

CHEMISTRY

OVERVIEW

The Chemistry Department currently offers graduate programs leading to either the M.S. or Ph.D. in analytical, inorganic, organic, or physical chemistry. In recent years about eight students per year have received the Ph.D. In the Chemistry Department, courses are offered in inorganic chemistry, organometallic chemistry, physical inorganic chemistry, synthetic organic chemistry, physical organic chemistry, heterocyclic chemistry, advanced analytical chemistry, optical spectroscopy, mass spectrometry, electrochemistry, thermodynamics, quantum chemistry, and polymer chemistry.

Upon arrival, new graduate students in Chemistry take examinations in analytical, inorganic, organic, and physical chemistry in order to place students properly in the graduate curriculum. The exams are nationally standardized by the American Chemical Society, and national norms are used. Appropriate course work and didactic opportunities are in place to strengthen any student weakness that may appear from the exams.

Early in the fall semester faculty present a series of short talks that describe their research interests. New graduate students attend these talks and then discuss specific research interests with individual faculty members. After this process, students normally make a decision regarding their research direction and particular advisor around the end of November of the first year. Detailed information about the degree requirements of the program can be found via the Graduate Program link of the Chemistry Department's website.

DEGREES

- Chemistry AMP
- Chemistry M.S.
- Chemistry Ph.D.

FACULTY

Brewer, Matthias; Associate Professor, Department of Chemistry; PHD, University of Wisconsin Madison

Goldberg, Joel Michael; Associate Professor, Department of Chemistry; PHD, University of Michigan Ann Arbor

Landry, Christopher C.; Professor, Department of Chemistry; PHD, Harvard University

Leenstra, Willem R.; Associate Professor, Department of Chemistry; PHD, University of Washington

Li, Jianing; Assistant Professor, Department of Chemistry; PHD, Columbia University

Liptak, Matthew Denis; Assistant Professor, Department of Chemistry; PHD, University of Wisconsin

Madalengoitia, Jose Santos; Associate Professor, Department of Chemistry; PHD, University of Virginia

Matthews, Dwight E.; Professor, Department of Chemistry; PHD, Indiana University Bloomington

Petrucci, Giuseppe A.; Associate Professor, Department of Chemistry; PHD, University of Florida

Schneebeli, Severin; Assistant Professor, Department of Chemistry; PHD, Columbia University

Waterman, Rory; Associate Professor, Department of Chemistry; PHD, University of Chicago

Whalley, Adam C.; Assistant Professor, Department of Chemistry; PHD, Columbia University

Courses

CHEM 201. Advanced Chemistry Laboratory. 3 Credits.

Discussion and laboratory experiments using spectroscopy techniques (mass spectrometry, NMR, IR, UV/visible, and atomic spectroscopy) to solve problems in analytical, physical, and inorganic chemistry. Prerequisites: CHEM 121, and CHEM 142 or CHEM 144. CHEM 161 strongly recommended.

CHEM 202. Advanced Chemistry Laboratory. 2 Credits.

Laboratory problems requiring modern analytical, physical, and inorganic synthetic techniques. Journal article writing. Prerequisite: CHEM 201.

CHEM 205. Biochemistry I. 3 Credits.

Introduction to chemistry and structure of biological macromolecules; examination of mechanisms of chemical processes in biological systems including enzyme catalysis, biosynthesis, regulation, and information transfer. Prerequisite: CHEM 142 or CHEM 144. Cross-listed with: BIOC 205 and MMG 205.

CHEM 206. Biochemistry II. 3 Credits.

Continuation of Biochemistry I. Biochemistry of nucleic acids; nucleic acid based processes, such as replication and transcription; cellular information transfer, genomics, and proteomics. Prerequisite: BIOC 205, CHEM 205, or MMG 205. Cross-listed with: BIOC 206 and MMG 206.

CHEM 207. Biochemistry Lab. 2 Credits.

Introduction to biochemical tools, including spectrometry, chromatography, and electrophoresis; natural and recombinant enzyme isolation; assays of DNA-modifying enzymes; computer-based structure/function exercises. Prerequisite: BIOC 205, CHEM 205, or MMG 205. Cross-listed with: BIOC 207 and MMG 207.

CHEM 214. Polymer Chemistry. 3 Credits.

Polymer synthesis and characterization. Kinetic models for polymerization and copolymerization. Physical properties, characterization of polymers in the solid state and in solution. Prerequisite: CHEM 142 or CHEM 144, and CHEM 162.

CHEM 221. Instrumental Analysis. 3 Credits.

Systematic survey of modern methods of chemical analysis. Fundamental principles and applications of spectroscopy, electrochemistry, and separation techniques. Prerequisite: CHEM 121. Credit for or concurrent enrollment in CHEM 161 or CHEM 162 strongly recommended.

CHEM 223. Mass Spectrometry. 3 Credits.

An in-depth treatment of modern mass spectrometry, instrumentation and techniques with discussion of biological and chemical applications. Prerequisites: CHEM 142 or CHEM 144, and CHEM 221, or Instructor permission.

CHEM 225. Electroanalytical Chemistry. 3 Credits.

Principles and techniques of modern electrochemical analysis and applications to redox chemistry. Heterogeneous effects; voltammetry; electron-transfer processes and reactions. Prerequisite: CHEM 221.

CHEM 226. Analytical Spectroscopy. 3 Credits.

Principles of optical spectroscopic methods of analysis. Emphasis on theory and practice of atomic spectroscopy and new molecular spectroscopic methods. Prerequisite: CHEM 221. Alternate years.

CHEM 227. Spec Topics in Analytical Chem. 1-3 Credits.

Selected topics of current interest in analytical chemistry. New techniques and methodologies, especially in chemical instrumentation. Credit as arranged.

CHEM 228. Spec Topics in Analytical Chem. 1-4 Credits.

Selected topics of current interest in analytical chemistry. New techniques and methodologies, especially in chemical instrumentation. Credit as arranged.

CHEM 231. Advanced Inorganic Chemistry. 3 Credits.

Molecular symmetry and group theory with an emphasis on applications (vibrational and electronic spectra, bonding and reactivity); introduction to transition metal processes; bioinorganic chemistry. Prerequisite: CHEM 142 or CHEM 144.

CHEM 234. Organometallic Chemistry. 3 Credits.

Synthesis, structure, bonding, properties, reactions, and applications of organometallic systems; mechanisms of organometallic reactions including oxidative addition and insertion reactions with applications in catalysis. Prerequisite: CHEM 131 or CHEM 231.

CHEM 236. Physical Inorganic Chemistry. 3 Credits.

Determination of molecular and electronic structure of inorganic complexes using spectroscopic techniques. Topics include ligand field theory, magnetism, magnetic resonance, Mossbauer spectroscopy, and X-ray crystallography. Prerequisites: CHEM 131 or CHEM 231, and CHEM 161.

CHEM 237. Special Topics: Inorganic. 1-3 Credits.

Areas of current interest involving inorganic systems.

CHEM 238. Special Topics: Inorganic. 1-3 Credits.

Areas of current interest involving inorganic systems.

CHEM 241. Advanced Organic Chemistry 1. 3 Credits.

Stereochemistry, conformational analysis, stereoelectronic effects, transition state theory, molecular orbital theory, and reactivity criteria are discussed in regards to reaction mechanisms and functional group manipulations. Prerequisite: CHEM 142 or CHEM 144.

CHEM 242. Advanced Organic Chemistry 2. 3 Credits.

Modern synthetic organic methods and approaches to multi-step synthesis are discussed. Selected total syntheses are reviewed to highlight important concepts including diastereoselective and enantioselective processes. Prerequisite: CHEM 241.

CHEM 251. Physical Organic Chemistry. 3 Credits.

Experimental and computational techniques for determining and interpreting structure, properties and reactivity of organic molecules, with an emphasis on the mechanisms of organic reactions. Prerequisites: CHEM 142 or CHEM 144, and CHEM 161, or graduate standing.

CHEM 257. Special Topics in Organic Chem. 1-3 Credits.

Advanced level discussion of specific topics in organic chemistry of current interest such as photochemistry, carbenes, bioorganic chemistry, magnetic resonance, etc. Credit as arranged.

CHEM 258. Special Topics in Organic Chem. 1-3 Credits.

Advanced level discussion of specific topics in organic chemistry of current interest such as photochemistry, carbenes, bioorganic chemistry, magnetic resonance, etc. Credit as arranged.

CHEM 260. Advanced Physical Chemistry. 3 Credits.

Builds on the concepts from Introductory Physical Chemistry (CHEM 165). The three major areas of quantum chemistry, thermodynamics, and kinetics are extended in greater depth, and at a higher level of mathematical rigor. Prerequisite: CHEM 165. Co-requisites: CHEM 167 or MATH 121.

CHEM 262. Chemical Thermodynamics. 3 Credits.

Classical and statistical thermodynamics. Systematic study of applications of thermodynamics to chemical problems. Prerequisites: CHEM 161 and CHEM 162.

CHEM 264. Adv Quantum & Spectroscopy. 3 Credits.

In-depth theoretical discussion of molecular states, their symmetry, and transition probabilities. Explicit treatment of vibrations, electronic states, and vibronic spectroscopy. Prerequisites: CHEM 161 and MATH 121.

CHEM 267. Special Topics: Physical. 1-3 Credits.

Selected topics of current interest in physical chemistry.

CHEM 268. Special Topics: Physical. 1-3 Credits.

Selected topics of current interest in physical chemistry.

CHEM 285. Special Topics. 1-3 Credits.**CHEM 286. Special Topics. 1-3 Credits.****CHEM 318. Current Topics in Chemistry. 0 or 1 Credits.**

Survey of current topics in the chemistry literature.

CHEM 380. Chemical Investigations. 1 Credit.

Current problems and literature.

CHEM 381. Grad Seminar. 1 Credit.

Current problems and literature.

CHEM 384. Advanced Topics in Chemistry. 2 Credits.

Comprehensive independent study in chemistry.

CHEM 391. Master's Thesis Research. 1-18 Credits.**CHEM 395. Independent Lit Rsch Project. 1-12 Credits.**

Reading and literature research culminating in the preparation of a comprehensive and critical review of a topic of current interest in chemistry.

CHEM 484. Advanced Topics in Chemistry. 2 Credits.

Comprehensive independent study in chemistry.

CHEM 488. Rsch Prob Conception&Solution. 1 Credit.

Independent origination of research problems and the methods of their solution.

CHEM 491. Doctoral Dissertation Research. 1-18 Credits.