
Chemistry

In the College of Sciences

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Faculty

Carl J. Carrano, Ph.D., Professor of Chemistry,
Chair of Department

A. Stephen Dahms, Ph.D., Professor of Chemistry

Douglas B. Grotjahn, Ph.D., Professor of Chemistry (Graduate
Admissions Adviser)

Robert P. Metzger, Ph.D., Professor of Chemistry

Stephen B. W. Roeder, Ph.D., Professor of Chemistry and Physics

William E. Stumph, Ph.D. Professor of Chemistry

William G. Tong, Ph.D., Professor of Chemistry

Dale A. Chatfield, Ph.D., Associate Professor of Chemistry

Thomas E. Cole, Ph.D., Associate Professor of Chemistry

Andrew L. Cooksy, Ph.D., Associate Professor of Chemistry

David P. Pullman, Ph.D., Associate Professor of Chemistry
(Graduate Adviser)

Diane K. Smith, Ph.D., Associate Professor of Chemistry

B. Mikael Bergdahl, Ph.D., Assistant Professor of Chemistry

David J. Burkey, Ph.D., Assistant Professor of Chemistry

Hong-Chang Liang, Ph.D., Assistant Professor of Chemistry

John J. Love, Ph.D., Assistant Professor of Chemistry

Shelli R. McAlpine, Ph.D., Assistant Professor of Chemistry

Gillian H. Roehrig, Ph.D., Assistant Professor of Chemistry

Lifang Sun, Ph.D., Assistant Professor of Chemistry

Associateships

Graduate teaching associateships and graduate nonteaching associateships in chemistry are available to a limited number of qualified students. Application blanks and additional information may be secured from the graduate adviser in the Department of Chemistry.

General Information

The Department of Chemistry offers graduate study leading to the Master of Arts, the Master of Science and the Doctor of Philosophy degrees in chemistry. The Ph.D. degree is offered jointly with the Department of Chemistry at the University of California, San Diego. Thesis research in all graduate programs is offered in the five traditional areas of chemistry, i.e., analytical chemistry, biochemistry, inorganic chemistry, organic chemistry, and physical chemistry.

The Chemistry Department at SDSU provides a substantial inventory of modern chemical instrumentation in support of teaching and research. Included are systems for the performance of nearly all major types of chemical separations; several GC- and two HPLC-mass spectrometric systems; 200, 300, and 500 MHz nuclear magnetic resonance (NMR) spectrometers; two FT infrared spectrometers; ultraviolet-visible spectrometric instruments for both atomic and molecular emission and absorption studies; electrochemical instrumentation for potentiometric, voltammetric and coulometric measurements; radiochemical instrumentation; and laser systems for spectroscopy. Several groups have inert-atmosphere gloveboxes for conducting research on air- and moisture-sensitive compounds. The University of California, San Diego and the Instituto Tecnológico de Tijuana provide access to X-ray crystallography. The departmental computer lab has 25 personal computers (Mac and PC) for general use, and numerous research-grade computers are housed in individual laboratories.

Access is also available to accounts at the San Diego Supercomputer Center. In-house support staff includes NMR, analytical instrument, and electronics technicians as well as a full-time shop technician for machining, plastic working, welding, and other fabrications needs.

Admission to Graduate Study

Students applying for admission should electronically submit the University application available at www.csumentor.edu.

The following materials should be submitted as a complete package directly to the Department of Chemistry:

- (1) Two sets of official transcripts (in sealed envelopes) from each institution attended;
- (2) GRE General Test scores (for the Ph.D. program, also the chemistry test scores);
- (3) Three letters of reference from people who can comment on your academic and research abilities;
- (4) Personal statement, including your goals and motivation for graduate study;
- (5) Application for Teaching Associate position (if desired);
- (6) TOEFL examination report for international student applicants.

Mail or deliver your complete admissions package to:

Department of Chemistry

(Attention: Graduate Admissions Director)

San Diego State University

5500 Campanile Drive

San Diego, CA 92182-1030

Section I. Master's Degree Programs

Advancement to Candidacy

All students must satisfy the general requirements for advancement to candidacy as stated in Part Two of this bulletin. In addition, the student must pass orientation examinations in chemistry. These examinations should be taken during the first year in residence.

Specific Requirements for the Master of Arts Degree

(Major Code: 19051)

In addition to meeting the requirements for classified graduate standing and the basic requirements for the master's degree as described in Part Two of this bulletin, the student must complete a graduate program of 30 units which includes a major consisting of at least 24 units in chemistry from courses listed below as acceptable on master's degree programs. At least 15 of these units must be in 600- and 700-numbered courses. Chemistry 711 and 791 are required. This degree is offered under the non-thesis, Plan B option, as described in Part Two of this bulletin. A written comprehensive examination is required.

Specific Requirements for the Master of Science Degree

(Major Code: 19051)

In addition to meeting the requirements for classified graduate standing, the student must satisfy the basic requirements for the master's degree as described in Part Two of this bulletin. The student must also complete a graduate program of 30 units which includes a major consisting of at least 24 units in chemistry from courses listed below as acceptable on master's degree programs. At least 15 of these units must be in 600- and 700-numbered courses. Chemistry 711*, 791, 792 and 799A are required. A student must pass a final oral examination on the thesis.

* Chemistry 762 may be substituted for Chemistry 711, with approval of the graduate adviser, by students whose thesis project is in the area of biochemistry.

Section II. Doctoral Program

www.chemistry.sdsu.edu/chemistry/degrees.php#jdp

General Information

(Major Code: 19051)

The cooperating faculties of the Departments of Chemistry at San Diego State University and at the University of California, San Diego possess complementary specialties that enable the doctoral student to gain familiarity with most areas in chemistry and to find research activity and direction in a great variety of specific problems.

The entering student will be required to have a mastery of the subjects usually presented in the undergraduate curriculum: physical, organic, analytical, and inorganic chemistry. All applicants will be expected to have taken the equivalent of one year of physics and of mathematics at least through integral calculus. Students should be prepared to take placement examinations which will be administered by a joint committee and will cover the fields of inorganic, organic and physical chemistry.

On admission to the program, the student is guided by Requirements for the Doctoral Degree Program given in Part Two of this bulletin. Students will normally spend their first year in the program completing their year of residency at the University of California, San Diego. It is desirable for the student to complete the qualifying examination by the end of the fifth semester and to be advanced to candidacy.

Faculty

The following faculty members of the Departments of Chemistry of the cooperating institutions participate in the joint doctoral program, being available for direction of research and as departmental members of joint doctoral committees.

San Diego State University:

Graduate Advisers: Karen Peterson and David Pullman
Graduate Admissions: Douglas Grotjahn
Committee Members: Bergdahl, Burkey, Carrano, Chatfield, Cobble, Cole, Cooksy, Dahms, Grotjahn, Liang, Love, McAlpine, Metzger, Pullman, Roeder, Smith, Stumph, Sun, Tong

University of California, San Diego:

Graduate Adviser: Charles Perrin
Committee Members: Allison, Magde, Oesterreicher, Perrin, Sawrey

Courses Acceptable on Master's and Doctoral Degree Programs in Chemistry (CHEM)

UPPER DIVISION COURSES

510. Advanced Physical Chemistry (3)

Prerequisite: Chemistry 410B.

Problems in chemical thermodynamics, statistical mechanics, chemical kinetics, quantum chemistry and molecular structure and spectroscopy, with applications.

515. Computational Chemistry (3)

Prerequisites: Chemistry 410A and 410B.

Overview of modern computational chemistry. Use of computational chemistry tools and their application to problems of chemical interest.

520A-520B. Inorganic Chemistry (3-3) I, II

Prerequisite: Credit or concurrent registration in Chemistry 410A. Chemistry 520A is prerequisite to 520B.

Nature of chemical bond and an advanced systematic study of representative and transition elements and their compounds.

530. Physical Organic Chemistry (3)

Prerequisites: Chemistry 410A and 431. Recommended: Credit or concurrent registration in Chemistry 410B.

Electronic and physical properties of organic molecules; structure-reactivity correlations: Electronic structure of molecules (qualitative molecular orbital theory); stereochemistry; and linear free energy relationships.

531. Synthetic Organic Chemistry (3)

Prerequisite: Chemistry 431.

Modern methods, strategies, and mechanisms in advanced organic synthesis. Retrosynthetic analysis of and synthetic routes towards biologically important compounds.

537. Organic Qualitative Analysis (4)

Two lectures and six hours of laboratory.

Prerequisites: Chemistry 431 and credit or concurrent registration in Chemistry 410A. Recommended: Chemistry 417 and 457.

Chemical, physical, and spectral methods discussed and employed to determine structure of organic compounds. Purification and separation techniques stressed.

550. Instrumental Methods of Chemical Analysis (2) I

Prerequisites: Chemistry 431 and credit or concurrent registration in Chemistry 410B; concurrent registration in Chemistry 457 for undergraduate students only.

Theory and application of those instrumental methods of chemical separation and analysis most frequently used in all subdisciplines of chemistry.

551. Advanced Analytical Chemistry (3) II

Prerequisite: Chemistry 550.

Expanded treatment of instrumental methods for separation and quantification not covered in Chemistry 550. Non-instrumental separations, quantitative organic microanalysis, sampling theory and techniques, reaction rate applications and interpretation of experimental data.

552. Chromatographic Separations (1)

Prerequisite: Chemistry 550.

Theory of chemical separations and solvent theory and their application to gas and liquid chromatographic media and capillary electrophoresis, emphasizing practiced methods of analysis.

553. Interpretation of Mass Spectra (1)

Prerequisite: Chemistry 550.

Methods of ionization used to produce mass spectra from atoms and molecules. Interpretation of electron impact mass spectra. Applications to modern methods of analysis of large organic molecules from gas, liquid, and capillary electrophoresis forms of chromatography.

560A-560B. General Biochemistry (3-3) I, II

Prerequisites: Chemistry 431 and credit or concurrent registration in Chemistry 410A.

The structure, function, metabolism, and thermodynamic relationships of chemical entities in living systems. Not open to students with credit in Chemistry 361A-361B, 368, 562, or 563.

562. Intermediary Metabolism (2) I

Prerequisites: Chemistry 361A or 560A or Chemistry 365 and 368.

Catabolic and biosynthetic pathways of carbohydrate, lipid, amino acid, and nucleotide metabolism; TCA cycle, mitochondrial and chloroplast electron transport chains, ATP generation and their interactions and control. Not open to students with credit in Chemistry 361B or 560B.

563. Nucleic Acid Function and Protein Synthesis (2) I

Prerequisites: Chemistry 361A or 560A or Chemistry 365 and 368.

DNA replication, RNA transcription, RNA processing, and protein translation, including chemical mechanisms of synthesis and cellular mechanisms of regulating gene expression; genomics, recombinant DNA, and DNA topology. Not open to students with credit in Chemistry 560B.

564. Receptor Biochemistry and Protein Modification (2) II

Prerequisites: Chemistry 361A or 560A or Chemistry 365 and 368.

Biochemical study of receptors, second messengers, and cellular proteins that participate in extracellular and intracellular communication, with focus on protein structures, post-translational modifications, and biochemical mechanisms that regulate receptors and effector enzymes.

567. Biochemistry Laboratory (3) I, II

One lecture and six hours of laboratory.

Prerequisite: Chemistry 361A or 560A.

Theory and practice of procedures used in study of life at molecular level. Includes purification and characterization of enzymes, isolation of cell components, and use of radioactive tracer techniques.

571. Environmental Chemistry (3)

Prerequisites: Chemistry 231 and 251; consent of instructor for all other majors.

Fundamentals of chemistry applied to environmental problems. Chemistry of ecosystems; analysis of natural constituents and pollutants; sampling methods; transport of contaminants; regulations and public policy.

596. Advanced Special Topics in Chemistry (1-3)

Prerequisite: Consent of instructor.

Advanced selected topics in modern chemistry. May be repeated with new content. See Class Schedule for specific content. Limit of nine units of any combination of 296, 496, 596 courses applicable to a bachelor's degree. Maximum credit of six units of 596 applicable to a bachelor's degree. Maximum combined credit of six units of 596 and 696 applicable to a 30-unit master's degree.

GRADUATE COURSES

711. Chemical Thermodynamics (3)

Prerequisite: Chemistry 410B.

Chemical thermodynamics and an introduction to statistical thermodynamics.

712. Chemical Kinetics (3)

Prerequisite: Chemistry 410B.

Theory of rate processes; applications of kinetics to the study of reaction mechanisms.

713. Quantum Chemistry (3)

Prerequisite: Chemistry 410B.

Quantum mechanics of atomic and molecular systems; applications to chemical bonding theory.

722. Structural Methods in Inorganic Chemistry (3)

Prerequisite: Chemistry 520A.

Spectroscopic and analytical techniques used in structural elucidation of inorganic and organometallic compounds, with emphasis on interpretation of spectral data.

730. Advanced Topics in Organic Chemistry (1-3)

Prerequisite: Chemistry 431.

Selected topics in organic chemistry. May be repeated with new content. See Class Schedule for specific content. Maximum credit six units applicable to a master's degree.

731. Mechanisms of Organic Reaction (3)

Prerequisites: Chemistry 410B and 431.

Reactivity and mechanism in organic reactions.

732. Advanced Organic Chemistry (3)

Prerequisite: Chemistry 431.

Applications and limitations of organic reactions from the viewpoint of synthesis.

750. Advanced Topics in Analytical Chemistry (1-3)

Prerequisite: Chemistry 550.

Selected topics from the field of analytical chemistry. May be repeated with new content. See Class Schedule for specific content. Maximum credit six units applicable to a master's degree.

751. Separations Science (3)

Prerequisites: Chemistry 550 and 711.

Theoretical bases for separation techniques important in analytical chemistry. Chemical and physical interactions between components of different classes of separation systems, including selection and optimization of operational parameters.

752. Mass Spectrometry (3)

Prerequisites: Chemistry 410B and 550.

Theory and practice in analysis of volatile and involatile organic and inorganic compounds, basic design principles, theory of ionization processes; interpretation of mass spectra.

753. Analytical Spectroscopy (3)

Prerequisite: Chemistry 550.

Theory and application of atomic and molecular absorption, emission and fluorescence methods. Modern optical instrumentation and methods of analysis. Nonlinear laser spectroscopic methods in chemical analysis.

754. Electroanalytical Chemistry (3)

Prerequisite: Chemistry 550.

Principles of electrochemistry. Theory and practice in use of electrochemical techniques to understand electrode reactions and for quantitative analysis. Other important applications of electrochemistry.

762. Enzymology (2)

Prerequisite: Credit or concurrent registration in Chemistry 410B.

Theory and techniques used in the study of the mechanism of action of enzymes.

763. Cellular Regulation (2)

Prerequisite: Chemistry 560B.

The biochemistry of cellular regulatory mechanisms in eucaryotic cells. The regulation of gene transcription, in mRNA translation and post-translational processes, including the mechanism and regulation of intracellular protein turnover.

764. Membrane Biochemistry (1-3)

Prerequisite: Chemistry 560B.

Membrane structure and function. Biophysical and biochemical properties of membranes from prokaryotic and eucaryotic cells and animal cell viruses; biosynthesis and assembly of membrane components; molecular basis of solute transport, energy coupling, cell surface transformation, and cellular recognition, adhesion and fusion.

790. Seminar (1-3)

An intensive study in advanced chemistry. May not be substituted for Chemistry 791. May be repeated with new content. See Class Schedule for specific content. Maximum credit six units applicable to a master's degree.

791. Research Seminar (1)

Prerequisite: Consent of department chair.

Discussions on current research by students, faculty, and visiting scientists. Each student will make a presentation based on the current literature.

792. Bibliography (1)

Exercise in the use of basic reference books, journals, and specialized bibliographies, preparatory to the writing of a master's project or thesis.

797. Research (1-3) Cr/NC/RP

Prerequisite: Consent of instructor.

Research in one of the fields of chemistry. Maximum credit six units applicable to a master's degree.

798. Special Study (1-3) Cr/NC/RP

Prerequisite: Consent of staff; to be arranged with department chair and instructor.

Individual study. Maximum credit six units applicable to a master's degree.

799A. Thesis (3) Cr/NC/RP

Prerequisite: An officially appointed thesis committee and advancement to candidacy.

Preparation of a project or thesis for the master's degree.

799B. Thesis Extension (0) Cr/NC

Prerequisite: Prior registration in Thesis 799A with an assigned grade symbol of RP.

Registration required in any semester or term following assignment of RP in Course 799A in which the student expects to use the facilities and resources of the university; also student must be registered in the course when the completed thesis is granted final approval.

897. Doctoral Research (1-15) Cr/NC/RP

Prerequisite: Admission to the doctoral program.

Independent investigation in the general field of the dissertation.

899. Doctoral Dissertation (1-15) Cr/NC/RP

Prerequisites: An officially constituted dissertation committee and advancement to candidacy.

Preparation of the dissertation for the doctoral degree. Enrollment is required during the term in which the dissertation is approved.

