

# CHEMISTRY (PH.D.)

<https://ceps.unh.edu/chemistry/program/phd/chemistry>

## Description

The Ph.D. program prepares students for careers in science as researchers and educators by expanding their knowledge of chemistry while developing their ability for critical analysis, creativity, independent study and complex problem solving. Graduates are well positioned for careers as professional chemists in industry, academia, government, and related areas. All students take coursework, carry out original research with a faculty mentor, and submit a dissertation. The program has a focus on developing strong writing and oral communication skills. Financial support is available through either a teaching assistantship or research assistantship.

## Requirements

### Ph.D. Degree Requirements

- Coursework: To be determined with the consent of the research advisor beyond the 1st. semester, a minimum of 6 courses is required including a minimum of 3 at the 900 level.
- Professional development courses required - 4 courses.
- Attendance at Department Seminars.
- Attendance at Graduate Research Update (GRU) sessions and presentation once annually from year two onward.
- Satisfactory presentation of a Thesis Research Proposal (TRP)
- Preparation and oral defense of an Original Research Proposal (ORP) in the third year of residence. Successful completion of the ORP enables the student to advance to candidacy.
- One oral presentation at a regional or technical conference, and one oral or poster presentation at the UNH Graduate Research Symposium.
- Preparation, public presentation, and oral defense of a written dissertation.
- Required 3.0 GPA or above to graduate.

### Faculty Research Advisor and Dissertation Committee

Students select a research advisor during the first semester in the program after interviewing at least three faculty members. During each semester thereafter, students conduct independent research under the supervision of the Faculty Research Advisor. In the second year of residence and before the Thesis Research Proposal, a dissertation committee is selected. This committee evaluates the student's Thesis Research Proposal and the Original Research Proposal. Once the Original Research Proposal has been passed and the student advances to candidacy, a fifth committee member is selected and added to the Dissertation Committee to evaluate the Dissertation Defense.

Code	Title	Credits
<b>Professional Development Courses</b>		
CHEM 800	Introduction to Chemistry Teaching and Research Practices	1
CHEM 801	Modern Tools for Researchers in the Chemical Sciences	1
CHEM 802	Critical Thinking for Chemists	1
CHEM 803	Creative Thinking for Chemists	1
CHEM 992	Graduate Writing Portfolio	1
<b>Program Courses</b>		

CHEM 808	Spectroscopic Investigations of Organic Molecules	3
CHEM 862	Advanced Chemical Analysis Instrumentation	3
CHEM 840	Chemical Biology	3
CHEM 855	Advanced Organic Chemistry	3
CHEM 903	Advanced Inorganic Chemistry I	3
CHEM 902	Theoretical Organic Chemistry II	3
CHEM 904	Advanced Inorganic Chemistry II	3
CHEM 911	Synthetic Organic Chemistry I	4
CHEM 918	Advanced Special Topics	2-4
CHEM 925	Surface Chemistry	3
CHEM 927		3
CHEM 930	Advanced Optical Methods	3
CHEM 934		3
CHEM 935	Advanced Analytical Chemistry	3
CHEM 995	Colloquium ( Courses options: A) Inorganic Chemistry; B) Organic Chemistry; C) Theoretical Organic Chemistry; D) Physical Chemistry; E) Analytical Chemistry; F) Chemical Education.)	1-4
MATH 835	Statistical Methods for Research	3
<b>Research</b>		
CHEM 999	Doctoral Research	0

## Student Learning Outcomes

### Program Learning Outcomes

All Chemistry graduate students will be able to:

**Display a comprehensive knowledge of chemistry, with greater depth demonstrated in at least one subdiscipline.**

- Chemistry students in the Ph.D. and the M.S. program should have a basic knowledge of the field, with that knowledge being at least the level of the material taught in first-year chemistry and the initial courses in undergraduate sub-disciplinary classes (analytical, inorganic, organic, physical chemistry, and biochemistry).

**Ph.D. students should demonstrate focused and deep expertise in their area of scholarly exploration, including an understanding of the current status of the topic. M.S. students should also demonstrate clear focus in scholarly pursuits.**

- In the area of specialization, a Ph.D. student's knowledge of the field should, at a minimum, be comparable to special topics classes at the graduate level.
- Students should demonstrate capabilities of searching the literature to become familiar with the current state of the field.

## **Apply critical thinking skills in the evaluation of scientific work, by analyzing, organizing, and evaluating scientific data and knowledge.**

- Careful attention to and critical evaluation of material encountered in the literature, in seminars, and research activity is evidence of scientific maturation.

## **Generate hypotheses, design strategies, perform studies, and interpret results that lead to new knowledge in the field, including the...**

- Application of central methods and techniques, including laboratory skills, statistical and computational methods, data gathering, and record-keeping to deliver detailed information and reproducible results.
- Demonstration of an understanding of the scientific method through the Original Research Proposal and through laboratory research (dissertation).
- Conduct of consequential scientific inquiry that advances a scientific field as required for a dissertation and peer-reviewed publications.

## **Communicate scientific information with effectiveness to both experts and novices in oral and written form, including methods, results, and conclusions.**

- Demonstration of the ability to engage in communication appropriate for the audience.
- Present scientific material with clarity, accuracy, and precision.

## **Perform research in a professional, ethical, and safe manner.**

- Students must participate in and apply knowledge from required training in laboratory safety and the responsible conduct of research; additional specialized training in these areas is encouraged.
- Students should develop skills in applicable professional areas, such as pedagogy, teamwork and team building, and leadership, through mentoring, instructional activity, and workshops.
- Safety and ethical behavior should be demonstrated in all activities, including both instructional and research activity.