

Department of Natural Sciences

Professors: Stuart I. Cromarty, Edward J. Dix (Chairperson), Brian K. Niece, Owen D.V. Sholes, Steven J. Theroux; *Associate Professors:* Elizabeth A. Colby Davie, David Crowley, Aisling S. Dugan, Georgi Y. Georgiev, James F. Hauri, Michele L. Lemons, Kimberly A. Schandel; *Assistant Professors:* Karolina Fucikova, Benjamin J. Knurr, Laura Marcotte, Jessica A. McCready; *Visiting Instructors:* Elissa Kraus, Anthony Sacino; *Lecturers:* Soraya Betancourt-Calle, Arthur LaPlante, Mary Lou Lombardi-Butler, Sandra Nedelescu, Hubert G. Meunier (Professor *Emeritus*).

MISSION STATEMENT

The Department of Natural Sciences is dedicated to preparing students to live and work in a changing world by ensuring competency in the natural sciences and scientific inquiry. The department strives to provide a basic understanding of classical and contemporary scientific concepts in these areas. While developing an understanding of the scientific process and its application, the following critical skills are stressed: observation, inquiry, data collection, analysis, communication, and correlation of scientific concepts. The department prepares students for careers and professional opportunities in the sciences as well as for life-long learning in the context of a liberal arts curriculum in the Catholic tradition.

PROGRAMS OF STUDY AND CAREER OPTIONS

The Department of Natural Sciences offers majors in Biology, Biology with a Concentration in Neuroscience and Behavior, Biotechnology and Molecular Biology, Neuroscience, Chemistry, Environmental Science, and Environmental Science with a Concentration in Environmental Policy. The Department also offers minors in Biology, Environmental Science, Chemistry, and Physics, and it co-sponsors a concentration in Physical and Occupational Therapy with the Department of Human Services and Rehabilitation Studies. Research opportunities are available at the College and at nearby institutions (e.g., University of Massachusetts Medical School and the Biotechnology Park). Students interested in teaching science in the public school system should work with a science faculty member and a member of the Education Department in planning their course of study. The Department also offers courses for non-majors.

Students who want to pursue careers in medicine, dentistry or one of the many other health professions must complete the necessary prerequisites for admission to the health profession schools of their choice. These individuals should consult their academic advisors and the Health Professions Advisor (Dr. Steven Theroux) when designing their course of study. The Health Professions Program helps students meet the admissions requirements for these professional programs. The Department has agreements with several institutions that offer degrees in the health professions. Students interested in Allopathic or Osteopathic Medicine, Podiatric Medicine, Pharmacy, Physical Therapy, Optometry, Physician Assistant Studies, Nursing, or Biotechnology should discuss these agreements with the Health Professions Advisor, Professor Steven Theroux.

The College has established a collaborative program of study in Engineering with the University of Notre Dame. Students spend three years at Assumption College completing foundational courses in math and science before transferring to Notre Dame to complete engineering studies. Interested students should contact Professor Jimmy Hauri, Director of the 3:2 Engineering Program.

The College also has agreements with several graduate schools. In conjunction with Duke University we offer combined B.A. and Master's degree programs in Environmental Science Management and Forestry Management. There are several options for students interested in the legal profession, especially those interested in practicing environmental law or intellectual property law. Science students interested in the learning more about all of these programs should see Professor Steven Theroux.

The Department offers a post-graduate program for those who have a bachelor's degree in an area other than Biology and who are interested in pursuing admission to a health professions program (e.g., medicine, dentistry, pharmacy, etc.) Details about this certificate program can be obtained from the Health Professions Advisor, Dr. Steven Theroux.

Students who graduate with an undergraduate degree in science can pursue employment in industry, government, or in an educational setting. Some of our students pursue graduate studies in science, one of the health professions, business or law.

Upon the completion of the appropriate graduate program our students can pursue research careers in environmental management, or in the biotechnology, pharmaceutical and chemical industries. They can also develop careers in elementary, secondary and higher education, or in the health professions, business management, government, or legal profession.

MAJOR IN CHEMISTRY (16)

Assumption College offers two tracks of study in Chemistry: the traditional bachelor's degree program and an American Chemical Society (ACS)-approved bachelor's degree program. The objective of both is to provide the student with knowledge of the fundamental principles governing the structure of matter. The courses are organized to establish a foundation in the basic areas of inorganic chemistry, organic chemistry, physical chemistry, biochemistry, and analytical chemistry, and to develop an understanding of the unity of Chemistry by relating these basic areas to each other and to other scientific disciplines. The laboratories are designed to develop a degree of proficiency in the practical aspects of experimentation and instrumentation.

Through a well-planned choice of electives, a student can prepare for graduate study in chemistry, biochemistry, or some other area of science; for industrial employment; for teaching Chemistry; or for professional study in medicine, dentistry, or other health sciences. Qualified chemistry majors may also pursue a dual degree program leading to a B.A. in Chemistry from Assumption College and a B.S. in Chemical Engineering from The University of Notre Dame. Interested students should contact Professor Jimmy Hauri, Director of the 3:2 Engineering Program.

REQUIRED COURSES (14)

Chemistry majors should take CHE 131 and BIO 160 in their first semester.

First Year

BIO 160	Concepts in Biology
CHE 131–132	General Chemistry I and II
MAT 117–118	Calculus I and II

OR

MAT 131–132	Honors Calculus I and I
-------------	-------------------------

Sophomore

CHE 201–202	Organic Chemistry I and II
PHY 201–202	General Physics I and II

Junior

CHE 311–312	Physical Chemistry I and II
-------------	-----------------------------

Junior/Senior

CHE 315	Analytical Chemistry
CHE 316	Inorganic Chemistry
CHE 414	Biochemistry

Electives (2)

Two additional three- or four-credit courses from among: CHE 318, CHE 416, CHE 450, CHE 460, CHE 470, CHE 480, CHE 491–492. At least one of the electives must include a lab. Only one Independent Study course (CHE 491 or CHE 492) or Internship may be counted towards the Chemistry Elective requirement.

AMERICAN CHEMICAL SOCIETY CERTIFICATION

The American Chemical Society (ACS) Certification option serves as evidence that a graduate has completed a rigorous program in chemistry approved by a national scientific organization. Employers and graduate schools recognize ACS certification as a sign of the high quality of a student's preparation for employment or further study in the chemical sciences. Completion of the ACS Certified program is determined by the department.

In addition to completing the Chemistry major as described above, students wishing to receive ACS certification must:

- Complete PHY 201H-202H, the honors versions of General Physics I and II
- Take CHE 450 (Instrumental Chemistry) as one of their chemistry electives.
- Take a course that includes a lab component for their other chemistry elective.
- Complete at least 3 credits of laboratory research.

STUDENT RESEARCH—SUMMER OPPORTUNITIES

Department faculty members oversee research programs on campus that engage upper-level students in the projects associated with their research interests. Summer research positions that provide a stipend are available on a competitive basis. Assumption students have been accepted into prestigious summer research programs at major research institutions around the country. The sponsoring institutions for this research include the National Science Foundation, the National Institutes of Health, and the American Cancer Society.

PREPARATION FOR TEACHING SCIENCE AT THE SECONDARY LEVEL

Students interested in seeking certification to teach high school biology or chemistry should consider a Major in Biology or Chemistry and a Major in Education, Secondary License. Application to the Education Major must be made by April 30 of the sophomore year. Please see a complete description of procedures and policies in the Department of Education section of the catalog. A student should carefully plan a course of study in conjunction with advisors in both departments (Education and Natural Sciences).

Biology – Field of Knowledge Competencies:

BIO 160	Concepts in Biology
BIO 210	Genetics
BIO 230	Botany
BIO 220	Zoology
BIO 240	Human Anatomy
BIO 370	General Physiology
BIO 360	Ecology
CHE 131–132	General Chemistry I and II

Chemistry – Field of Knowledge Competencies:

CHE 131–132	General Chemistry I and II	
CHE 201–202	Organic Chemistry I and II	
CHE 316	Inorganic Chemistry	
CHE 315	Analytical Chemistry	
CHE 311–312	Physical Chemistry I and II	
PHY 201–202	Physics I and II	
MAT 117–118	Calculus I and II	OR
MAT 131–132	Honors Calculus I and II	

PRE-MEDICAL/PRE-DENTAL

As a liberal arts college, Assumption offers students the knowledge necessary for entrance to and success in medical and/or dental school. Most students interested in pursuing a career in Medicine or Dentistry major in Biology, however, it is possible to choose other majors and still prepare for such a career. Although there is no universal standard for medical school admissions, most school requirements would be fulfilled by inclusion of the following courses:

BIO 160 Concepts in Biology

One from the following three Biology courses:

BIO 210	Genetics
BIO 240	Human Anatomy
BIO 340	Molecular and Cellular Biology
CHE 131–132	General Chemistry I and II (Note: MAT114 is a pre-requisite for CHE132)
CHE 201–202	Organic Chemistry I and II

PHY 201–202	General Physics I and II
ENG 130	English Composition
LTE 140	Introduction to Literature

Additional courses that are usually highly recommended include:

CHE 414 Biochemistry

MAT 117 Calculus I or MAT131 Honors Calculus I

ECO 115 or PSY 224 Statistics

Courses in Psychology, and Computer Science

Additional courses in Biology, Chemistry, and Mathematics are helpful.

Note these courses reflect a **suggested** course load. Students should contact their desired schools and Dr. Steven Theroux before committing to a plan of study.

HEALTH PROFESSIONS PROGRAM

The Health Professions Program is designed to help students enter graduate school in one of the health professions (Medicine, Dentistry, Physical Therapy, Occupational Therapy, Physician’s Assistant, etc.). The program focuses on preparing the student to earn good grades and strong scores on the admissions test and graduate school interview. Those who complete the program requirements will have the fact that they did so listed on their transcript. All students interested in a health profession should consult with their advisors and Dr. Steven Theroux, Chairperson of the Health Sciences Committee, at the beginning of their undergraduate careers.

To complete the Health Professions Program, the student must:

- Successfully finish a major in Biology; Biology with a Concentration in Neuroscience and Behavior; Biotechnology and Molecular Biology; Chemistry; Psychology; Psychology with a Concentration in Neuroscience of Human Behavior; or Human Services and Rehabilitation Studies
- Complete the required coursework with a cumulative GPA of 3.0 or better overall and a GPA of 3.0 or better in the major
- Complete the “Social, Economic and Ethical Issues in the Health Professions” course
- submit at least one list of prerequisite courses required for a specific health-related graduate program to which he or she intends to apply
- Submit a statement indicating that the prerequisite courses required for admission to a particular health professions graduate program were successfully completed
- Present evidence from Kaplan that he or she successfully completed a Kaplan Test Preparation Course (e.g., MCAT, DAT, OAT, VCAT, PCAT, GRE, etc.). (The exact course that the student completes will vary depending on the graduate program the individual hopes to enter.)
- Present evidence that he or she took a graduate admissions test (e.g., MCAT, DAT, GRE, etc.) and scored in the top 50% of those taking the test in that year. Kaplan preparation courses are offered on campus at reduced rates. Financial aid is available.

Students who plan to pursue a graduate degree in a health profession should be aware of the timetable in which to fulfill their requirements, which include admissions exams and letters of reference from the Health Sciences Committee. Students should be prepared for entrance exams in their junior year and request a letter of reference at that time. Students must contact Dr. Theroux at least two weeks before the scheduled Committee meeting times in the second week of October, the second week of February, and the second week of May. The letters will usually be ready within four to five weeks of the meeting.

ARTICULATION AGREEMENTS IN THE SCIENCE AND HEALTH PROFESSIONS

Assumption College holds a wide range of agreements with graduate institutions in the health sciences. For a complete list, including agreements with law schools and Notre Dame’s College of Engineering, see the “Cooperative Programs of Study and Agreements” section of the catalog and contact the Health Professions Advisor, Prof. Steven Theroux, stheroux@assumption.edu.

Massachusetts College of Pharmacy and Health Sciences B.A./Bachelor of Science in Nursing (B.S.N.)

The Massachusetts College of Pharmacy and Health Sciences (MCPHS) has agreed to provide at least three seats at their Manchester, NH campus and three seats in their Worcester, MA campus for qualified Assumption students who want to earn a Bachelor of Science in Nursing. To qualify for one of the limited number of guaranteed seats, Assumption students must complete the specified prerequisites with a grade of C or better (with no repeats), earn a cumulative GPA of 3.2 in the required prerequisites, and obtain a GPA of 3.2 or higher. Please see the Health Professions Advisor for additional details and requirements.

Massachusetts College of Pharmacy and Health Sciences B.A./Doctor of Pharmacy (Pharm.D.)

The Massachusetts College of Pharmacy and Health Sciences (MCPHS) has agreed to provide two seats at their Manchester, MA campus and five seats at their Worcester, MA campus for qualified Assumption students who want to enter an accelerated doctoral program in pharmacy. To qualify for admission into this 34-month course of study, Assumption students must complete the required prerequisites with a grade of C or better (no repeats). They must also have a GPA of 3.4 in the required prerequisites and an overall GPA of 3.4.

Massachusetts College of Pharmacy and Health Sciences B.A./Master of Science in Physician Assistant Studies (M.S.P.A.S.)

The Massachusetts College of Pharmacy and Health Sciences (MCPHS) has agreed to provide at least one seat at their Manchester, MA campus and one seat at their Worcester, MA campus for qualified Assumption students who want to earn a master's degree in Physician Assistant Studies. This is a 24-month program, and to qualify for one of the limited seats, Assumption students must complete the prerequisites with a grade of C or better (with no repeats). They must also have a GPA of 3.4 in the required prerequisites, an overall GPA of 3.4, and they must pass an interview at MCPHS.

New York Chiropractic College (NYCC) B.A./Doctor of Chiropractic (D.C.)

There are two options at NYCC for Assumption students interested in pursuing a doctorate in Chiropractic.

Traditional Doctoral Program (D.C.) Five seats are available at NYCC each year for qualified Assumption students who want to enter a doctoral program in Chiropractic.

Accelerated Doctoral Program (D.C.) Qualified Assumption students are also eligible to enter an accelerated program of study at NYCC. This course of study allows qualified students to complete a doctorate in chiropractic in six years of study instead of the typical seven.

Barry University B.A./Doctor of Podiatric Medicine (D.P.M.)

Assumption College and Barry University School of Podiatric Medicine have agreed to cooperate in providing an accelerated, seven-year curriculum of undergraduate and professional education leading to the Bachelor of Arts degree with a major in Biology from Assumption College and the Doctor of Podiatric Medicine degree from Barry University School of Podiatric Medicine. Upon successful completion of their first year at Barry University College of Podiatric Medicine, individuals in this program are eligible to graduate with a bachelor's degree from Assumption College. Admission into the School of Podiatric Medicine is not guaranteed.

New England College of Optometry B.A./Doctor of Optometry (O.D.)

Assumption College and the New England School of Optometry have agreed to cooperate in providing an accelerated, seven-year curriculum of undergraduate and professional education leading to the Bachelor of Arts degree with a Major in Biology from Assumption College, and the Doctor of Optometry degree from the New England College of Optometry. The program consists of a three-year curriculum at Assumption College followed by a four-year curriculum in optometry at the New England School of Optometry. Upon successful completion of their first year at the New College of Optometry, individuals in this program are eligible to graduate with a bachelor's degree from Assumption College. Admission into the School of Optometry is not guaranteed.

Massachusetts College of Pharmacy and Health Sciences B.A./Doctor of Optometry (O.D.)

The Massachusetts College of Pharmacy and Health Sciences (MCPHS) has agreed to provide five seats at their Worcester, MA campus for qualified Assumption students who want to earn a Doctorate in Optometry. To qualify for admission, students must complete the required prerequisites with a grade of C or better (no repeats). They must also have a GPA of 3.2 in the required prerequisites and an overall GPA of 3.2, and they must pass an interview at MCPHS.

Regis College M.S.in Molecular Imaging and Therapeutics

Regis College has reserved two seats for Assumption students who want to enter the Molecular Imaging and Therapeutics M.S. program. To be eligible, Assumption students must complete the prerequisite courses, and they must have a minimal GPA of 3.0. Eligible students receive waivers for the GRE/MAT requirement and the application fee. The top two eligible candidates are also given preferred admission without the competition of the rest of the applicant pool. Prior to starting the program the accepted student must earn a B.A. at Assumption College. For more information, see the Health Professions Advisor, Prof. Steven Theroux.

Northeastern University Graduate School

Northeastern University will reserve space for two qualified Assumption College students in its Master of Science in Biotechnology program. The minimum requirements for acceptance include a GPA of 3.2, satisfactory completion of all prerequisites, and a completed application. The GRE and application fee will be waived for these students. In addition, Northeastern University will waive the application fee and the GRE requirement for qualified Assumption College students who are interested in pursuing graduate studies in Biotechnology, Pharmaceutical Science, Physician Assistant Studies, Health Informatics, Public Health, Exercise Physiology and School Counseling. The minimal requirements for these waivers include a GPA of 3.2.

Duke University Marine Sciences Education Consortium (MSEC)

Assumption students are eligible to study at Duke University's Marine Laboratory in Beaufort, North Carolina. The Duke program offers an opportunity for intensive study in marine science and marine ecology. In addition, Assumption students may participate in the MSEC's study abroad programs which include sites in Singapore, Trinidad, Hawaii, Panama and France. This program should be of particular interest to Environmental Science majors and minors and to those who seek a science-intense study abroad opportunity.

Duke University 3:2 Program in Environmental Science Management and Forestry Management

Students interested in pursuing a master's degree from Duke University in Environmental Science Management (MEM) or Forestry Management (FM) can complete their general education requirements, their major requirements, and their application for admission to the Duke graduate school in three years. If accepted into the Duke professional master's degree program, the student is eligible to receive his or her Assumption College undergraduate degree upon the successful completion of their first year of graduate studies at Duke. At the end of the second year of graduate study, the student is eligible to receive the MEM or the FM from the Nicholas School at Duke University. The Duke agreement does not guarantee that Assumption College students will be accepted into the graduate program, and admission is competitive.

The University of Notre Dame B.S. in Engineering

Assumption College has established an agreement with the University of Notre Dame College of Engineering that allows qualified Assumption students to earn a B.A. in Chemistry, Environmental Science, Mathematics or Computer Science from Assumption College and a B.S. in one of several fields of Engineering from the University of Notre Dame. This program is a 3:2 program, which means students spend three years studying at Assumption College followed by two years at Notre Dame. Contact Professor Joseph Alfano for more information.

Washington University at St. Louis B.S. in Engineering

Assumption College and Washington University offer a 3:2 engineering degree that leads to a B.A. from Assumption and a B.S. in one of several fields of engineering. This program is very similar to the University of Notre Dame's 3:2 degree program described above. To participate a student must have a 3.25 GPA, and admission to Washington University is not guaranteed. Assumption College and Washington University also offer a 3:3 option for those seeking to earn a Master's Degree in Engineering. Students in this course of study spend three years at Assumption College and three years at Washington University, and upon completion they are awarded a B.A. from Assumption College and a Masters in Engineering from Washington University. Participation in the 3:3 program also requires the student to maintain a 3.25 GPA while at Assumption, and admission to Washington University is not guaranteed. Washington University has a highly-regarded and nationally ranked engineering program, and qualified students who enter the 3:2 or 3:3 programs can choose to study Biomedical Engineering, Chemical Engineering, Computer Engineering, Electrical Engineering, Mechanical Engineering or Systems Science and Engineering. Students entering the 3:2 or 3:3 programs are eligible for financial aid from Assumption College and Washington University. For more information contact Prof. James Hauri at 508 767-7359.

POST-BACCALAUREATE CERTIFICATE PROGRAM IN PREREQUISITES FOR PROFESSIONAL SCHOOLS IN HEALTH FIELDS

This program is designed for individuals who hold Bachelor's degrees, who have not previously made application to Professional Schools in the Health Professions, and who are seeking to complete prerequisites before making an application. Participants will have "non-matriculating" status, and will be charged tuition and fees at the rate listed in the catalog. All courses will be taken with undergraduate students. Programs will be planned in consultation with the College's Advisor for the Health Professions, Dr. Steven Theroux. A participant must complete at least four courses with three different faculty members in the Department of Natural Sciences at Assumption in order to earn a certificate and a recommendation from the Recommendation Committee for the Health Professions. Applicants need to submit a completed application form, available from Dr. Steven Theroux, a written statement describing their motivation for the chosen health career, and official undergraduate transcripts. To be applicants get a seat in the courses that they need to take, these applications should be completed by the end of February prior to their Fall attendance. Completion of this certificate does not guarantee admission to a professional school.

Course Descriptions

CHEMISTRY (CHE)

CHE 105 EVERYDAY CHEMISTRY

This course is designed for non-majors to better understand the chemistry that they interact with in their everyday lives. Even though chemistry has a constant and ubiquitous impact on our lives, most people are unaware of the science behind the products that they use every day. Emphasis will be on the connection between fundamental chemical properties and concepts and the student's everyday lives. Topics will be organized around the chemistry seen in different household areas such as the kitchen, bathroom, laundry room, and garage. There is \$200 lab fee associated with the course. Counts as a science in the NEW core starting with the Class of 2020. This course is NOT eligible to count as a science with a lab under the OLD core.

Hauri/Three credits

CHE 131–132 GENERAL CHEMISTRY I AND II

Fundamental principles of chemistry. Topics covered in CHE 131 include: matter and measurement, atomic and electronic structure, stoichiometry, gases, bonding, and solutions. In CHE 132: chemical equilibria (gases, solubility), acids and bases, electrochemistry, thermochemistry, nuclear and coordination chemistry. Emphasis is placed on problem solving. Laboratory work includes Qualitative Analysis. CHE 131 is a prerequisite for CHE 132. Intended science majors should take this series in their first year. Lab Fee: \$400.00 each semester. This course fulfills the Core Curriculum requirement for a science with a lab. (Part I, Fall; Part II, Spring.) Pre-requisite: MAT 114.

Hauri, Knurr, Marcotte, Niece /*Four credits each semester*

CHE 201–202 ORGANIC CHEMISTRY I AND II

The chemistry of organic compounds (the compounds of carbon) is studied. The topics include covalent bonding, molecular structure, and resonance; constitutional, geometric, and optical isomerism; the reactions of organic compounds through their functional groups; the nucleophilic, electrophilic, and free radical reaction mechanisms; and spectroscopy. These theoretical and practical principles are applied to the solution of such organic chemical problems as structure determination, chemical synthesis of desired molecules, the effect of structure on properties, and the biological roles of organic molecules. This full-year course meets the needs of students who expect to pursue graduate studies in natural sciences and also of those who plan to enter professional schools. Prerequisite: CHE 131–132. Lab Fee: \$400.00 each semester. (Fall, Spring)

Colby Davie, Dix/Four credits each semester

CHE 275 SPECIAL TOPICS IN CHEMISTRY

This special topics course will explore an area of chemistry using the literature, and if appropriate, a cross-disciplinary approach. The course will allow the students and faculty an opportunity to investigate areas of chemistry that are not part of the regular curriculum.

Staff/Three credits

CHE 291 INTERNSHIP IN CHEMISTRY

Directed study within an internship program. The student will be expected to keep a journal detailing the internship. The student will also be expected to write a paper (usually approximately 10 pages in length) summarizing an area related to the internship experience. An evaluation by the on-site supervisor will be considered when determining the grade. The student will be required to have a G.P.A. of 3.0 to enroll.

CHE 311–312 PHYSICAL CHEMISTRY I AND II

An intensive study of the structure and interconversions of matter in its several states. Intra- and inter-molecular forces, thermodynamics, equilibria, electrochemistry, kinetics, and statistical and quantum mechanics are considered. Prerequisites: CHE 201–202, PHY 201–202 (may be concurrent with permission of instructor), MAT 117–118 or MAT 131–132 or permission of the instructor. Lab Fee: \$400.00 per semester. (Fall, Spring)

Knurr/Four credits each semester

CHE 315 ANALYTICAL CHEMISTRY

A study of the major methods of chemical analysis, including statistics in evaluating the error associated with measurements, the systematic treatment of acid-base equilibria, introductory electrochemistry and spectrophotometry, and the theory of separations (chromatography). Three lectures and one three-hour laboratory per week. Prerequisite: CHE 201–202. Lab Fee: \$400.00. (Fall, odd-numbered years)

Niece/Four credits

CHE 316 INORGANIC CHEMISTRY

A study of the structure and properties of the elements and their compounds. Topics covered are atomic structure, periodic relationships, molecular bonding, acid-base systems, and coordination compounds. Laboratory work focuses on the interaction between experiment and theory in understanding and predicting chemical phenomena. Three lectures and one laboratory period per week. Prerequisite: CHE 201–202. Lab fee: \$400.00. (Fall, even-numbered years)

Niece/Four credits

CHE 318 ENVIRONMENTAL CHEMISTRY

A specialized knowledge of chemistry is needed in order to identify, understand, and solve environmental problems. This course will be an in depth study of the chemistry of environmental issues and pollutants. Students will learn the mechanisms of important chemical reactions, as well as relevant analytical techniques related to environmental chemistry. In the lab, students will combine field work, analytical chemistry, and remediation techniques during their investigation of environmental problems. Prerequisites: CHE 131–132, CHE 201–202. Lab Fee: \$400.00

Hauri/Four credits

CHE 414 BIOCHEMISTRY

The major classes of biochemicals, carbohydrates, proteins, lipids, and nucleic acids are studied with particular attention to the relationship between their chemical structures and biological functions. Specific topics include (but are not limited to) biocatalysis, receptors, membrane structure, metabolism, biosynthesis, and energy production. Prerequisite: CHE 201–202 and BIO 160. Lab Fee: \$400.00. (Fall, Spring)

CHE 416 MOLECULAR STRUCTURE AND CHARACTERIZATION

A detailed study of current chemical bonding theories and characterization techniques. Topics covered include molecular symmetry, molecular orbital theory, and computer molecular modeling. Molecular characterization with electronic, vibrational, and nuclear magnetic resonance spectroscopies is addressed. Laboratory work includes molecular modeling, NMR, UV/Visible, and IR Spectroscopy. Three lectures and one laboratory period per week. Prerequisites: CHE312 (can be concurrent with instructor's permission, CHE316. Lab Fee: \$400.00 (Spring, odd-numbered years)

Niece/Four credits

CHE 450 INSTRUMENTAL CHEMISTRY

The study of the theory of instrumental methods of analysis and their application in the laboratory. Topics include computers in data collection and management, UV-vis, IR, AA, fluorimetry, and electrochemical methods. In addition, NMR and mass spectrometry are covered in the lecture. Two lectures and one laboratory period per week. Prerequisite: CHE 202 or permission. Lab Fee: \$400.00. (Spring, even-numbered years)

Niece/Four credits

CHE 460 MEDICINAL CHEMISTRY

Natural and synthetic medicines are investigated with attention to their fate in a living organism: absorption, distribution, and elimination; dose-response and time-response relationships of drugs; and the relationship between chemical structure and biological activity. The biochemistry of several diseases (probably including AIDS) will be examined to learn different ways that chemicals can be used to interfere with the course of a disease. Prerequisite: CHE 201–202 and BIO 160. (Spring, even-numbered years)

Dix/Three credits

CHE 470 ADVANCED ORGANIC CHEMISTRY

An advanced course surveying modern organic chemistry. Topics include synthetic methods, mechanistic analysis, isotope effects, pericyclic and photochemical reactions, and electron transfer. Several case studies will be used to illustrate these topics. Three lectures per week. Prerequisites: CHE 201–202 and CHE 311 or CHE 313. (Spring, odd-numbered years)

Colby Davie/Three credits

CHE 480 SEMINAR IN CHEMISTRY

The student researches specified areas of Chemistry under the guidance of faculty members for oral presentation and defense before the class. Written papers are submitted for final review. Offered upon sufficient demand. Prerequisites: six courses in Physics and Chemistry.

Staff/Three credits

CHE 491–492 INDEPENDENT STUDY

Directed study and research in some aspect of chemistry. Open to students who have a minimum GPA of 3.0 and at least six courses in chemistry or other science. Offered by arrangement with a faculty member. (Fall, Spring)

Staff/Three credits each semester