THE UNIVERSITY OF DELAWARE IS A STATE-ASSISTED, PRIVATELY CONTROLLED COEDUCATIONAL LAND, SEA AND SPACE GRANT INSTITUTION WITH ROOTS IN AN ACADEMY FOUNDED IN 1743. TODAY, OVER 14,500 UNDERGRADUATE STUDENTS CHOOSE FROM APPROXIMATELY 105 MAJORS. THE UNIVERSITY OFFERS THE MASTER’S DEGREE IN 80 FIELDS AND THE DOCTORAL DEGREE IN 40 DISCIPLINES, AND HAS A GRADUATE ENROLLMENT OF ABOUT 2,500.


THE STATE OF DELAWARE ALSO HAS PLAYED A MAJOR ROLE IN THE FIELDS OF SCIENCE AND CHEMISTRY IN PARTICULAR. FROM ITS CORPORATE AND ACADEMIC LABORATORIES HAS COME A CONTINUING STREAM OF DEVELOPMENTS TO IMPROVE THE QUALITY OF LIFE. COMMERCIALIZATION OF INVENTIONS SUCH AS PHARMACEUTICALS, AGRICULTURAL CHEMICALS, SYNTHETIC POLYMERS, GAS CHROMATOGRAPHS, SYNTHETIC REPLACEMENT BODY PARTS, SOLAR CELLS AND SOLAR STORAGE DEVICES, AND POLYMER-COMPOSITE MATERIALS HAS PLACED DELAWARE AT THE CUTTING EDGE OF TECHNOLOGY AND INNOVATION FOR MANY DECADES.
Newark (pronounced “New Ark”), a city of approximately 30,000 situated in the northwestern corner of the state, is the home of the University of Delaware. It offers a pleasant small-town setting in a location that affords easy access to major cultural and entertainment centers in nearby metropolitan areas.

THE DEPARTMENT

Located in three interconnected buildings, H. Fletcher Brown Laboratory, Quaesita Drake Hall, and Lammot du Pont Laboratory, the Chemistry and Biochemistry Department occupies more than 200,000 square feet of teaching, office and research-laboratory space. Its degree programs include the Bachelor of Arts (with majors in Chemistry and Chemistry Education), the Bachelor of Science (with majors in Chemistry, Biochemistry, and Chemistry with Environmental Concentration), the Master of Arts, the Master of Science and the Doctor of Philosophy.

PROGRAMS

The graduate program in chemistry was one of the first advanced-degree programs established at the University of Delaware, awarding its first Ph.D.s in 1948. Over the years, more than 500 doctoral degrees and more than 300 master’s degrees have been awarded. Alumni of the department have successful careers in industry, academia and government laboratories. The undergraduate program has a long history as a major producer of chemists and biochemists. The hallmarks of the Delaware program include a strong concentration on the subject, close contact with faculty and a concern for the individual student. The department is proud of the accomplishments of its many distinguished alumni, including Daniel Nathans, winner of the 1978 Nobel Prize in medicine and physiology.

THE DELAWARE COMMITMENT

The moderate size of the graduate student body allows excellent student-faculty interaction. The resources of the department provide a variety of research opportunities comparable to graduate programs of much larger size. Many students participate in research across traditional boundaries in the chemical sciences. For example, a graduate student in analytical chemistry might collaborate with a faculty member in biochemistry or physical chemistry on a project of common interest, or a biochemistry student might collaborate with a molecular biologist. The breadth of the program is enhanced by joint faculty appointments in chemical engineering, life sciences and marine studies and by interdisciplinary training programs.

The 30-plus faculty and approximately 110 graduate students continue the tradition of excellence in teaching and research in the five major areas of chemistry and biochemistry, as well as in interdisciplinary areas. In recent years, this effort has resulted in annual publication rates of over 150 scholarly articles. The annual department budget is approximately $10 million per year, of which approximately $4 million is devoted to research.

GETTING TO THE UNIVERSITY OF DELAWARE

The I-95 corridor is minutes from campus facilitating travel to four of the East Coast’s largest cities: New York, Philadelphia, Baltimore and Washington, D.C. The University of Delaware is reached from I-95 by going north on Delaware route 896 at exit 1. A visitors’ parking lot is located on South College Avenue (route 896) adjacent to the Visitors Center.
A wide variety of resources are available to chemistry and biochemistry graduate students.

Staff. The department has an outstanding staff to support its teaching and research mission. A full-time glassblower, four machinists, and three electronics technicians aid in the design, construction and maintenance of laboratory equipment. A computational chemistry specialist and two computer technicians oversee the computing and networking infrastructure of the department. The chemistry stockroom handles the day-to-day supplies and expedites the processing of special orders. Laboratory services support teaching of laboratory courses.

Libraries. The Chemistry Library, located in Brown Laboratory, contains an extensive collection of reference works and monographs, and carries subscriptions to over 200 journals. The Hugh M. Morris Library is a two-minute walk from the department and contains more than 2 million volumes. Catalogs of the Morris Library and the branch libraries are conveniently available on-line from locations within the department and outside the University. Other bibliographic databases, including those of the American Chemical Society, are also available on-line.

Research Instrumentation. Three major facilities support the research of faculty and students. These laboratories are operated by Ph.D.-level scientists who provide analytical service and training courses. The NMR laboratory houses five liquid- and solid-state FT-NMR spectrometers and one FT-ESR spectrometer. Graduate students routinely use these instruments in their research. Included is a 400 MHz NMR with gradients that allows rapid acquisition of data for characterization of molecules and complex synthetic intermediates. The mass spectrometry laboratory encompasses six instruments that provide service in electrospray ionization (ESI), matrix-assisted laser desorption ionization (MALDI), fast-atom bombardment (FAB), chemical ionization (CI), and electron ionization (EI) mass spectrometry. GC/MS and LC/MS instruments are available for routine student use. The X-ray laboratory includes two state-of-the-art diffractometers for small molecule crystallography. A research facility to perform macromolecular crystallography is also housed in the department.

A wide variety of equipment is available in individual research laboratories such as FTIR, UV-VIS, fluorescence and stopped-
flow spectrometers, high performance liquid chromatographs, gloveboxes and high vacuum lines for air-sensitive manipulations, electrochemical analyzers, instrumentation for electrochemical impedance spectroscopy, a quartz crystal microbalance, amino acid analyzers, peptide sequencers, peptide and DNA synthesizers, preparative and analytical ultracentrifuges, circular dichroism spectrometers, ion lasers, nanosecond and picosecond pulsed lasers, oil-imersion optical microscopes, an atomic force microscope, Fourier-transform, time-of-flight, quadrupole and sector mass spectrometers, aerosol generation and characterization equipment, and high vacuum equipment.

In addition, many faculty have developed specialized instruments for particular research projects, for example ultrafast and high temperature/pressure FTIR and Raman spectrometers, aerosol mass spectrometers, tandem mass spectrometers for molecular beam scattering experiments, an apparatus for measuring conductance and density of aqueous solutions to high temperature and pressure, multichannel frequency and time domain spectrofluorimeters, and a laser fluorimeter capable of single-molecule detection.

Outstanding facilities are available for molecular modeling and computational chemistry. The department has many Silicon Graphics workstations and a CaChe system for modeling, visualization and data analysis. For the most computationally intensive work, two high-performance multiprocessor Silicon Graphics computers are available in the department and the University maintains multiprocessor Cray and Silicon Graphics computers. A wide variety of applications software is available for quantum chemistry, molecular dynamics simulations and other techniques.

Campus-wide research centers, for example the Center for Composite Materials and the Center for Catalytic Science and Technology, offer additional equipment and resources for research.
GRADUATE STUDY IN CHEMISTRY AND BIOCHEMISTRY

Requirements vary from degree to degree, and a brochure describing these may be obtained from the department. Briefly, each student must successfully complete a course of study that depends on the area in which the student chooses to qualify and the degree sought. The M.A. is a nonthesis degree that requires 18 credit hours of coursework and completion of cumulative-examination and language requirements. The M.S. degree is a thesis-based degree and requires 18 credit hours of coursework. The Ph.D. program includes 18 credit hours of coursework, a series of cumulative examinations, a foreign-language examination (organic division only) and the submission and oral defense of a dissertation on original research.

GRADUATE COURSES AND SEMINARS. Students usually satisfy course requirements in the area of concentration in two or three semesters. Current graduate courses are listed in an insert. Depending on their concentration, students take courses in their major area and additional courses in other areas.

Special topics courses offered by the faculty focus on the latest research in specific subfields. Three weekly seminar series (in biochemistry, organic/inorganic chemistry, and analytical/physical chemistry) feature renowned academic, industrial and government scientists lecturing on their research. The department holds monthly colloquia at which scientists discuss topics of general interest to the entire chemistry community. The colloquia feature departmental faculty and distinguished scientists from outside the University. The department sponsors annual meetings focusing on mass spectrometry and NMR spectrometry. The University periodically sponsors symposia on topics such as agricultural chemistry, combinatorial chemistry and catalysis. These meetings bring speakers from around the world to the campus for intensive discussions on these topics. Thus, graduate students at Delaware have many venues to gain a broad knowledge of chemistry and biochemistry.

STUDENT LIFE. Although the heart of our graduate program is research, graduate school is also a time to learn about the world in other ways. The faculty, graduate students and departmental visitors represent a broad cross-section of people from various cultures. Relationships and friendships made here truly span the globe.

Life as a graduate student begins the week before the start of classes. New students attend University and departmental orientation programs, take proficiency examinations, meet with a faculty advisor to select coursework and receive training in their roles as teaching assistants. Social activities provide an opportunity to meet faculty, senior graduate students, postdoctoral associates and other new graduate students.

In the first semester of graduate study, students attend courses and seminars, fulfill teaching responsibilities, and choose a research project and faculty advisor. A series of faculty seminars introduces students to many research opportunities offered in the department. By the end of the first
A research topic is chosen by mutual agreement between the student, faculty advisor and department chair. Research typically begins at the end of the first semester, and the student becomes deeply involved in the project thereafter.

In the second year, students take cumulative examinations, monthly three-hour written examinations on general topics in the various areas of chemistry. The student may satisfy the cumulative-examination requirement by taking examinations in more than one area. After successful completion of the course, cumulative-examination, and foreign-language (organic students only) requirements, an advisory committee is formed to aid the student in determining research directions. The student is admitted to candidacy for the Ph.D. degree after the first meeting of the advisory committee. This committee serves as an examining committee at the student’s oral dissertation defense.

Activities. While scientific study dominates the student's life at Delaware, the atmosphere is casual and interactions among students are strongly encouraged. Students lunch together on the steps of Brown Lab or participate in team sports such as basketball, softball or hockey in the University’s intramural sports leagues. The Newark area abounds in things to do, from attending one of the many University-sponsored cultural activities, to affording easy access to events in Philadelphia, Baltimore or Washington D.C., or to a day at the beach in southern Delaware. Department parties and picnics add a sense of community to the graduate student experience. Students may participate in teaching courses and serve as representatives on several committees that determine the affairs of the department.

Housing. The University provides both individual and family graduate dormitory housing. In addition, apartments, shared houses and other off-campus arrangements can often be made through the University. The department also assists students to find comfortable, affordable housing, either separately or as groups.

Financial Assistance. Students are supported as teaching assistants, research assistants and/or research fellows, and a stipend is provided. (The current stipend is listed on a sheet inserted in the brochure pocket.) In addition, the student’s tuition is waived. Teaching assistants spend eight or nine hours per week supervising undergraduate laboratories and a comparable amount of time in preparation, office hours, and grading. These assistants are an integral part of the teaching program of the department, and their interaction with undergraduate students add depth to the education of undergraduates and graduates alike. Research assistants are paid from faculty research grants. There are also University and departmental fellowships awarded to students who have performed exceptionally well. Graduate students in good standing in the Ph.D. program are provided calendar-year support for five years from the time of entry in the graduate program. In addition, students may be eligible for Federally guaranteed loans.

Professional Development. The northern Delaware economy is strongly tied to the chemical industry. Many of the largest chemical and biochemical firms in the country are incorporated in Delaware and operate company-wide research facilities within a five-
minute to one-hour drive from campus. The Delaware section of the American Chemical Society is one of the largest and most active in the country. This environment provides a unique opportunity for graduate students to interact with chemistry and biochemistry professionals. Delaware students regularly attend professional groups and meetings such as the Delaware Valley and Baltimore/Washington Mass Spectrometry Discussion Groups, the Delaware Valley Chromatography Forum, the Philadelphia Section of the Electrochemical Society, the Philadelphia Catalysis Club, the Delaware Valley Enzymology Club, and "PUDDuP" (an inorganic discussion group consisting of University of Delaware, University of Pennsylvania and DuPont researchers).

Most students attend national or international conferences during their graduate career. In addition, students routinely attend annual meetings held in close proximity to campus (within a few hours driving) such as the Mid-Atlantic Regional Meeting of the American Chemical Society and the Eastern Analytical Symposium. Thus, many outlets for professional development are available at the University of Delaware which transcend the boundaries of conventional degree programs.

AFTER GRADUATE SCHOOL

Many students ask what they can expect after achieving an advanced degree. Virtually all graduates find positions in industry, academia or government laboratories. The University of Delaware, the Department of Chemistry and Biochemistry, and the faculty thesis advisor work together to help each student find the right place to pursue a career. The University’s Career Planning and Placement Office arranges campus interviews for graduate students with employer representatives who visit the campus. The Office offers advice and help in preparation for these interviews. The chemistry and biochemistry faculty provide an important link to employers. Initial contacts between students and potential employers frequently occur through the many contacts our faculty have with industry, government and academic institutions.

The best indicators of the opportunities afforded by an advanced degree in chemistry and biochemistry from the University of Delaware.
Delaware are the over 500 graduates of our program. Ask any of these graduates, and you will learn the possibilities that graduate education in chemistry and biochemistry at the University of Delaware can bring!

Where Do Delaware Graduates Come From? Here is a sampling of undergraduate institutions from which our graduate students have come since 1993: Bucknell University, College of William and Mary, Dickinson College, Elizabethtown College, Franklin and Marshall College, Georgetown University, Hamline University, Indiana University of Pennsylvania, Juniata College, Knox College, Lafayette College, LaSalle University, Lebanon Valley College, Lehigh University, Lindenwood College, Lock Haven State University, Louisiana State University, Loyola College, Muhlenberg College, Pennsylvania State University, Rider University, Rowan College of New Jersey, Rutgers University, Salisbury State University, St. Joseph's University, St. Mary's College, Seton Hall University, Shippensburg University, Temple University, Trenton State University, Towson State University, University of Iowa, University of Massachusetts, University of Michigan, University of Minnesota, University of Pittsburgh, University of Scranton, University of Virginia, Ursinus College, Virginia Polytechnic Institute, Washington College, West Chester University, Western Maryland College, Wilkes University.

Where Do Delaware Graduates Go? Over half of our graduates enter industry after completing their degree. The remainder find employment in academia, government laboratories, and other endeavors. Here is a sampling of full-time positions taken by our students who have graduated since 1993: industrial positions: Advanced Technology Materials, Appolon, Automotive Systems Laboratory, ARCO Chemical Company, BASF Corporation, Ciba-Geigy, Centcorr, Century Lubricants, Clariant Corporation, Cytec Industries, Eastman Kodak, Exxon, DuPont, DuPont-Merck, Galaxy Scientific, Goodyear, Hercules, Intel Corporation, Mobil, NIR Systems, Nicolet, Perkin-Elmer, Pfizer, Rohm and Haas, Rhone-Poulenc Rorer, Separation Methods Technologists, Smith-Kline Beecham, Supercritical Fluids Technologies, Synaptic Pharmaceutical, TEVA Pharmaceuticals, Varian, Warner Lambert; faculty positions: Dickinson College, Felician College, Frostburg State University, Philadelphia College of Pharmacy and Sciences, Sacred Heart University, San Bernardino State College, University of Oklahoma Health Science Center; positions in government laboratories: Aberdeen Proving Ground, Armed Forces DNA Identification Laboratory, Oak Ridge National Laboratory.

Using computational chemistry to predict reaction mechanisms.