

General Information

Why Major in Chemistry?

Chemistry is often called the central science that is playing a key role in growing fields such as biotechnology, nanotechnology, and alternative energy, areas poised for growth in the 21st century.

Chemists are employed in many established profitable industries including those related to pharmaceuticals, foods and beverages, cosmetic and personal care products, and materials for high technology products. Chemists can also work in state and government labs in areas such as environmental chemistry, food safety, and forensics.

Saint Louis is an active center of the chemical and life science industries, and is a major location for a number of major companies including Monsanto, Covidien, Steris, Solutia, and Sigma-Aldrich. Numerous smaller companies and labs also provide employment opportunities for chemists. Placement of B.A. and B.S. chemistry graduates from UM-St. Louis into jobs in local industry has been excellent.

A degree in chemistry is an excellent pre-professional degree for those considering medicine, optometry, law, business, or other areas of graduate study in addition to chemistry.

Degrees and Areas Concentration.

The Department of Chemistry and Biochemistry offers courses leading to the following degrees:

B.A. in Chemistry

B.S. in Chemistry

B.S. in Chemistry with an emphasis in Biochemistry

B.S. in Biochemistry and Biotechnology (jointly with the Department of Biology)

B.S. in Education with emphasis in Chemistry (in cooperation with the School of Education)

B.A. in Chemistry with a Biochemistry certificate

B.A. in Chemistry with teacher certification (in cooperation with the School of Education)

The Department of Chemistry and Biochemistry is accredited by the American Chemical Society. Students completing the B.S. degree in chemistry are certified by the

American Chemical Society and are well prepared for graduate study in chemistry or a career in the chemical industry.

The Department also offers work leading to the M.S. degree in chemistry, with or without a thesis. The Ph.D. degree in chemistry is offered in the emphasis areas: inorganic, organic, physical chemistry, and biochemistry.

In addition to a balanced program of basic graduate courses, the Department offers special topics courses and seminars in current research areas. Research is being carried out in inorganic chemistry, organic chemistry, physical chemistry, and biochemistry by postdoctoral associates, faculty members, and graduate and undergraduate students.

The Department provides students with opportunities for strong interaction with faculty representing the various areas. Students and faculty working in one area consult freely with members in other areas. In addition, there are joint research projects involving faculty and students from two or more areas.

The Department has graduated over 850 B.A. and B.S graduates since it was founded in 1966.

Undergraduate Studies

General Education Requirements

Students must satisfy the University and College General Education requirements. Courses in chemistry may be used to meet some of these requirements as specified in the list of courses that may be counted as general education requirements in the various knowledge and skill areas (see course descriptions). The College's foreign language requirement fulfills the departmental requirements for B.A. candidates. It is recommended that candidates for the B.S. degree fulfill the language requirement in German or French, but any language that meets the College requirement for the B.A. degree is acceptable. For those students entering UM-St. Louis for the first time in fall 2005 and later and seeking a B.S. degree, the study of a foreign language is optional. Students who entered in fall 2005 and later also have the option of requesting to graduate under the requirements in effect during the academic year of their graduation. General Education requirements changed in Fall 2015 and students entering after this date must follow the new requirements.

Satisfactory/Unsatisfactory Restrictions

Chemistry majors may not take required or elective chemistry, mathematics, or physics courses on a satisfactory/unsatisfactory basis.

Grade Requirements

Students who receive a grade below C- in a course that is a pre-requisite to other required course(s) are expected to repeat the course until they receive a grade higher than C- in order to meet their pre-requisites. Students who receive a grade below C- are urged to

contact their advisor as soon as possible to discuss necessary changes in their schedule to complete the coursework that needs to be repeated.

Pre-major status

Students seeking to major in chemistry are first designated as 'pre-chemistry majors' until they have completed both Chemistry 1111 and Chemistry 1121 or equivalent courses. Upon successful completion of Chemistry 1111 and Chemistry 1121 with grades of C or better, students will be allowed to declare chemistry as their major. Each of these courses must be completed successfully within two attempts. Pre-chemistry students are advised the same as students who officially declared.

Degree Requirements

Bachelor of Arts in Chemistry

This degree is suitable for preprofessional students in the health sciences and related areas, as well as prelaw students interested in patent law. The degree is also suitable for students seeking employment in the chemical industry or graduate work, although additional coursework may be required. Candidates must complete the following chemistry courses:

- 1111**, Introductory Chemistry I
- 1121**, Introductory Chemistry II
- 2223**, Quantitative Analysis
- 3022**, Introduction to Chemical Literature
- 3312**, Physical Chemistry I
- 3322**, Physical Chemistry II
- 3333**, Physical Chemistry Laboratory I
- 3412**, Basic Inorganic Chemistry
- 2612**, Organic Chemistry I
- 2622**, Organic Chemistry II
- 2633**, Organic Chemistry Laboratory
- 4897**, Seminar (1 credit hour)



In addition, candidates must complete one laboratory course chosen from Chemistry 4343, 4233, 4433, 3643, and 4733.

No more than 45 hours in chemistry may be applied toward the degree. Chemistry majors must present a seminar and take the major field achievement test (MFAT), a comprehensive examination during the senior year.

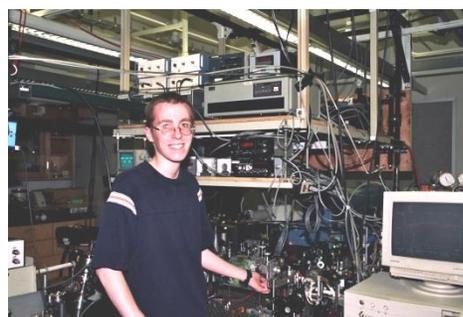
After fulfilling the general education and specific major degree requirements, students are to take the remaining hours required to complete the B.A. degree from courses, which the appropriate department has evaluated as being of university-level quality, from one or more of the following areas or their university-quality equivalents at other institutions: anthropology/archaeology, art (appreciation, history, studio), biology, chemistry, communication, criminology and criminal justice, economics, English, foreign

languages/literatures, history, mathematics/computer science, music (appreciation, history, performance), philosophy, physics, political science, psychology, social work, sociology, business, education, engineering, and interdisciplinary. The chemistry department may require students to pass a tracking test in order to enroll in the next level course, provided this or an equivalent test is administered to all students seeking to enroll in that course.

Bachelor of Science in Chemistry

This is the first professional degree in chemistry. It may be taken as a terminal degree by students intending to become professional chemists or for preparation for graduate work in chemistry or biochemistry. Candidates must complete the requirements for the B.A. degree in chemistry. In addition, the following chemistry courses are required:

- 4343**, Physical Chemistry Laboratory II
- 3643**, Advanced Organic Chemistry Laboratory
- 4212**, Instrumental Analysis
- 4233**, Laboratory in Instrumental Analysis
- 4412**, Inorganic Chemistry
- 4433**, Inorganic Chemistry Laboratory
- 4712**, same as **Bio 4712**, Biochemistry



Students must also take two elective hours of advanced work in Chemistry at the 3000 level or above. Students are encouraged to take Chemistry 3905, Chemical Research, to fulfill the advanced elective requirement. Participation in research requires the submission of a final report on the project.

Not more than 51 hours of chemistry courses may be applied toward the degree. Each candidate must present a seminar and take a comprehensive examination during their senior year.

Biochemistry Option

Candidates must complete the requirements for the B.A. degree in chemistry. The following chemistry and biology courses are also required:

Biology

- 1811**, Introductory Biology I
- 3622**, Cell Biology **or**
- 2012**, Genetics



Chemistry

4212, Instrumental Analysis

4233, Laboratory in Instrumental Analysis

3643, Advanced Organic Lab*

4712, same as **Bio 4712**, Biochemistry

4722, Advanced Biochemistry

4733, Biochemistry Laboratory

4764, Interdisciplinary Topics in Biochemistry, **or**

4772, Physical Biochemistry **or** 3 credits of Chemistry 3905,

Chemical Research (which must be a project in biochemistry and for which a final report must be submitted)

*students who entered prior to fall 2011 should take Chem 4412, Advanced Inorganic Chemistry instead of Chem 3643 if they wish to retain their earlier catalog year.

Bachelor of Arts in Chemistry with a Biochemistry Certificate

The university offers a certificate program for science majors who are interested in careers in biochemistry. Students interested in a chemistry degree and who have interests in biochemistry are advised to pursue the B.S. with the biochemistry option described above. This is an interdisciplinary program that involves additional courses in biochemistry and biology. In addition to the usual requirements for the B.A. degree in chemistry, the student must take the following courses:

Chemistry

4712, same as **Bio 4712**, Biochemistry

4722, Advanced Biochemistry

4733, Biochemistry Laboratory

4764, Interdisciplinary Topics in Biochemistry **or**

4772, Physical Biochemistry

Biology

1811, Introductory Biology I

3622, Cell Biology

2012, Genetics

4614, Biotechnology Laboratory I **or**

4602, Molecular Biology

Related Area Requirements



Bachelor of Arts and Bachelor of Science in Chemistry Degrees

Candidates for both degrees must also complete:

Mathematics 1800, Analytic Geometry and Calculus I

Mathematics 1900, Analytic Geometry and Calculus II

Mathematics 2000, Analytic Geometry and Calculus III

*Physics 2111, Physics: Mechanics and Heat

*Physics 2112, Physics: Electricity, Magnetism, and Optics

*If neither of these courses included a laboratory, a separate laboratory course is required.

GPA Requirements for Graduation

Students earning BA or BS degrees in chemistry must achieve a GPA of 2.0 or higher for the combination of chemistry courses and required related area courses.

Residency Requirements

Forty-five hours of chemistry courses may be applied toward the B.A. degree in chemistry. B.A. degree candidates must complete at least 12 credits at the 3xxx level at UMSL.

Fifty-one hours of chemistry courses may be applied toward the B.S. degree in chemistry. B.S. degree candidates must complete at least 24 hours of chemistry at the 3xxx level or higher at UMSL.

Each chemistry major must present a seminar and pass a comprehensive examination during the senior year.

Undergraduate Research Opportunities in the Department

The Department of Chemistry and Biochemistry welcomes the involvement of undergraduates in research. Involvement in research can provide unique and valuable training, enhance the prospects for employment or admittance to graduate school, and aid in the development of a student's intellectual ability and background. In many cases, a student will have opportunities to present their project at local or regional scientific meetings and to become coauthor of a publication derived from the work. Undergraduates have the opportunity to pursue a research project under the guidance of a faculty member during the regular academic year and/or during the summer sessions. Students choosing to engage in research can expect access to all of the departmental facilities and support staff on a regular basis. In order to take part in research, a student typically consults with a number of faculty members to find a project suitable to their interests and background. Students engaged in research must enroll in Chemistry 3905, Research. Students seeking either the B.S. degree or the B.S. with an Emphasis in Biochemistry may use Chemistry 3905 to meet their advanced elective requirements. Students interested in research are encouraged to

read the descriptions of research areas on the department webpage and then arrange to talk to individual faculty.

Degrees with Distinction in Chemistry

A student who wishes to earn a B.A. or B.S. degree in chemistry with distinction must meet the general criteria. Students who have completed a minimum of 75 credit hours, have begun undergraduate research under a faculty mentor, and with a GPA of 3.5 or greater may apply for candidacy during their final year before graduation. The student must submit their application for candidacy to the Department Chair at least one semester prior to graduation. It is expected that students seeking a chemistry degree with distinction will complete at least two continuous semesters of enrollment in Chemical Research (Chemistry 3905). The student shall select a committee consisting of their mentor and two other faculty members qualified to evaluate their work. The student must present and defend their research project and its results no later than 6 weeks prior to commencement during their final semester. The student shall schedule a presentation of their work that is open to the public. It is expected that the student will give a 30 minute oral presentation of the results of their research project and then answer questions from their committee. The students shall also complete a written thesis in accordance with the stated specifications of the department. It is expected that this thesis will include an introduction, summary of methods, summary of results, discussion of results, and fully and appropriately reference the relevant literature. Please inquire to your research mentor for further details on the format of the student thesis required to complete a chemistry degree with distinction.



Advising

All chemistry majors are assigned permanent advisors and are expected to meet with them each semester prior to enrolling in courses for the subsequent semester. *It must be emphasized that not every chemistry course, and especially those at the upper levels, is offered every semester.* Meeting with your advisor is intended to help you schedule appropriately in order to complete your degree in a timely manner. Projected course offerings for upcoming semesters may also be found on the departmental webpage.

Requirements for the Minor in Chemistry

Students may complete a minor in chemistry as described below:

The following five required courses are:

Chemistry 1111, Introductory Chemistry I
Chemistry 1121, Introductory Chemistry II

Chemistry 2223, Quantitative Analysis
Chemistry 2612, Organic Chemistry I
Chemistry 2633, Organic Chemistry Laboratory

One course must be completed from the following list:

Chemistry 3312, Physical Chemistry I
Chemistry 3412, Basic Inorganic Chemistry
Chemistry 2622, Organic Chemistry II
Chemistry (or Biology) 4712, Biochemistry

Courses that are prerequisites to subsequent courses in the minor may not be taken on a satisfactory/unsatisfactory basis. A GPA of at least 2.0 is required for the courses presented for the minor. At least three courses towards the Chemistry minor must be completed at UM-St. Louis.

Bachelor of Science in Biochemistry and Biotechnology

This degree is intended for students seeking training encompassing the basic principles of biochemistry and the basic background and methods of biotechnology. The degree would be highly suitable for students seeking a career in the life sciences industry or those intending to pursue graduate studies in the life sciences. It is also suitable as a pre-professional degree. This degree program is a cooperative effort between the Department of Chemistry and Biochemistry and the Department of Biology.



Candidates must complete the following courses in chemistry and biology:

Biology Core

Biology 1811, Introductory Biology I
Biology 2482, Microbiology
Biology 2483, Microbiology Lab
Biology 2012, Genetics
Biology 2013, Genetics Lab
Biology 3622, Cell Biology
Biology 4602, Molecular Biology

Chemistry Core

Chemistry 1111, Introductory Chemistry I
Chemistry 1121, Introductory Chemistry II
Chemistry 2223, Quantitative Analysis
Chemistry 2612, Organic Chemistry I
Chemistry 2612, Organic Chemistry II
Chemistry 2633, Organic Chemistry Laboratory

Biochemistry/Biotechnology Core

Chemistry (or Biology) 4712, Biochemistry
Chemistry 4722, Advanced Biochemistry
Chemistry 4733 or Biology 4713, Biochemistry Laboratory
Chemistry 3302, Physical Chemistry for the Life Sciences
Biology 4614, Biotechnology Laboratory I

Biochemistry/Biotechnology Electives (minimum of 6 credits required):

Chemistry 4772, Physical Biochemistry
Biology 4615, Biotechnology Laboratory II
Biology 4632, Nucleic Acid and Structure
Biology 4612, Molecular Genetics of Bacteria
Biology 4642, Plant Molecular Biology and Genetic Engineering
Biology 4652, Virology
Biology 4622, Molecular Cell Biology
Biology 4842, Immunobiology
Biology 5712, Topics in Biochemistry
Chemistry 3905, Research or Biology 4905, up to 3 credits may be taken as an elective.

Related Area Requirements

Math 1030, College Algebra
Math 1035, Trigonometry
Math 1100, Basic Calculus
Or Math 1800, Analytical Geometry and Calculus I
Physics 1011, Basic Physics I
Physics 1012, Basic Physics II

Recommendations for free elective credits include basic statistics (Math 1310 or Math 1320), computer science, public speaking (communications 1040), foreign language, ethics, and undergraduate research (Biology 4905 or Chemistry 3905).

Goals of our Undergraduate Programs

Competencies that all students must demonstrate to complete the program successfully:

1. Knowledge and comprehension in areas of chemistry - Graduates should have a foundation of knowledge in chemistry suitable for the pursuit of further study in the discipline. In order to achieve the goals of any one of our chemistry degrees, knowledge is required from the related areas of introductory physics and calculus. *Students earning a B.S. degree as opposed to a B.A. degree are expected to distinguish themselves both in terms of superior grasp of the fundamental areas and by displaying knowledge from the advanced lecture courses taken only by B.S. degree students.*

2. Scientific problem-solving skills - Graduates should understand valid scientific approaches to problem solving and be able to design experiments to test a hypothesis. *Students earning a B.S. degree are expected to be able to design experiments drawing upon a wider range of methods including those they uniquely gain experience with in advanced laboratory courses that B.S. degree majors complete.*

3. Data analysis/quantitative skills - Graduates should be able to draw valid conclusions from experimental data and observations. Graduates should be able to carry out statistical and linear regression analysis of data. Graduates should be able to identify the main possible sources of error in laboratory measurements.

4. Laboratory skills - Graduates should be able to carry out the basic techniques of preparative and analytical chemistry. An appreciation some aspects of chemical spectroscopy should be achieved. Graduates should be able to keep accurate records of experiments. Graduates should be able to work effectively in the laboratory individually or as a part of a small team. Graduates should have an awareness of the basic aspects of safe laboratory practices. *Students earning a B.S. degree are expected to be display more advanced skills in preparative and analytical chemistry.*

5. Communication skills - Graduates should be able to communicate scientific ideas clearly both orally and in written form. This includes the effective presentation of quantitative data and of scientific concepts or procedures using diagrams and/or figures.

6. Library/Information skills - Graduates should be able to search for and retrieve information from scientific journals, databases, and handbooks, especially those widely used by professional chemists.

7. Computer/software skills - Graduates should be proficient in the use of software widely used by practicing scientists, including word processors, scientific plotting and analysis software, and spreadsheets. *Students earning a B.S. degree are expected to be display more sophisticated skills in the use of the aforementioned software.*

Major Field Achievement Test

All graduating seniors are required by the university in compliance with state guidelines to take an exit exam to assess their performance in their degree program. The Department of Chemistry and Biochemistry uses the major field achievement test (MFAT) available from the Educational Testing Service (ETS), who also prepare and administer the Graduate Record Examination (GRE) and the Scholastic Aptitude Test (SAT). The MFAT is administered late in the semester in chemistry 4897 (Seminar) taken during the last semester of enrollment by seniors. The MFAT results consist of an overall score as well as sub-scores in the fields of inorganic, organic, physical, and analytical chemistry. The scores are matched with percentiles based on the performance of students in the group

of schools nationwide taking the MFAT. Your scores and percentiles will be sent to you by letter as soon as the department receives the results from ETS. The scores are shared with the entire chemistry faculty and can be a consideration in faculty assessment of individual student performance in the chemistry program such as when writing letters of recommendation, for example, for students. The overall average scores for the department are viewed and considered seriously by the College of Arts and Sciences and the UM-Saint Louis administration as a measure of the quality of the chemistry degree programs. We urge that you take the exam seriously and perform to the best of your ability.



Descriptions of Chemistry and Biochemistry Courses for Majors

General education requirement areas (for requirements prior to Fall 2015) met by a course are noted after the course description (C = Communicating Skills, M = Managing Information Skills, S = Mathematical and Life/Natural Sciences Knowledge)

Chemistry 1081. Introductory Chemistry IA (3)

This course is designed for students who want to have an in depth understanding of introductory concepts in Chemistry. Chem 1081 covers the topics taught in the first half of Chem 1111 but at a slower pace, thus allowing students time to fully integrate the concepts and thereby build a stronger foundation for their subsequent Chemistry courses. Chem 1081 consists of the first half of Chem 1111 (excluding laboratory experiments), whereas Chem 1091 covers all the laboratory experiments and second half of lecture part of Chem 1111. Three hours of lecture or workshop per week.

Chemistry 1091. Introductory Chemistry IB (3)

Prerequisites: CHEM 1081. Chem 1091 is the completion of Chem 1111 for students who have completed Chem 1081. The laboratory portion of this course will start at the beginning of the semester. The lecture part of the course starts in mid-semester and students join an ongoing Chem 1111 class. Students who completed Chem 1081 must complete Chem 1091 to receive credit for Chem 1111. Three hours of lecture and one and one half hours of workshop during the second half of the semester, and three hours of laboratory per week during the entire semester.

Chemistry 1111. Introductory Chemistry I (5)

Prerequisites: MATH 1030 (or a score of 26 or higher on either the Math ACT or the Missouri Math Placement Test) and MATH 1035 (MATH 1035 may be taken concurrently) Presents an introduction to the fundamental laws and theories of chemistry. Laboratory experiments are designed to demonstrate some aspects of qualitative and quantitative analysis and to develop skills in laboratory procedures. [S]

Chemistry 1121. Introductory Chemistry II. (5)

Prerequisite: Chem 1111 or advanced placement. Lecture and laboratory are a continuation of Chemistry 11. [M, S]

Chemistry 2223. Quantitative Analysis (2)

Prerequisite: Chem 1121. Principles and practice of elementary quantitative chemistry. The lecture treats descriptive statistics with emphasis on small samples; various types of competing equilibria pertaining to acid-base, buffer, and polyprotic acid systems; quantitative explanations of acid-base, complexometric, and potentiometric titrations; and an introduction to spectrophotometric processes. The laboratory provides exercises in titrimetric, gravimetric and spectrophotometric techniques. [C, M, S]

Chemistry 2612. Organic Chemistry I (3)

Prerequisite: Chem 1121. An Introduction to the structure, properties, synthesis, and reactions of aliphatic and aromatic carbon compounds. [M, S]

Chemistry 2622. Organic Chemistry II (3)

Prerequisite: Chem 2612. A systematic study of organic reactions and their mechanisms; organic synthetic methods. [M, S]

Chemistry 2633. Organic Chemistry Laboratory (2)

Prerequisite: Chem 2612. An introduction to laboratory techniques and procedures of synthetic organic chemistry. [C, M, S]

Chemistry 3022. *Introduction to Chemical Literature (1)*

Prerequisite: Chem 2622 (may be taken concurrently) and Chem 3412 (previous number 2412). The course will familiarize the student with the literature of chemistry and its use.

Chemistry 3312. *Physical Chemistry I (3)*

Prerequisite: Chem 1121, Math 2000 (may be taken concurrently), and Physics 2111 (or equivalent). Principles of physical chemistry including thermodynamics, theory of gases, phase equilibria, kinetics, crystal structure, spectroscopy and quantum mechanics.

Chemistry 3322 *Physical Chemistry II (3)*

Prerequisite: Chem 3312 and Math 2000. Continuation of Chemistry 3312.

Chemistry 3333 *Physical Laboratory Chemistry I (2)*

Prerequisite: Chem 3312 (may be taken concurrently) and Chem 2223. Experiments designed to illustrate principles introduced in Chemistry 3312.

Chemistry 3412 *Basic Inorganic Chemistry (2).* *Prerequisite: Chem 1121. Review of principles of atomic structure, covalent and ionic bonding. Properties of the elements and synthesis, reactions and bonding aspects of important compounds of main group and transition metal compounds. [M, S]*

Chemistry 3643. *Advanced Organic Chemistry Laboratory (2)* *Prerequisites: Chem 2223, 3022 (may be taken concurrently), 2622, and 2633. Identification of organic compounds by classical and spectroscopic methods; advanced techniques in synthesis and separation of organic compounds.*

Chemistry 3905. *Chemical Research (1-10).* *Prerequisite: Consent of instructor. Independent laboratory and library study, in conjunction with faculty member, of fundamental problems in chemistry. A written report describing the research is required.*

Chemistry 4212. *Instrumental Analysis (2)*

Prerequisite: Chem 3322. Principles and applications of modern methods of instrumental analysis for analytical chemistry measurements. Topics will be selected from the areas of electrochemistry, absorption and emission spectroscopy, chromatography, mass spectrometry, surface analysis, and nuclear magnetic resonance.

Chemistry 4233. *Laboratory in Instrumental Analysis (2)*

Prerequisite: Chem 4212 and Chem 3333. Experiments designed to illustrate the principles and practices of instrumental analysis, involving the use of modern instrumentation in analytical chemistry applications.

Chemistry 4343. *Physical Laboratory Chemistry II (2)*

Prerequisites: Chem 3322 (may be taken concurrently) and Chem 3333. Experiments designed to illustrate principles introduced in Chemistry 4322.

Chemistry 4412. *Inorganic Chemistry (3)*

Prerequisite: Chem 3322 (may be taken concurrently), 3412, and 2622. An introduction to the chemistry of the elements, including atomic and molecular structure, acids and bases, the chemistry of the solid state, and main group and transition metal chemistry.

Chemistry 4433. Inorganic Chemistry Laboratory (2)

Prerequisite: Chem 3333, 4412, and 3643 (may be taken concurrently). The more sophisticated techniques of physical and analytical chemistry will be used to study inorganic compounds and their reactions.

Chemistry 4712. Biochemistry (3)

(Same as Biology 371) Prerequisite: Chem 2612 and either Biology 1811 or Chem 2622. The chemistry and function of cell constituents, and the interaction and conversions of intracellular substances.

Chemistry 4722. Advanced Biochemistry (3)

Prerequisite: Chem 4712. Selected advanced topics in the chemistry of life processes.

Chemistry 4733. Biochemistry Laboratory (2)

Prerequisite: Chem 4712 (may be taken concurrently) and Chem 2223. Laboratory study of biochemical processes in cellular and subcellular systems with emphasis on the isolation and subcellular systems with emphasis on the isolation and purification of proteins (enzyme) and the characterization of catalytic properties.

Chemistry 4764. Interdisciplinary Topics in Biochemistry

Prerequisites: Chem 4712; Chem 4722 strongly recommended. Includes advanced studies of enzyme mechanisms, the role of metal ions in enzymatic and non-enzymatic process, and the application of computational chemistry to biological systems.

Chemistry 4772: Physical Biochemistry (3)

Prerequisite: Chem 4712 or Chem 3312 . Designed to acquaint students with concepts and methods in biophysical chemistry. Topics that will be discussed include protein and DNA structures, forces involved in protein folding and conformational stability, protein-DNA interactions, methods for characterization and separation of macromolecules, electron transfer, and biological spectroscopy.

Chemistry 4897. Seminar (1)

Prerequisites: Chem 3022 and Senior standing. Presentation of papers by students, faculty, and invited speakers. Chemistry majors must enroll during the Fall or Winter semester of the year in which they graduate. Completion of a comprehensive examination is a course requirement. One hour of lecture and one hour of discussion per week.



Bachelor of Arts in Chemistry with Biochemistry Certificate

University of Missouri-St. Louis

• General Education Requirements

(see UMSL Bulletin for details, note: these are the requirements as of Fall 2015)

First Year Writing: _____

Advanced Expository Writing-Junior Level English Requirement (Eng 3100 or Eng 3160 preferred):

American History and Government Requirement: (1 course)

Cultural Diversity Requirement (1 course, see Bulletin for list):

Communication Proficiency (1 course):

Information Literacy (1 course):

Social and Behavioral Sciences (9 hours):

Humanities and Fine Arts (9 hours):

Mathematical and Life/Natural Sciences (9 hours):

• Core Curriculum

- Chemistry 1111 Introductory Chemistry I (5)
- Chemistry 1121 Introductory Chemistry II (5)
- Chemistry 2223 Quantitative Analysis (3)
- Chemistry 3022 Intro. to Chemical Literature (1)
- Chemistry 3312 Physical Chemistry I (3)
- Chemistry 3322 Physical Chemistry II (3)
- Chemistry 3333 Physical Chemistry Laboratory I (2)
- Chemistry 3412 Basic Inorganic Chemistry (2)
- Chemistry 2612 Organic Chemistry I (3)
- Chemistry 2622 Organic Chemistry II (3)

- Chemistry 2633 Organic Chemistry Laboratory (2)
- Chemistry 4712 Biochemistry (3)
- Chemistry 4722 Advanced Biochemistry (3)
- Chemistry 4733 Biochemistry Laboratory (3)
- Chemistry 4772 Physical Biochemistry (3)
- Chemistry 4897 Seminar (1)

• Advanced Laboratory Requirement

(One laboratory course chosen from: Chemistry 4343, 4433, 3643, 4233 or 4733; lecture prerequisites required for 4433 and 4233)

• Related Area Requirements:

- Math 1800 Analytical Geometry & Calculus I (5)
- Math 1900 Analytical Geometry & Calculus II (5)
- Math 2000 Analytical Geometry & Calculus III (5)
- Phys 2111 Physics: Mechanics and Heat (5)
- Phys 2112 Physics: Electricity, Magnetism & Optics (5)
- Bio 1831, Introductory Biology (5)
- Bio 2012, Genetics (3)
- Bio 3622, Cell Biology (3)
- Bio 4602, Molecular Biology (3) OR
- Bio 4614, Biotechnology Lab (4)

Foreign Language (must fulfill College requirement):

1. _____
2. _____
3. _____

• Major Field Achievement Test:

• Electives:

- _____
- _____
- _____

Bachelor of Science in Chemistry

University of Missouri-St. Louis

- **General Education Requirements**

(see UMSL Bulletin for details, note: these are the requirements as of Fall 2015)

First Year Writing: _____

Advanced Expository Writing-Junior Level English Requirement (Eng 3100 or Eng 3160 preferred):

American History and Government Requirement: (1 course)

Cultural Diversity Requirement (1 course, see Bulletin for list):

Communication Proficiency (1 course):

Information Literacy (1 course):

Social and Behavioral Sciences (9 hours):

Humanities and Fine Arts (9 hours):

Mathematical and Life/Natural Sciences (9 hours):

- **Core Curriculum**

- ☐ - Chemistry 1111 Introductory Chemistry I (5)
- ☐ - Chemistry 1121 Introductory Chemistry II (5)
- ☐ - Chemistry 2223 Quantitative Analysis (3)
- ☐ - Chemistry 3022 Intro. to Chemical Literature (1)
- ☐ - Chemistry 3312 Physical Chemistry I (3)
- ☐ - Chemistry 3322 Physical Chemistry II (3)
- ☐ - Chemistry 3333 Lab in Physical Chemistry I (2)
- ☐ - Chemistry 4343 Lab in Physical Chemistry II (2)
- ☐ - Chemistry 3412 Basic Inorganic Chemistry (2)

- ☐ - Chemistry 2612 Organic Chemistry I (3)
- ☐ - Chemistry 2622 Organic Chemistry II (3)
- ☐ - Chemistry 2633 Organic Chemistry Laboratory (2)
- ☐ - Chemistry 4897 Seminar (1)
- ☐ - Chemistry 4212 Instrumental Analysis (2)
- ☐ - Chemistry 4233 Laboratory in Instrumental Analysis (2)
- ☐ - Chemistry 4412 Inorganic Chemistry (3)
- ☐ - Chemistry 4433 Inorganic Chemistry Laboratory (2)
- ☐ - Chemistry 3643 Advanced Organic Chemistry Laboratory (2)
- ☐ - Chemistry 4712 Biochemistry (3)
- ☐ - Two elective credits of advanced work in chemistry at the 3000 level or above. Students are encouraged to take Chemistry 3905.

- **Related Area Requirements:**

- ☐ - Math 1800 Analytical Geometry & Calculus I (5)
- ☐ - Math 1900 Analytical Geometry & Calculus II (5)
- ☐ - Math 2000 Analytical Geometry & Calculus III (5)
- ☐ - Phys 2111 Physics: Mechanics and Heat (5)
- ☐ - Phys 2112 Physics: Electricity, Magnetism & Optics (5)

- **Major Field Achievement Test:**

- **Electives:**

- _____
- _____

Bachelor of Science in Chemistry with an Emphasis in Biochemistry

University of Missouri-St. Louis

General Education Requirements

(see UMSL Bulletin for details, note: these are the requirements as of Fall 2015)

First Year Writing: _____

Advanced Expository Writing-Junior Level English Requirement (Eng 3100 or Eng 3160 preferred):

American History and Government Requirement: (1 course)

Cultural Diversity Requirement (1 course, see Bulletin for list):

Communication Proficiency (1 course):

Information Literacy (1 course):

Social and Behavioral Sciences (9 hours):

Humanities and Fine Arts (9 hours):

Mathematical and Life/Natural Sciences (9 hours):

• Core Curriculum

o-Chemistry 1111 Introductory Chemistry I (5)

o-Chemistry 1121 Introductory Chemistry II (5)

o-Chemistry 2223 Quantitative Analysis (3)

o-Chemistry 3022 Intro. To Chemical Literature (1)

o-Chemistry 3312 Physical Chemistry I (3)

o-Chemistry 3322 Physical Chemistry II (3)

o-Chemistry 3333 Physical Chemistry Laboratory I (2)

o-Chemistry 3412 Basic Inorganic Chemistry (2)

o-Chemistry 2612 Organic Chemistry I (3)

o-Chemistry 2622 Organic Chemistry II (3)

o-Chemistry 2633 Organic Chemistry Laboratory (2)

o-Chemistry 4897 Seminar (1)

o-Chemistry 4212 Instrumental Analysis (2)

o-Chemistry 4233 Laboratory in Instrumental Analysis (2)

o-Chemistry 3643 Advanced Organic Chemistry Lab (2)

o-Chemistry 4712 Biochemistry (3)

o-Chemistry 4722 Advanced Biochemistry (3)

o-Chemistry 4733 Biochemistry Laboratory (2)

o- Advanced Elective (3 credits) must be from Chemistry 3905 Research in Chemistry, Chemistry 4764 Special Topics in Biochemistry (3) or Chemistry 4772 Physical Biochemistry (3). Research must be an approved biochemistry project.

• Related Area Requirements:

o-Math 1800 Analytical Geometry & Calculus I (5)

o-Math 1900 Analytical Geometry & Calculus II (5)

o-Math 2000 Analytical Geometry & Calculus III (5)

o-Phys 2111 Physics: Mechanics and Heat (5)

o-Phys 2112 Physics: Electricity, Magnetism & Optics (5)

o-Biology 1811 Introductory Biology (5)

o-Biology 3622 Biology (3) or Biology 2012 Genetics (3)

• Major Field Achievement Test:

Bachelor of Science in Biochemistry and Biotechnology

University of Missouri-St. Louis

- **General Education Requirements**

(see UMSL Bulletin for details, note: these are the requirements as of Fall 2015)

First Year Writing: _____

Advanced Expository Writing-Junior Level English Requirement (Eng 3100 or Eng 3160 preferred):

American History and Government Requirement: (1 course)

Cultural Diversity Requirement (1 course, see Bulletin for list): _____

Communication Proficiency (1 course):

Information Literacy (1 course):

Social and Behavioral Sciences (9 hours):

Humanities and Fine Arts (9 hours):

Mathematical and Life/Natural Sciences (9 hours):

- **Chemistry Core Curriculum**

- Chemistry 1111 Introductory Chemistry I (5)
- Chemistry 1121 Introductory Chemistry II (5)
- Chemistry 2223 Quantitative Analysis (3)
- Chemistry 2612 Organic Chemistry I (3)
- Chemistry 2622 Organic Chemistry II (3)
- Chemistry 2633 Organic Chemistry Laboratory (2)

- **Biology Core Curriculum**

- Biology 1811, Introductory Biology I
- Biology 2482, Microbiology
- Biology 2483, Microbiology Lab
- Biology 2012, Genetics
- Biology 2013, Genetics Lab

- Biology 3622, Cell Biology

- Biology 4602, Molecular Biology

- **Biochemistry/Biotechnology Core**

- Chemistry (or Biology) 4712, Biochemistry

- Chemistry (or Biology) 4722, Advanced Biochemistry

- Chemistry 4733 or Biology 4713, Biochemistry

Laboratory

- Chemistry 3302, Physical Chemistry for the Life Sciences

- Biology 4614, Biotechnology Laboratory I

- Chemistry 4897 or Biology 4889, Capstone seminar

- **Biochemistry/Biotechnology Electives**

A minimum of 6 credits from the following courses:

- Chemistry 4722, Advanced Biochemistry

- Chemistry 4772, Physical Biochemistry

- Biology 4615, Biotechnology Laboratory II

- Biology 4632, Nucleic Acid and Structure

- Biology 4642, Plant Molecular Biology and Genetic Engineering

- Biology 4652, Virology

- Biology 4612, Molecular Genetics of Bacteria

- Biology 4622, Molecular Cell Biology

- Biology 4842, Immunobiology

- Biology 5712, Topics in Biochemistry

- Chemistry 3905 or Biology 3905 (up to 3 credits)

- **Related Area Requirements:**

- Math 1030 College Algebra

- Math 1035 Trigonometry

- Math 1800 Analytical Geometry & Calculus II (5)
or Math 1100, Basic Calculus (5)

- Phys 1011 Basic Physics I (5)

- Phys 1012 Basic Physics II (5)

- **Major Field Achievement Test**

TEACHING & RESEARCH INTERESTS

LAWRENCE BARTON, Professor Emeritus - Office: M302, 516-5334, lbarton@umsl.edu.

B.Sc., 1960, B.Sc.(Hons), 1961, Ph.D., 1964, Liverpool University Research Associate, 1964-66, Cornell University; Senior Research Fellow, 1970-71, Explosives Research and Development Establishment, Waltham Abbey, UK.

Teaching: Inorganic Chemistry I, Inorganic Chemistry II, Inorganic Reactions, Undergraduate Chemical Research, and Senior Seminar.

Research Interests: Inorganic Chemistry. Synthesis, structure and chemistry of borane and metalborane cage compounds, transition metallaborane complexes, boron oxygen ring systems, organometallic chemistry.

JAMES K. BASHKIN, Professor of Chemistry & Biochemistry, Member of the Center for Nanoscience - Office R103, 516-7352, bashkinj@umsl.edu

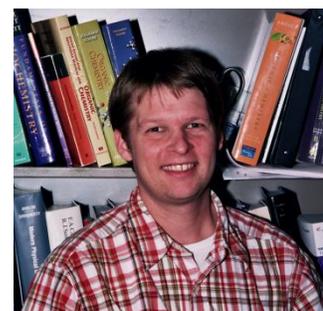
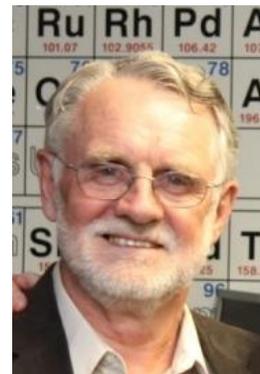
B.A., 1977, University of California, Irvine; D.Phil. 1982, University of Oxford, U.K. Postdoctoral and NIH Postdoctoral Fellow, 1983-5, Harvard University, Cambridge, MA.

Teaching: Biochemistry, Inorganic Chemistry, General Chemistry, Undergraduate Chemical Research

Research Interests: prevention of cervical cancer through antiviral agents, biochemistry and bioorganic chemistry of drug-DNA interactions, discovery and development of potential anti-Human Papillomavirus agents, environmentally benign chemistry, catalysis for organic synthesis, inorganic chemistry, materials chemistry and smart materials, fundamental and applied chemistry.

EIKE BAUER, Associate Professor – Office R326a, 516-5340, bauere@umsl.edu.

Vordiplom (B.S. degree) 1995, University of Erlangen-Nuremberg (Germany); Hauptdiplom (Thesis M.S. degree) 1999, University of Erlangen-Nuremberg; Ph.D., 2003, University of Erlangen-Nuremberg; Postdoctoral Fellow, 2004-2005, University of California – Riverside.



Teaching: Organic Chemistry I and II, Advanced Organic Chemistry, Organometallic Chemistry.

Research Interests: Organometallic and Organic Chemistry. Organometallic complexes as catalysts in organic syntheses; water-compatible organometallic catalysts systems, application of ring-closing metathesis in the syntheses of novel organometallic architectures.

ALICIA M. BEATTY, Associate Professor, Office: M207, 516-4383, beattya@umsl.edu

B.S. Chemistry, 1989, University of Missouri - St. Louis.
Ph.D. Chemistry, 1994, Washington University in St. Louis.

Teaching: General Chemistry, Basic Inorganic Chemistry, Advanced Inorganic Chemistry, Inorganic Chemistry Laboratory.



Research Interests: Crystal engineering, organic and inorganic solid state chemistry, organic synthesis, coordination chemistry, solid state characterization (X-ray diffraction, thermal methods, electron microscopy).

BENJAMIN J. BYTHELL, Assistant Professor, Office: S404, 314-516-5314

M.Chem., 2002, University of Bath (UK); Ph.D. 2007, Oregon State University. Postdoctoral Associate, 2008-2010, German Cancer Research Center (DKFZ), Heidelberg; Postdoctoral Associate, 2010-2013, National High Magnetic Field Laboratory, Tallahassee, FL.

Teaching: Analytical Chemistry, Instrumental Analysis, Physical Chemistry.



Research Interests: Analytical Chemistry, Computational Chemistry, Biophysical Chemistry and Physical Chemistry. I like to break things (ions) and then determine why they broke the way they did. This provides useful information on chemical structure and thus potential function. I use mass spectrometry, isotopic labeling, ion-molecule reactions, spectroscopy and computational chemistry techniques to do this. I then apply this knowledge for practical purposes to enable identification of unknown compounds.

JAMES S. CHICKOS, Professor - Office: R103, 516-5377, jsc@umsl.edu.

B.S. 1963, S.U.N.Y., Buffalo; Ph.D., 1966, Cornell University. NIH Fellow, 1966-67, Princeton University; NIH Fellow, 1967-69, University of Wisconsin.

Teaching: Introductory Chemistry I, Chemistry for the Health Professions, General Chemistry Laboratory, Introduction to Chemical Literature, Techniques of Organic Chemistry, Advanced Organic Chemistry, and Undergraduate Chemical Research, Physical Organic Chemistry.

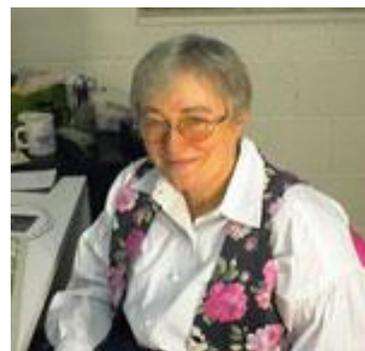


Research Interests: Organic Chemistry. Synthesis of chiral organo-deuterium compounds, thermal reactions of hydrocarbons, stereochemistry, heats of sublimation, isotope effects.

JOYCE Y. COREY, Professor Emeritus - Office: S404, 516-5360, corey@umsl.edu.

B.S., 1960, M.S., 1961, University of North Dakota; Ph.D., 1964, University of Wisconsin.

Teaching Introductory Chemistry II, Inorganic Chemistry I, Inorganic Chemistry II, Inorganic Reactions, and Undergraduate Chemical Research.



Research Interests: Inorganic Chemistry. Synthesis and characterization of organometallic compounds containing elements from groups III and IV with emphasis on group IV analogs of pharmaceutically active derivatives.

ALEXEI V. DEMCHENKO, Curators' Professor - Office S308, 516-7995, demchenkoa@msx.umsl.edu.

M.Sc., 1988, Mendeleev University of Chemical Technology of Russia, Moscow; Ph.D., 1993, Zelinsky Institute of Organic Chemistry (IOC), Russia; Research Associate, 1993-1995, IOC; BBSRC Postdoctoral Research Fellow, 1995-1998, University of Birmingham, UK; Research Associate, 1998-2001, Complex Carbohydrate Research Center, GA.



Teaching: Organic Chemistry I and II, Structural Organic Chemistry, Modern Carbohydrate Chemistry.

Research Interests: Carbohydrate chemistry, novel synthetic strategies and approaches, drug discovery, synthetic vaccines, medicinal chemistry, polymer-supported synthesis. IV analogs of pharmaceutically active derivatives.

VALERIAN T. D'SOUZA, Associate Professor - Office: S122, 516-5324, vally@umsl.edu.

B.Sc., 1976, M.Sc., 1979, Bombay University; Ph.D., 1983, University of Detroit. Postdoctoral Fellow, 1983-87, Northwestern University.

Teaching: General Organic Chemistry, Introduction to Chemical Literature, Techniques of Organic Chemistry, Undergraduate Chemical Research, and Biochemistry.



Research Interests: Bioorganic Chemistry. Bioorganic chemistry, kinetics, mechanisms and structure-function relationships of organic reactions particularly of biological processes; enzyme mechanisms, mimics and catalysis; cyclodextrin and modified cyclodextrin chemistry.

CYNTHIA M. DUPUREUR, Professor and Chair - Office: M307, 516-4392, cdup@umsl.edu.

B.S., 1987, Southwest Missouri State University, Ph.D., 1992, Ohio State University. Postdoctoral Fellow, 1992-1995, California Institute of Technology.

Teaching: Physical Biochemistry, Advanced Biochemistry, and Biochemical Techniques.



Research Interests: Biochemistry. Metallo- and nucleic acid enzyme structure-function relationships; biophysical chemistry; biological applications of fluorescence and NMR spectroscopy.

GEORGE W. GOKEL, Distinguished Professor of Science- Office: S411, 516-5321, gokelg@umsl.edu.

B.S. 1968, Tulane University, New Orleans. Ph.D. 1971, University of Southern California, Los Angeles; Post doctoral Fellow, U.C.L.A. 1972-1974.

Teaching: Organic Chemistry.



Research Interests: Bioorganic chemistry, chemical biology, supramolecular chemistry. Design, synthesis, and characterization of model systems that mimic biological function. Development and study of models that probe supramolecular interactions.

BRUCE C. HAMPER, Assistant Teaching Professor, Office: R204, 516-5311, hamper@umsl.edu.

Ph.D., 1984, Organic Chemistry, University of Illinois-Urbana. Science Fellow and Project Leader, Pfizer (2003-2009); Science Fellow, Monsanto (1984-2002)

Teaching: General Chemistry, Chemistry for the Health Professions, Environmental Chemistry, Brewing Science, and Undergraduate Chemical Research

Research Interests: Organic and Analytical Chemistry; continuous flow processes, chiral synthesis, analytical and synthetic method development, ion and chiral chromatography.

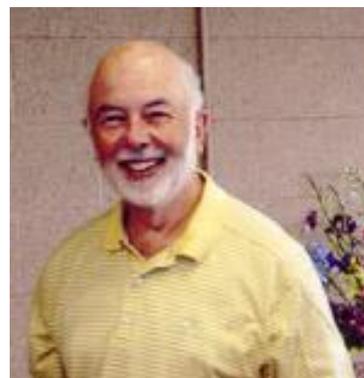


HAROLD H. HARRIS, Founder's Professor Emeritus-Office: R103, 516-5344, hharris@umsl.edu.

B.S., 1962, Harvey Mudd College; Ph.D. 1966, Michigan State University. Postdoctoral Fellow, 1966-67, University of California-Irvine.

Teaching: General Chemistry, 1, General Chemistry Laboratory, Quantitative Analysis, Physical Chemistry I & II, Laboratory in Physical Chemistry I & II, Methods of Teaching Physical Sciences, Chemistry Seminar, Undergraduate Chemical Research, Intermediate Physical Chemistry, Advanced Physical Chemistry.

Research Interest: Physical Chemistry. Self-organizing systems; combustion chemistry; chemical education.

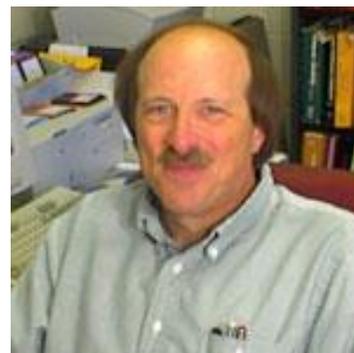


WESLEY R. HARRIS, Professor, Associate Dean of the Graduate School - Office: R308, 516-5331, wharris@umsl.edu.

B.S., 1974, Ph.D., 1977, Texas A&M University. Postdoctoral Associate, 1977, University of California-Berkeley.

Teaching: Inorganic Chemistry I, Inorganic Chemistry II, Inorganic Reactions, and Undergraduate Chemical Research and The Teaching and Practices of Chemistry in Colleges and Universities.

Research Interest: Inorganic Chemistry. Complexation equilibrium with proteins and low molecular weight ligands. Metal ion exchange kinetics with serum transferrin. Linear free-energy relationships in coordination chemistry.



STEPHEN M. HOLMES, Professor and Director of Graduate Studies - Office: B418, 516-4382, holmesst@umsl.edu.

B.S., 1992, Southwest Texas State University (now Texas State University); Ph.D. 1999, University of Illinois at Urbana-Champaign. Postdoctoral Associate, 1999-2001, Cornell University.

Teaching: Introductory Chemistry, General Chemistry, Inorganic Chemistry, Laboratory in Inorganic Chemistry, Spectroscopy and Methods in Chemistry, and Undergraduate Chemical Research.

Research Interests: Inorganic and Materials Chemistry. Magnetic and optically responsive materials, coordination and organometallic chemistry, catalysis, and electronic materials and devices.



RENSHENG LUO, Research Associate Professor – Office: S308, 516-6748, luor@umsl.edu.

M.S., 1982, Wuhan University, Ph.D., 1999, Chinese Academy of Sciences, Postdoctoral Associate, University of Illinois at Urbana-Champaign, 1999-2001, St. Jude's Children Hospital, 2001-2004.

Research Interests: Dr. Luo is the Director of the Nuclear Magnetic Resonance Laboratory, providing nuclear magnetic resonance services to the department. He is responsible for handling lab administration, maintaining the spectrometers, assisting users with the setup of NMR experiments, and training new users to operate the spectrometers. In addition, he is implementing new NMR experiments and advising and collaborating with members of the department in the solution of chemical and biochemical problems using NMR spectroscopy. Dr. Luo recently assumed responsibility for the Mass Spectrometry Facility.



LYNDA M> McDowell, Assistant Teaching Professor, - Office: S-315, 516-5311, McDowelllm@umsl.edu

B.A. University of Minnesota, Ph.D. Washington University in St. Louis. Postdoctoral Fellowship, Washington University. Faculty appointments in Chemistry and Medicine at Washington University and in Chemistry Saint Louis, Lindenwood and Maryville Universities in St. Louis.

Teaching: Introductory, Analytical and Physical Chemistry.



Research Interests: Biophysical Chemistry. electron transfer in biological systems as well as Rotational Echo Double Resonance NMR Spectroscopy (REDOR) including applications to biological chemistry. Glycosaminoglycans.

MICHAEL R. NICHOLS, Associate Professor – Office S204, 516-7345, nicholsmic@umsl.edu.

B.S., 1993, Lindenwood College; Ph.D., 1999, Purdue University; Postdoctoral Fellow, Associate Consultant/Asst. Professor, 1999-2004, Mayo Clinic Jacksonville

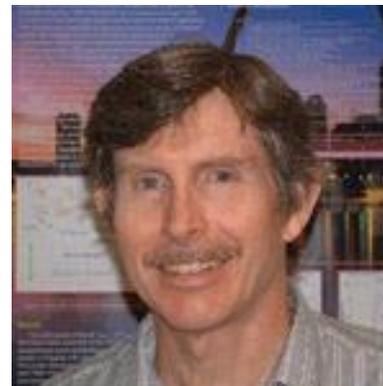
Teaching: Biochemistry and Biochemistry Laboratory, Undergraduate Chemical Research



Research Interests: Biochemistry, Biophysical Chemistry. Mechanisms of protein assembly. Structural characterization of macromolecules. Signaling mechanisms in inflammatory cells.

JAMES J. O'BRIEN, Professor - Office: M105, 516-5717, obrienjja@umsl.edu.

B.Sc. Honors (1st class), 1975, James Cook University of Queensland, Australia; 1981, Australian National University, Canberra, Australia. CSIRO (Australia) Fellowship, 1981-82, University of California-Berkeley; NRC Associateship, 1982-84, National Research Council of Canada, Ottawa, Canada; Postdoctoral Associate, 1985-88, University of Arizona, Tucson.



Teaching: Instrumental Analysis, Laboratory in Instrumental Analysis, Physical Chemistry I & II, and Undergraduate Chemical Research.

Research Interests: Physical Chemistry. Gaseous species important in pyrolytic and plasma assisted chemical vapor deposition processes studied laser spectroscopy; laboratory spectra of species important in planetary atmospheres.

NIGAM P. RATH, Research Professor - Office: M304, 516-5333, nigam_rath@umsl.edu.

B.Sc. (Hons), M.Sc., Berhampur University in India; Ph.D. from Oklahoma State University. Postdoc Fellow and Assistant Faculty Fellow at the University of Notre Dame. He is the department's X-ray Diffraction specialist.

Teaching: General Chemistry, X-Ray Crystallography.

Research Interests: Dr. Rath's research interests are in the field of chemical crystallography and inorganic chemistry. His research involves single crystal x-ray diffraction



structure determination of novel organic and organometallic compounds. Also, he is interested in developing techniques for high-resolution data collection.

CHRISTOPHER D. SPILLING, Professor Vice Provost for Research and Graduate Studies. Office: W341 Woods, 516-5899, cspill@umsl.edu.

B.Sc. (Hons), 1983, Ph.D., 1986, University of Technology, Loughborough. Postdoctoral fellow, 1986, Northwestern University.

Teaching: Structural Organic Chemistry, Techniques of Organic Chemistry, Advanced Organic Chemistry, and Undergraduate Chemical Research.

Research Interests: Organic Chemistry. Organic synthesis; new synthetic methods; chiral phosphonate and phosphoramides in asymmetric synthesis; carbohydrate chemistry and synthesis of natural products.



KEITH J. STINE, Professor and Director of Undergraduate Studies - Office: M204, 516-5346, kstine@umsl.edu.

B.S., 1984, Fairleigh Dickinson University; Ph.D. 1988, Massachusetts Institute of Technology. Postdoctoral Associate, 1988-90, University of California, Los Angeles.

Teaching: Introductory Chemistry, General Chemistry, Physical Chemistry, Laboratory in Physical Chemistry, Surface Chemistry, and Undergraduate Chemical Research.

Research Interests: Physical Chemistry, Biophysical Chemistry, and Nanoscience. Modification of nanostructures and nanoporous materials for biological applications. Study of monolayer modified surfaces using electrochemistry and microscopy (SEM, TEM, AFM, etc). Monolayers at the water-air interface, and other lipid microstructures.



JANET BRADDOCK-WILKING, Associate Professor - Office: M306, 516-6436, wilkingj@umsl.edu.

B.A., 1985, UM-St. Louis; M.A., 1987, Washington University; Ph.D., 1990, Washington University; Postdoctoral Fellow, 1990-91, Harvard University; Postdoctoral Fellow, 1992-93, Mallinckrodt Medical, Inc.

Teaching Interests: Introductory Chemistry II, Inorganic Chemistry I, Inorganic Chemistry II, Inorganic Reactions, Undergraduate Chemical Research



Research Interests: Inorganic and Organometallic Chemistry. Synthesis, properties, and reaction chemistry of complexes containing bonds between transition-metals and heavier group 14 elements (Si, Ge, Sn, Pb). NMR spectroscopy.

CHUNG F. WONG, Associate Professor - Office: M203, 516-5318, wongch@msx.umsl.edu.

B.Sc.(Hons.), 1980, Chinese University of Hong Kong; Ph.D., 1984, University of Chicago; Postdoctoral fellow, 1985-1988, University of Houston.

Teaching: Biochemistry, Physical Chemistry for Life Sciences, Biological and Chemical Informatics, Special Topics in Biochemistry.

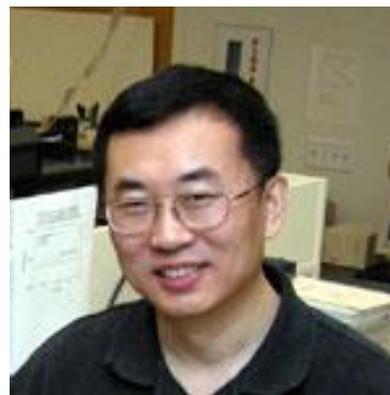


Research Interests: Develop and apply computational methods to study biomolecular structure, dynamics, and function and to aid the design of bioactive molecules. Protein kinases and phosphatases. Computer-aided drug design.

ZHI XU, Associate Professor - Office: M206, 516-5328, zhixu@umsl.edu.

B.S., 1982, Tsinghua University, Beijing; M.S., 1985, Tsinghua University, Beijing; Ph.D., 1991, University of Pittsburgh. Postdoctoral Fellow, 1991-94, University of Illinois.

Teaching: Intermediate Physical Chemistry, Advanced Physical Chemistry, Physical Chemistry Lab, Instrumental Analysis, and Undergraduate Chemical Research.



Research Interests: Physical Chemistry. Surface chemistry, molecular electronics and non-linear laser spectroscopy, development of molecular devices with picosecond optical response.

Departmental Research Facilities

The Department of Chemistry and Biochemistry is a research intensive department with a doctoral program. This presents special opportunities for undergraduate chemistry majors to participate in and receive mentoring from a faculty member's research lab and students and also to make use of state-of-the art facilities within the Department. Some of these facilities are shared by different research groups and include:

Cell Culture Facility: Cell culture is an important tool for understanding basic biological processes and for analysis of compounds that may have therapeutic potential in a variety of human diseases. The facility is utilized by multiple users who maintain and employ numerous mammalian and insect cell lines for research purposes.

X-Ray Diffraction Facility: X-ray crystal structure determination is an important technique for most inorganic and organic chemists. The Laboratory is equipped with state-of-the-art instrumentation and computational facilities for solid state three dimensional crystal and molecular structure determinations. The facility is located in custom-designed laboratory space in the Center for Nanoscience.

Mass Spectrometry Facility: The mass spectrometry facility is housed in a 1000 sq ft laboratory located in the UMSL Research Building. In addition to three mass spectrometers, there are areas for data processing, instrument maintenance, parts storage and sample preparation. The instrumentation is used for support of research and teaching.

Microscopy Instrumentation and Spectroscopy Facility: This facility is housed in the Center for Nanoscience and houses field emission scanning electron microscopy, transmission electron microscopy, atomic force microscopy, confocal fluorescence microscopy, and extensive facilities for sample preparation and image analysis.

High-Field NMR Facility: the facility houses three NMR spectrometers: an Agilent DD2-600, a Bruker Avance 300 and a Varian Unity Plus 300 with an Oxford wide-bore magnet. These spectrometers are used for a variety of basic (^1H , ^{13}C) and advanced studies of molecular structure using two-dimensional techniques and other nuclear probes.

Fellowships and Scholarships

The **Brunngraber Undergraduate Research Fellowship** is given annually to a chemistry major based on GPA, research interests, financial need, and performance in course work.

The **William and Erma Cook Chemistry Fellowship** is given annually to an outstanding full-time chemistry major who is at least a sophomore and has financial need.

Aid to Education Scholarships are given to approximately 10 junior or senior chemistry majors annually. Awardees are selected on the basis of merit.

The **Lawrence Barton Scholarship** is awarded annually to a junior chemistry major, with preference given to first generation college students.

The **Barbara Willis Brown Scholarship for Women in Chemistry** is awarded annually to an outstanding female chemistry major over the age of 25 who will be encouraged to participate in undergraduate research.

The **Charles W. Armbruster Undergraduate Scholarship** is presented every year to a new transfer student majoring in chemistry.

The **Stephen S. Lawrence Scholarship** is awarded to a junior or senior chemistry major with a GPA of at least 2.8, enrolled in a minimum of 9 hours. Recipients will have a record of good departmental citizenship.

The **Hal and Mary Harris Endowed Scholarship in Chemistry** is awarded on the basis of merit to a junior seeking a degree in chemistry and enrolled in a minimum of 12 credit hours.

The **Eugene and Joyce Corey Scholarship** is awarded on the basis of merit to chemistry majors with preference given to students who have made outstanding service contributions to the department.

The **Rath Family scholarship** is awarded to a full-time, undergraduate student who is pursuing a degree in the STEM disciplines.

A series of undergraduate awards are given each year to the outstanding students. The **CRC Introductory Chemistry Award** is given to the outstanding student in Introductory chemistry, the **American Chemical Society Division of Analytical Chemistry Award** is given to the outstanding student in analytical chemistry, the **American Chemical Society Division of Organic Chemistry Award** is given to the outstanding student in organic chemistry, the **American Chemical Society Division of Inorganic Chemistry Award** is given to the outstanding student in inorganic chemistry, the **American Chemical Society - St. Louis Section, Outstanding Junior Chemistry Major Award** is given to the outstanding junior chemistry major, and the outstanding senior receives the **Alan F. Berndt Award**.

Career Outlook

The B.S. degree in chemistry is the usual foundation for graduate study in chemistry, while any bachelor's degree in chemistry provides students with professional competence to enter the chemical industry. The St. Louis Metropolitan Area is a major center for industrial chemistry, and the demand for graduates consistently exceeds the supply.

A major in chemistry provides students excellent preprofessional training in the health sciences. A double major in chemistry and biology is often chosen by premedical and pre dental students, and by those interested in graduate work in biochemistry or biology. A minor in chemistry provides the minimum qualifications and training for a position as laboratory technician in industry, hospital laboratories, etc.

For further information, contact:

**Department of Chemistry and Biochemistry
University of Missouri – St. Louis
One University Boulevard
St. Louis, MO 63121
Phone: (314) 516-5311
Fax: (314) 516-5342**

<http://www.umsl.edu/chemistry/>

Email inquiries to:

**Keith J. Stine
kstine@umsl.edu, Director of Undergraduate Studies**

or

**Cynthia M. Dupureur
cdup@umsl.edu, Chair of Department**

or

**Pre-medical Advisor: Professor James J. O'Brien
(314) 516-5717, email: obrienjja@umsl.edu**