

# Department of Chemistry

---

## College of Arts and Sciences

### Faculty

**Randy F. Johnston** (1994). Professor of Chemistry and Department Chair. B.S., University of Missouri, St. Louis; Ph.D., Texas Tech University.

**Charles M. Baldwin** (1970-81, 1988). O.P. and Evalyn Hammons University Professor of Pre-Medical Studies. B.A., University of Corpus Christi; Ph.D., Texas Tech University; CChem FRSC. Additional study, University of Texas, Stanford University, Imperial College (London).

**Jimmy H. Davis** (1978). University Professor of Chemistry and Associate Provost. B.S., Union University; Ph.D., University of Illinois; Additional study, University of Florida, Oak Ridge Associated Universities, Argonne National Laboratory, Harvard University and Oxford University (England).

**Sally A. Henrie** (1998). Associate Professor of Chemistry. B.S., University of Arizona; Ph.D., South Dakota State University.

**Carol Leslie** (1985). Associate Professor of Chemistry. B.S., University of Tennessee at Martin; M.S., University of Tennessee at Knoxville.

**Marlyn Newhouse** (1992). Associate Professor of Chemistry. M.A. and B.S.Ed., Northern Arizona University; D.A., Middle Tennessee State University.

**Michael R. Salazar** (2001). Assistant Professor of Chemistry. B.S., New Mexico State University; Ph.D., University of Utah; Additional study, Los Alamos Laboratory.

The chemistry program at Union University seeks to serve effectively all students, recognizing different needs, interests, and career goals. The faculty seeks to help students understand the physical world, the methods by which it may be studied, and its relationship to other aspects of the human experience. It is the intention of the faculty to create an environment in which students are challenged to acquire skills in problem solving utilizing the modern methods of science and to study in-depth the chemical processes which characterize life systems while developing an inquiring attitude toward scientific exploration. The curriculum is intended to provide liberal arts students with a working knowledge of science and to meet the needs of students who wish to:

- teach science at the elementary or secondary school level,
- prepare to enter a health science profession such as medicine, dentistry, medical technology, pharmacy, nursing, physical therapy, or other allied health fields,
- become a professional/industrial chemist or
- continue study in chemistry at the graduate level.

### Chemistry

Students pursuing a major in Chemistry must complete Math 211, 212; Physics 231, 232, and meet the following requirements in Chemistry:

#### I. Major in Chemistry—46 hours

- A. CHE 111, 112, 211, 221, 314, 315, 317, 318, 319, 324, 325, 327, 335, 498
- B. Research, 3 hours from: 424 or 425
- C. One of: 405, 430, 435

#### II. Major in Medical Technology Leading to the BS in Medical Technology

- A. Chemistry 111, 112, 211-21, 314-15, 319, 324-25
- B. Biology 112, 211, 221, 222, 315, 316, 320
- C. Physics 213-214 or 231-232

- D. Computer Science (3 hours) and MAT 111 or preferably MAT 211
- E. A minimum of 33 hours of Medical Technology at an affiliated hospital as the fourth year of study.

### III. Major in Chemical Physics\*—105 semester hours

- A. Chemistry 111, 112, 211, 221, 314, 315, 324, 325, 317, 318, 327, 319, 335 ..... 34
- B. Physics 231, 232, 311, 313, 314; 325 or 420; 430 ..... 26
- C. PHY 424 or CHE 424; PHY 498 or CHE 498; Upper level PHY or CHE ..... 6
- D. Math 211, 212, 213, 314 ..... 15
- E. English 111, 112; 201 or 202 ..... 9
- F. Art 210; CHR 111, 112; and 9 hours of social science ..... 18

\*This is a three year program for talented students. Qualifications are listed below. Students who are not qualified for the 3-year program may extend the program to four years and must meet all graduation requirements in doing so.

### IV. Teacher Licensure with Endorsement in Chemistry 7-12

- A. Complete the requirements for the Chemistry major as shown above including CHE 405.
- B. Professional Education: EDU 150, 250, 326, 418, 433; PSY 213, 318; SE 225
- C. Completion of applicable portions of the Praxis II.
- D. For additional information, see the Director of Teacher Education.

### V. Teacher Licensure With Dual Endorsements in Chemistry 7-12 and Physics 7-12

- A. Complete the requirements for the Chemical Physics major including both PHY 498 and CHE 498 plus PHY 317.
- B. Professional Education: EDU 150, 250, 326, 418, 433; PSY 213, 318; SE 225.
- C. Completion of applicable portions of the Praxis II.
- D. For additional information, see the Director of Teacher Education.

### VI. Minor in Chemistry—26 or 27 hours

- A. CHE 111, 112, 211, 221, 314, 315, 324 325
- B. Elective, one of: 317, 319, 335, 405, 430

64

## Bachelor of Science in Chemical Physics

This program is designed for a student seeking a broad background in the physical sciences to pursue graduate work in chemistry or physics or secondary teacher licensure in chemistry and physics. It will permit the student to take advantage of previous experiences in the sciences and shorten the time spent in formal education, without reducing the quality of the degree obtained.

Students admitted into this program will be selected from those entering with an above-average preparation in high school science and mathematics, or from those who after one year of college decide to enter the program and who are properly qualified.

Entrance as a freshman will be permitted under these conditions:

1. Minimum ACT mathematics score of 25
2. Four years of high school mathematics with a B average or better
3. High school chemistry and physics with a B average or better
4. Minimum ACT composite of 26
5. Successful personal interview with a committee of science faculty

Entrance as a sophomore or junior will be permitted under these conditions:

1. The student is prepared to enter MAT 211, CHE 111, and PHY 231.
2. He/she has a GPA of 2.5 based on all work attempted. It is expected that the GPA in Natural Science courses will be higher than 2.5.
3. Successful personal interview with a committee appointed from science faculty.

## Assessment of Majors

The Department utilizes standardized tests, of the American Chemical Society, as final examinations for the second semester of all one-year courses. These courses include General (CHE 111-2), Organic (CHE 314-5), and Physical (CHE 317-8). Standardized examinations are also used as the final examination in Fundamentals (CHE 105), Analytical (CHE 211), and Biochemistry (CHE 319), Inorganic (CHE 430). Examination results are used to monitor progress of students as a group through their course of study at Union. Strengths and weaknesses of courses are also assessed by comparing class averages with national norms. Students are required to complete a research project (CHE 424), and give a seminar to faculty and colleagues (CHE 498).

## Student Organizations

**Student Affiliate of the American Chemical Society** has been organized to better acquaint those students interested in chemical science with professional opportunities in the field and the mechanics of preparing and presenting technical material. The organization instills professional pride in the chemical sciences, while stimulating awareness of the responsibilities and challenges of the modern chemist. Membership is open to any student pursuing an undergraduate degree in chemistry or physics.

**Sigma Zeta** is a national honorary science society for those who have completed 15 hours in natural science and mathematics and with a minimum 3.0 GPA in these courses. Membership advantages include recognition for academic achievements by the Sigma Zeta Honor Award, participation in nationally recognized research projects, and a means of cooperation in similar areas of interest by students of different colleges.

## Student Awards

**The Academic Excellence Medal** is awarded to the graduating senior with the highest average in the major provided the average is not less than 3.5. Before Awards Day, the student must have completed at least 15 credit hours in the major at Union University, exclusive of pass/fail courses. If no major is eligible, the medal will be given to the minor meeting the minimum requirements.

**The Chemistry Research Award** is given by the faculty of the Department of Chemistry and Physics to the student who presents the best research paper of the year. The research must have been an original piece of work and must have been presented at a state, regional, or national professional chemistry meeting prior to graduation.

**The C.R.C. Freshman Chemistry Award**, given to encourage and sustain interest in the sciences, is awarded in recognition of outstanding scholastic achievement in Freshman Chemistry.

**Whiteaker Freshman Chemistry Award.** The Chemistry Department selects a freshman chemistry major or minor to receive this award based on outstanding scholastic achievement, financial need, Christian service, and school spirit.

## Course Offerings in Chemistry (CHE)

( ) Hours Credit; F-Fall; W-Winter; S-Spring; Su-Summer

### 105. Fundamentals of Chemistry I (4) F, S, Su

An introductory general chemistry course that includes study of both physical and chemical properties, structure and reaction of matter. Not applicable to pre-health professions except Nursing. Science credit will not be given to a student who has completed a course in either CHE or PHY. Three lectures and one 2-hour laboratory period/week.

### 106. Fundamentals of Chemistry II (4)

Prerequisite: CHE 105 or 111.

A beginning course in organic and biochemistry with emphasis on topics specifically related to the health sciences: carbohydrates, fats, proteins, vitamins, and hormones.

Normal and abnormal metabolic processes and the role of ATP. Not open to science majors other than physical science and nursing. Three 1-hour lectures and one 3-hour laboratory period/week.

### 111. General Chemistry (4) F, W

Prerequisite: high school chemistry or PHY 111. A strong mathematics background (especially in algebra) is recommended.

A comprehensive study of the fundamental experiments, principles, and theories of chemistry with emphasis on the quantitative relationships. The structure and properties of matter with their energy relationships are stressed. Three lectures and one 3-hour laboratory/week.

### 112. Chemical Equilibrium (4) W, S

Prerequisite: CHE 111.

Detailed study of the principles of equilibrium in chemical systems. The laboratory is qualitative analysis. Three lectures and one 3-hour laboratory period/week.

### 113. Survey of Chemical Instrumentation (2) W

Prerequisite: CHE 111

An introduction to chemical instrumentation used in industry, including titrations, spectroscopy and chromatography. One lecture and one 3-hour lab/week.

### 211. Analytical Chemistry (3) S

Prerequisite: CHE 112; Corequisite: CHE 221.

A continuation of the study of fundamental principles including topics in statistics, gravimetric analysis, titrimetric analysis (neutralization, precipitation, complex formation, oxidation-reduction), and spectrophotometric analysis.

### 66 221. Analytical Chemistry Laboratory (2) S

Prerequisite: CHE 112; Corequisite: CHE 211.

The application of gravimetric, titrimetric and spectrophotometric quantitative analysis to the study of chemistry. Two 3-hour laboratory periods/week.

### 300. Chemical Safety and Health (1) S

Survey of safety policies and procedures associated with the use of hazardous chemicals. Topics: safety awareness, routes of chemicals into the body, personal safety apparatus and its use; identification, types and literature on chemical hazards; and proper ways to label, handle, store, and dispose of hazardous chemicals.

### 301. Perspectives in Science (4) F, W

See PHY 301 for course description.

### 314. Organic Chemistry I (3) F

Prerequisite: CHE 112; Corequisite: CHE 324.

An introduction to the compounds of carbon, with emphasis on the relationship between structure and properties. Applications of bonding theory, reaction mechanism, and stereochemistry are included. Some functional groups containing halogen and oxygen will be examined in detail.

### 315. Organic Chemistry II (3) S

Prerequisite: CHE 314; Corequisite: CHE 325.

An in-depth examination of the common oxygen and nitrogen functional groups with respect to structure and chemistry. Continued application of basic theory is included. Heterocyclic and biomolecules will also be examined. Three lectures/week.

**317. Physical Chemistry I (3) F**

Prerequisites: CHE 211, MAT 212, and PHY 232.

Application of physical techniques to chemical systems with emphasis on thermodynamics. The laws of thermodynamics will be derived and applied to phase and chemical equilibria, electrochemical cells, and surface phenomena.

**318. Physical Chemistry II (3) S**

Prerequisite: CHE 317.

A continuation of CHE 317 with emphasis on dynamics and quantum chemistry. Includes kinetics, mechanisms, and photochemistry. Quantum chemistry includes atomic and molecular electronic structure and their application to spectroscopy.

**319. Biochemistry (4) F**

Prerequisite: CHE 315, CHE 325, and BIO 112.

Introduction to the organic chemistry of living systems. Topics: structure and function of proteins, enzymic control of chemical reactions, catabolism, anabolism, bioenergetics, biosynthesis, and molecular biology. Three lectures and one 3-hour lab/week.

**324. Organic Chemistry I Laboratory (2) F**

Corequisite: CHE 314.

Introduction to the basic techniques for the physical characterization and isolation of organic compounds. Use of spectrometric methods as applied to the determination of structure is included, as are some synthetic methods. Two 3-hour labs/week.

**325. Organic/Inorganic Synthesis Laboratory (2) S**

Prerequisite: CHE 314 and CHE 324; Corequisite: CHE 315.

Application of laboratory techniques in synthesis and characterization of organic and inorganic compounds. Two 3-hour laboratory periods/week.

**327. Physical Chemistry Laboratory (2) S**

Corequisite: CHE 318.

The application of physical methods in the study of chemical compounds. Two 3-hour labs/week.

**335. Intermediate Inorganic Chemistry (3) S**

Prerequisite: CHE 315.

Introduction to inorganic compounds with an emphasis on coordination, bioinorganic, nuclear, and organometallic chemistry. The relationships between structure, physical properties and reactivity will be examined in detail.

**405. Environmental Chemistry (4) S**

Prerequisite: CHE 315.

Study of the rapid changes in the earth's atmosphere, water and soil caused by the activities of humankind. Attention to the ozone layer, air quality and water cycles at the surface of the earth. The vectors, fate, and treatment/removal strategies for organic and heavy metal pollutants will be discussed. Three lectures and one 3-hour lab/week.

**424-5. Introduction to Research (1-3) 424—F, 425—S**

The student's knowledge is integrated by application of a simple piece of original work. Prerequisite: 20 hours of chemistry and a junior/senior standing. Each course will be three hours per week per credit hour.

**430. Advanced Inorganic Chemistry (4) F—Even Years**

Prerequisite: CHE 211. Prerequisite or Corequisite: CHE 318 and 335.

A theoretical treatment of fundamental inorganic topics such as chemical bonding, periodic relationships, stereochemistry of inorganic complexes, acids and bases, and physical properties of inorganic compounds. Three lectures and one 3 hour lab/week.

**435. Advanced Organic Chemistry (4) F—Odd Years**

Prerequisite: CHE 315.

Extensive treatment of topics including reaction mechanisms, stereochemistry, heterocyclic chemistry, and molecular rearrangements. Three lectures and one 3-hour lab/week.

**498. Seminar (1-3) S**

Prerequisite: 20 hours of chemistry and junior/senior standing.

Skills in scientific and technical presentations, written and oral, will be polished. To be used at the discretion of the department for majors and minors only.

**Medical Technology Hospital-in-Residence Curriculum****411. Clinical Chemistry (6)**

Chemical analysis of various body fluids and the study of their relationship to disease states.

**412. Instrumentation (1)**

The principles, use and care of instruments found in up-to-date laboratories.

**421. Hematology and Coagulation (7)**

**68** Application of theory to technical performance in hematological procedures which aid in classification of anemias, leukemias, and other blood cell abnormalities.

**422. Advanced Microbiology (7)**

A lecture and lab course covering the role of microorganisms as they cause disease in man. Methods employed in the identification of bacteria, fungi, viruses, and rickettsiae.

**423. Serology (2)**

A lecture and lab course in immunology, demonstrating reactions between antigens and antibodies are considered. Use of these reactions as a serodiagnostic tool is presented.

**424. Immunohematology (5)**

Includes selection, testing and bleeding of donors, identification of blood group antigens and antibodies, procedures employed in providing compatible blood for patients, and principles and procedures used in blood component therapy.

**425. Parasitology (2)**

A study of parasites of medical significance, both indigenous and foreign, with particular emphasis on life cycles and identification.

**431. Urinalysis (2)**

Gross, physical, microscopic, and chemical analysis of urine.

**432. Clinical Correlations (1)**

Basic understanding of altered physiology in disease; correlation between laboratory test results and anatomical/physiological changes.

**440. Principles of Management and Ethics (0)**

Preparation for the the medical graduate for positions of leadership as supervisors and instructors.

---

**180-280-380-480. Study Abroad Programs (1-4) As Needed**

All courses and their application must be defined and approved prior to travel.

**195-6-7. Special Studies (1-4) On Demand**

Lower-level group studies which do not appear in the regular departmental offerings.

**395-6-7. Special Studies (1-4) On Demand**

Upper-level group studies which do not appear in the regular departmental offerings.

**495-6-7. Seminar (1-3)**

To be used at the discretion of the department for majors only.