DEPARTMENT OF CHEMISTRY AND BIOCHEMISTRY

Web Site: http://www.twu.edu/chemistry-biochemistry

Chair: *Richard D. Sheardy, Professor*
Location: *ASSC 323*
Phone: *940-898-2550*
Fax: *940-898-2548*
E-mail: *chembiochem@twu.edu*

Undergraduate Degrees Offered

- B.S. in Biochemistry with American Chemical Society Certification (http://catalog.twu.edu/undergraduate/arts-sciences/chemistry-biochemistry/biochemistry-acs)
- B.S. in Biochemistry (for Pre-Health Majors) (http://catalog.twu.edu/undergraduate/arts-sciences/chemistry-biochemistry/biochemistry-bs)
- B.S. in Chemistry (http://catalog.twu.edu/undergraduate/arts-sciences/chemistry-biochemistry/chemistry-bs)
- B.S. in Chemistry (Environmental Chemistry) (http://catalog.twu.edu/undergraduate/arts-sciences/chemistry-biochemistry/chemistry-bs-environmental)
- B.S. in Chemistry with American Chemical Society Certification (http://catalog.twu.edu/undergraduate/arts-sciences/chemistry-biochemistry/chemistry-bs-american-chemical-society-certification)
- B.S. in Chemistry/Biochemistry with 7-12 Science Teacher Certification (http://catalog.twu.edu/undergraduate/arts-sciences/chemistry-biochemistry/chemistry-bs-7-12-science-teacher)
- B.S. in Chemistry/Biochemistry with 6-12 Physical Science Teacher Certification (http://catalog.twu.edu/undergraduate/arts-sciences/chemistry-biochemistry/chemistry-bs-6-12-physical-science-teacher)

The Department of Chemistry and Biochemistry (http://www.twu.edu/chemistry-biochemistry) offers programs leading to the B.S. in Biochemistry and in Chemistry, both with or without certification by the American Chemical Society (ACS), and to the M.S. in Chemistry. The ACS certified degrees are recommended to those students interested in pursuing advanced degrees in chemistry or biochemistry. The B.S. in Biochemistry is recommended for those students interested in pursuing careers in the health related professions. Academic minors are offered in chemistry and in general science. Teacher certification to teach general science and physical science in secondary schools is also offered.

The objectives of the undergraduate chemistry program are to lead the student to

1. achieve an understanding of the chemical and physical behavior of material substances and of the energy changes accompanying this behavior and
2. to prepare students for advanced degrees, teaching, or professional careers in the sciences. The programs offered prepare the students for graduate studies in chemistry or biochemistry, admission to medical, dental, or pharmacy school, or a career as a professional chemist or teacher.

Graduates are employed as chemists, scientists, and managers in research, development, and production positions in a variety of settings and fields including: pharmaceuticals, cosmetics, food products, forensics, agricultural chemicals, medical research, and environmental law enforcement. Others go on to earn masters and doctoral degrees. Pre-professional graduates have successfully earned medical/dental/pharmacy degrees from medical/dental/pharmacy schools in and outside of Texas.

Students who have taken advanced chemistry courses in high school may earn advanced placement credit for CHEM 1113. Advanced placement may be earned by a satisfactory score on the Advanced Placement Examination in Chemistry or on a departmentally-administered examination.

For more information about the Department, please visit the Department's home page www.twu.edu/chemistry-biochemistry.

Course Load

Recommended course loads for both chemistry and biochemistry majors are 14-18 semester credit hours per semester, but students are ultimately responsible for developing individual course load plans with their academic advisors. When determining course loads, students should be prepared to spend a minimum of two hours outside of class for each lecture period and at least one-half hour outside of class for laboratories in order to be successful in these courses.

Special Requirements for Majors

Only courses in which a grade of C or better is earned may be counted toward a departmental major. In addition, to register for any course required for the major, a grade of C or better in any of its prerequisites is required. Finally, any course required for the degree cannot be taken more than two times in order to achieve a passing grade (C or better). All students pursuing the ACS certified degree must also register for CHEM 4983 (Undergraduate Research) and CHEM 4991 (Senior Thesis). A paper describing the research project must be written and approved by the ACS for certification.

Graduate Courses

Please refer to the Graduate Catalog (http://catalog.twu.edu/graduate) for information regarding graduate courses.

Minors

Chemistry Minor

A minor in Chemistry requires a minimum of 19 semester credit hours, six of which must be advanced (3000 or 4000 level). In addition to the courses listed below, an additional 3 credit hours must be taken from the following list: CHEM 3313, CHEM 3333/3331, CHEM 3411 with CHEM 3413, or CHEM 3632 with CHEM 3633.

Code	Title	SCHs
Required Courses		
CHEM 1111	General Chemistry Laboratory I	1
CHEM 1113	General Chemistry I	3
CHEM 1121	General Chemistry Laboratory II	1
CHEM 1123	General Chemistry II	3
CHEM 2211	Organic Chemistry Laboratory I	1
CHEM 2213	Organic Chemistry I	3
CHEM 3221	Organic Chemistry Laboratory II	1
CHEM 3223	Organic Chemistry II	3

General Science Minor

The minor in General Science requires 18 hours, six of which must be advanced. These must be divided among three of the following: biology, chemistry, physics and science courses. If the major is biology or chemistry, the hours must be divided between two of the remaining three.

Certificates

Undergraduate Certificate Program in Science, Society and Sustainability

Undergraduate certificate programs are intended to provide additional opportunities to benefit TWU students. Certificate programs are distinct from regular degree programs. Each program is an integrated group of courses that meet a clearly defined need, such as:

1. meeting specific work force needs with skills and knowledge,
2. providing continuing education or accreditation for a particular profession, or
3. providing basic competency in an emerging area of interdisciplinary study.

Program Description

Sustainability can be defined as using resources to meet the needs of today without jeopardizing future generations from being able to do the same. However, different disciplines have different perceptions with regard to sustainable practices. The goal of the Certificate in Science, Society and Sustainability is to integrate the principles and values of sustainable practices into all aspects of education and learning in order to enable our students to address the social, economic, cultural and environmental problems facing the new millennium.

Program Requirements

The certificate requires 15 credits of upper division courses (i.e., 3000 and 4000 level) in an organized and integrated course of study. Students will be responsible for any prerequisites for courses required for the certificate. A capstone course requiring a civic engagement component addressing a local sustainability issues is also required.

Coursework

The first course serves as a foundation for the certificate. All students pursuing the certificate will be required to take this course. *Community Conversations in Sustainability (SCI 3013)* is a multidisciplinary, team taught course discussing all aspects of sustainability from scientific, sociological and economic points of view. Topics include the impacts of energy production, food production, industry and our modern life style on our local and global community with an emphasis on systems and possible solutions. The course is formatted as a three credit seminar.

The building block courses will examine sustainability within specific disciplines in the College of Arts and Sciences. Students would be required to take at least one 3000 or 4000 level course (3 credits each) in the three areas of focus (Natural Sciences and Mathematics; Arts, Humanities and Social Sciences; Government and Business) from a list provided by appropriate departments. This would total a minimum of 9 credits.

The synthesis course is a capstone course where students take everything they have learned and put it all together within a civic engagement project. All students pursuing the certificate will also be required to take this course. *Building Sustainable Communities (SCI 4923)* is a three credit seminar course which requires completion of a civic engagement project with a public presentation of sustainable solutions for a selected complex civic issue.

Benefits to Students

Upon completion of the certificate, students will be able to understand the nature of sustainability from different disciplinary points of view enabling them to make smart decisions about their careers and lifestyles. More importantly, it will give them critical thinking and communication skills that will benefit them in their chosen careers.

Admissions

Please see Admission (http://catalog.twu.edu/undergraduate/admission-information) section of this catalog. The same standards for admission to the University apply to the Department of Chemistry and Biochemistry.

Courses

Chemistry Courses

CHEM 1001. Horizons of Chemistry and Biochemistry I: Career Possibilities. Explores career possibilities in biochemistry and chemistry. Weekly classes, enhanced by speakers and field experiences, will illustrate the many applications of these fields to contemporary issues and career paths. May not be used to satisfy any core science requirement. One lecture hour a week. Credit: One hour.

CHEM 1011. Introductory Chemistry Laboratory. (TCCN CHEM 1106) Laboratory to be taken concurrently with CHEM 1013. Co-requisite: CHEM 1013. Three laboratory hours a week. Credit: One hour.

CHEM 1013. Introductory Chemistry. (TCCN CHEM 1305) General principles and laws of chemistry; structure of matter and periodicity of the elements; special areas such as equilibrium, colloids, nuclear chemistry, and solutions. Prerequisite: Adequate score on placement examination or grade of C or higher for SCI 1003. Co-requisite: CHEM 1011. Three lecture hours a week. Credit: Three hours.

CHEM 1021. Introduction to Organic and Physiological Chemistry Laboratory. (TCCN CHEM 1107) Laboratory to be taken concurrently with CHEM 1023. Co-requisite: CHEM 1023. Three laboratory hours a week. Credit: One hour.

CHEM 1023. Introduction to Organic and Physiological Chemistry. (TCCN CHEM 1307) Nomenclature and reactions of aliphatic and aromatic compounds; introduction to the chemistry of carbohydrates, fats, proteins, and nucleic acids and their metabolism. Prerequisite: One year of high school chemistry and a passing score on placement examination or grade of C or higher for CHEM 1013. Co-requisite: CHEM 1021. Three lecture hours a week. Credit: Three hours.

CHEM 1101. Horizons of Chemistry and Biochemistry II: Current Applications. Explores how chemistry and biochemistry impact contemporary life through new developments such as gene therapy, designer steroids, new drug therapies, and dietary supplements. Examines current events to further develop interests in and perspectives on chemistry and biochemistry. May not be used to satisfy any core science requirement. One lecture hour a week. Credit: One hour.

CHEM 1111. General Chemistry Laboratory I. (TCCN CHEM 1111) Laboratory to be taken concurrently with General Chemistry I. Co-requisite: CHEM 1113. Three laboratory hours a week. Credit: One hour.

CHEM 1113. General Chemistry I. (TCCN CHEM 1311) Introduction to the principles of chemistry, primarily for biology and allied health majors: classification of matter, elements and compounds; stoichiometry; acids and bases; gases; thermochemistry; periodic law; atomic and molecular structure. Prerequisites: One year of high school chemistry and a passing score on placement examination, or a minimum grade of C in CHEM 1013. Co-requisite: CHEM 1111. Three lecture hours a week. Credit: Three hours.

CHEM 1121. General Chemistry Laboratory II. (TCCN CHEM 1112) Laboratory to be taken concurrently with General Chemistry II. Prerequisite: CHEM 1111. Co-requisite: CHEM 1123. Three laboratory hours a week. Credit: One hour.

CHEM 1123. General Chemistry II. (TCCN CHEM 1312) A continuation of the introduction to the principles of chemistry, primarily for biology and allied health majors: Solids,liquids, and solutions; oxidation-reduction;reaction rates; equilibrium; thermodynamics;electrochemistry; chemistry of the common elements; and nuclear chemistry. Prerequisite: A minimum grade of C in CHEM 1113. Co-requisite: CHEM 1121. Three lecture hours a week. Credit: Three hours.

CHEM 1211. Principles of Chemistry Laboratory I. Laboratory taken concurrently with Principles of Chemistry I. Co-requisite: CHEM 1213. Three laboratory hours a week. Credit: One hour.

CHEM 1213. Principles of Chemistry I. Development of the principles of chemistry, primarily for chemistry and biochemistry majors, from an atoms first approach: atoms and compounds, atomic and molecular structure, stoichiometry, chemical reactions, thermochemistry, states of matter. Prerequisites: One year of high school chemistry and a passing score on placement examination, or a minimum grade of C in CHEM 1013; must be a chemistry or biochemistry major or permission of the instructor. Co-requisite: CHEM 1211. Three lecture hours a week. Credit: Three hours.

CHEM 1221. Principles of Chemistry Laboratory II. Laboratory taken concurrently with Principles of Chemistry II. Prerequisite: CHEM 1211. Co-requisite: CHEM 1223. Three laboratory hours a week. Credit: One hour.

CHEM 1223. Principles of Chemistry II. A continuation of the development of the principles of chemistry, primarily for chemistry and biochemistry majors, from an atoms first approach: solutions, equilibrium, thermodynamics, kinetics, and main group chemistry. Prerequisites: Minimum grade of C in CHEM 1213 or permission of instructor. Co-requisite: CHEM 1221. Three lecture hours a week. Credit: Three hours.

CHEM 2211. Organic Chemistry Laboratory I. (TCCN CHEM 2123) Introduction to the techniques of separation, isolation and purification of covalent compounds. Co-requisite: CHEM 2213. Three laboratory hours a week. Credit: One hour.

CHEM 2213. Organic Chemistry I. (TCCN CHEM 2323) Theories of covalent molecular structure; hydrocarbons and derived halides; aromaticity; mechanisms of free radical, nucleophilic, and electrophilic substitutions; and of additions and eliminations. Prerequisite: CHEM 1123 and CHEM 1121, or CHEM 1223 and CHEM 1221, with a grade of C or higher. Co-requisite: CHEM 2211. Three lecture hours a week. Credit: Three hours.

CHEM 3221. Organic Chemistry Laboratory II. Introduction to the practice of organic synthesis and to classical methods of compound identification. Prerequisites: CHEM 2211 and 2213 with a grade of C or higher. Co-requisite: CHEM 3223. Three laboratory hours a week. Credit: One hour.

CHEM 3223. Organic Chemistry II. Continuation of CHEM 2213. Organic compounds of oxygen, nitrogen, and sulfur; alcohols and ethers; organic acids and bases; carbonyl compounds; compounds of biological origin. Prerequisite: CHEM 2213 with a grade of C or higher. Co-requisite: CHEM 3221. Three lecture hours a week. Credit: Three hours.

CHEM 3313. Physical Chemistry for the Life Sciences. Equilibrium thermodynamics, kinetics, and spectroscopy with an emphasis on applications to biochemical systems. Prerequisite: CHEM 1123 with a grade of C or higher. Three lecture hours a week. Credit: Three hours.

CHEM 3331. Quantitative Chemical Analysis Laboratory. Application of various methods and techniques used in analytical chemistry, statistical treatment of data, gravimetric and titrimetric methods, spectrophotometric and chromatographic techniques. Prerequisite: CHEM 1123 or CHEM 1223. Co-requisite: CHEM 3333. Four laboratory hours a week. Credit: One hour.

CHEM 3333. Quantitative Chemical Analysis. Theoretical principles of various methods involved in quantitative determinations, statistical treatment of data, gravimetric and titrimetric methods, spectrophotometric and chromatographic techniques. Prerequisite: CHEM 1123 or CHEM 1223 with a grade of C or higher. Co-requisite: CHEM 3331. Three lecture hours a week. Credit: Three hours.

CHEM 3411. Physical Chemistry Laboratory I. Introduction to experimental measurement of physical properties and change, record keeping, data analysis, and report writing. Co-requisite: CHEM 3413. Three laboratory hours a week. Credit: One hour.

CHEM 3413. Physical Chemistry I. Introductory theories of physical chemistry covering states of matter, equilibrium thermodynamics, and kinetic processes. Prerequisites: MATH 2023, PHYS 2163, CHEM 3223, and CHEM 3334. Three lecture hours a week. Credit: Three hours.

CHEM 3421. Physical Chemistry Laboratory II. Continuation of CHEM 3411. Emphasis on spectroscopic measurement. Prerequisite: CHEM 3411. Co-requisite: CHEM 3423. Three laboratory hours a week. Credit: One hour.

CHEM 3423. Physical Chemistry II. Continuation of CHEM 3413. Introductory quantum theory, atomic and molecular structure, spectroscopy, and statistical thermodynamics. Prerequisite: CHEM 3413. Co-requisite: CHEM 3421. Three lecture hours a week. Credit: Three hours.

CHEM 3632. Biochemistry I Laboratory. Biochemical techniques: analysis, purification and characterization of amino acids, proteins, and nucleic acids, including enzyme assays and kinetics. Lab skills include record keeping, computer utilization, safety, chromatography, electrophoresis, and spectroscopy. Prerequisite: CHEM 3223 with a grade of C or higher. Co-requisite: CHEM 3633. Five laboratory hours a week. Credit: Two hours.

CHEM 3633. Biochemistry I. Fundamental structure and chemistry of biomolecules (proteins, nucleic acids, carbohydrates, and lipids) and their biologically relevant interactions. Prerequisite: CHEM 3223 with a grade of C or higher. Co-requisite: CHEM 3632. Three lecture hours a week. Credit: Three hours.

CHEM 3643. Biochemistry II. Biochemistry of metabolic pathways (mammalian) using normal and disease states as examples. Metabolism of carbohydrates, amino acids, lipids, and nucleic acids, energy metabolism, and their integration. Prerequisite: CHEM 3633 with a grade of C or higher. Three lecture hours a week. Credit: Three hours.

CHEM 3711. Environmental Chemistry Laboratory I. Environmental chemistry lab with focus on water chemistry: the analysis of natural waters, ground water and man-made water, wastewater treatment, acid-base equilibrium, precipitation and dissolution, oxidation-reductions, complexation applied to water chemistry, analytical methods used in environmental analysis. Co-requisite: CHEM 3713. Three laboratory hours a week. Credit: One hour.

CHEM 3713. Environmental Chemistry I. Exploration of environmental chemistry with focus on water chemistry: the chemistry of natural surface waters, ground waters and man-made water; wastewater treatment; acid-base equilibrium; precipitation and dissolution, oxidation-reductions, complexation applied to water chemistry; analytical methods used in environmental analysis. Prerequisites: CHEM 3221 and CHEM 3223. Co-requisite: CHEM 3711. Three lecture hours a week. Credit: Three hours.

CHEM 4001. Research Presentations in Chemistry and Biochemistry. To prepare chemistry and biochemistry students for presentations of research results at scientific meetings. Prerequisite: Senior standing or permission of the Chair. One seminar hour a week. Credit: One hour.

CHEM 4311. Instrumental Analysis Laboratory. Major concepts of instrumental analysis and certain instrumental techniques most commonly used in analytical chemistry; emphasizes the use of modern, commercial instrumentation to perform quantitative and qualitative analyses of the physical properties and chemical composition of samples; representative experiments in several of the analytical methods covered in CHEM 4313. Co-requisite: CHEM 4313. Three laboratory hours a week. Credit: One hour.

CHEM 4313. Instrumental Analysis. Fundamental principles underlying chemical methods and modern analytical techniques; introduction to various modern analytical instrumentation including spectroscopic methods (FTIR, UV-Vis spectroscopy, luminescence, Raman, atomic spectroscopy), chromatography, electrochemistry, and mass spectrometry. Prerequisites: CHEM 3313 and CHEM 3413. Three lecture hours a week. Credit: Three hours.

CHEM 4511. Inorganic Chemistry Laboratory. Inorganic synthesis and spectroscopic/magnetic analysis of various metal complexes. Co-requisite: CHEM 4513. Three laboratory hours a week. Credit: One hour.

CHEM 4513. Inorganic Chemistry. Survey of periodic relationships of elements, chemical bonding, acid-base theory, coordination compounds, electronic structure of atoms and molecules, inorganic nomenclature, symmetry and group theory, and other selected topics. Prerequisite: CHEM 3413 with grade of C or higher. Three lecture hours a week. Credit: Three hours.

CHEM 4911. Independent Study. Independent student readings or experimentation in chemistry. Prerequisites: Junior standing and permission of the department chair. Credit: One hour.

CHEM 4912. Independent Study. Independent student readings or experimentation in chemistry. Prerequisites: Junior standing and permission of the department chair. Credit: Two hours.

CHEM 4913. Independent Study. Independent student readings or experimentation in chemistry. Prerequisites: Junior standing and permission of the department chair. Credit: Three hours.

CHEM 4953. Cooperative Education. Credit: Three hours.

CHEM 4956. Cooperative Education. Credit: Six hours.

CHEM 4981. Undergraduate Research. Original research at the undergraduate level. Formal, written report required. May be taken for honors credit and repeated for additional credit. Prerequisite: Permission of the department chair. Three laboratory hours a week. Credit: Three hours.

CHEM 4983. Undergraduate Research. Original research at the undergraduate level. Formal, written report required. May be taken for honors credit and repeated for additional credit. Prerequisite: Permission of the department chair. Nine laboratory hours a week. Credit: Three hours.

CHEM 4991. Senior Thesis. The writing of a thesis based on original research at the undergraduate level. May be taken for honors credit only. Prerequisites: CHEM 4981 or CHEM 4983, and permission of the department chair. Credit: One hour.

Physics Courses

PHYS 1131. Principles of Physics Laboratory I. (TCCN PHYS 1101) Experimental laboratory work on topics from PHYS 1133 correlated with its lecture material. Co-requisite: PHYS 1133. Three laboratory hours a week. Credit: One hour.

PHYS 1133. Principles of Physics I. (TCCN PHYS 1301) Introductory algebra-based physics. Mechanics, heat, and sound. May not be substituted for PHYS 2153. Three lecture hours a week. Credit: Three hours.

PHYS 1141. Principles of Physics Laboratory II. (TCCN PHYS 1102) Experimental laboratory work on topics from PHYS 1143 correlated with its lecture material. Co-requisite: PHYS 1143. Three laboratory hours a week. Credit: One hour.

PHYS 1143. Principles of Physics II. (TCCN PHYS 1302) Introductory algebra-based physics. Electricity and magnetism, light, and atomic and nuclear physics. May not be substituted for PHYS 2163. Prerequisite: PHYS 1133 with a grade of C or higher. Three lecture hours a week. Credit: Three hours.

PHYS 2151. General Physics Laboratory I. (TCCN PHYS 2125) Experimental laboratory work on topics from PHYS 2153 correlated with its lecture materials. Corequisite: PHYS 2153. Three laboratory hours a week. Credit: One hour.

PHYS 2153. General Physics I. (TCCN PHYS 2325) Introductory calculus-based physics for science majors; mechanics, heat, and sound. Prerequisite: MATH 2014. Co-requisite: PHYS 2151. Three lecture hours a week. Credit: Three hours.

PHYS 2161. General Physics Laboratory II. (TCCN PHYS 2126) Experimental laboratory work on topics from PHYS 2163 correlated with its lecture material. Co-requisite: PHYS 2163. Three laboratory hours a week. Credit: One hour.

PHYS 2163. General Physics II. (TCCN PHYS 2326) A continuation of PHYS 2153. Introductory calculus-based physics for science majors; electricity and magnetism, light, and atomic and nuclear physics. Prerequisite: PHYS 2153 with a grade of C or higher. Three lecture hours a week. Credit: Three hours.

PHYS 4911. Independent Study. Individual study in advanced physics. Credit: One hour.

PHYS 4913. Independent Study. Individual study in advanced physics. Credit: Three hours.

Faculty

Professors

BRITT, BILLY MARK, Professor of Chemistry and Biochemistry. B.S., Millsaps College; Ph.D., University of Oregon.

JOHNSON, JAMES E., Cornaro Professor of Chemistry and Biochemistry . B.Chem., University of Minnesota, Twin Cities; M.S., University of Minnesota, Twin Cities; Ph.D., University of Missouri, Columbia.

RIGGS, CHARLES L., Professor of Fashion and Textiles; Professor of Chemistry and Biochemistry. B.S., University of North Texas; Ph.D., Oklahoma State University.

SHEARDY, RICHARD D., Professor of Chemistry and Biochemistry; Chair of the Department of Chemistry and Biochemistry. B.S., Michigan State University; Ph.D., University of Florida.

Associate Professors

ANDERSON, MARY E., Associate Professor of Chemistry and Biochemistry. B.A., Hollins College; Ph.D., Cornell University.

JONES, RICHARD C., Associate Professor of Science Education. B.A., West Virginia University; M.A.T, University of Texas at Dallas; Ph.D., Texas A&M University .

OMARY, MANAL A., Associate Professor of Chemistry and Biochemistry. B.S., Yarmouk University; Ph.D., University of Maine, Augusta.

Assistant Professor

MIRSALEH-KOHAN, NASRIN, Assistant Professor of Chemistry and Biochemistry. B.S., University of Tehran; M.S., Bowling Green State University; Ph.D., University of Tennessee, Knoxville.

Lecturers

MAGUIRE, CYNTHIA F., Senior Lecturer of Chemistry and Biochemistry. B.S., University of Central Oklahoma; M.S., Texas Woman's University.

PEEBLES, LYNDA R., Senior Lecturer of Chemistry and Biochemistry. B.S., Harding University; Ph.D., University of North Texas.