Chemistry

Department Information

- **Department Chair:**
  Gregory Cook, Ph.D.
- **Graduate Coordinator:**
  Mukund Sibi, Ph.D.
- **Department Location:**
  Ladd Hall
- **Department Phone:**
  (701) 231-8694
- **Department Web Site:**
  www.ndsu.edu/chemistry/
- **Application Deadline:**
  March 1 for fall, September 1 for spring. Spring admissions are given occasionally depending on fellowship availability 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 (general required; subject recommended)
- **English Proficiency Requirements:**
  TOEFL ibT 81 (23 speak; 21 write) – TA, 71 – RA; IELTS 6.5 – TA; 6 – RA

Program Description

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. As a consequence, 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. candidates, leaving later years for full-time thesis 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 has more than 10 externally funded faculty research programs. Research expenditures have averaged $1.8 million over the last 10 years, with more than $2.2 million in the last two years.

All research and most teaching activities within the department occur within three centrally-located buildings, including two connected facilities, Ladd Hall and Dunbar Laboratory, as well as the Quentin Burdick Building, located across the street.

Most departmental offices, classrooms and teaching labs, as well as some research labs are located in Ladd Hall, while Dunbar and the third floor of the Quentin Burdick Building primarily consist of research laboratories. Ladd Hall also houses departmental glass, machine, and electronics shops.

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 recently 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. A dedicated LC can be integrated with the both the instruments.

The Organic Spectroscopy Laboratory is primarily devoted to maintenance and operation of Nuclear Magnetic Resonance (NMR) spectrometers. The facility includes three modern high-field instruments: Varian 500, 400, and 300 MHz spectrometers. All have multinuclear, 2-D, and variable temperature capabilities, and the 400 MHz instrument has been recently upgraded for solids capabilities. This center also includes the departmental FTIR.

The Materials Characterization Laboratory houses the departmental crystallography faculties including a Bruker single crystal CCD X-ray diffractometer with low temperature capabilities, a Philips MPD (Multi- Purpose Diffractometer), two Philips X-ray powder diffractometers, and a Kevex X-ray fluorescence unit. CHN Elemental analysis, thermogravimetric analysis (TGA), differential scanning calorimetry (DSC), and differential thermal analysis (DTA) are also available.
The Center for Protease Research - Core Biology Facility is a new facility housing equipment and technical personnel for performing bioassay, cell and tissue culture, and molecular biology experiments. For bioassays, the facility has a fluorimeter capable of top or bottom reading and the capability to handle both 96- and 384-well plates. For sample preparation, researchers can utilize cell and tissue culture capabilities such as flow hoods and culture chambers. In addition, RT-PCR and FPLC protein purification technology is available.

The chemistry library, located in Ladd Hall, provides graduate students and faculty with convenient 24-hour access to more than 200 journals and approximately 10,000 volumes. Literature searching via SciFinder is supported.

Prospective students are encouraged to visit the Department of Chemistry and Biochemistry website (http://www.ndsu.edu/chemistry) for the latest descriptions of research programs and instrumentation.

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 during both the academic year and during summer months by either teaching assistantships (TA) or research assistantships (RA). As of the 2014-2015 academic year, the standard stipend is $22,000 per year for both RAs and TAs. University tuition (no fees) is waived for all TAs and RAs in good academic standing.

Master of Science

The Master of Science program requires the completion of a total 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 consist of at least 16 semester credits from letter-graded course work.

<table>
<thead>
<tr>
<th>Code</th>
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<tbody>
<tr>
<td>CHEM 720</td>
<td>Introduction to Chemical Research</td>
<td>2</td>
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<tr>
<td>CHEM 790</td>
<td>Graduate Seminar (second year seminar)</td>
<td>1</td>
</tr>
<tr>
<td>or BIOC 790</td>
<td>Graduate Seminar</td>
<td>1</td>
</tr>
<tr>
<td>UNIV 720</td>
<td>Scientific Integrity</td>
<td>1</td>
</tr>
<tr>
<td>CHEM 790</td>
<td>Graduate Seminar (defense seminar)</td>
<td>1</td>
</tr>
<tr>
<td>or BIOC 790</td>
<td>Graduate Seminar</td>
<td>1</td>
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Didactic Credits (601-689, 691; 700-789, 791; 800-889 and 891) 16 *

CHEM 798 6-10

CHEM 798 6-10

Total Credits Required 30

As part of total semester credits, the following departmental courses are recommended for students based on discipline:

**Analytical**

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<tr>
<td>CHEM 632</td>
<td>Analytical Chemistry II</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 730</td>
<td>Separations</td>
<td>2</td>
</tr>
<tr>
<td>CHEM 732</td>
<td>Advanced Survey of Analytical Chemistry</td>
<td>4</td>
</tr>
<tr>
<td>CHEM 736</td>
<td>Mass Spectrometry</td>
<td>2</td>
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**Biochemistry and Molecular Biology**

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<td>BIOC 673</td>
<td>Methods of Biochemical Research</td>
<td>3</td>
</tr>
<tr>
<td>BIOC 674</td>
<td>Methods of Recombinant DNA Technology</td>
<td>3</td>
</tr>
<tr>
<td>BIOC 701</td>
<td>Comprehensive Biochemistry I</td>
<td>4</td>
</tr>
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<td>BIOC 702</td>
<td>Comprehensive Biochemistry II</td>
<td>4</td>
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**Inorganic**

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<tr>
<td>CHEM 724</td>
<td>Chemical Applications of Group Theory</td>
<td>1</td>
</tr>
<tr>
<td>CHEM 725</td>
<td>Advanced Survey of Inorganic Chemistry</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 727</td>
<td>Organometallic Chemistry</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 728</td>
<td>Physical Methods for Chemical and Biomolecular Research</td>
<td>2</td>
</tr>
<tr>
<td>CHEM 744</td>
<td>Organic Spectroscopy</td>
<td>2</td>
</tr>
</tbody>
</table>
Organic
CHEM 741  Physical Organic Chemistry I  4
CHEM 742  Physical Organic Chemistry II  2
CHEM 744  Organic Spectroscopy  2
CHEM 745  Organic Synthesis  4
Physical
BIOC 665  Statistical Thermodynamics  4
CHEM 763  Kinetics  2
CHEM 764  Dynamics  2

* 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 a total of 90 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 consist of at least 27 semester credits from letter-graded course work.

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<td>4</td>
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<tr>
<td>CHEM 759</td>
<td>Advanced Survey of Physical Chemistry</td>
<td>4</td>
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<td>CHEM 790</td>
<td>Graduate Seminar (second year seminar)</td>
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<td>CHEM 790</td>
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<td>Graduate Seminar (defense seminar)</td>
<td>1</td>
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<tr>
<td>CHEM 899</td>
<td>(Number of research credits determined by student and supervisory committee)</td>
<td>1-68</td>
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Additional credits numbered 601 - 689, 691, 700 - 789 and 791 may also count toward the 90 credit total required by the School of Graduate and Interdisciplinary Studies if approved by the student’s advisory and examination committee.

Total Credits  90

* 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:

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Biochemistry and Molecular Biology

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Inorganic
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 advisory 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 advisory committee.

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

Denley Jacobson, Ph.D.
Purdue University, 1984
Postdoctoral, California Institute of Technology, 1984-1986
Research Area: Gas Phase Ion 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

Guodong Liu, Ph.D.
Hunan University, 2001
Postdoctoral, New Mexico State University, 2002-2004;
Postdoctoral, Pacific Northwest National Laboratory, 2004-2006
Research Area: Nanotechnology and Biological Sensing

James Nyachwaya, Ph.D.
University of Minnesota, 2012
Research Area: Chemistry / STEM Education

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
Research Area: Synthetic Organic Chemistry; Natural Products

Wenfang Sun, Ph.D.
Institute of Photographic Chemistry, Chinese Academy of Sciences, 1995
Postdoctoral, University of Alabama, Birmingham, 1997-1999
Research Area: Organic Materials Chemistry

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