DEPARTMENT OF CHEMISTRY

Chemistry is the central science; the foundation on which a variety of applied and nonapplied disciplines build. Chemistry deals with the composition, structure, and properties of substances and the changes they undergo. It is the study of the materials of which the entire universe is composed. Chemistry graduates will find an impressive array of options and exciting opportunities in fields such as basic research, environmental protection, instrumentation, the search for and synthesis of new therapeutic drugs, new product and process development, technical marketing, market research, forensic chemistry, teaching at all levels, and information science. Moreover, an education in chemistry is valuable in health sciences such as medicine, pharmacology, clinical chemistry, and industrial hygiene. It can be useful as well in nontechnical areas such as advertising, journalism, patent law, banking, and investment counseling. The options are bounded only by the limits of one's imagination.

There are four distinct undergraduate curricula designed to meet a wide range of professional needs. The professional option is the curriculum of choice for students who are interested in practicing chemistry as a career, including graduate study for an advanced degree in chemistry or a related field. The degree is certifiable to the American Chemical Society. The general chemistry option provides a suitable foundation for those students needing a strong background in chemistry, but not necessarily aspiring to become professional chemists, such as those in Education or Chemical Engineering. The pre-medical option has been designed to serve the needs of those students interested in careers in medicine, pharmacy, dentistry, or other health related fields. The forensics option is a full-fledged chemistry degree that prepares students for a career in forensic science.

Students majoring in chemistry at UI have the very good fortune to interact with an award-winning, distinguished teaching faculty. They have a unique opportunity to participate in undergraduate research in a nurturing environment where they work side by side with graduate students, postdoctoral fellows, and faculty members. Very often the research carried out by undergraduates results in publications in leading chemical journals. As a result of the strong research programs in the department, undergraduates have the opportunity in their courses to have hands-on experience with, or to acquire data from, modern sophisticated instrumentation such as FT nuclear magnetic resonance spectrometers, gas chromatographs interfaced with mass spectrometers, and laser Raman, infrared and ultraviolet spectrometers, in addition to the more classical techniques. Considerable use of computers is made in laboratory courses and as an aid to instruction. Because our students receive a first-class education, they are in demand by prospective employers and graduate schools.

The Chemistry Department trains its B.S. graduates to attain a high level of familiarity with:

- basic chemical concepts and fundamental chemical processes;
- organic synthesis and characterization;
- analytical and environmental approaches and problem solving;
- inorganic, material, and nuclear chemical concepts and applications;
- physical chemical aspects of natural systems and theoretical modeling thereof.

In the course of their studies, students will acquire:

- strong lab techniques and synthetic skills;
- familiarity with the chemical literature and relevant search techniques;
- an awareness of safety issues;
- communication skills;
- problem solving skills;
- basic research skills;
- a sense of professionalism and competence.

M.S. and Ph.D. degrees are offered in chemistry with concentrations in analytical, inorganic, organic, and physical chemistry.

Entering graduate students (master's and doctoral candidates) are expected to demonstrate proficiency in chemistry by taking a series of four examinations in the areas of analytical (qualitative, quantitative, and instrumental), inorganic, organic (including qualitative organic analysis), and physical chemistry. These must be taken at the first offering after the student's arrival. These examinations are offered immediately before registration week of the fall and spring semesters. Questions are at an advanced undergraduate level.

Students who score at greater than the 50th percentile (established nationally) on a qualifying examination may begin with a 500-level course in that area in their first semester and are given credit for the relevant 400-level course (CHEM 455, CHEM 466, CHEM 476, and/or CHEM 496). Students who score below the 50th percentile on an examination will begin course work in the respective area: analytical, CHEM 454 (the lab in this course may be bypassed by petition if the student can present evidence of adequate exposure; previous course at B level); CHEM 495; CHEM 463, CHEM 473.

All candidates for the M.S. or Ph.D. degree in chemistry are required to have teaching experience, here or elsewhere, as part of their training and will complete CHEM 506 (Introduction to Teaching and Research Skills) at their first opportunity on entering the program.

Chemistry graduate students will acquire advanced perspectives in analytical, inorganic, organic, and physical chemistry. They will gain a detailed understanding of the problems, challenges, and opportunities in their chosen subdiscipline, and an in-depth familiarity with the theoretical underpinnings and methodologies in their specific research area. Graduate students will also acquire skills in teaching, directing, and mentoring others.

Ray von Wandruszka, Dept. Chair (116 Malcolm M. Renfrew Hall 83844-2343; phone 208-885-6552; chemoff@uidaho.edu).

ADDLEMAN, Shane R; 2013; Adjunct Faculty of Chemistry; Ph.D.; 1999; University of Idaho.

*ALLEN, Peter B; 2014; Assistant Professor of Chemistry; Ph.D.; 2008; University of Washington.

*ATKINSON, David A; 1996; Adjunct Assistant Professor of Chemistry; Ph.D.; 1992; Washington State University.

BAEK, Donna; 2018; Adjunct Assistant Professor of Chemistry; Ph.D.; 2014; University of Idaho.

*BITTERWOLF, Thomas E; 1988; Professor of Chemistry; Ph.D.; 1976; West Virginia University.
Department of Chemistry

*BRAUNS, Eric B; 2005; Associate Professor of Chemistry; Ph.D.; 2001; University of South Carolina.

BURDGE, Julia; 2009; Adjunct Associate Professor of Chemistry; Ph.D.; 1994; University of Idaho.

*CHENG, I. Francis (Frank); Professor in Chemistry; Ph.D.; 1988; Pennsylvania State University.

*FLETCHER, T. Rick; 1989; Associate Professor of Chemistry; Ph.D.; 1986; University of California Davis.

FOX, Robert V; 2006; Adjunct Assistant Professor of Chemistry; Ph.D.; 2003; University of Idaho.

FUTRELL, Jean H; 2000; Adjunct Professor of Chemistry; Ph.D.; 1958; University of California Berkeley.

*HRDLICKA, Patrick J; 2006; Professor in Chemistry; Affiliate Associate Professor of Biological Sciences; Ph.D.; 2006; University of Southern Denmark.

KENNEDY, J. Rory; 2007; Adjunct Assistant Professor of Chemistry; Ph.D.; 1987; Northwestern University.

KLAEHN, John Ray; 2015; Adjunct Faculty in Chemistry; Ph.D.; 1999; Texas Christian University.

LI, Jun; 2006; Adjunct Professor of Chemistry; Ph.D.; 1992; Chinese Academy of Sciences.

LINEHAN, John C; 2002; Adjunct Associate Professor of Chemistry; Ph.D.; 1986; University of California Davis.

*MAGOLAN, Jakob; 2010; Associate Professor in Chemistry; Ph.D.; 2007; University of Western Ontario.

MINCHER, Bruce J; 1997; Adjunct Assistant Professor of Chemistry; Ph.D.; 1997; University of Idaho.

NELSON, Janet E; 2016; Clinical Professor in Chemistry; Vice President, Research and Economic Development; Ph.D.; 1991; California Institute of Technology.

NICHOLAS, Nolan W; 2012; Adjunct Faculty of Chemistry; Ph.D.; 2009; Rice University.

*PASILIS, Sofie P; 2008; Assistant Professor of Chemistry; Ph.D.; 2004; University of Arizona.

*SHAPIRO, Pamela J; 1991; Professor of Chemistry; Ph.D.; 1991; California Institute of Technology.

*SHREEVE, Jeanne M; 1961; Distinguished Professor of Chemistry; Ph.D.; 1961; University of Washington.

STELCK, Daniel S; 2008; Senior Instructor of Chemistry; Ph.D.; 2001; University of Idaho.

STORFER, Dinara; 2011; Senior Instructor of Chemistry; Ph.D.; 2001; University of Idaho.

THOMPSON, Darren; 2016; Adjunct Faculty in Chemistry; Ph.D.; 2009; University of California.

*VON WANDRUSZKA, Ray; 1987; Professor of Chemistry; Affiliate Professor of Environmental Science; Department Chair, Department of Chemistry; Interim Department Chair, Department of Physics; Ph.D.; 1977; University of Wyoming.

WAYNANT, Kristopher V; 2014; Clinical Assistant Professor of Chemistry; Ph.D.; 2008; New Mexico State University.

*WILLIAMS, Richard V; 1989; Professor of Chemistry; Ph.D.; 1978; University of Cambridge.

Majors

• Chemistry (B.S.) (https://catalog.uidaho.edu/colleges-related-units/science/chemistry/chemistry-bs)

Minors

• Chemistry Minor (https://catalog.uidaho.edu/colleges-related-units/science/chemistry/chemistry-minor)

Graduate Programs

Candidates must fulfill the requirements of the College of Graduate Studies and of the Department of Chemistry. See the College of Graduate Studies (https://client-snap.dev6.leepfrog.com/UIDAHO/uidaho.smartcatalogiq.com/en/2017-2018/University-of-Idaho-General-Catalog-Colleges-and-Related-Units/College-of-Graduate-Studies.html) section for the general requirements applicable to each degree.

• Chemistry (M.S.) (https://catalog.uidaho.edu/colleges-related-units/science/chemistry/chemistry-ms)

• Chemistry (Ph.D.) (https://catalog.uidaho.edu/colleges-related-units/science/chemistry/chemistry-phd)

CHEM 101 Introduction to Chemistry

Chem 101 Introduction to Chemistry (3 cr)

*Gen Ed: Natural and Applied Sciences

Full credit may be earned in only one of the following: Chem 101 or Chem 111. General treatment of the fundamentals of chemistry. Does not satisfy the prereq for Chem 112.

CHEM 101L Introduction to Chemistry Laboratory

1 credit

*Gen Ed: Natural and Applied Sciences

This is the companion laboratory course to CHEM 101 and provides an introduction to Chemistry lab practices. It does not satisfy the lab requirement for CHEM 111 or CHEM 112. One 3-hour lab a week.

Prereq or Coreq: CHEM 101.

CHEM 111 Principles of Chemistry I

Chem 111 Principles of Chemistry I (3 cr)

*Gen Ed: Natural and Applied Sciences

Full credit may be earned in only one of the following: Chem 101, or 111. Note that grades in Chem 111 will supersede any grades earned in Chem 101. Intensive treatment of principles and applications of chemistry. Recommended Preparation: A grade of 'B' or better in a high school chemistry course.

Prereq: min 580 SAT math or min 25 ACT math , or min 46 ALEKS; or a grade of 'C' or better in Chem 101, Math 143, Math 160, or Math 170; or Permission.
CHEM 111L Principles of Chemistry I Laboratory
1 credit
*Gen Ed: Natural and Applied Sciences*
This is the companion laboratory course to CHEM 111 and provides an intensive treatment of Chemistry lab practices. One 3-hour lab a week.

**Prereq or Coreq:** CHEM 111.

CHEM 112 Principles of Chemistry II
Chem 112 Principles of Chemistry II (4 cr)
*Gen Ed: Natural and Applied Sciences*
Continuation of Chem 111. Some work in inorganic chemistry, kinetics, equilibrium, liquids, solids, acid-base, electrochemistry, nuclear chemistry, thermodynamics, and qualitative inorganic analysis. Three lecture and one recitation.

**Prereq:** Chem 111 and 111L or Permission.

CHEM 112L Principles of Chemistry II Laboratory
1 credit
*Gen Ed: Natural and Applied Sciences*
This is the companion laboratory course to CHEM 112 and teaches Chemistry lab practices in inorganic chemistry, kinetics, equilibrium, acid-base, electrochemistry, thermodynamics, and qualitative analysis. One 3-hour lab a week.

**Prereq or Coreq:** CHEM 112.

CHEM 121 Glassblowing
Chem 121 Glassblowing (1 cr)
Techniques used in constructing scientific apparatus from glass. Graded P/F. One 3-hr lab a wk.

**Prereq:** Permission of department.

CHEM 200 (s) Seminar
Chem 200 (s) Seminar (cr arr).

CHEM 204 (s) Special Topics
Chem 204 (s) Special Topics (cr arr).

CHEM 253 Quantitative Analysis
Chem 253 Quantitative Analysis (3 cr)
Fundamental principles and techniques of chemical analysis; intro to sampling, standardization, data evaluation, gravimetric/volumetric methods, and instrumental techniques. (Fall only)

**Prereq:** Chem 112.

CHEM 254 Quantitative Analysis: Lab
Chem 254 Quantitative Analysis: Lab (2 cr)
Laboratory portion of Quantitative Analysis (Chem 253).

**Prereq or Coreq:** Chem 253.

CHEM 275 Carbon Compounds
Chem 275 Carbon Compounds (3 cr)
Aspects of organic chemistry important to students in the life sciences.

**Prereq:** Chem 101, 111, or Permission.

CHEM 276 Carbon Compounds Lab
Chem 276 Carbon Compounds Lab (1 cr)
Lab to accompany Chem 275; for students who need only 1 cr of lab. One 3-hr lab a wk.

**Prereq or Coreq:** Chem 275 or 277.

CHEM 277 Organic Chemistry I
Chem 277 Organic Chemistry I (3 cr)
Principles and theories of organic chemistry; properties, preparation, and reactions of organic compounds.

**Prereq:** Chem 112.
CHEM 409 Proseminar
Chem 409 Proseminar (1 cr)
Gen Ed: Senior Experience
Current publications in chemistry and chemical engineering with reports on typical scientific papers. Preparation of application materials for graduate work and/or careers in chemistry. 
Prereq: Chem 372 and junior standing.

CHEM 418 Environmental Chemistry
Chem J418/J518 Environmental Chemistry (3 cr)
Chemistry of atmosphere, soil, and water; pollution monitoring and remediation; treatment of waste in the environment. Additional projects/assignments reqd for grad cr. (Spring only)
Prereq: Chem 253, Chem 254, and Chem 275 or 277, or Permission.

CHEM 436 Electronics for Scientists
Chem J436/J535 Electronics for Scientists (2-4 cr, max 4)
Theory and application of analog and digital electronics used in scientific instrumentation. Registration for Chem 535 requires completion of an additional term paper or other assignment (Fall, alt/yr).
Prereq: Permission.

CHEM 454 Instrumental Analysis
Chem 454 Instrumental Analysis (3-4 cr)
For students in chemistry and allied fields. Techniques in operating new and specialized instruments for qualitative and quantitative analysis and analytical methods of an advanced nature. Three lec and one 4-hr lab a wk. Permission required to register for 3 credits (Spring only)
Prereq: Chem 253, Chem 254, and Chem 305
Prereq or Coreq: Chem 306 

CHEM 455 Survey of Analytical Chemistry
Chem 455 Survey of Analytical Chemistry (3 cr)
Fundamentals of modern analytical chemistry. Open only to chemistry M.S. and Ph.D. students. Cr is not allowed in both Chem 454 and 455.
Prereq: Permission.

CHEM 463 Inorganic Chemistry
Chem 463 Inorganic Chemistry (3 cr)
Principles, complex ions and coordination compounds, theory of acids and bases, bonding theory, non-aqueous solvents, familiar elements and their relationship to the periodic table. (Fall only)
Prereq: Chem 305 or Permission.

CHEM 464 Inorganic Chemistry
Chem J464/J564 Inorganic Chemistry (3 cr)
Principles, complex ions and coordination compounds, theory of acids and bases, bonding theory, non-aqueous solvents, familiar elements and their relationship to the periodic table. Additional projects/assignments reqd for grad cr. (Spring only)
Prereq or Coreq: Chem 463, or 466, or Permission.

CHEM 465 Inorganic Chemistry Laboratory
Chem 465 Inorganic Chemistry Laboratory (1 cr)
Lab to accompany Chem 464. One 3-hr lab a wk. (Spring only)
Coreq: Chem 464.

CHEM 466 Survey of Inorganic Chemistry
Chem 466 Survey of Inorganic Chemistry (3 cr)
Fundamentals of modern inorganic chemistry. Open only to chemistry M.S. and Ph.D. students. Cr is not allowed in both Chem 463 and 466.
Prereq: Chem 306 and Permission.

CHEM 472 Medicinal Chemistry
Chem J472/J572 Medicinal Chemistry (3 cr)
Synthetic chemistry necessary for design and preparation of medicinal agents, and mechanistic chemistry germane to action of pharmaceuticals. Graduate students are required to write an original research proposal on a topic related to drug discovery. (Alt/yr)
Prereq or Coreq: Chem 473, 476 or Permission.

CHEM 473 Intermediate Organic Chemistry
Chem 473 Intermediate Organic Chemistry (3 cr)
Theories and mechanisms of organic chemistry. (Fall only)
Prereq: Chem 372
Prereq or Coreq: Chem 306.

CHEM 476 Survey of Organic Chemistry
Chem 476 Survey of Organic Chemistry (3 cr)
Fundamentals of modern organic chemistry. Open only to chemistry M.S. and Ph.D. students. Cr is not allowed in both Chem 473 and 476.
Prereq: Permission.

CHEM 491 (s) Research
Chem 491 (s) Research (1-6 cr, max 12)
Submission of a report of the research done for placement in the permanent dept files is required.
Prereq: Permission of department.

CHEM 495 Statistical Thermodynamics
Chem 495 Statistical Thermodynamics (3 cr)
See Phys 333.

CHEM 496 Survey of Physical Chemistry
Chem 496 Survey of Physical Chemistry (3 cr)
Fundamentals of modern physical chemistry. Open only to chemistry M.S. and Ph.D. students. Cr is not allowed in both Chem 495 and 496.
Prereq: Permission.

CHEM 498 (s) Internship
Chem 498 (s) Internship (cr arr).

CHEM 499 (s) Directed Study
Chem 499 (s) Directed Study (cr arr).

CHEM 500 Master's Research and Thesis
Chem 500 Master's Research and Thesis (cr arr).

CHEM 501 (s) Seminar
Chem 501 (s) Seminar (1 cr, max 2).

CHEM 502 (s) Directed Study
Chem 502 (s) Directed Study (cr arr).

CHEM 503 (s) Workshop
CHEM 504 (s) Special Topics
Chem 504 (s) Special Topics (cr arr).

CHEM 505 (s) Professional Development
CHEM 506 Introduction to Teaching and Research Skills
Chem 506 Introduction to Teaching and Research Skills (2 cr)
Skills required of teaching assistants in laboratory, recitations, office hours, help sessions; skills required for research; use of library; introduction to faculty research. Graded P/F. (Fall only)
Prereq: Permission.

CHEM 509 Advanced Physical Chemistry
Chem 509 Advanced Physical Chemistry (3 cr)
Application of quantum theory to chemical bonding, molecular spectroscopy, and molecular structure. (Spring only)
Prereq: Chem 306, 495, 496, or Permission.
CHEM 511 Seminar
Chem 511 Seminar (0 cr).

CHEM 518 Environmental Chemistry
Chem 518 Environmental Chemistry (3 cr)

CHEM 535 Electronics for Scientists
Chem J436/J535 Electronics for Scientists (2-4 cr, max 4)
Theory and application of analog and digital electronics used in scientific instrumentation. Registration for Chem 535 requires completion of an additional term paper or other assignment (Fall, alt/yrs).
Prereq: Permission .

CHEM 542 Biochemistry and Molecular Biology
Chem 542 Biochemistry II (3 cr)
See Biol J454/554.

CHEM 550 Radioanalytical Chemistry
Chem 550 Radioanalytical Chemistry (2 cr)
Fundamental concepts of radiochemistry, including the principles of radioactive decay processes and counting techniques; in-depth treatment of radioanalytical techniques, especially neutron activation and isotope dilution methods; decay processes as sources of x-rays; the use of synchrotron radiation in analytical chemistry. (Alt/yrs)
Prereq: Chem 454, or 455, or Permission.

CHEM 551 Electronic Spectrometry
Chem 551 Electronic Spectrometry (2-3 cr, max 3)
A brief review of fundamental concepts, including electronic transitions, optical properties of materials, and laws of radiation absorption; detailed coverage of instrumentation used for ultraviolet and visible absorption spectroscopy, with regard to optical components, overall design strategy, and signal processing; analytical performance related to these aspects and presented from both theoretical and practical standpoints; in-depth coverage of luminescence spectroscopy, including phosphorimetry and fluorimetry; atomic spectroscopy (both flame and plasma-based versions), including principles of operation, instrumental requirements, and analytical application; survey of x-ray absorption and fluorescence spectroscopy. (Alt/yrs)
Prereq: Chem 454, 455 or Permission.

CHEM 553 Separation Theory and Chromatography
Chem 553 Separation Theory and Chromatography (2-3 cr, max 3)
Gas and liquid chromatography and related fields. Students enrolled in Chem 553 are required to complete additional written assignments. (Alt/ yrs)
Prereq: Chem 306 .

CHEM 556 Molecular Spectroscopy
Chem 556 Molecular Spectroscopy (3 cr)
Interpretation of IR, UV, NMR, and mass spectra. Registration for Chem 556 requires completion of additional assignments.
Prereq: Chem 306 or Permission .

CHEM 558 Electrochemistry
Chem 558 Electrochemistry (2-3 cr, max 3)
Fundamental concepts of electrochemistry, including the principles of redox processes; in-depth treatment of electroanalytical techniques, especially voltammetric and potentiometric methods; advanced treatment of selected topics, including ultramicro and in vivo electrochemical techniques. (Alt/yrs)
Prereq: Chem 454, or 455, or Permission.

CHEM 571 (s) Topics In Organic Chem
Chem 571 (s) Topics in Organic Chemistry (1-9 cr, max 9)
Selected topics from the current literature.
Prereq: Chem 473, 476, or Permission.

CHEM 572 Medicinal Chemistry
Chem 572 Medicinal Chemistry (3 cr)

CHEM 590 Doctoral Research Proposal
Chem 590 Doctoral Research Proposal (1 cr)
Taken no later than one semester after completion of cumulative exams; required for advancement to Ph.D. candidacy. Includes review of relevant literature and original research proposal describing the student's intended research project.

CHEM 598 (s) Internship
CHEM 599 (s) Non-thesis Master's Research
CHEM 600 Doctoral Research and Dissertation
Chem 600 Doctoral Research and Dissertation (cr arr).