# DEPARTMENT OF CHEMISTRY
## COLLEGE OF ARTS AND SCIENCES

## Faculty

Michael Hayes (2009). Professor of Chemistry and Department Chair. B.S., Union University; Ph.D., University of Texas at Austin.

Jimmy H. Davis (1978). Hammons Professor of Chemistry and Vice President for Institutional Research. 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

(2008). Professor of Chemistry. B.S., Wheaton College; Ph.D., Northwestern University.

### Staff

Frances Lancaster (2016). Academic Secretary–Biology and Chemistry. B.A., Rhodes College; Johan Wolfgang Goethe University, Frankfurt, Germany.

Giley Wright (2004). Stockroom Coordinator. B.S., Union University.

## Curriculum

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:

- continue study in chemistry at the graduate level;
- 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; or
- become a professional/industrial chemist.

Students who complete the chemistry or biochemistry degree as described below or upon their coursework being approved by the chair of the department, will receive degrees that are certified by the American Chemical Society. Our certified programs offer students a broad-based and rigorous chemistry education that provides them the intellectual, experimental, and communication skills necessary to become successful scientific professionals.

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

I. Major in Chemistry–46 hours
   A. CHE 111, 112, 211, 221, 314, 315, 317, 318, 319, 324, 326, 327, 335, 498
   B. Research, 3 hours from: 424 or 425
   C. One of: 405, 430, 435

II. Major in Biochemistry–70 hours
   A. CHE 111, 112, 211, and 221–13 hours
   B. CHE 314, 315, 324, 326–10 hours
   C. CHE 317, 318, 319, 329, 327, 335–19 hours
   D. CHE 424/425–3 hours
   E. CHE 498–1 hour
   F. BIO 112, 211, 315, 325–16 hours
   G. BIO–one 200-level Elective–4 hours
   H. BIO–one 300-level Elective–4 hours
   I. No minor is required.

III. Major in Medical Technology–102–105 hours
   A. Chemistry 111, 112, 211-21, 314-15, 319, 324, 326
   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.

IV. Major in Chemical Physics–119 hours

Designed for those seeking a broad background in the physical sciences to pursue graduate work in chemistry or physics or secondary teacher licensure, the major permits students with previous experiences to shorten the time

A. CHE 111, 112, 211, 221, 314, 315, 324, 326, 317, 318, 327, 319, 335–38 hours
B. PHY 231, 232, 311, 313, 314; 325 or 420; 430–26 hours
C. PHY or CHE 424; PHY or CHE 498; Upper-level PHY or CHE–4 hours
D. MAT 211, 212, 213, 314–15 hours
E. ENG 111, 112; 201 or 202–9 hours
F. ART 210; CHR 111, 112; BIO 112; CLU 195; HIS 101; and 9 hours of social science–27 hours
G. No minor is required.

V. Teacher Licensure with Endorsement in Chemistry 6–12
A. Complete the requirements for the Chemistry major as shown above including CHE 405.
B. Additional Requirements: CSC 105, PHY 112 (in B.S. core), PHY 231 and 232, MAT 212 (in B.S. Core), and membership in SMACS.
C. Professional Education:
1 Prior to Internship–EDU 150, EDU 305, EDU 358, PSY 213, PSY/SE 230.
2. Fall of Internship Year–EDU 306, 340, 418, 440
3. Spring of Internship Year–EDU 441 and 451
4. CSC 105 is required in the BA core
D. Completion of applicable portions of the Praxis II.
E. For additional information, see the Director of Educator Preparation.

VI. Minor in Chemistry
A. CHE 111, 112, 211, 221, 314, 315, 324 326–23 hours
B. Elective, one of: 317, 319, 335, 405, 430–3 or 4 hours

### Major in Chemistry with Discipline-Specific Honors

In addition to the requirements listed in I., students must complete

A. Honors contracts in two of the following courses: CHE 211, 315, 318, 319, or 335
B. An honors contract in one of the following courses: CHE 405, 430, or 435
C. An honors contract in CHE 424/425 and 498

### Major in Biochemistry with Discipline-Specific Honors

In addition to the requirements listed in II., students must complete

A. Honors contracts in two of the following courses: CHE 211, 315, 318, 319, or 335.
B. An honors contract in CHE 329.
C. An honors contract in CHE 424/425 and 498.

Admission Requirements for Majors with Discipline-Specific Honors

- Completion of at least 15 hours at Union University or in transfer

Progression in Majors with Discipline-Specific Honors

To remain in the program a student must earn at least a B in each honors contract course in the major. A student who earns a B in two honors contract courses in the major may continue in the program only with permission of the department committee. This committee of three or four faculty (including the course instructor or research mentor) will be created for each course. The committee will approve the honors contract with the student and will evaluate the honors project on a satisfactory/unsatisfactory basis. The course instructor will determine the overall course grade.

Honors Contract Courses

1. Honors Contract Course Projects
In addition to the normal coursework, the discipline-specific honors student must complete one project in each honors contract course as noted here:
a. In the first honors contract course, prepare a review article on a topic studied within the course.
b. In the second honors contract course, prepare and deliver two 30-minute lectures on topics studied within the course.
c. In the third honors contract course, prepare a societal impact study of an important chemically related topic.
2. Research Course Project
The student must complete the first honors lecture course before starting the research course. The research course includes preparation of a formal written proposal for the work to be completed (written before work starts) and a defense of the proposal before the department committee.
3. Seminar Course Project
The student must prepare a research proposal (similar to the one for the research course) on a different topic and make an oral presentation of the proposal to the class and committee.

## Assessment of Majors

The Department utilizes standardized tests of the American Chemical Society as final examinations for the first and/or second semester of all one-year courses. These courses include General (CHE 111-2), Organic (CHE 314-5 and CHE 435), and Physical (CHE 317-8). Standardized examinations are also used as the final examination in Fundamentals (CHE 105), Analytical (CHE 211), and Biochemistry (CHE 319-29), and Inorganic (CHE 335 and 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 facund17.889868 223.2547 Tm[ar)

315. Organic Chemistry II (3) S
Prerequisite: CHE 314; Corequisite: CHE 326.
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 are examined. Three 1-hour 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 are 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: kinetics, mechanisms, and photochemistry; atomic and molecular electronic structure and application to spectroscopy.

319. Biochemistry (4) F
Prerequisite: CHE 315, CHE 326, and BIO 112.
Introduction to the organic chemistry of living systems. Topics include the structure and function of proteins, enzymatic control of chemical reactions, catabolism, anabolism, bioenergetics, biosynthesis, and molecular biology. Three 1-hour lectures and one 3-hour lab/week.

324. Organic Chemistry 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.

326. 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 labs/week.

## Medical Technology Hospital-in-Residence Curriculum

411. Clinical Chemistry (6)
Chemical analysis of various body fluids and the study of their