Chemistry and Biochemistry (CHBC)

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Department of Chemistry and Biochemistry Website (https://fulbright.uark.edu/departments/chemistry/)

Degrees Conferred:
M.S., Ph.D. in Chemistry (CHEMMS, CHEMPH)

Areas of Study: Analytical, inorganic, organic, physical, biophysical, and biochemistry.

Primary Areas of Faculty Research: Specialized centers complement traditional research areas in the Department of Chemistry and Biochemistry. These include the Center for Protein Structure and Function and the State-Wide Mass Spectrometry Facility.

Requirements for M.S. in Chemistry

Admission to Graduate Program: In addition to the application for admission to the Graduate School and the transcripts required for Graduate School admission, applicants for admission to the degree programs of the Department of Chemistry and Biochemistry must submit a.) three letters of recommendation from persons familiar with the applicant's previous academic and professional performance and b.) official scores from the Graduate Record Examination (General Test). Advanced subject GRE tests scores (Chemistry, Biochemistry, etc.) are encouraged but not required.

Basic Program for Advanced Degree Candidates: In addition to the material given below, the student is referred to the general Graduate School requirements mentioned earlier in this catalog and to the bulletin *Information for Graduate Students in Chemistry and Biochemistry* available from the Department of Chemistry and Biochemistry.

1. An undergraduate program, consisting of courses in general chemistry, analytical chemistry (two semesters), organic chemistry (three semesters), physical chemistry (two semesters), and inorganic chemistry (one semester) provide an adequate foundation for graduate work in chemistry and biochemistry. If a graduate student lacks any part of this introductory program, it must be completed within the first four semesters as a graduate student. If the student has the necessary prerequisites, courses for graduate credit may be taken concurrently. Proficiency in physical chemistry must be demonstrated by satisfactory performance on placement examinations. Inadequate performance may be remedied by enrollment in one or more recommended courses.
2. The department has no foreign language requirement for either the M.S. or Ph.D. degree.
3. Each advanced degree candidate must present a suitable program of advanced courses and research. The specific courses needed to provide a basis for scholarly work beyond the B.S. level will vary with the student's undergraduate preparation, area of concentration and the degree sought. Individual course enrollments must be approved initially by the graduate adviser and subsequently by the student's advisory committee.
4. Every student must register for a minimum of one credit hour of CHEM 6000V or CHEM 7000V in each term during which the student is present and doing thesis or dissertation research. Post-candidacy doctoral students are required to be enrolled in at least one hour of dissertation credit (CHEM 7000V) every semester (fall, spring, summer), until the degree is conferred.

Additional Requirement for Master of Science Degree: The Master of Science degree in Chemistry requires a minimum 24 hours of course work plus six hours of thesis. A thesis reporting original research will be required of all candidates for the Master of Science degree in chemistry.

Students should also be aware of Graduate School requirements with regard to master's degrees (http://catalog.uark.edu/graduatecatalog/degreerequirements/#mastersdegreestext).

Requirements for Ph.D. in Chemistry

Additional Requirements for the Doctor of Philosophy Degree:A doctoral advisory committee is appointed to evaluate the candidate's preparation and to draw up a suitable program of study and research. This committee consists of the student's major professor and at least three other members of the graduate faculty. Under most circumstances, the major professor serves as the chairperson of that committee.

For chemistry students, the candidacy examination is of the cumulative type. Five cumulative examinations are given each semester in each of the areas of concentration mentioned above. To complete the candidacy examination, seven of these cumulative examinations must be passed within a specified time, usually by the end of the fifth semester of graduate work.

Students should also be aware of Graduate School requirements with regard to doctoral degrees (http://catalog.uark.edu/graduatecatalog/degreerequirements/#phdandedddegreestext).

Graduate Faculty

Adams, Paul D., Ph.D. (Case Western Reserve University), B.S. (Louisiana State University), Professor, 2006, 2021.
Allison, Neil T., Ph.D. (University of Florida), B.S. (Georgia College), Associate Professor, 1980.
Chen, Jingyi, Ph.D. (University of Washington), M.A. (State University College at Buffalo), B.S. (Zhongshan University), Professor, 2010, 2019.
Chevrier, Vincent Francois, Ph.D. (CEREGE, Aix-en-Provence, France), M.E.S. (University Paris VII), B.S. (Academy of Versaille, France), Research Associate Professor, 2005.
Coridan, Robert, Ph.D., M.S. (University of Illinois-Urbana-Champaign), B.S. (The Ohio State University), Professor, 2015, 2023.
Dong, Bin, Ph.D. (Iowa State University), B.S. (Xiamen University), Assistant Professor, 2021.
Edwards, Martin, Ph.D., M.Sc., M.Math. (University of Warwick), Assistant Professor, 2020.
Fan, Chenguang, Ph.D. (Iowa State University), B.S. (Nanjing University), Associate Professor, 2016, 2022.
Fritsch, Ingrid, Ph.D. (University of Illinois-Urbana-Champaign), B.S. (University of Utah), Professor, 1992, 2005.

He, Maggie, Ph.D. (ETH Zürich), M.S. (University of Pennsylvania), B.S. (City College of New York), Assistant Professor, 2019.
Hershberger, Margaret, Ph.D., M.S. (University of Chicago), B.S. (The Ohio State University), Teaching Assistant Professor, 2015, 2023.
Heyes, Colin David, Ph.D. (Georgia Institute of Technology), B.S. (Loughborogh University), Professor, 2008, 2021.
Kilyanek, Stefan M., Ph.D., M.S. (University of Chicago), B.S. (Grand Valley State University), Associate Professor, 2014, 2019.
Lay, Jackson, Ph.D. (University of Nebraska-Lincoln), Professor, 2002.
Mazzanti, Christopher L., Ph.D., M.S. (University of Arkansas), B.S. (University of Arkansas at Monticello), Instructor, 2012.
McIntosh, Matt, Ph.D. (Pennsylvania State University), B.A. (Virginia Tech), Professor, 1996, 2011.
Millett, Francis, Ph.D. (Columbia University), B.S. (University of Wisconsin), Distinguished Professor, 1972, 2003.
Moradi, Mahmoud, Ph.D. (North Carolina State University), M.S., B.S. (Sharif University of Technology), Professor, 2015, 2023.
Sakon, Joshua, Ph.D. (University of Wisconsin-Madison), B.S. (Southern Oregon University), Professor, 1997, 2016.
Stenken, Julie A., Ph.D. (University of Kansas), B.S. (University of Akron), Professor, 21st Century Chair of Proteomics, 2007.
Striegler, Susanne, Ph.D., M.S., B.S. (Ulm University, Germany), Professor, 2012, 2015.
Thallapuranam, Suresh, Ph.D. (Osmania University), Professor, 2003, 2015.
Tian, Ryan, Ph.D. (University of Connecticut), B.S. (Fudan University, Shanghai), Professor, 2004, 2023.
Wang, Feng, Ph.D. (University of Pittsburgh), Ph.D. (Kutztown University of Pennsylvania), B.S. (Peking University), Distinguished Professor, Charles E. and Clydene Scharlau Endowed Professor, 2012, 2023.
Wilkins, Charles L., Ph.D. (University of Oregon), B.S. (Chapman College), Distinguished Professor, 1998.
Zheng, Nan, Ph.D. (University of Michigan-Ann Arbor), M.S. (University of Rochester), B.S. (University of Science and Technology of China), Professor, 2008, 2021.

Courses

CHEM 5050V. Special Topics in Chemistry. 1-4 Hour.
Potential topics include: advanced spectroscopic methods, bioanalytical chemistry, bioinorganic chemistry, bioorganic chemistry, biophysical chemistry, chemical sensors, drug discovery and design, nanomaterials, pharmaceutical chemistry, process analytical chemistry, and protein folding and design. Graduate degree credit will not be given for both CHEM 4050V and CHEM 5050V. Prerequisite: Instructor consent. (Typically offered: Irregular)

CHEM 51001. Introduction to Research. 1 Hour.
This eight week course introduces new graduate students to research opportunities and skills in chemistry and biochemistry. Meets 2 hours per week in the first half of the semester. Safety and ethics in research and scholarship are discussed. Students learn about research programs in the department to aid in choosing an advisor. (Typically offered: Fall)

CHEM 51203. Advanced Inorganic Chemistry. 3 Hours.
Reactions and properties of inorganic compounds from the standpoint of electronic structure and the periodic table. Emphasis on recent developments. Knowledge comparable to material in CHEM 34603 is recommended. (Typically offered: Fall)

CHEM 51403. Advanced Inorganic Chemistry II. 3 Hours.
Chemistry of metallic and non-metallic elements emphasizing molecular structure, bonding and the classification of reactions. Knowledge of inorganic chemistry comparable to material in CHEM 41203 and CHEM 51203 is recommended. (Typically offered: Irregular)

CHEM 51503. Structural Chemistry. 3 Hours.
Determination of molecular structure by diffraction, spectroscopic, and other techniques. Illustrative examples will be chosen from inorganic chemistry and biochemistry. (Typically offered: Irregular)

CHEM 52103. Instrumental Analysis. 3 Hours.
Provides students, especially those in the physical, agricultural, and biological sciences, with an understanding of the theory and practice of modern instrumental techniques of analysis. Lecture 3 hours per week. Knowledge comparable to material in CHEM 22673 and CHEM 36053 is recommended. (Typically offered: Fall and Spring)

CHEM 52303. Chemical Separations. 3 Hours.
Modern separation methods including liquid chromatography (adsorption, liquid-liquid partition, ion exchange, exclusion) and gas chromatography. Theory and instrumentation is discussed with emphasis on practical aspects of separation science. (Typically offered: Fall Even Years)

CHEM 52403. Electrochemical Methods of Analysis. 3 Hours.
Topics will include diffusion, electron transfer kinetics, and reversible and irreversible electrode processes followed by a discussion of chronoamperometry, chronocoulometry, polarography, voltammetry, and chronopotentiometry. Knowledge of analytical chemistry comparable to material in CHEM 42203 is recommended. (Typically offered: Spring Even Years)

CHEM 52503. Spectrochemical Methods of Analysis. 3 Hours.
Principles and methods of modern spectroscopic analysis. Optics and instrumentation necessary for spectroscopy is also discussed. Topics include atomic and molecular absorption and emission techniques in the ultraviolet, visible, and infrared spectral regions. Knowledge of analytical chemistry comparable to material in CHEM 42203 is recommended. (Typically offered: Fall Odd Years)

CHEM 52803. Energy Conversion and Storage. 3 Hours.
Fundamental and applied concepts of energy storage and conversion with sustainability implications. Chemical reactions (kinetics, thermodynamics, mass transfer), emphasizing oxidation-reduction, electrochemical, and interfacial processes, and impact on performance of fuel and biofuel cells, batteries, supercapacitors, and photochemical conversion. (Typically offered: Fall Even Years)

CHEM 54403. Physical Chemistry of Materials. 3 Hours.
Physical and chemical characteristics of materials and discussion of the science behind materials engineering and performance. Topics include theory, principles of characterization methods, modeling, and applications in the context of materials. Knowledge comparable to material in CHEM 35204 and CHEM 35004 or CHEM 34603 or CHEG 37103 or MEEG 24003 is recommended. (Typically offered: Irregular)

CHEM 54503. Quantum Chemistry I. 3 Hours.
Fundamental quantum theory: Hamiltonian formalism in classical mechanics, Schrodinger equation, operators, angular momentum, harmonic oscillator, barrier problems, rigid rotator, hydrogen atom, and interaction of matter with radiation. Knowledge of physical chemistry comparable to material in CHEM 35004 is recommended. (Typically offered: Spring Odd Years)

CHEM 54703. Chemical Kinetics. 3 Hours.
Theory and applications of the principles of kinetics to reactions between substances, both in the gaseous state and in solution. Knowledge of physical chemistry comparable to material in CHEM 35204 is recommended. (Typically offered: Spring)

CHEM 55703. Statistical Thermodynamics. 3 Hours.
Covers fundamentals in thermodynamics, molecular dynamics, Monte Carlo, phase transitions, behavior of gases and liquids and basic concepts in chemical kinetics and physical kinetics. Knowledge comparable to physical chemistry materials in CHEM 35204 is recommended. (Typically offered: Irregular)

CHEM 56003. Physical Organic Chemistry. 3 Hours.
Introduction to the theoretical interpretation of reactivity, reaction mechanisms, and molecular structure of organic compounds. Application of theories of electronic structure; emphasis on recent developments. Knowledge of material comparable to CHEM 36203, CHEM 362H3, CHEM 37203 and CHEM 35204 is recommended. (Typically offered: Fall)

CHEM 56303. Organic Reactions. 3 Hours.
The more important types of organic reactions and their applications to various classes of compounds. Knowledge of organic chemistry comparable to material in CHEM 36053 is recommended. (Typically offered: Irregular)

CHEM 56403. Chemistry of Carbohydrates. 3 Hours.
Introduction to carbohydrate chemistry including structures of mono-, di- and oligosaccharides; properties including stereochemistry; characterization including spectroscopy, and molecular recognition; and real life examples including blood groups; current strategies, research groups and topics at the forefront in the field. (Typically offered: Spring Even Years)

CHEM 57203. Experimental Methods in Organic Chemistry. 3 Hours.
Introduction to the application of synthetic and spectroscopic methods in organic chemistry, including mass spectrometry, infrared spectroscopy, and nuclear magnetic resonance spectrometry. Lecture 3 hours per week. Knowledge comparable to material in CHEM 36203 is recommended. (Typically offered: Fall)

CHEM 57503. Methods of Organic Analysis. 3 Hours.
Interpretation of physical measurements of organic compounds in terms of molecular structure. Emphasis on spectroscopic methods (infrared, ultraviolet, magnet resonance, and mass spectra). Knowledge of organic chemistry comparable to material in CHEM 36053 is recommended. (Typically offered: Fall)

CHEM 58103. Biochemistry I. 3 Hours.
The first of a two-course series covering biochemistry for graduate students in biology, agriculture, and chemistry. Topics covered include protein structure and function, enzyme kinetics, enzyme mechanisms, and nucleic acid and carbohydrate structures. Knowledge of organic chemistry comparable to material in CHEM 36203 is recommended. (Typically offered: Fall)

CHEM 58403. Biochemistry II. 3 Hours.
A continuation of CHEM 58103 covering topics including biological membranes and bioenergetics, photosynthesis, lipids and lipid metabolism, nucleic acid and amino acid metabolism, and molecular biology. Knowledge of organic chemistry comparable to material in CHEM 36203 is recommended. Prerequisite: CHEM 58103. (Typically offered: Spring)

CHEM 6000V. Master's Thesis. 1-6 Hour.
Master's Thesis. Chemistry graduate students enroll in this course as needed until all CUMES are passed and the student is officially a doctoral candidate. Prerequisite: Chemistry graduate student. (Typically offered: Fall, Spring and Summer) May be repeated for degree credit.

CHEM 60101. Chemistry Seminar. 1 Hour.
Weekly discussion of current chemical research. Departmental and divisional seminars in analytical chemistry, biochemistry, inorganic, organic, and physical chemistry are held weekly. Seminar credit does not count toward the minimum hourly requirements for any chemistry graduate degree. (Typically offered: Fall and Spring) May be repeated for degree credit.

CHEM 6190V. Special Topics in Inorganic Chemistry. 1-3 Hour.
Topics which have been covered in the past include: technique and theory of x-ray diffraction, electronic structure of transition metal complexes, inorganic reaction mechanisms, and physical methods in inorganic chemistry. (Typically offered: Irregular) May be repeated for degree credit.

CHEM 62803. Mass Spectrometry. 3 Hours.
This course is devoted to the fundamental principles and applications of analytical mass spectrometry. Interactions of ions with magnetic and electric fields and the implications with respect to mass spectrometer design are considered, as are the various types of mass spectrometer sources. Representative applications of mass spectrometry in chemical analysis are also discussed. Prerequisite: Graduate standing. (Typically offered: Spring Odd Years)

CHEM 6290V. Special Topics in Analytical Chemistry. 1-3 Hour.
Topics that have been presented in the past include: electroanalytical techniques, kinetics of crystal growth, studies of electrode processes, lasers in chemical analysis, nucleosynthesis and isotopic properties of meteorites, thermoluminescence of geological materials, early solar system chemistry and analytical cosmochemistry. (Typically offered: Irregular) May be repeated for degree credit.

CHEM 6490V. Special Topics in Physical Chemistry. 1-3 Hour.
Topics which have been covered in the past include advanced kinetics, solution chemistry, molecular spectra, nuclear magnetic resonance spectroscopy, and methods of theoretical chemistry. (Typically offered: Irregular) May be repeated for degree credit.

CHEM 66303. Chemistry of Organic Natural Products. 3 Hours.
Selected topics concerned with structure elucidation and synthesis of such compounds as alkaloids, antibiotics, bacterial metabolites, plant pigments, steroids, terpenoids, etc. Prerequisite: CHEM 56003 and CHEM 56303. (Typically offered: Irregular)

CHEM 66403. Organometallic Chemistry. 3 Hours.
Theories and principles of organometallic chemistry. Concepts include bonding, stereochemistry, structure and reactivity, stereochemical principles, conformational, steric and stereoelectronic effects. Transition metal catalysis of organic reactions will also be described. Knowledge of material comparable to CHEM 37203 and CHEM 35204 is recommended. (Typically offered: Irregular)

CHEM 6690V. Special Topics in Organic Chemistry. 1-3 Hour.
Topics which have been presented in the past include heterogeneous catalysis, isotope effect studies of organic reaction mechanisms, organometallic chemistry, stereochemistry, photochemistry, and carbanion chemistry. (Typically offered: Irregular) May be repeated for degree credit.

CHEM 68203. Physical Biochemistry. 3 Hours.
Physical chemistry of proteins, nucleic acids, and biological membranes. Ultracentrifugation, absorption and fluorescent spectrophotometry, nuclear magnetic resonance spectroscopy, x-ray diffraction, and other techniques. Prerequisite: CHEM 58103. (Typically offered: Fall Even Years)

CHEM 68603. Enzymes. 3 Hours.
Isolation, characterization, and general chemical and biochemical properties of enzymes. Kinetics, mechanisms, and control of enzyme reactions. Prerequisite: CHEM 58103 and CHEM 58403. (Typically offered: Fall Odd Years)

CHEM 68703. Molecular Biochemistry. 3 Hours.
Nucleic acid chemistry in vitro and in vivo, synthesis of DNA and RNA, genetic diseases, cancer biochemistry and genetic engineering. Prerequisite: CHEM 58103 and CHEM 58403. (Typically offered: Spring Odd Years)

CHEM 68803. Bioenergetics and Biomembranes. 3 Hours.
Cellular energy metabolism, photosynthesis, membrane transport, properties of membrane proteins, and the application of thermodynamics to biological systems. Prerequisite: CHEM 58103 and CHEM 58403. (Typically offered: Spring Even Years)

CHEM 7000V. Doctoral Dissertation. 1-12 Hour.
Doctoral Dissertation. For chemistry graduate students who have passed all CUMES and have officially been admitted to doctoral candidacy. Prerequisite: Chemistry graduate student. (Typically offered: Fall, Spring and Summer) May be repeated for degree credit.