CHEMISTRY AND BIOCHEMISTRY

Chemistry and Biochemistry Department (http://www.csuchico.edu/chem/
Science Building 357A
530-898-5259
530-898-4363 (fax)
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Chair: Christopher J. Nichols

Insight

Chemistry is a part of everything known about the world and beyond. There are chemists, biochemists, and chemical technicians working to prepare materials, analyze evidence, create new substances, and answer the seemingly unanswerable questions that are presented each day. The Department of Chemistry and Biochemistry provides the top-notch knowledge and experience needed to embark on a long and successful academic or professional career in any of the major branches of chemistry—organic, inorganic, analytical, physical, chemical education, materials, and biochemistry.

The bachelor's degrees in chemistry and biochemistry include a broad selection of courses in the sciences and mathematics that provide an excellent background for careers in the wide-ranging areas of science or academia. They also prepare students to advance to graduate and professional schools, especially in medicine, dentistry, and pharmacy. With courses prescribed by American Chemical Society guidelines, students can be certified as professional chemists and awarded the American Chemical Society certificate in chemistry upon successful completion of course requirements.

The department also offers a chance for students to carry out undergraduate research in collaboration with faculty in the Chemistry Summer Research Institute (CSRI) and receive a stipend for 10 weeks of full-time research. Since 2000, CSRI has supported the efforts of over 150 students, who have conducted research in all the major branches of chemistry and worked on cutting-edge cross-disciplinary projects.

Experience

The Department of Chemistry and Biochemistry has chemistry faculty, facilities, and curriculum approved by the Committee on Professional Training of the American Chemical Society, which is a clear testament to the superior quality of its programs and graduates—a testament that will resonate with anyone in the field.

The department's permanent faculty hold PhDs in chemistry or biochemistry, representing all major areas of the field, and smaller class sizes allow students to get hands-on learning and experimentation experience in all the typical analyses that chemists perform and training on equipment used in modern, professional labs. Additionally, opportunities for individual research projects are available for upper-division students, granting them real-world research experience on a specialized subject that fits their interests.

The department is housed in the newly completed Science Building, which is the most state-of-the-art facility on campus and one of the most visionary buildings within the 23-campus California State University system. It includes 10 teaching laboratories, four research laboratories, and a number of specialized instrument rooms. With studio labs, active-learning classrooms, and professional quality undergraduate and graduate research spaces, students are immersed in experiential learning beginning with their first semester of study of the department's curriculum.

Outlook

A bachelor's degree in chemistry or biochemistry is the minimum requirement for starting a career as a chemist or biochemist, and graduate training is necessary for most research and college teaching positions.

A substantial number of chemists and biochemists are involved in research and development, extending scientific knowledge and creating new products in industries including pharmaceuticals and biotechnology. Others work in manufacturing, chemical analysis, forensics, or environmental laboratories, or work as teachers, industry and government consultants, or marketing or sales representatives.

The demand for pollution control, improved health care programs, industrial products, net-zero emissions energy technologies, and much more will continue to provide opportunities for chemists and biochemists. With such demand, larger enrollments in chemistry education are expected and the need for chemists and biochemists to teach at universities, community colleges, and high schools will increase. The Department of Chemistry and Biochemistry at California State University, Chico is one of only eight in the entire CSU system to have a degree program for future chemistry teachers approved by the California Commission on Teacher Credentialing. Plus, the University has financial incentives for future science teachers that can pay for most college expenses.

The department is uniquely poised to make significant contributions to the training of future scientists, engineers, health practitioners, and educators at all levels. When chemistry and biochemistry students graduate from Chico State, they have a multifaceted education that has prepared them to compete and succeed in the finest graduate programs, professional schools, and the full array of field-related career settings.

Programs

Undergraduate

Bachelor's

- Biochemistry BS (https://catalog.csuchico.edu/colleges-departments/college-natural-sciences/chemistry-biochemistry/biochemistry-bs/)
- Chemistry BA (https://catalog.csuchico.edu/colleges-departments/college-natural-sciences/chemistry-biochemistry/chemistry-ba/)
- Chemistry BS (https://catalog.csuchico.edu/colleges-departments/college-natural-sciences/chemistry-biochemistry/chemistry-bs/)

Minors

- Biochemistry Minor (https://catalog.csuchico.edu/colleges-departments/college-natural-sciences/chemistry-biochemistry/biochemistry-minor/)
- Chemistry Minor (https://catalog.csuchico.edu/colleges-departments/college-natural-sciences/chemistry-biochemistry/chemistry-minor/)

Certificates

- American Chemical Society Certificate in Chemistry (https://catalog.csuchico.edu/colleges-departments/college-natural-
CHEM 100 Chemistry and Current Issues 3 Units GE
Typically Offered: Fall and spring
Designed for non-science majors, this course will introduce students to some of the fundamental concepts of chemistry and illustrate how they apply to important contemporary issues, including nuclear power, water purification, alternative energy, climate change, and foods and drugs. 3 hours activity, 2 hours lecture. (001819)
General Education: Laboratory Activity (B3); Physical Science (B1)
Grade Basis: Graded
Repeatability: You may take this course for a maximum of 3 units
Course Attributes: Lower Division

CHEM 107 General Chemistry for Applied Sciences 4 Units GE
Prerequisite: GE Mathematics/Quantitative Reasoning Ready, Intermediate Algebra.
Typically Offered: Fall and spring
A survey of the principles of chemistry, primarily for students in agriculture, industry and technology, and pre-nursing. 3 hours laboratory, 3 hours lecture. (001826)
General Education: Laboratory Activity (B3); Physical Science (B1)
Grade Basis: Graded
Repeatability: You may take this course for a maximum of 4 units
Course Attributes: Lower Division

CHEM 108 Organic Chemistry for Applied Sciences 4 Units GE
Prerequisite: CHEM 107 or CHEM 111 or equivalent.
Typically Offered: Fall and spring
A survey of organic chemistry emphasizing the structure, properties, and reactions of all major functional groups of organic molecules. Not applicable towards a degree in chemistry or biochemistry. 3 hours laboratory, 3 hours lecture. (001828)
General Education: Laboratory Activity (B3); Physical Science (B1)
Grade Basis: Graded
Repeatability: You may take this course for a maximum of 4 units
Course Attributes: Lower Division

CHEM 111 General Chemistry I 4 Units GE
Prerequisite: GE Mathematics/Quantitative Reasoning Ready; second-year high school algebra; one year high school chemistry. (One year of high school physics and one year of high school mathematics past Algebra II are recommended.)
Typically Offered: Fall and spring
Principles of chemistry for students in science and engineering programs. Topics include atoms, molecules and ions, reactions, stoichiometry, the periodic table, bonding, chemical energy, gases, and solution chemistry. The laboratory sequence supports the above topics including both qualitative and quantitative experiments, analysis of data, and error propagation. 3 hours laboratory, 3 hours lecture. (001816)
General Education: Laboratory Activity (B3); Physical Science (B1)
Grade Basis: Graded
Repeatability: You may take this course for a maximum of 4 units
Course Attributes: Lower Division

CHEM 111X General Chemistry Fundamentals 1 Unit
Typically Offered: Fall and spring
Designed to give students a fundamental knowledge of chemistry to supplement prior chemistry knowledge in preparation for or in conjunction with CHEM 111. Provides students with the opportunity for additional assistance in developing chemistry knowledge and problem-solving abilities. 2 hours activity. (001830)
Grade Basis: Credit/No Credit
Repeatability: You may take this course for a maximum of 2 units
Course Attributes: Lower Division

CHEM 112 General Chemistry II 4 Units
Prerequisite: CHEM 111 with a grade of C- or higher.
Typically Offered: Fall and spring
A continuation of CHEM 111. Topics include kinetics, equilibrium, acid-base chemistry, electrochemistry, chemical thermodynamics, coordination chemistry, and nuclear chemistry. The laboratory sequence supports the above topics including both qualitative and quantitative experiments, analysis of data, and error propagation. 3 hours laboratory, 3 hours lecture. (001817)
Grade Basis: Graded
Repeatability: You may take this course for a maximum of 4 units
Course Attributes: Lower Division

CHEM 189 Internship in Chemistry 1-3 Units
Typically Offered: Fall and spring
9 hours supervision. (001844)
Grade Basis: Credit/No Credit
Repeatability: You may take this course for a maximum of 15 units
Course Attributes: Lower Division

CHEM 198 Special Topics 1-3 Units
Prerequisite: Department permission.
Typically Offered: Fall and spring
This course is for special topics offered for 1.0-3.0 units. Typically the topic is offered on a one-time-only basis and may vary from term to term and be different for different sections. See the Class Schedule for the specific topic being offered. 3 hours lecture. (001846)
Grade Basis: Graded
Repeatability: You may take this course more than once
Course Attributes: Lower Division
CHEM 270  Organic Chemistry I  4 Units
Prerequisite: CHEM 112.
Typically Offered: Fall and spring
A study of the fundamental principles of organic chemistry: the chemistry of carbon compounds. Lecture topics include structure, bonding, nomenclature, physical properties of organic compounds, stereochemistry, basic spectroscopy, and basic chemical reactions and their mechanisms. Laboratory topics include the discussion and application of organic laboratory techniques, reactions, and an introduction to organic synthesis. 3 hours laboratory, 3 hours lecture. (001840)
Grade Basis: Graded
Repeatability: You may take this course for a maximum of 4 units
Course Attributes: Lower Division

CHEM 320  Quantitative Analysis  4 Units
Prerequisite: CHEM 112 with a grade of C- or higher.
Typically Offered: Fall only
Precision and accuracy in measurements, interpretation of data by statistical analysis, and development of good quantitative techniques. Analysis by gravimetry, titrimetry, potentiometry, chromatography, and spectrometry. 2 hours discussion, 6 hours laboratory. (001847)
Grade Basis: Graded
Repeatability: You may take this course for a maximum of 4 units
Course Attributes: Upper Division

CHEM 331  Physical Chemistry I  3 Units
Prerequisite: CHEM 370M, MATH 220, PHYS 202B or PHYS 204C.
Typically Offered: Fall only
Overview of fundamental principles of time-independent quantum mechanics and spectroscopy, statistical thermodynamics, and chemical kinetics. 3 hours discussion. (001882)
Grade Basis: Graded
Repeatability: You may take this course for a maximum of 3 units
Course Attributes: Upper Division

CHEM 332  Physical Chemistry II  3 Units
Prerequisite: CHEM 331 with a grade of C- or higher.
Typically Offered: Spring only
In-depth exploration of quantum mechanics and spectroscopy, classical thermodynamics, and chemical and phase equilibria. 3 hours discussion. (001883)
Grade Basis: Graded
Repeatability: You may take this course for a maximum of 3 units
Course Attributes: Upper Division

CHEM 350  Introductory Biochemistry  3 Units
Prerequisite: CHEM 108 or CHEM 270.
Typically Offered: Fall and spring
A survey of biochemistry, principally for nutrition and exercise physiology majors. 3 hours discussion. (001849)
Grade Basis: Graded
Repeatability: You may take this course for a maximum of 3 units
Course Attributes: Upper Division

CHEM 350L  Introductory Biochemistry Laboratory  1 Unit
Prerequisite: CHEM 350 (may be taken concurrently).
Typically Offered: Fall and spring
Fundamental laboratory studies and examination of the major classes of biological compounds. Principally for agriculture, child development, and nursing students. Normally not open to chemistry or biological sciences majors. 3 hours laboratory. (001850)
Grade Basis: Graded
Repeatability: You may take this course for a maximum of 1 unit
Course Attributes: Upper Division

CHEM 351  Inorganic Chemistry  3 Units
Prerequisite: CHEM 112; MATH 220; PHYS 202A and PHYS 202B or PHYS 204A, PHYS 204B, and PHYS 204C.
Typically Offered: Spring only
Emphasis on description and theory of inorganic substances: atomic structure; ionic and covalent bonding; acid-base concepts of inorganic substances; structure, bonding, thermodynamics, and reaction mechanisms of transition metal complexes; organometallic chemistry and catalysis; and bioinorganic chemistry. 3 hours lecture. (001887)
Grade Basis: Graded
Repeatability: You may take this course for a maximum of 3 units
Course Attributes: Upper Division

CHEM 370  Organic Chemistry II  3 Units
Prerequisite: CHEM 270 with a grade of C- or higher.
Typically Offered: Fall and spring
A continuation of CHEM 270. Topics include properties and reactions of ethers, conjugated systems, aromatic compounds, aldehydes and ketones, amines, carboxylic acids and derivatives, and biologically relevant molecules. 3 hours discussion. (001852)
Grade Basis: Graded
Repeatability: You may take this course for a maximum of 3 units
Course Attributes: Upper Division

CHEM 370L  Organic Chemistry Laboratory  1 Unit
Prerequisite: CHEM 370 (may be taken concurrently).
Typically Offered: Fall and spring
Laboratory continuation of CHEM 270. Laboratory experiments in organic chemistry focused on topics discussed in CHEM 370. Not applicable towards a degree in chemistry or biochemistry. 3 hours laboratory. (001856)
Grade Basis: Graded
Repeatability: You may take this course for a maximum of 1 unit
Course Attributes: Upper Division

CHEM 370M  Organic Chemistry Laboratory  2 Units
Prerequisite: CHEM 370 (may be taken concurrently).
Typically Offered: Fall and spring
An in-depth laboratory experience in organic chemistry for chemistry and biochemistry majors. Students are introduced to and become competent in modern laboratory techniques, including handling air-sensitive reagents and column chromatography. Students also get hands-on experience with advanced instrumentation. Completes the two-semester organic lab sequence for chemistry majors. 6 hours laboratory. (001853)
Grade Basis: Graded
Repeatability: You may take this course for a maximum of 2 units
Course Attributes: Upper Division

CHEM 381  Integrated Chemistry Laboratory I  2 Units
Prerequisite: CHEM 331 (may be taken concurrently), CHEM 361 (may be taken concurrently), CHEM 370M.
Typically Offered: Fall and spring
Integrated application of concepts and techniques in analytical, inorganic, and physical chemistry with supervised studies in individual literature searches, including the use of Chemical Abstracts, Patent Indexes, and other reference compilations. 6 hours laboratory. (001885)
Grade Basis: Graded
Repeatability: You may take this course for a maximum of 2 units
Course Attributes: Upper Division
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Units</th>
<th>Prerequisite(s)</th>
<th>Typically Offered</th>
<th>Corequisites</th>
<th>Course Attributes</th>
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<tbody>
<tr>
<td>CHEM 382</td>
<td>Integrated Chemistry Laboratory II</td>
<td>2</td>
<td>CHEM 331, CHEM 361, CHEM 381.</td>
<td>Fall only</td>
<td>A continuation of CHEM 381. 6 hours laboratory.</td>
<td>Upper Division</td>
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<tr>
<td>CHEM 389</td>
<td>Internship in Chemistry</td>
<td>1-3</td>
<td></td>
<td></td>
<td>9 hours supervision.</td>
<td>Upper Division</td>
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<tr>
<td>CHEM 398</td>
<td>Special Topics</td>
<td>1-3</td>
<td>CHEM 112, faculty permission.</td>
<td>Fall and spring</td>
<td>This course is for special topics offered for 1.0-3.0 units. Typically the topic is offered on a one-time-only basis and may vary from term to term and be different for different sections. See the Class Schedule for the specific topic being offered. 0 hours lecture.</td>
<td>Upper Division</td>
</tr>
<tr>
<td>CHEM 401W</td>
<td>Communicating Chemistry (W)</td>
<td>3</td>
<td>CHEM 320, CHEM 370, either CHEM 331, CHEM 361, or CHEM 451.</td>
<td>Fall only</td>
<td>A course helps students improve their skills in written communication and oral communication of chemical and biochemical information. The course centers on one particular topic within chemistry and biochemistry (chosen by the instructor) and students are asked to prepare short papers, long papers, and oral presentations focused on that topic. 2 hours activity, 2 hours discussion.</td>
<td>Upper Division; Writing Course; Graduation Writing Assessment</td>
</tr>
<tr>
<td>CHEM 420</td>
<td>Instrumental Analysis</td>
<td>3</td>
<td>CHEM 332.</td>
<td>Fall only</td>
<td>Theory and procedures used in separations and instrumental analysis. Emphasis on rational design of instrumental conditions based on experiment goals. Topics include atomic and molecular spectroscopies, separation methods, and electroanalytical chemistry. 3 hours discussion.</td>
<td>Upper Division</td>
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<tr>
<td>CHEM 451</td>
<td>Biochemistry I</td>
<td>3</td>
<td>CHEM 370 with a grade of C- or higher.</td>
<td>Fall and spring</td>
<td>A general study of the chemistry of biomolecules. Conformation and function of enzymes and other proteins; metabolism, energy generation, and storage; brief discussion of important physiological processes. 3 hours discussion.</td>
<td>Upper Division</td>
</tr>
<tr>
<td>CHEM 452</td>
<td>Biochemistry II</td>
<td>3</td>
<td>CHEM 451.</td>
<td></td>
<td>Advanced topics in biochemistry. Biosynthesis of lipids, steroids, amino acids, and nucleotides. Comprehensive study of the chemical role of DNA and RNA in replication, transcription, protein synthesis, and viral activity. 3 hours discussion.</td>
<td>Upper Division</td>
</tr>
<tr>
<td>CHEM 453L</td>
<td>Biochemistry Laboratory</td>
<td>1</td>
<td>CHEM 451 (may be taken concurrently). Recommended: CHEM 370L or CHEM 370M.</td>
<td>Fall and spring</td>
<td>Separation, identification, and/or analysis of biological materials by modern procedures, such as spectrophotometry, chromatography (gas, TLC, column, ion exchange), electrophoresis, enzymology, fluorimetry, and high-speed centrifugation. Fulfills laboratory requirement for certain biological science majors. Does not fulfill requirement for biochemistry major. 3 hours laboratory.</td>
<td>Upper Division</td>
</tr>
<tr>
<td>CHEM 453MW</td>
<td>Biochemistry Laboratory (W)</td>
<td>3</td>
<td>CHEM 370M.</td>
<td>Fall and spring</td>
<td>Separation, identification, and/or analysis of biological materials by modern procedures, such as spectrophotometry, chromatography (gas, TLC, column, ion exchange), electrophoresis, enzymology, fluorimetry, and high-speed centrifugation. This course fulfills laboratory requirements for biochemistry majors. 6 hours laboratory, 1 hour lecture.</td>
<td>Upper Division</td>
</tr>
<tr>
<td>CHEM 477</td>
<td>Seminar in Organic Spectroscopy</td>
<td>1</td>
<td>Concurrent enrollment in or prior completion of CHEM 370.</td>
<td></td>
<td>A course whose objectives is to help students become experts at the structural determination of organic compounds using modern spectroscopic methods, including IR, UV-Vis, mass spectra, and 1D and 2D NMR techniques. 1 hour seminar.</td>
<td>Upper Division</td>
</tr>
</tbody>
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CHEM 483W Integrated Chemistry Laboratory III (W)  2 Units  W
Prerequisite: CHEM 381, CHEM 382, CHEM 420.
Typically Offered: Spring only
A continuation of CHEM 382, with a specific emphasis on independent
experimental design and use of instruments. Students design, carry
out, and orally present their findings for 2-3 major projects. 6 hours
laboratory.  (001889)
Grade Basis: Graded
Repeatability: You may take this course for a maximum of 2 units
Course Attributes: Upper Division; Writing Course

CHEM 489 Internship in Chemistry  1-3 Units
Typically Offered: Fall and spring
9 hours supervision.  (001923)
Grade Basis: Credit/No Credit
Repeatability: You may take this course for a maximum of 15 units
Course Attributes: Upper Division

CHEM 490 Research in Chemistry  1-2 Units
Prerequisite: CHEM 332.
Typically Offered: Fall and spring
This course is an independent study offered for 1.0-2.0 units. You must
register directly with a supervising faculty member. Original laboratory
or library investigation under individual faculty supervision. 6 hours
supervision.  (001875)
Grade Basis: Graded
Repeatability: You may take this course for a maximum of 4 units
Course Attributes: Upper Division

CHEM 491 Research Project  3 Units
Prerequisite: Open by invitation to chemistry majors with a GPA of 3.0 or
higher; faculty permission.
Typically Offered: Fall and spring
A research project within chemistry or an interdisciplinary project
which involves chemistry. Students will be involved with design, library,
laboratory, and data analysis aspects of a research problem. 9 hours
supervision.  (001921)
Grade Basis: Graded
Repeatability: You may take this course for a maximum of 6 units
Course Attributes: Upper Division

CHEM 498 Special Topics  1-3 Units
Prerequisite: Department permission.
Typically Offered: Fall and spring
This course is for special topics offered for 1.0-3.0 units. Typically the
topic is offered on a one-time-only basis and may vary from term to term
and be different for different sections. See the Class Schedule for the
specific topic being offered. 3 hours lecture.  (001925)
Grade Basis: Graded
Repeatability: You may take this course more than once
Course Attributes: Upper Division

CHEM 499 Special Problems  1-3 Units
Prerequisite: Faculty permission.
Typically Offered: Fall and spring
This course is an independent study of special problems offered for
1.0-3.0 units. You must register directly with a supervising faculty
member. 3 hours supervision.  (001926)
Grade Basis: Credit/No Credit
Repeatability: You may take this course for a maximum of 6 units
Course Attributes: Upper Division

CHEM 499HW Honors Research Project (W)  3 Units  W, GW
Prerequisite: GE Written Communication (A2) requirement, CHEM 320,
CHEM 331, CHEM 332, CHEM 370M, MATH 220, PHYS 204A, PHYS 204B,
PHYS 204C; faculty permission.
Typically Offered: Fall and spring
Open by invitation to chemistry majors who have a GPA of 3.5 or higher.
Not open to students who have credit for CHEM 491 or CHEM 492. This is
an "Honors in the Major" course. 9 hours supervision.  (001927)
Grade Basis: ABC/No Credit
Repeatability: You may take this course for a maximum of 6 units
Course Attributes: Upper Division; Writing Course; Graduation Writing
Assessment

Chemistry and Biochemistry Department

The Faculty
Tiffani N Anderson  2006
Lecturer
Master of Science Purdue Univ Main Campus

Carolynn C Arpin  2014
Associate Professor
Doctor of Philosophy Univ of Colorado at Boulder

Jenelle L Ball  2022
Lecturer
Master of Arts Univ of Cal-Santa Barbara

Daniel D Clark  2005
Professor
Doctor of Philosophy Utah St Univ

Daniel J Edwards  2005
Professor
Doctor of Philosophy Univ of Cal-Davis

Stephen L Hillyard  2014
Lecturer
Doctor of Philosophy Univ of Cal-Davis

Ryan M Jones  2014
Lecturer
Master of Science Univ of Cal-Santa Barbara

Lisa K Kendhammer  2016
Associate Professor
Doctor of Philosophy Univ of Wisconsin-Milwaukee

Nadezhda Korovina  2020
Assistant Professor
Doctor of Philosophy Univ of Southern Cal

Tina R Lewis  2015
Lecturer
Master of Science CSU-Chico

Lisa S Ott  2008
Professor
Doctor of Philosophy Colorado St Univ

Sisarie Sherry  2016
Lecturer
Bachelor of Science CSU-Chico

Monica C So  2015
Associate Professor
Doctor of Philosophy Northwestern Univ

Erik C Wasinger 2007
Professor
Doctor of Philosophy Stanford Univ

Thea M Wilson 2019
Lecturer
Doctor of Philosophy Northwestern Univ

Jinsong Zhang 2006
Professor
Doctor of Philosophy Univ of Montana

Emeritus Faculty

Donald B Alger
Emeritus
Doctor of Philosophy Washington St Univ

David B Ball
Emeritus
Doctor of Philosophy Univ of Cal-Santa Barbara

Ron C Cooke
Emeritus
Master of Science Univ of The Pacific

William D Korte 1966
Emeritus

Barbara O Mejia
Emeritus
Doctor of Philosophy Univ of Cal-Davis

Randy M Miller 1988
Professor
Doctor of Philosophy Univ of Cal-Davis

James M Postma
Emeritus
Doctor of Philosophy Univ of Cal-Davis

Rodney H Quacchia
Emeritus