in chemistry. Writing scientific proposals develops expertise in evaluating the scientific literature, integrating knowledge from several areas, formulating interesting scientific questions, designing a research project to answer those questions, writing clear scientific prose, and defending a project proposal. Two proposals are required: one during the second year related to the student's dissertation research plans and a second, in the fourth year, on a novel idea not directly related to the student's current work.

DISSERTATION AND DEFENSE

The successful completion of a significant body of original research and the defense of a dissertation is the single most important requirement for the PhD. The candidate will defend the dissertation to their faculty advisory committee, followed by a seminar open to the department and the broader community.

CONCENTRATIONS

CHEMICAL PHYSICS

Guiding Committee: Lutz Hüwel, *Physics*; Carlos Jimenez-Hoyos, *Chemistry*; Stewart E. Novick, *Chemistry*; Brian Stewart, *Physics*

Upon admission and while in their first year, students in the chemistry or physics graduate programs may petition their department for admission to the interdisciplinary program in chemical physics. The philosophy underlying the program is that the solution to contemporary problems must increasingly be sought not within a single traditional specialty but from the application of different disciplines to particular problems. Students in the program will pursue a course of study and research that will familiarize them with both the Physics and Chemistry Departments and, in particular, with those areas of overlapping interest that we broadly categorize as chemical physics.

Students entering the chemical physics program will be assigned an interdepartmental committee to oversee their progress toward the PhD degree. Chemistry graduate students will receive a PhD in chemistry and are expected to choose a research advisor in the Chemistry Department. Students in the

Chemical Physics Program will be expected to enroll in courses from both departments and choose an advisor in the Chemistry Department. The core of the program of courses consists of quantum chemistry (offered by the Chemistry Department), quantum mechanics (offered by either department), electrodynamics (offered by the Physics Department), statistical mechanics (either department), and mathematical physics (Physics Department). For details of the course offerings, see the listings under the Chemistry and Physics Departments on WesMaps.

Seminars. Students will participate in the Chemical Physics Seminar series and will be expected to present at least one talk per year.

Examinations. Chemistry students in the Chemical Physics program will follow the requirements of the Chemistry Department, including two research proposals, oral defense of the second year proposal, and the submission and oral defense of the research dissertation. Students in the Chemical Physics program are expected to take all progress exams offered in the general area of physical chemistry and are required to pass 10 elementary and five advanced exams (in any area).

Research Rotations. Students in the Chemical Physics program complete three rotations in the first semester to choose a research advisor from among the participating faculty.

MOLECULAR BIOPHYSICS

The Chemistry Department participates in an interdisciplinary program of graduate study in molecular biophysics with the Departments of Molecular Biology and Biochemistry (MB&B), Biology, and Physics. The program provides a course of study and research that overlaps the disciplinary boundaries of chemistry, physics, biology, and molecular biology and is designed for students with an undergraduate background in any one of these areas. Students in the program are enrolled in one of the participating departments and fulfill canonical requirements of that department. In addition, they take advanced courses in molecular biophysics and pursue dissertation research with one of the faculty in the program. Centerpieces of the program are the weekly interdepartmental journal club in molecular biophysics and an annual off-campus research retreat. Both activities bring together students, research associates, and faculty from all participating departments and foster interdisciplinary collaborative projects.

Students interested in this program may indicate their interest on the application for admission to the Chemistry, MB&B, Physics, or Biology Departments. Application forms for these departments are available at: <https://admission.wesleyan.edu/apply/>.