

# Chemistry

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## Department Information

- **Department Chair:**  
Gregory Cook, Ph.D.
- **Graduate Coordinator:**  
Uwe Burghaus, Ph.D.
- **Department Location:**  
Ladd Hall
- **Department Phone:**  
(701) 231-8694
- **Department Web Site:**  
[www.ndsu.edu/chemistry/](http://www.ndsu.edu/chemistry/) (<http://www.ndsu.edu/chemistry/>)
- **Application Deadline:**  
April 15 for fall, October 31 for spring. Spring admissions depend on the availability of fellowships and faculty interests. If there are no spring openings, spring applications are automatically considered for the subsequent fall semester.
- **Credential Offered:**  
Ph.D., M.S.
- **Test Requirement:**  
GRE required for applicants who have not earned a degree in the U.S. GRE (general and subject recommended for domestic applicants, but not required)
- **English Proficiency Requirements:**  
RA - TOEFL 71, IELTS 6, Duolingo 105; TA Grader - TOEFL 79, IELTS 6.5, Duolingo 110; TA Instructor - TOEFL 81, IELTS 7, Duolingo 115

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The Department of Chemistry and Biochemistry offers programs leading to the Master of Science (M.S.) and Doctor of Philosophy (Ph.D.) degrees in Chemistry. At the start of the first year of study, entering graduate students take entrance examinations in analytical, inorganic, organic, and physical chemistry, as well as chemistry and biochemistry. The graduate student progress committee uses these exams for advisory purposes in recommending course work during the first year. Consequently, programs are individually tailored to the needs of each student. Typically, course work is completed in one to one-and-a-half years for M.S. candidates, and two years for Ph.D. students, leaving later years for full-time thesis or dissertation research. The typical time to complete a graduate degree averages three years for the M.S. degree and approximately five years for the Ph.D.

## Research Opportunities and Infrastructure

The Department of Chemistry and Biochemistry is a research intensive department with funded research programs spanning areas from materials to medicine. External research grants from the National Science Foundation, National Institutes of Health as well as many other public and private agencies support the graduate programs in the department.

All research and most teaching activities within the department occur within two centrally-located buildings. Sugihara Hall, a 100,000 square foot modern research facility, was opened in January 2022 to house the department offices, core instrument facilities and research labs. Research is also carried out in the Quinten Burdick building directly across the street from Sugihara Hall.

The department facilities house both teaching and research labs, glassblowing facilities, as well as stockroom and multiuser equipment for the campus. Modern instrumentation is vital to research in the chemical sciences. The quality and quantity of instrumentation within the department has been greatly enhanced in the last few years through aggressive fundraising efforts and university matching support.

The department has upgraded its mass spectrometry capabilities to include a Bio-TOF III with accurate mass analysis, ESI and CI ionization; as well as an Esquire 3000 Plus - an Ion trap instrument with MS-MS and proteomics capabilities. The department also has modern 400 and 500 MHz Nuclear Magnetic Resonance (NMR) spectrometers for research with specialized capabilities for both small molecule analysis and protein NMR. The Materials Characterization Laboratory houses the departmental X-ray crystallography facilities and a brand new Analytical Ultracentrifuge. In addition to materials characterization, a Core Biology Facility that serves multiple users is housed within the department for performing bioassays, cell and tissue culture work, and molecular biology experiments. The facility has 96- and 384-well plate fluorimeters, culture changers, flow hoods, RT-PCR and FPLC protein purification instrumentation. All core facilities are staffed with highly trained technical staff for scientific consultation and training.

Prospective students are encouraged to visit the **Department of Chemistry and Biochemistry website** for contact and more information.

The graduate programs in chemistry are open to all qualified graduates of universities and colleges of recognized standing. To be admitted with full standing to the program, the applicant must meet the Graduate School's admission requirements, have adequate preparation for the study

of chemistry at the graduate level, and show potential to undertake advanced study and research as evidenced by academic performance and experience.

## Financial Assistance

The student must first apply to the Graduate School and be accepted in full or conditional status before he/she is eligible for an assistantship in the Department of Chemistry and Biochemistry.

Graduate students in the Department of Chemistry and Biochemistry are supported by either teaching assistantships (TA) or research assistantships (RA). The standard stipend is \$24,000 per year for both Research Assistants (RA) and Teaching Assistants (TA). In addition to the stipend, graduate assistants in good standing receive a graduate tuition waiver. Tuition waivers cover base tuition for NDSU graduate credits. Students are responsible for differential tuition, student fees, and tuition for non-graduate level credits taken or Cooperative Education credits.

## Master of Science

The Master of Science program requires the completion of 30 graduate semester credits with an overall GPA of 3.0 or better. This total is comprised of both class work and research credit, but must include at least 16 semester credits of didactic course work (<https://catalog.ndsu.edu/graduate/graduate-school-policies/>).

Code	Title	Credits
<b>Required Courses</b>		
CHEM 720	Introduction to Chemical Research	2
CHEM 790	Graduate Seminar (second year seminar)	1
or BIOC 790	Graduate Seminar	
UNIV 720	Scientific Integrity	1
CHEM 790	Graduate Seminar (defense seminar)	1
or BIOC 790	Graduate Seminar	
Didactic Credits (601-689, 691; 700-789, 791; 800-889 and 891)		16 *
CHEM 798	Master's Thesis	6-10
or BIOC 798	Master's Thesis	
<b>Total Credits Required</b>		<b>30</b>
<b>As part of total semester credits, the following departmental courses are recommended for students based on discipline:</b>		
<b>Analytical</b>		
CHEM 632	Analytical Chemistry II	3
CHEM 730	Separations	2
CHEM 732	Advanced Survey of Analytical Chemistry	4
CHEM 736	Mass Spectrometry	2
<b>Biochemistry and Molecular Biology</b>		
BIOC 673	Methods of Biochemical Research	3
BIOC 674	Methods of Recombinant DNA Technology	3
BIOC 701	Comprehensive Biochemistry I	4
BIOC 702	Comprehensive Biochemistry II	4
<b>Inorganic</b>		
CHEM 724	Chemical Applications of Group Theory	1
CHEM 725	Advanced Survey of Inorganic Chemistry	3
CHEM 727	Organometallic Chemistry	3
CHEM 728	Physical Methods for Chemical and Biomolecular Research	2
CHEM 744	Organic Spectroscopy	2
<b>Organic</b>		
CHEM 741	Physical Organic Chemistry I	4
CHEM 742	Physical Organic Chemistry II	2
CHEM 744	Organic Spectroscopy	2
CHEM 745	Organic Synthesis	4
<b>Physical</b>		
BIOC 665		
CHEM 760	Statistical Thermodynamics	4

CHEM 763	Kinetics	2
CHEM 764	Dynamics	2

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A minimum of 10 must be from courses numbered 701-789; 791 or 800-889; 891

## Doctor of Philosophy

The Ph.D. program requires the completion of 90 graduate semester credits, post-baccalaureate, with an overall GPA of 3.0 or better. This total must comprise credits from both didactic and non-didactic work. Non-didactic credits must include those earned in research and seminars. The didactic credits (<https://catalog.ndsu.edu/graduate/graduate-school-policies/>) must total at least 19 for the required courses listed below.

Code	Title	Credits
<b>Required Didactic Courses</b>		
CHEM 720	Introduction to Chemical Research	
UNIV 720	Scientific Integrity	
CHEM 725	Advanced Survey of Inorganic Chemistry	
CHEM 732	Advanced Survey of Analytical Chemistry	
CHEM 741	Physical Organic Chemistry I	
CHEM 759	Advanced Survey of Physical Chemistry	
<b>Required Non-Didactic Courses</b>		
CHEM 790	Graduate Seminar (second year seminar)	
CHEM 790	Graduate Seminar (proposal seminar)	
CHEM 790	Graduate Seminar (defense seminar)	
CHEM 899	Doctoral Dissertation ( Number of research credits determined by student and supervisory committee)	
Additional credits numbered 601 - 689, 691, 700 - 789 and 791 may also count toward the 90 credit total required by the College of Graduate and Interdisciplinary Studies if approved by the student's advisory and examination committee.		
Total Credits		90

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A student matriculating with a master's degree, including one earned at an international institution, must earn not fewer than 60 graduate credits at NDSU. These credits must include the 19 listed above under Required Didactic Courses. Courses numbered 601-689 may be used for the Plan of Study as long as they have not been taken in an undergraduate or previous graduate program. Approved courses are Department of Chemistry & Biochemistry 625, 626, 627, 628, 630, and 676.

## ADDITIONALLY, The following departmental courses ARE available for students; CONSULT WITH COMMITTEE FOR RECOMMENDATIONS:

Code	Title	Credits
<b>Analytical</b>		
CHEM 632	Analytical Chemistry II	3
CHEM 730	Separations	2
CHEM 736	Mass Spectrometry	2
<b>Biochemistry and Molecular Biology</b>		
BIOC 673	Methods of Biochemical Research	3
BIOC 674	Methods of Recombinant DNA Technology	3
BIOC 701	Comprehensive Biochemistry I	4
BIOC 702	Comprehensive Biochemistry II	4
<b>Inorganic</b>		
CHEM 724	Chemical Applications of Group Theory	1
CHEM 727	Organometallic Chemistry	3
CHEM 728	Physical Methods for Chemical and Biomolecular Research	2
CHEM 744	Organic Spectroscopy	2
<b>Organic</b>		
CHEM 742	Physical Organic Chemistry II	2

CHEM 744	Organic Spectroscopy	2
CHEM 745	Organic Synthesis	4
<b>Physical</b>		
CHEM 665	Survey of Physical Chemistry	4
CHEM 760	Statistical Thermodynamics	4
CHEM 763	Kinetics	2
CHEM 764	Dynamics	2
CHEM 676	Introduction to Computational Quantum Chemistry	3

Each student chooses a thesis adviser within six months of beginning graduate school. As this is one of the most important decisions made in graduate school, students are strongly urged to visit multiple faculty members to discuss research opportunities. In addition, faculty seminars during the fall semester are designed to acquaint new students with the available research programs.

By the end of the first academic year, each student selects an advisory and examination committee, which consists of the thesis adviser, two other faculty members in the chemistry department, and one faculty member from a department outside the Department of Chemistry and Biochemistry.

Admission to candidacy for the Ph.D. degree is accomplished by satisfying three requirements:

1. satisfactory performance in course work with a minimum 3.0 grade point average,
2. satisfactory performance in comprehensive examinations taken by the end of the 4th semester, and
3. satisfactory defense of an original research proposal on a topic approved by the student's supervisory committee.

The defense of this proposal must occur at least eight months prior to the final oral examination. Following completion of dissertation research, the candidate must complete a written dissertation and an oral presentation to the department and supervisory committee.

**Philip Boudjouk**

University of Wisconsin, 1971  
 Postdoctoral, UC Davis, 1971-1973  
 Research Area: Main Group Organometallic Chemistry, Materials

**Uwe Burghaus, Ph.D.**

Free University of Berlin, 1995  
 Postdoctoral, University of Genoa, Italy, 1995-1997  
 Research Area: Surface Physical Chemistry

**Gregory R. Cook, Ph.D.**

Michigan State University, 1993  
 Postdoctoral, Stanford University, 1994-1996  
 Research Area: Synthetic Organic Chemistry

**John F. Hershberger, Ph.D.**

Yale University, 1986  
 Postdoctoral, Columbia University, 1986-1989  
 Research Area: Experimental Physical Chemistry, Laser Kinetics

**Dmitri Kilin, Ph.D.**

Chemnitz University of Technology, 2000  
 Research Area: Computational Chemistry of Materials, Theoretical Physical Chemistry

**Svetlana Kilina, Ph.D.**

University of Washington, Seattle 2007  
 Los Alamos National Lab, 2007-2010  
 Research Area: Computational Chemistry

**Alexey Leontyev, Ph.D.**

University of Northern Colorado, 2015  
 Research Area: Chemistry Education and Assessment

**Gudrun Lukat-Rodgers**

Iowa State University, 1985  
 Postdoctoral: University of Iowa, 1985-1988  
 Postdoctoral: Princeton University, 1989-1003  
 Research Area: Bioinorganic Chemistry

**James Nyachwaya, Ph.D.**

University of Minnesota, 2012

Research Area: Chemistry / Discipline Based Education Research

**Alexander Parent, Ph.D.**

Yale University, 2013

Research Area: Inorganic/Organic Chemistry, Green Chemistry

**Seth C. Rasmussen, Ph.D.**

Clemson University, 1994

Postdoctoral, University of Oregon, 1995-1999

Research Area: Inorganic/Organic Materials Chemistry, Chemical History

**Kenton R. Rodgers, Ph.D.**

University of Iowa, 1988

Postdoctoral, Princeton University, 1989-1993

Research Area: Inorganic and Bioinorganic Chemistry

**Mukund P. Sibi, Ph.D.**

City University of New York, 1980

Postdoctoral, Dartmouth College, 1980-1982; University of Waterloo, 1982-1985

Research Area: Synthetic Organic Chemistry; Natural Products

**Zhongyu Yang, Ph.D.**

University of Pittsburgh, 2010

Research Area: Bioanalytical chemistry; Biophysics; Electron Paramagnetic Resonance Spectroscopy

**Pinjing Zhao, Ph.D.**

Cornell University, 2003

Postdoctoral, Yale University, 2004-2006; University of Illinois at Urbana-Champaign, 2006-2007

Research Area: Inorganic and Organometallic Chemistry