

# Chemistry, Biochemistry and Physics

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## School

School of Science, Engineering and Technology (<http://www.stmarytx.edu/set/>)

## School Interim Dean

Thomas "Ted" Macrini, Ph.D. ([tbeam@stmarytx.edu](mailto:tbeam@stmarytx.edu))

## Department

Chemistry and Biochemistry (<https://www.stmarytx.edu/academics/department/chemistry/>)

## Department Chair

Susan Oxley, Ph.D. ([soxley@stmarytx.edu](mailto:soxley@stmarytx.edu))

The Chemistry and Biochemistry majors at St. Mary's University provide excellent preparation for graduate school, professional school, or entering a career in industry. The degree programs offered include:

- B.A. in Chemistry
- B.S. in Chemistry
- B.A. in Chemistry with Secondary Teaching Certification
- B.S. in Biochemistry

Our programs place a strong emphasis on critical problem solving. Students learn to work as part of a laboratory team yet also develop the ability to work independently. The Chemistry and Biochemistry programs promote versatility and prepare students for a wide range of options after graduation. The programs stress not only the fundamentals of chemistry, but the development of the intellectual skills necessary to apply them. The department offers small class sizes, close interaction with the faculty and a variety of tutoring options.

## Majors in Chemistry and Biochemistry

- B.A. in Chemistry (<https://catalog.stmarytx.edu/undergraduate/majors-programs/science-engineering-technology/chemistry-biochemistry/chemistry-ba/>)
- B.A. in Chemistry with Secondary Teaching Certification (<https://catalog.stmarytx.edu/undergraduate/majors-programs/science-engineering-technology/chemistry-biochemistry/chemistry-ba-teacher-certification/>)
- B.S. in Chemistry (<https://catalog.stmarytx.edu/undergraduate/majors-programs/science-engineering-technology/chemistry-biochemistry/chemistry-bs/>)
- B.S. in Biochemistry (<https://catalog.stmarytx.edu/undergraduate/majors-programs/science-engineering-technology/chemistry-biochemistry/biochemistry-bs/>)

## Minor in Chemistry

- Chemistry (<https://catalog.stmarytx.edu/undergraduate/majors-programs/science-engineering-technology/chemistry-biochemistry/chemistry-minor/>)

**All courses serving as prerequisites in the School of Science, Engineering and Technology must be completed with a "C" or better in order to advance to the next sequenced course**

### CH 1100. Chemistry Seminar I. 1 Semester Hour.

This seminar is an introduction to the college chemistry experience and successful learning in chemistry. The students will familiarize themselves with Chemistry and Biochemistry department resources, classes and faculty. The integrating theme of the course is the science of learning as applied to chemistry. Content of the course includes strategic use of academic resources. The course involves practicing new skills through participating in chemistry outreach events and personal reflection. Presentations by faculty, and invited speakers from industry and academia on careers in Chemistry/Biochemistry, as well as research/internship/job opportunities. (Spring only).

### CH 1101. General Chemistry I Lab. 1 Semester Hour.

### CH 1303. Preparatory Chemistry. 3 Semester Hours.

This course is designed for students with inadequate background for CH1401. Manipulative skills and basic concepts requiring problem solving will be stressed. Not accepted in lieu of CH1401, CH1402. This course satisfies the general education requirement.

### CH 1304. Chemistry Concepts & Applications. 3 Semester Hours.

This course is designed for the non-science major as part of one's general education. Basic chemistry concepts will be developed as well as some of its applications to everyday life. Topics will vary.

**CH 1305. Chemistry for Health Professions. 3 Semester Hours.**

Introduction to elementary inorganic chemistry, organic chemistry and biochemistry. Topics include atomic structure, chemical bonding, stoichiometry, solutions, acids and bases, structures of organic compounds, and the chemistry of lipids, carbohydrates, nucleic acids, and proteins. This course is suitable for non-science majors and students pursuing degrees in allied health and nursing. (Lecture 2 hours; Lab 2 hours).

**CH 1401. General Chemistry I. 4 Semester Hours.**

Fundamentals of chemistry for scientists and engineers; the first semester is an introduction to chemical reactivity, aqueous solution chemistry, stoichiometry, thermochemistry, molecular structure, and bonding. Prerequisite: eligibility for MT1411. (Fall; Spring; Summer) (Lecture 3 hours, laboratory 4 hours) Additional fee associated with this course. See fee schedule for details at <https://www.stmarytx.edu/admission/financial-aid/tuition/>.

**CH 1402. General Chemistry II. 4 Semester Hours.**

Fundamentals of chemistry for scientists and engineers; the second semester of general chemistry is an introduction to chemical kinetics, chemical equilibrium, aqueous acids and bases, chemical thermodynamics, and electrochemistry. Prerequisite: CH 1401. (All courses serving as prerequisites in the School of Science, Engineering and Technology must be completed with a "C" or better in order to advance to the next sequenced course.) (Fall; Spring; Summer) (Lecture 3 hours, laboratory 4 hours). Additional fee associated with this course. See fee schedule for details at <https://www.stmarytx.edu/admission/financial-aid/tuition/>.

**CH 1404. Intro to Organic & Biochemistry. 4 Semester Hours.**

This course is designed to provide a general overview of these two specific areas of chemistry for non- majors. It will provide the general basics of organic chemistry including basic carbon chemistry, nomenclature, structures of organic compounds, chemical characteristics and function, reactions, and mechanisms. This will provide the background necessary to study the concepts of organic chemistry that apply to the structure and function of biological macro molecules. Topics in this course will cover the main biological macro molecules of proteins, nucleic acids, carbohydrates, and lipids, and their role in cellular metabolism, states of disease, and drug applications. Upon completion of this course, students should be able to demonstrate an understanding of fundamental chemical concepts needed to pursue studies in related professional fields. Prerequisite: CH 1401. (All courses serving as prerequisites in the School of Science, Engineering and Technology must be completed with a "C" or better in order to advance to the next sequenced course.) (Lecture 3 hours; Lab 4 hours.).

**CH 2411. Organic Chemistry I. 4 Semester Hours.**

The study of the compounds of carbon. The major functional groups are examined on their basis of the physical and chemical properties. Fundamental theories of bonding, structures, mechanisms, synthesis, and spectroscopy are topics covered in the organic chemistry curriculum. (Fall only) Prerequisite: CH1402 (All courses serving as prerequisites in the School of Science, Engineering and Technology must be completed with a "C" or better in order to advance to the next sequenced course.) (Lecture 3 hours; Lab 4 hours.).

**CH 2412. Organic Chemistry II. 4 Semester Hours.**

The study of the compounds of carbon. The major functional groups are examined on their basis of the physical and chemical properties. Fundamental theories of bonding, structures, mechanisms, synthesis, and spectroscopy are topics covered in the organic chemistry curriculum. (Spring only) Prerequisite: CH2411 (All courses serving as prerequisites in the School of Science, Engineering and Technology must be completed with a "C" or better in order to advance to the next sequenced course.)(Lecture 3 hours; Lab 4 hours.).

**CH 3100. Chemistry Seminar II. 1 Semester Hour.**

This seminar is an introduction to topics in current chemical research and career planning/reparation. Students will participate in a semester-long research project connecting the frontiers of chemistry research with career planning. Students will develop professional skills by attending presentations by faculty and invited speakers from industry and academia on careers in Chemistry/Biochemistry, as well as research/internship/job opportunities. (Spring only).

**CH 3411. Organic Chemistry I. 4 Semester Hours.**

The study of the compounds of carbon. The major functional groups are examined on their basis of the physical and chemical properties. Fundamental theories of bonding, structures, mechanisms, synthesis, and spectroscopy are topics covered in the organic chemistry curriculum. (Fall only) Prerequisite: CH1402 (All courses serving as prerequisites in the School of Science, Engineering and Technology must be completed with a "C" or better in order to advance to the next sequenced course.) (Lecture 3 hours; Lab 4 hours.).

**CH 3412. Organic Chemistry II. 4 Semester Hours.**

The study of the compounds of carbon. The major functional groups are examined on their basis of the physical and chemical properties. Fundamental theories of bonding, structures, mechanisms, synthesis, and spectroscopy are topics covered in the organic chemistry curriculum. (Spring only) Prerequisite: CH3411 (All courses serving as prerequisites in the School of Science, Engineering and Technology must be completed with a "C" or better in order to advance to the next sequenced course.)(Lecture 3 hours; Lab 4 hours.).

**CH 3423. Analytical Chemistry. 4 Semester Hours.**

The objective of this course is to explore the theory and methods associated with quantitative chemical analysis. The focus will be on problem solving in the context of analyzing the components in a chemical system. In the laboratory, students will learn proper laboratory technique, experimental design, and basic scientific writing. Prerequisites: CH1402 (All courses serving as prerequisites in the School of Science, Engineering and Technology must be completed with a "C" or better in order to advance to the next sequenced course.) (Fall; Spring) (Lecture 3 hours; Lab 4 hours).

**CH 3424. Instrumental Analysis. 4 Semester Hours.**

The objective of this course is to learn the theory and methods associated with instrumental chemical analysis. The focus will be on instrument design, experimental design, and data analysis. In the laboratory, students will learn proper use of instruments, experimental methods, and basic scientific writing. (Spring only) Prerequisite: CH2411 and CH3423 (All courses serving as prerequisites in the School of Science, Engineering and Technology must be completed with a "C" or better in order to advance to the next sequenced course.) (Lecture 3 hours; Lab 4 hours).

**CH 3433. Physical Chemistry I. 4 Semester Hours.**

This is an introduction for chemistry and biochemistry students to chemical thermodynamics, classical statistical mechanics, chemical kinetics, and transport properties with a writing intensive laboratory. (Fall only) Prerequisites: CH1402, MT2413, PY1402 or PY2404. (All courses serving as prerequisites in the School of Science, Engineering and Technology must be completed with a "C" or better in order to advance to the next sequenced course.) (Lecture 3 hours; Lab 4 hours).

**CH 3434. Physical Chemistry II. 4 Semester Hours.**

An introduction to quantum mechanics applied to chemistry. This includes the quantization of motion, atomic structure and spectroscopy, molecular electronic structure, molecular rotational, vibrational and electronic spectroscopy, quantum computational chemistry and magnetic resonance. The laboratory is writing intensive. (Spring only) Prerequisites: CH1402, MT2413, PY1402 or PY2404. (All courses serving as prerequisites in the School of Science, Engineering and Technology must be completed with a "C" or better in order to advance to the next sequenced course.) (Lecture 3 hours; Lab 4 hours).

**CH 3440. Inorganic Chemistry. 4 Semester Hours.**

Introduction to the fundamentals of atomic/molecular structure and bonding, molecular symmetry, solid state chemistry, acid-base theories, redox chemistry, periodicity, coordination compounds, ligand field theory, molecular magnetism and electronic spectra in transition metal complexes, main group and descriptive chemistry. Includes the synthesis and characterization of inorganic compounds and the use of specialized laboratory techniques. Prerequisite: CH 1402 (3 hr lecture and 4 hr lab) (Fall only).

**CH 3450. Forensic Chemistry. 4 Semester Hours.**

This course will cover the major techniques and instruments used in the analysis of non-biological trace chemical evidence and pattern evidence commonly encountered at crime scenes. The techniques covered will include gas and liquid chromatography, UV-visible spectroscopy, infrared spectroscopy, and others. Impressions and physical matches will also be covered. The laboratory will focus on the hands-on use of these techniques on samples of forensic interest. Prerequisites: CH 3411, CH 3412 and FS 3301 OR permission of instructor (Fall even years).

**CH 4100. Seminar in Chemistry. 1 Semester Hour.**

Presentation and discussion of current research in the field of chemistry. (May be repeated for a maximum of 2 semester hours.) Prerequisite: Permission of Instructor.

**CH 4125. Chemical Research. 1 Semester Hour.**

Practical literature and laboratory experience with an original problem in chemical research. (May be repeated for a maximum of 4 semester hours.) Prerequisite: Permission of the Instructor.

**CH 4150. Spec. Topics Chemistry/Biochem. 1 Semester Hour.**

This advanced course introduces a field of chemistry that is of current interest in the chemistry community of today. Examples of possible topics are material sciences, polymer chemistry, chemical separations, and chemical spectroscopy. This course may be repeated only if the current topic is different from any previous enrollment of that student. Prerequisite: Permission of Instructor.

**CH 4225. Chemical Research. 2 Semester Hours.**

Practical literature and laboratory experience with an original problem in chemical research. (May be repeated for a maximum of 4 semester hours.) Prerequisite: Permission of the Instructor.

**CH 4250. Spec. Topics Chemistry/Biochem. 2 Semester Hours.**

This advanced course introduces a field of chemistry that is of current interest in the chemistry community of today. Examples of possible topics are material sciences, polymer chemistry, chemical separations, and chemical spectroscopy. This course may be repeated only if the current topic is different from any previous enrollment of that student. Prerequisite: Permission of Instructor.

**CH 4310. Advanced Organic Chemistry. 3 Semester Hours.**

This course presents advanced theory and current topics in organic chemistry which build on and expand on those covered in Organic Chemistry I and II, including stereochemistry, molecular orbital theory, reaction mechanisms, and synthesis. Emphasis is on theoretical and empirical generalizations including organic reaction mechanisms and modern methods of organic synthesis. (Fall even years) Prerequisite: CH2412 (All courses serving as prerequisites in the School of Science, Engineering and Technology must be completed with a "C" or better in order to advance to the next sequenced course.) (3 hr lecture).

**CH 4325. Chemical Research. 3 Semester Hours.**

Practical literature and laboratory experience with an original problem in chemical research. (May be repeated for a maximum of 4 semester hours.) Prerequisite: Permission of the Instructor.

**CH 4330. Chemical Thermodynamics. 3 Semester Hours.**

An introduction to statistical thermodynamics and its application to chemistry and biochemistry. The course may conclude with non-equilibrium thermodynamics. Prerequisites: CH3433 and CH3434. (All courses serving as prerequisites in the School of Science, Engineering and Technology must be completed with a "C" or better in order to advance to the next sequenced course.).

**CH 4340. Advanced Inorganic Chemistry. 3 Semester Hours.**

This course will extend general principles of inorganic chemistry with an in-depth view across the periodic table. Particular emphasis is placed on the descriptive main group, transition metal and f-block chemistry, catalysis, organometallic and solid state chemistry. The chemical behavior together with the structural, magnetic and electronic properties of these families of materials will be discussed in detail. (Spring even years) Prerequisite: CH 3443 (Lecture 3 hrs).

**CH 4350. Spec. Topics Chemistry/Biochem. 3 Semester Hours.**

This advanced course introduces a field of chemistry that is of current interest in the chemistry community of today. Examples of possible topics are material sciences, polymer chemistry, chemical separations, and chemical spectroscopy. This course may be repeated only if the current topic is different from any previous enrollment of that student. Prerequisite: Permission of Instructor.

**CH 4353. Biochem of Specialized Tissues. 3 Semester Hours.**

Biomolecular aspects of the structure and controlled functioning of specialized systems in prokaryotes and eukaryotes, highlighted by studies of the sensory and immune systems, muscle contraction/mobility and membrane transport phenomena. Prerequisites: CH/BL4451 or concurrent registration. (All courses serving as prerequisites in the School of Science, Engineering and Technology must be completed with a "C" or better in order to advance to the next sequenced course.).

**CH 4354. Biochemistry of the Hormones. 3 Semester Hours.**

The biochemical basis of normal versus abnormal functioning of the hormonal control mechanisms in mammalian systems; this will include a detailed discussion of molecular mechanisms for hormonal control of the path ways of intermediary metabolism and of the absence/aberration of such regulatory processes evidenced in metabolic disease. Prerequisites: CH/BL4452 or concurrent registration. (All courses serving as prerequisites in the School of Science, Engineering and Technology must be completed with a "C" or better in order to advance to the next sequenced course.).

**CH 4355. Immunochemistry. 3 Semester Hours.**

The molecular basis of the normal operation of the vertebrate immune system and studies of aberrations of immune mechanisms in disease processes. The latter is exemplified by the biomolecular aspects of infectious diseases (caused by pathogenic microorganisms) autoimmune disorders, tissue damage, and cancer. Prerequisites: CH/BL 4451 or concurrent registration. (All courses serving as prerequisites in the School of Science, Engineering and Technology must be completed with a "C" or better in order to advance to the next sequenced course.).

**CH 4356. Enzyme Chemistry. 3 Semester Hours.**

The molecular architecture of enzymes and the dynamics of enzyme mediated catalysis. Topics include a classification of enzyme systems, enzyme kinetics, mechanisms of enzyme action and the regulation of the activity of enzymes. Prerequisites: CH/BL 4451. (All courses serving as prerequisites in the School of Science, Engineering and Technology must be completed with a "C" or better in order to advance to the next sequenced course.).

**CH 4400. Field Based Environmental Chemistry. 4 Semester Hours.**

Environmental Chemistry is a project-based course during which students apply environmental science and chemistry concepts to the analysis of a natural environment. The course is focused on the analysis of soil and water chemistry at a field site in San Antonio. Students will design and implement sampling plans based on best practices. Field measurements will be performed on site. Samples will be analyzed in the laboratory using major chemical instrumentation. An emphasis will be placed on quality control and assurance in the design of the laboratory analysis. Students will prepare the results of their analysis in written and oral forms. (Spring odd years) Prerequisites: CH1402. (All courses serving as prerequisites in the School of Science, Engineering and Technology must be completed with a "C" or better in order to advance to the next sequenced course.) (Lecture 3 hours, Lab 4 hours).

**CH 4451. Biochemistry I. 4 Semester Hours.**

Study of the processes of life at the molecular level. The physiochemical properties of the biologically important molecules and macromolecules is presented with the goal of understanding their structure vs. biological activity relationships. Major topics include the study of enzymes, metabolism, bioenergetics, and regulation of biochemical processes, membranes and molecular genetics. (Fall only) Prerequisites: CH 3411, CH 3412 (All courses serving as prerequisites in the School of Science, Engineering and Technology must be completed with a "C" or better in order to advance to the next sequenced course.) (Lecture 3 hours; Lab 4 hours).

**CH 4452. Biochemistry II. 4 Semester Hours.**

Study of the processes of life at the molecular level. The physiochemical properties of the biologically important molecules and macromolecules is presented with the goal of understanding their structure vs. biological activity relationships. Major topics include the study of enzymes, metabolism, bioenergetics, and regulation of biochemical processes, membranes and molecular genetics. (Spring only) Prerequisites: CH 4451 (All courses serving as prerequisites in the School of Science, Engineering and Technology must be completed with a "C" or better in order to advance to the next sequenced course.) (Lecture 3 hours; Lab 4 hours).