

NATURAL SCIENCES DIVISION

BIOLOGY, FORENSIC BIOLOGY, MOLECULAR BIOLOGY, and ENVIRONMENTAL SCIENCE Department

Joseph Kulkosky, PhD, Professor of Biology

- Chair of the Natural Sciences Division; Chair of the Biology Department

Lakshmi Atchison, PhD, Professor of Biology

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Lisa McKernan, PhD, Associate Professor of Biology

Kenneth Soprano, PhD, Professor of Biology

Chestnut Hill College offers an Associate of Science with a concentration in Life Sciences (AS), Bachelor of Science (BS) in Biology, a Bachelor of Science (BS) in Forensic Biology, a Bachelor of Science (BS) in Molecular Biology, and a Bachelor of Science (BS) in Environmental Science. In addition, the Department offers minors in Biology, Environmental Science, and Molecular Biology. Interested students should contact Dr. Joseph Kulkosky, Room 522, St. Joseph Hall. Telephone: 215.248.7157. Email: kulkoskyj@chc.edu.

The Secondary Education Co-Major and Special Education Minor are available to Biology Majors as part of the *Secondary Education Certification Preparation Program in Biology (Grades 7 -12)*. Students interested in the Co-Major/Minor should contact the Education Office at 215.248.7129.

Advanced Placement Test Information

Generally, a score of 3 or above on an *Advanced Placement Test* earns academic credit at the College. Scores on the following tests are equivalent to the course/credit indicated however; the Department reserves the right to require the student to demonstrate sufficient laboratory skills to award credit. Evidence of such skills may consist of a detailed description of the laboratory exercises performed or a detailed laboratory notebook signed by the High School Instructor.

AP TEST	SCORE	EQUIVALENT COURSE
Biology	3, 4, or 5	BIOL-111: Principles of Biology I (4 credits)
Environmental Sciences	3, 4, or 5	BIOL-106: Ecology and Environmental Issues (4 credits)

General Course Options

In addition to courses for majors, there are many Biology courses that are open to students of any major wishing to fulfill the *Natural Science Core Requirement*, or are interested in exploring personal interests without committing to a minor. The following are open to any undergraduate student meeting the Prerequisites; check the *Course Descriptions* section for additional information on the following:

Biology/Core Natural Science Requirement

BIOL-101: General Biology I (3.5 credits)

BIOL-102: General Biology II (3.5 credits)

BIOL-106: Ecology and Environmental Issues (4 credits)

BIOL-125: Ponds and Streams (4 credits)

BIOL-126: The Biology of Cancer

BIOL-145: Forests and Fields

BIOL-215: Biological and Medical Ethics (Fulfills Core Ethics Req)

BIOL-206: General Zoology (4 credits)

BIOL-210: Nutrition (4 credits)

Departmental Mission

The Biology Department supports the liberal arts tradition of Chestnut Hill College by providing fundamental knowledge in all areas of Biology. The Biology major provides students with a sound and comprehensive understanding of information and issues in several sub-disciplines of the biological and biomedical sciences as well as a strong foundation in Chemistry, Mathematics, and Physics. The curriculum develops communication skills, problem solving abilities, analytical reasoning, and critical thinking. The goal is to meet the specific needs of individual students and to prepare them to be competitive when moving on to post-graduate education, other professional specialization, or careers in the life sciences.

All students receive a core of courses that provides a common broad base of sound scientific knowledge to provide students with a well-rounded, solid education. Elective courses then complete the curriculum to further develop the student's expertise in a sub-discipline of Biology. Students exposed to such a multidisciplinary program should be better prepared to think in more global terms in their approach to the diversity of problems in the life sciences.

Articulation Agreements

Students interested in any of the following programs should contact Lisa McKernan, Room 521, St. Joseph Hall. Telephone: 215.248.7106. Email: mckernanl@chc.edu

Physician's Assistant Program

Chestnut Hill College and Arcadia University have entered into an articulation agreement concerning the early consideration for acceptance of Chestnut Hill College graduates into the Physician's Assistant Program at Arcadia with early consideration for financial aid. Certain requirements must be met by the College graduate including but not limited to: certain course requirements, GPA of 3.30 in Prerequisite courses, and 500 hours of patient care and/or research experience. Please note that the course requirements of this articulation agreement will be met by students majoring in Biology or Molecular Biology.

Medical Laboratory Sciences and Biotechnology Program

Students can earn both a *Bachelor of Science in Biology* and a *Master of Science in Biotechnology, Cytotechnology, or Medical Laboratory Science* as part of this cooperative agreement between Chestnut Hill College and Jefferson School of Health Professions of Thomas Jefferson University (TJU). Students will spend the first three years at Chestnut Hill College and then proceed to TJU for the final two years of coursework. A Bachelor of Science in Biology with a concentration in Bioscience Technologies will be awarded by the College after successful completion of the first year at TJU. A Master of Science in one of the Bioscience Technologies disciplines will be awarded by Thomas Jefferson University after successful completion of the second year.

Radiologic Sciences Program

Students can earn both a *Bachelor of Science in Biology* and a *Bachelor of Science in Radiologic Sciences* as part of this cooperative agreement between Chestnut Hill College and Jefferson School of Health Professions of Thomas Jefferson University (TJU). Students will spend the first three years at Chestnut Hill College and then proceed to TJU for the final two years of coursework. A Bachelor of Science in Biology with a concentration in Radiologic Sciences will be awarded by the College after successful completion of the first year at TJU. A Bachelor of Science in Radiologic Sciences will be awarded by Thomas Jefferson University after successful completion of the second year.

Awards and Scholarships

The Biology Department offers majors 50% reimbursement for expenses relating to courses taken in advance of, and in preparation for, standardized professional school entry exams if the student has a GPA of 3.40 at the time of course enrollment. These preparatory courses methodically prepare students for the Medical College Admissions Test (MCAT), the Graduate Record Exam (GRE), and the Dental School Admissions Test (DAT), but the award is not necessarily limited to these specific testing areas. For information, please contact Dr. Joseph Kulkosky, Room 522, St. Joseph Hall, Telephone: 215.248.7157. Email: kulkoskyj@chc.edu.

The endowed *Amelia Kulkosky Scholarship Award* in the Biological Sciences at Chestnut Hill College funds an exceptional student who has dual interests in the biological sciences and music. The award is granted to an incoming First-year in the Department of Biology major's program. Only candidates declaring a major in Biology, Forensic Biology, Molecular Biology, or Environmental Sciences are eligible to apply. The candidate is to have a SAT score of 1150 for better (1600 scale) or 1725 or better (2400 scale). The candidate is expected to pursue either a Major or minor in Music, or participate in the College's Ensemble programs to the satisfaction of the scholarship committee, concurrently with a Major in the biological sciences. The award total over four years is \$2500. For information, please contact Dr. Joseph Kulkosky, Room 522, St. Joseph Hall, Telephone: 215.248.7157. Email: kulkoskyj@chc.edu.

Career Connections, Public Speaking and Technology Requirements

Majors in Biology, Forensic Biology, Molecular Biology, or Environmental Sciences fulfill the Career Connections requirement by engaging with nationally and internationally acclaimed scientists and health professionals through the Biomedical Seminar Series and by participating in the Science Career Day, which includes representatives from scientific research and health professional programs. The Public Speaking requirement is fulfilled by completing BIOL-300, BIOL-481, and BIOL-498, where students receive public speaking training and are required to make oral presentations on written research projects. The Technology requirement is completed by completing science lab sessions, which require students to become proficient in Microsoft Excel and Microsoft Word. Students also receive instruction in the use of various statistical programs.

Departmental Honors

Eligibility is determined by mastery of the major field and by general ability. To be eligible a student must have declared a major, have achieved a grade point average of 3.6 or higher in the major and an overall grade point average of 3.5 or higher, and completed 60 semester hours toward his/her degree (12 of which must be credits in the major). In addition, the student must have the recommendation of the faculty in the major department. Students not meeting this criteria might be recommended for the program by the major department. In most instances, students will receive a formal, written invitation early in the Fall semester of their Junior year. The Departmental Honors program provides an opportunity for independent study and research culminating in an Honors thesis submitted in the spring of Senior year. All students who have successfully completed the Honors Program will be recognized with Honors in their Major at the annual Honors Convocation and on their academic transcripts. In addition, the title of the completed *Honors Thesis* will appear on the academic transcript.

Honor Societies

Sigma Zeta is a national science and mathematics honor society founded in 1925. The society is dedicated to encouraging and fostering the attainment of knowledge in Mathematics, Computer Science, and the Natural Sciences. Membership in the society recognizes and honors scholarly achievement in the Major. Criteria for eligibility for membership include completion of 25 credits towards the degree, with a minimum of 15 credits in the Major, a grade point average of 3.00 in the Major, and a 3.00 grade point average overall. Students majoring in Biology, Forensic Biology, Molecular Biology, or Environmental Sciences may be invited by the department to join Sigma Zeta. Eligible students must be approved by the Department.

Post-Baccalaureate Study

Most medical schools require the MCAT exam. Non-science majors are advised to consider taking another year of Biology to be well prepared for the MCAT. Most veterinary schools require the GRE general exam, as well as one semester each of Biochemistry and Microbiology. Most graduate schools in Biological/Biomedical areas require the GRE general exam. Some require the writing test and/or one of two subject tests (Biochemistry, Cell and Molecular Biology, or Biology). Graduate programs of all three types can vary in their requirements. Students should consult the catalogs of the schools of their choice early in their undergraduate years to plan an appropriate course of study. Please note that most graduate programs of the types listed require:

- Two semesters of Biology
- Two semesters of General Chemistry
- Two semesters of Organic Chemistry
- Two semesters of Physics
- Two semesters of English Composition
(FILA-120 or IDHP-210 and ENGL-101, -105, or IDHP-220)

Seminar Series

The Biology Department sponsors two annual seminar series events: *The Biomedical Seminar Series*, initiated in 1994, sponsors prominent speakers in the biomedical field and in basic research; and *The Environmental Sciences Seminar Series*, started in 2000, provides students with an opportunity to learn about the unique activities in environmental research, issues and policies.

These seminars provide a forum for learning about recent advances in basic research, biomedicine, and environmental science and expose students and faculty to prominent scientific and medical professionals. The meetings foster collaboration, interaction, and career contacts for students pursuing careers in basic research, health, medicine, as well as environmental issues and policy.

Biology

The curriculum leading to a Major in Biology is designed to help the student understand the unifying concepts of the nature of life and to develop the laboratory skills needed for the study of organisms and the pursuit of sound scientific methodology. Students participate in various intercollegiate scientific seminars and often earn distinction and the Internship Program provides Biology majors with the opportunity to integrate academic learning with practical experience.

Major students who meet academic qualifications are encouraged to participate in the Biology Departmental Honors program, which provides greater levels of challenge. Students may perform independent study (*BIOL-490: Independent Study in Biology*) during the Junior or Senior year under the direction of a department member, an established scientist, or a physician at a graduate school or major research center.

Major in Biology

A minimum Career GPA of 2.00 and a minimum Major GPA of 2.00 are required for graduation. Students must earn a grade of C- (1.70) or better to successfully complete the requirements for the Major. An *Independent Study* may be available with appropriate permissions; *Special Topics* courses are repeatable for credit; as is *BIOL-401: Internship in Biology*. Courses are 3 or 4 credits unless indicated and may not be offered every semester.

Requirements for the Major in Biology

BIOL-111: Principles of Biology I (4 credits; Fulfills the Core Natural Science Requirement)

BIOL-201: Cell Biology (4 credits)

BIOL-217: Genetics (4 credits)

BIOL-233: Ecology and Evolutionary Biology (4 credits)

BIOL-498: Senior Seminar in Biology

CHEM-131: Principles of Chemistry I (4 credits)

CHEM-132: Principles of Chemistry II (4 credits)

CHEM-215: Organic Chemistry I (4 credits)

PHYS-121: Principles of Physics I (4 credits)

One Biology or Chemistry Elective

One 200-level Biology Elective

Two 300-level Biology Electives

Two 400-level Biology Electives

One Mathematics Elective (3 credits)

One Statistics Elective (3 credits)

One course from at least two of the Area Electives* (7 credits minimum)

* For students considering graduate study, a course from each of the areas (CHEM, MATH, PHYS) is highly recommended.

200-level Biology Electives:

BIOL-203: Human Anatomy and Physiology I (4 credits)

BIOL-206: General Zoology (4 credits)

BIOL-210: Nutrition (4 credits)

BIOL-215: Biological and Medical Ethics (Fulfills Core Ethics Req)

BIOL-281: Special Topics in Biology

300-level Biology Electives:

BIOL-300: Experimental Mth/Design (Writing Intensive; 4 credits)

BIOL-303: Human Anatomy and Physiology II (4 credits)

BIOL-312: Watersheds and Freshwater Ecology (4 credits)

BIOL-322: Terrestrial Ecology (4 credits)

BIOL-324: Microbiology (4 credits)

BIOL-325: Marine Biology (4 credits)

BIOL-332: Medical Terminology

BIOL-333: Evolution

BIOL-351: Molecular Biology

BIOL-360: Biotechnology

400-level Biology Electives:

BIOL-401: Internship in Biology

BIOL-410: Immunology (4 credits)

BIOL-411: Developmental Biology (4 credits)

BIOL-413: Conservation and Restoration Biology

BIOL-430: Forensic Medicine

BIOL-481: Advanced Special Topics in Biology

Mathematics Electives:

MATH-202: Math for Management II

MATH-203: Analytic Geometry and Calculus I

MATH-211: Calculus and Modern Analysis I

Statistics Electives:

MATH-227: Introduction to Probability and Statistics

MATH-262: Probability and Statistics

PSYC-216: Quantitative Methods in Psychology

Area Electives*:

Chemistry

CHEM-216: Organic Chemistry II (4 credits)

CHEM-250: Introduction to Biochemistry

Mathematics

MATH-204: Analytic Geometry and Calculus II

MATH-212: Calculus and Modern Analysis II

Physics

PHYS-122: Principles of Physics II (4 credits)

* For students considering graduate study, a course from each of the areas (CHEM, MATH, PHYS) is highly recommended.

Sample Academic Plan

Major in Biology

This is a *suggested academic plan only*; it is not meant to address each student's individual requirements or interests. Students will develop a personalized plan with a Faculty Advisor; however, it is the student's responsibility to be aware of, register for, and successfully complete all of the requirements for graduation in the Major. The minimum number of Academic Credits required for graduation is 120.

Year One/Fall	14 academic credits/15 credits total	Year One/Spring	14 academic credits/15 credits total
BIOL-111: Principles of Biology I (4 credits)		BIOL/CHEM Elective	
CHEM-131: Principles of Chemistry I (4 credits)		CHEM-132: Principles of Chemistry II (4 credits)	
FILA-120: Foundations in the Liberal Arts		ENGL-101: College Writing	
Foreign Language Requirement		Foreign Language Requirement or General Elective	
FYIN-120: First Year Initiative (1 credit non-academic)		Physical Education Requirement #1 (1 credit non-academic)	
Year Two/Fall	14 academic credits/15 credits total	Year Two/Spring	16 academic credits
BIOL-201: Cell Biology (4 credits)		200-level Biology Elective	
CHEM-215: Organic Chemistry I (4 credits)		BIOL-217: Genetics (4 credits)	
RLST-104: The Religious Imagination		Core Religious Studies 200-Level Requirement	
Mathematics Elective		Elective Area #1	
Physical Education Requirement #2 (1 credit non-academic)		Statistics Elective	
Year Three/Fall	16 academic credits	Year Three/Spring	16 academic credits
300-level Biology Elective #1		300-level Biology Elective #2	
Core Arts Requirement		BIOL-233: Ecology and Evolutionary Biology (4 credits)	
Core Ethics Requirement (BIOL-215)		Core Literature Requirement	
Core History Requirement		Core Social Science Requirement	
PHYS-121: Principles of Physics I (4 credits)		Elective Area #2	
Year Four/Fall	15 academic credits	Year Four/Spring	15 academic credits
400-level Biology Elective #1		400-level Biology Elective #2	
GLST-201: Global Awareness Seminar		BIOL-498: Senior Seminar in Biology	
Minor #1 or Biology or General Elective		Minor #4 or Biology or General Elective	
Minor #2 or Biology or General Elective		Minor #5 or Biology or General Elective	
Minor #3 or Biology or General Elective		Minor #6 or Biology or General Elective	

Major in Biology with Concentration in Sports Medicine

A minimum Career GPA of 2.00 and a minimum Major GPA of 2.00 are required for graduation. Students must earn a grade of C- (1.70) or better to successfully complete the requirements for the Major. An *Independent Study* may be available with appropriate permissions; *Special Topics* courses are repeatable for credit; as is *BIOL-401: Internship in Biology*. Courses are 3 or 4 credits unless indicated and may not be offered every semester.

Requirements for the Major in Biology with Concentration in Sports Medicine

BIOL-111: Principles of Biology I (4 credits; *Fulfills the Core Natural Science Requirement*)

BIOL-201: Cell Biology (4 credits)

BIOL-203: Human Anatomy and Physiology I (4 credits)

BIOL-215: Biological and Medical Ethics (*Fulfills Core Ethics Requirement*)

BIOL-217: Genetics (4 credits)

BIOL-300: Experimental Methods and Designs (*Writing Intensive*)(4 credits)

BIOL-303: Human Anatomy and Physiology II (4 credits)

BIOL-324: Microbiology (4 credits)

BIOL-351: Molecular Biology

BIOL-401: Internship in Biology

BIOL-498: Senior Seminar in Biology

CHEM-131: Principles of Chemistry I (4 credits)

CHEM-132: Principles of Chemistry II (4 credits)

CHEM-215: Organic Chemistry I (4 credits)

CHEM-216: Organic Chemistry II (4 credits) or CHEM-250: Intro Biochemistry

EXSC-301: Kinesiology

EXSC-302: Exercise Physiology (4 credits)

EXSC-304: Personal Training

OR EXSC-305: Exercise Testing

MATH-202: Math for Management II

PHYS-121: Principles of Physics I (4 credits)

PHYS-122: Principles of Physics II (4 credits)
 PSYC-101: General Psychology (Fulfills Core Social Sciences Requirement)
 Choice of:
 PSYC-210: Physiology of Behavior
 OR PSYC-217: Abnormal Psychology
 OR PSYC-230: Drugs and Behavior
 SPMA-210: Introduction to Sports Management
 SPMA-320: Sports Law
 One Statistics Elective (3 credits)

Statistics Electives:

MATH-227: Introduction to Probability and Statistics
 MATH-262: Probability and Statistics
 PSYC-216: Quantitative Methods in Psychology

Sample Academic Plan

Major in Biology with Concentration in Sports Medicine

This is a *suggested academic plan only*; it is not meant to address each student's individual requirements or interests. Students will develop a personalized plan with a Faculty Advisor; however, it is the student's responsibility to be aware of, register for, and successfully complete all of the requirements for graduation in the Major. The minimum number of Academic Credits required for graduation is 120.

Year One/Fall 14 academic credits/15 credits total	Year One/Spring 16 academic credits/17 credits total
BIOL-111: Principles of Biology I (4 credits) CHEM-131: Principles of Chemistry I (4 credits) FILA-120: Foundations in the Liberal Arts Foreign Language Requirement FYIN-120: First Year Initiative (1 credit non-academic)	CHEM-132: Principles of Chemistry II (4 credits) ENGL-101: College Writing PSYC-101: General Psychology RLST-104: The Religious Imagination Foreign Language Requirement or General Elective Physical Education Requirement #1 (1 credit non-academic)
Year Two/Fall 17 academic credits	Year Two/Spring 14 academic credits
BIOL-201: Cell Biology (4 credits) CHEM-215: Organic Chemistry I (4 credits) Core Religious Studies 200-Level Requirement GLST-201: Global Awareness Seminar SPMA-210: Introduction to Sports Management	BIOL-217: Genetics (4 credits) Core Arts Requirement CHEM-216: Organic Chemistry II (4 credits) MATH-202: Math for Management II
Year Three/Fall 17 academic credits	Year Three/Spring 18 academic credits
BIOL-203: Human Anatomy and Physiology I (4 credits) BIOL-215: Biological and Medical Ethics PHYS-121: Principles of Physics I (4 credits) PSYC-200 Level elective Statistics Elective	BIOL-303: Human Anatomy and Physiology II (4 credits) BIOL-324: Microbiology (4 credits) BIOL-351: Molecular Biology EXSC-301: Kinesiology PHYS-122: Principles of Physics II (4 credits)
Year Four/Fall 14 academic credits	Year Four/Spring 12 academic credits/13 credits total
BIOL-300: Experimental Methods (4 credits) BIOL-401: Internship in Biology Core History Requirement EXSC-302: Exercise Physiology (4 credits)	BIOL-498: Senior Seminar in Biology Core Literature Requirement EXSC-304: Personal Training OR EXSC-305: Exercise Testing SPMA-320: Sports Law Physical Education Requirement #2 (1 credit non-academic)

Major in Biology with Concentration in Bioscience Technologies

A Bachelor of Science (BS) in Biology with Concentration in Bioscience Technologies will be awarded by the College after successful completion of the first year at Thomas Jefferson University.

A minimum Career GPA of 2.00 and a minimum Major GPA of 2.00 are required for graduation. Students must earn a grade of C- (1.70) or better to successfully complete the requirements for the Major. *Special Topics* courses are repeatable for credit; as is *BIOL-401: Internship in Biology*. Courses are 3 credits unless indicated and may not be offered every semester.

Requirements for the Major in Biology with Concentration in Bioscience Technologies

BIOL-111: Principles of Biology I (4 credits; Fulfills Core Natural Science Requirement)
 BIOL-201: Cell Biology (4 credits)
 BIOL-203: Human Anatomy and Physiology I (4 credits)
 BIOL-217: Genetics (4 credits)
 BIOL-300: Experimental Methods and Designs (Writing Intensive)(4 credits)
 BIOL-303: Human Anatomy and Physiology II (4 credits)
 CHEM-131: Principles of Chemistry I (4 credits)
 CHEM-132: Principles of Chemistry II (4 credits)

CHEM-215: Organic Chemistry I (4 credits)
 CHEM-216: Organic Chemistry II (4 credits)
 or CHEM-250: Introduction to Biochemistry
 One Biology or Chemistry Elective
 MATH-201: Math for Management I or MATH-202: Math for Management II
 or MATH-203: Analytic Geometry and Calculus I
 MATH-262: Probability and Statistics
 or MATH 227: Intro to Probability and Statistics
 All *Additional Courses* as required at Thomas Jefferson University*

*Students must transfer a minimum of four science courses from Thomas Jefferson University and enough credits to meet the minimum 120 academic credits required for graduation by the College.

Sample Academic Plan

Major in Biology with Concentration in Bioscience Technologies

This is a *suggested academic plan only*; it is not meant to address each student's individual requirements or interests. Students will develop a personalized plan with a Faculty Advisor; however, it is the student's responsibility to be aware of, register for, and successfully complete all of the requirements for graduation in the Major. **Minimum Academic Credits required for graduation: 120 including transferred credits from Thomas Jefferson University.**

Year One/Fall	14 academic credits/15 credits total	Year One/Spring	14 academic credits/15 credits total
BIOL-III: Principles of Biology I (4 credits)	CHEM-131: Principles of Chemistry I (4 credits)	BIOL/CHEM Elective	CHEM-132: Principles of Chemistry II (4 credits)
FILA-120: Foundations in the Liberal Arts	Foreign Language Requirement	ENGL-101: College Writing	Foreign Language Requirement or General Elective
FYIN-120: First Year Initiative (1 credit non-academic)		Physical Education Requirement #1 (1 credit non-academic)	
Year Two/Fall	17 academic credits	Year Two/Spring	16 academic credits/17 credits total
BIOL-201: Cell Biology (4 credits)	CHEM-215: Organic Chemistry I (4 credits)	BIOL-217: Genetics (4 credits)	Core Arts Requirement
Core History Requirement	RLST-104: The Religious Imagination	Core Literature Requirement	Core Religious Studies 200-Level Requirement
MATH-201: Math for Management I		MATH-262: Probability and Statistics	Physical Education Requirement #2 (1 credit non-academic)
Year Three/Fall	17 academic credits	Year Three/Spring	16 academic credits
BIOL-203: Human Anatomy and Physiology I (4 credits)	BIOL-300: Experimental Methods and Design (4 credits)	BIOL-303: Human Anatomy and Physiology II (4 credits)	Core Social Science Requirement
Core Ethics Requirement (BIOL-215)	GLST-201: Global Awareness Seminar	General Elective	General Elective
General Elective		General Elective	
Year Four/Fall		Year Four/Spring	
Courses at Thomas Jefferson University		Courses at Thomas Jefferson University	

Major in Biology with Concentration in Radiologic Sciences

A Bachelor of Science (BS) in Biology with Concentration in Radiologic Sciences will be awarded by the College after successful completion of the first year at Thomas Jefferson University.

A minimum Career GPA of 2.00 and a minimum Major GPA of 2.00 are required for graduation. Students must earn a grade of C- (1.70) or better to successfully complete the requirements for the Major. *Special Topics* courses are repeatable for credit; as is *BIOL-401: Internship in Biology*. Courses are 3 credits unless indicated and may not be offered every semester.

Requirements for the Major in Biology with Concentration in Radiologic Sciences

BIOL-III: Principles of Biology I (4 credits; *Fulfills Core Natural Science Requirement*)
 BIOL-201: Cell Biology (4 credits)
 BIOL-203: Human Anatomy and Physiology I (4 credits)
 BIOL-217: Genetics (4 credits)
 BIOL-300: Experimental Methods and Design (4 credits)
 BIOL-303: Human Anatomy and Physiology II (4 credits)
 BIOL-332: Medical Terminology
 CHEM-131: Principles of Chemistry I (4 credits)
 CHEM-132: Principles of Chemistry II (4 credits)
 One Biology or Chemistry Elective
 MATH-202: Math for Management II/Applied Calculus

or MATH-203: Analytic Geometry and Calculus I
 MATH-262: Probability and Statistics
 or MATH 227: Intro to Probability and Statistics
 PHYS-121: Principles of Physics I (4 credits)
 PHYS-122: Principles of Physics II (4 credits)
 Choice of*:
 MATH-122: Precalculus III
 or MATH-204: Analytic Geometry and Calculus II
 *Math-122 taken before Math 202 or 203; Math 204 taken after 202 or 203.
 All **Additional Courses** as required at Thomas Jefferson University*

*Students must transfer a minimum of four science courses from Thomas Jefferson University and enough credits to meet the minimum 120 academic credits required for graduation by the College.

Sample Academic Plan

Major in Biology with Concentration in Radiologic Sciences

This is a *suggested academic plan only*; it is not meant to address each student's individual requirements or interests. Students will develop a personalized plan with a Faculty Advisor; however, it is the student's responsibility to be aware of, register for, and successfully complete all of the requirements for graduation in the Major. **Minimum Academic Credits required for graduation: 120 including transferred credits from Thomas Jefferson University.**

Year One/Fall	14 academic credits/15 credits total	Year One/Spring	17 academic credits/18 credits total
BIOL-111: Principles of Biology I (4 credits) CHEM-131: Principles of Chemistry I (4 credits) FILA-120: Foundations in the Liberal Arts Foreign Language Requirement FYIN-120: First Year Initiative (1 credit non-academic)		BIOL/CHEM Elective CHEM-132: Principles of Chemistry II (4 credits) Core Social Science Requirement ENGL-101: College Writing Foreign Language Requirement or General Elective Physical Education Requirement #1 (1 credit non-academic)	
Year Two/Fall	14 academic credits/16credits total	Year Two/Spring	17 academic credits
BIOL-201: Cell Biology (4 credits) BIOL-203: Human Anatomy and Physiology I (4 credits) GLST-201: Global Awareness Seminar MATH-202: Math for Management II or MATH-203: Analytic Geometry and Calculus I Physical Education Requirement #2 (1 credit non-academic)		BIOL-217: Genetics (4 credits) Core History Requirement MATH-227: Intro to Probability and Statistics or MATH-262: Probability and Statistics RLST-104: The Religious Imagination Second Mathematics Elective (if MATH-122 was not taken)	
Year Three/Fall	16 academic credits	Year Three/Spring	15 academic credits
BIOL-332: Medical Terminology Core Arts Requirement Core Literature Requirement Core Ethics Requirement (BIOL-215) PHYS-121: Principles of Physics I (4 credits)		BIOL-300: Experimental Methods and Design (4 credits) BIOL-303: Human Anatomy and Physiology II (4 credits) Core Religious Studies 200-Level Requirement PHYS-122: Principles of Physics II (4 credits)	
Year Four/Fall		Year Four/Spring	
Courses at Thomas Jefferson University		Courses at Thomas Jefferson University	

Major in Biology with Secondary Education Co-Major and Minor in Special Education

The *Secondary Education Certification Preparation Program in Biology (Grades 7 -12)* is available to Biology Majors seeking Pennsylvania Department of Education (PDE) Certification. The Program integrates educational theory and practice with field experiences that include practicum and student teaching, as well as opportunities to develop teaching competence through innovative and effective approaches to the educational process with focus on students at the Secondary Level. Students interested in the Co-Major/Minor should contact the Education Office at 215.248.7129.

The PDE requires that all *Secondary Education Certification Preparation Program* participants have 9 credits of Special Education and 3 credits of Teaching English as a Second Language, in addition, students must meet field experience competencies before Student Teaching: EDSC-203 provides 20 hours; EDSC-201 provides 20 hours; EDSC-326 provides 75; and Student Teaching, EDSC-420, is 14 weeks in duration.

Stage I and Stage II Portfolios are completed in the following courses:

EDSC-203: Foundations of High School Education

EDSC-201: Adolescent Development and Learning

Stage IIIA Portfolio is completed in the following course:

EDSC-326: Special Methods in Biology/Field Experience IIIA

Stage IV Portfolio is completed in the following courses:

EDSC-420: Clinical Field Experience/Student Teaching

EDSC-421: Clinical/Student Teaching Seminar

By 60 credits candidates must pass a basic skills test (PAPA or CORE) if not SAT/ACT exempt as required by PDE. An overall GPA of 3.0 or above is required for formal acceptance into the Education Dept. and for graduation. Students must successfully complete all required coursework, clinical field experiences, and student teaching.

Students must earn a grade of C- (1.70) or better to successfully complete the requirements for the Major unless an exception is noted. Majors may need to re-take courses with C- grades if their Career GPA is less than the Career GPA required by the PDE for Certification or if a higher grade is required to demonstrate competency as identified by the department. *Special Topics* courses are repeatable for credit. Courses are 3 credits unless indicated and may not be offered every semester.

Requirements for the Major in Biology with a Co-Major in Secondary Education and Minor in Special EducationBIOL-111: Principles of Biology I (4 credits; *Fulfills the Core Natural Science Requirement*)

BIOL-201: Cell Biology (4 credits)

BIOL-217: Genetics (4 credits)

BIOL-233: Ecology and Evolutionary Biology (4 credits)

BIOL-300: Experimental Methods and Design (4 credits)

BIOL-324: Microbiology (4 credits)

BIOL-498: Senior Seminar in Biology

CHEM-131: Principles of Chemistry I (4 credits)

CHEM-132: Principles of Chemistry II (4 credits)

CHEM-215: Organic Chemistry I (4 credits)

CHEM-250: Introduction to Biochemistry

EDSC-201: Adolescent Development and Learning (*Fulfills the Core Social Science Requirement*) (m) FE I Portfolio Rqd.

EDSC-203: The Foundations of High School (e) FE II Portfolio Rqd.

EDSC-315: General Methods and Assessment (e)

EDSC-326: Special Methods in Biology/Field Experience IIIA /Stage IIIA Portfolio (e)(m)

EDSC-420: Clinical Field Experience/Student Teaching /Stage IV Portfolio (9 credits) (e)

EDSC-421: Clinical/Student Teaching Seminar (e)

EDSP-340: Introduction to Special Education (m)

EDSP-347: Assessments & Interventions for all Learners (m)

EDSP-362: Teaching Reading for All Learners (m)

EDSP-390: ESL Foundations and Methods (m)

ENGL-101: College Writing (e)*

PHYS-105: Physical/Earth/Space Science

PHYS-121: Principles of Physics I (4 credits)

PHYS-122: Principles of Physics II (4 credits)

One Biology or Chemistry Elective

One 200-level or above Biology Elective

One American or British Literature Elective (e)*

Two Mathematics Elective (3 credits) (e)*

One Statistics Elective (3 credits)

(e) = courses required for Secondary Education Co-Major

(m) = courses required for Special Education Minor

*Student must earn grade of C or better

200-level Biology Electives:

BIOL-203: Human Anatomy and Physiology I (4 credits)

BIOL-206: General Zoology (4 credits)

BIOL-210: Nutrition (4 credits)

BIOL-215: Biological and Medical Ethics (*Fulfills Core Ethics Req*)

BIOL-281: Special Topics in Biology

300-level Biology Electives:

BIOL-303: Human Anatomy and Physiology II (4 credits)

BIOL-312: Watersheds and Freshwater Ecology (4 credits)

BIOL-322: Terrestrial Ecology (4 credits)

BIOL-325: Marine Biology (4 credits)

BIOL-332: Medical Terminology

BIOL-333: Evolution

BIOL-351: Molecular Biology

BIOL-360: Biotechnology

400-level Biology Electives:

BIOL-401: Internship in Biology

BIOL-405: Environmental Study Tour (4 credits)

BIOL-410: Immunology (4 credits)

BIOL-411: Developmental Biology (4 credits)

BIOL-413: Conservation and Restoration Biology

BIOL-430: Forensic Medicine

BIOL-481: Advanced Special Topics in Biology

Mathematics Electives:

MATH-202: Math for Management II

MATH-203: Analytic Geometry and Calculus I

Statistics Electives:

MATH-227: Introduction to Probability and Statistics
 MATH-262: Probability and Statistics

PSYC-216: Quantitative Methods in Psychology

Sample Academic Plan

Major in Biology with Co-Major in Secondary Education and Minor in Special Education

This is a *suggested academic plan only*; it is not meant to address each student's individual requirements or interests. Students will develop a personalized plan with a Faculty Advisor; however, it is the student's responsibility to be aware of, register for, and successfully complete all of the requirements for graduation in the Major. **The minimum number of Academic Credits required for graduation is 120.**

Year One/Fall	17 academic credits/18 credits total	Year One/Spring	17 academic credits
Take Basic Skills (reading, math, writing) test if not exempt BIOL-111: Principles of Biology I (4 credits) CHEM-131: Principles of Chemistry I (4 credits) FILA-120: Foundations in the Liberal Arts Foreign Language Requirement FYIN-120: First Year Initiative (1 credit non-academic) Math Elective Req. #1 (202, 203, or 211)		BIOL/CHEM Elective CHEM-132: Principles of Chemistry II (4 credits) EDSC-201: Adolescent Development and Learning FE I ENGL-101: College Writing Foreign Language Requirement or General Elective	
		Retake Basic Skills as needed. Must pass all before 60 credits	
Year Two/Fall	17 academic credits/18 credits total	Year Two/Spring	16 academic credits/17 credits total
BIOL-201: Cell Biology (4 credits) CHEM-215: Organic Chemistry I (4 credits) EDSC-203: The Foundations of High School FE II Math Elective Req. #2 - Statistics Elective (227 or 262) Physical Education Requirement #1 (1 credit non-academic) RLST-104: The Religious Imagination		American or British Literature Elective BIOL-217: Genetics (4 credits) CHEM-250: Introduction to Biochemistry Core Religious Studies 200-Level Requirement EDSC-315: General Methods and Assessment Physical Education Requirement #2 (1 credit non-academic)	
Complete Pre-Professional Benchmark		Apply for formal admission to Education Dept. after 48 credits and before 60 credits	
Year Three/Fall	16 academic credits	Year Three/Spring	16 academic credits
BIOL-300: Experimental Methods and Design EDSC-326: Sp Methods/Biology/Field Exp IIIA/Stage IIIA Ptf EDSP-340: Introduction to Special Education EDSP-362: Teaching Reading for all Learners PHYS-121: Principles of Physics I (4 credits)		BIOL-233: Ecology and Evolutionary Biology (4 credits) BIOL-324: Microbiology Core Arts Requirement EDSP-347: Assessments & Interventions for all Learners PHYS-122: Principles of Physics II	
Year Four/Fall	12 academic credits	Year Four/Spring	18 academic credits
EDSC-420: Cl Field Exp/Stu Tch /Stage IV Portfolio (9 credits) EDSC-421: Clinical/Student Teaching Seminar		200-Level Biology Elective/Core Ethics Requirement (BIOL-215) BIOL-498: Senior Seminar in Biology Core History Requirement EDSP-390: ESL Foundations and Methods GLST-201: Global Awareness Seminar PHYS-105: Physical/Earth/Space Science	

Minor in Biology

Students must earn a grade of C- (1.70) or better to successfully complete the requirements for the minor. An *Independent Study* may be available with appropriate permissions; *Special Topics* courses are repeatable for credit. Courses are 3 credits unless indicated and may not be offered every semester.

Requirements for the Minor in Biology

At Least Six Biology courses with Four at the 200-Level or above

200-level Biology Electives:

BIOL-201: Cell Biology (4 credits)
 BIOL-203: Human Anatomy and Physiology I (4 credits)
 BIOL-206: General Zoology (4 credits)
 BIOL-210: Nutrition (4 credits)

BIOL-215: Biological and Medical Ethics (Fulfills Core Ethics Req)
 BIOL-217: Genetics (4 credits)
 BIOL-233: Ecology and Evolutionary Biology (4 credits)
 BIOL-281: Special Topics in Biology

300- and 400-level Biology Electives:

BIOL-300: Experimental Mths Design (Writing Intensive) (4 credits)

BIOL-303: Human Anatomy and Physiology II (4 credits)

BIOL-312: Watersheds and Freshwater Ecology (4 credits)
 BIOL-322: Terrestrial Ecology (4 credits)
 BIOL-324: Microbiology (4 credits)
 BIOL-325: Marine Biology (4 credits)
 BIOL-333: Evolution
 BIOL-351: Molecular Biology

BIOL-360: Biotechnology
 BIOL-410: Immunology (4 credits)
 BIOL-411: Developmental Biology (4 credits)
 BIOL-413: Conservation and Restoration Biology
 BIOL-430: Forensic Medicine
 BIOL-481: Advanced Special Topics in Biology

Associate of Science with a concentration in Life Sciences

The Associate of Science (AS) with a concentration in Life Sciences degree is designed to fulfill the prerequisite requirements of most Nursing Programs, in particular Thomas Jefferson University’s College of Health Profession for Nursing.

The SUS Core for an AS degree includes: FYIN-120, FILA-120, ENGL-101, GLST-201, RLST -104, and an Ethics course plus four additional courses from the following six disciplines: Artistic, Foreign Language, Literary, History, Natural Science, Mathematics and Social Sciences. No more than one course from the same discipline can be applied to meet the requirements of the CORE.

A minimum Career GPA of 2.00 and a minimum Major GPA of 2.00 are required for graduation. Students must earn a grade of C- (1.70) or better to successfully complete the requirements for the Major. A minimum of 60 academic credits is required for the AS degree.

Requirements for the Associate of Science with a concentration in Life Sciences

- BIOL-101: Principles of Biology I
- BIOL-203: Anatomy and Physiology I (4 credits)
- BIOL-210: Nutrition (4 credits)
- BIOL-303: Anatomy and Physiology II (4 credits)
- BIOL-324: Microbiology (4 credits)
- CHEM-131: Principles of Chemistry I (4 credits)
- CHEM-132: Principles of Chemistry II (4 credits) **or** CHEM-250: Introduction to Biochemistry
- MATH-117: Enriched Precalculus *or* above
- MATH-227: Introduction to Statistics **or** MATH-262: Probability and Statistics
- PSYC-101: General Psychology
- PSYC-103: Psychology of Child Development
- PSYC-217: Abnormal Psychology
- SOCI-101: Introduction to Sociology

Sample Academic Plan

Associate of Science with a concentration in Life Sciences

This is a *suggested academic plan only*; it is not meant to address each student’s individual requirements or interests. Students will develop a personalized plan with a Faculty Advisor; however, it is the student’s responsibility to be aware of, register for, and successfully complete all of the requirements for graduation in the degree program. **Minimum Academic Credits required for graduation: 60.**

Year One/Fall	14 academic credits/15 credits total	Year One/Spring	16 academic credits/17 credits total
BIOL-101: Principles of Biology I (4 credits)	CHEM-131: Principles of Chemistry I (4 credits)	BIOL-210: Nutrition (4 credits)	BIOL-101: Principles of Biology I (4 credits)
FILA-120: Foundations in the Liberal Arts	FYIN-120: First Year Initiative (1 credit non-academic)	CHEM-132: Principles of Chemistry II (4 credits) <i>or</i> CHEM-250: Introduction to Biochemistry (3 credits)	CHEM-131: Principles of Chemistry I (4 credits)
MATH-117: Enriched Precalculus or above		ENGL-101: College Writing	FILA-120: Foundations in the Liberal Arts
		MATH-227: Intro to Probability and Statistics <i>or</i> MATH-262: Probability and Statistics	FYIN-120: First Year Initiative (1 credit non-academic)
		PSYC-101: General Psychology	MATH-117: Enriched Precalculus or above
Year Two/Fall	16 academic credits	Year Two/Spring	17 academic credits
BIOL-203: Human Anatomy and Physiology I (4 credits)	RLST-104: The Religious Imagination	Artistic, History or Foreign Language elective	BIOL-203: Human Anatomy and Physiology I (4 credits)
GLST-201: Global Awareness Seminar	PSYC-103: Psychology of Child Development	BIOL-303: Anatomy and Physiology II (4 credits)	GLST-201: Global Awareness Seminar
PSYC-103: Psychology of Child Development	SOCI-101: Introduction to Sociology	BIOL-324: Microbiology (4 credits)	PSYC-103: Psychology of Child Development
		Ethics Course	SOCI-101: Introduction to Sociology
		PSYC-217: Abnormal Psychology	

Environmental Science

The Major in Environmental Sciences provides an in-depth foundation in environmental concepts as well as an appreciation of the interdisciplinary nature of the field. Students may perform independent study (*BIOL-490: Independent Study in Biology*) during the Junior or Senior year under the direction of a department member, an established scientist, or a physician at a graduate school or major research center. Major students who meet academic qualifications are encouraged to participate in the Biology Departmental Honors program, which provides greater levels of challenge.

Major in Environmental Science

A minimum Career GPA of 2.00 and a minimum Major GPA of 2.00 are required for graduation. Students must earn a grade of C- (1.70) or better to successfully complete the requirements for the Major. An *Independent Study* may be available with appropriate permissions; *Special Topics* courses are repeatable for credit; as is *BIOL-401: Internship in Biology*. Courses are 3 credits unless indicated and may not be offered every semester.

Requirements for the Major in Environmental Science

BIOL-111: Principles of Biology I (4 credits; Fulfills the Core Natural Science Requirement)

BIOL-201: Cell Biology (4 credits)

BIOL-206: General Zoology (4 credits)

BIOL-217: Genetics (4 credits)

BIOL-233: Ecology and Evolutionary Biology (4 credits)

BIOL-300: Experimental Methods and Design (4 credits)

BIOL-312: Watersheds and Freshwater Ecology (4 credits)

BIOL-322: Terrestrial Ecology (4 credits)

BIOL-498: Senior Seminar in Biology

CHEM-131: Principles of Chemistry I (4 credits)

CHEM-132: Principles of Chemistry II (4 credits)

CHEM-215: Organic Chemistry I (4 credits)

CHEM-242: Environmental Chemistry

PHYS-121: Principles of Physics I (4 credits)

One Biology or Chemistry Elective

One 300/400-level Biology Elective (3 credits minimum)

One Mathematics Elective (3 credits)

One Statistics Elective (3 credits)

One additional Mathematics/Physics Elective (3 credits minimum)

300/400-level Biology Electives:

BIOL-300: Experimental Mths/ Design (4 credits; Writing Intensive)

BIOL-303: Human Anatomy and Physiology II (4 credits)

BIOL-324: Microbiology (4 credits)

BIOL-325: Marine Biology (4 credits)

BIOL-333: Evolution

BIOL-351: Molecular Biology

BIOL-360: Biotechnology

BIOL-401: Internship in Biology

BIOL-410: Immunology (4 credits)

BIOL-413: Conservation and Restoration Biology

BIOL-481: Advanced Special Topics in Biology

Mathematics Electives:

MATH-202: Math for Management II

MATH-203: Analytic Geometry and Calculus I

MATH-211: Calculus and Modern Analysis I

Statistics Electives:

MATH-227: Introduction to Probability and Statistics

MATH-262: Probability and Statistics

PSYC-216: Quantitative Methods in Psychology

Mathematics/Physics Electives*:

MATH-204: Analytic Geometry and Calculus II

MATH-212: Calculus and Modern Analysis II

PHYS-122: Principles of Physics II (4 credits)

* For students considering graduate study, a course from each of the areas (MATH and PHYS) is highly recommended.

Sample Academic Plan

Major in Environmental Science

This is a *suggested academic plan only*; it is not meant to address each student's individual requirements or interests. Students will develop a personalized plan with a Faculty Advisor; however, it is the student's responsibility to be aware of, register for, and successfully complete all of the requirements for graduation in the Major. The minimum number of Academic Credits required for graduation is 120.

Year One/Fall	14 academic credits/15 credits total	Year One/Spring	14 academic credits/15 credits total
BIOL-III: Principles of Biology I (4 credits)		BIOL/CHEM Elective	
CHEM-131: Principles of Chemistry I (4 credits)		CHEM-132: Principles of Chemistry II (4 credits)	
FILA-120: Foundations in the Liberal Arts		ENGL-101: College Writing	
Foreign Language Requirement		Foreign Language Requirement or General Elective	
FYIN-120: First Year Initiative (1 credit non-academic)		Physical Education Requirement #1 (1 credit non-academic)	
Year Two/Fall	14 academic credits/15 credits total	Year Two/Spring	17 academic credits
BIOL-201: Cell Biology (4 credits)		BIOL-206: General Zoology (4 credits)	
CHEM-215: Organic Chemistry I (4 credits)		BIOL-233: Ecology and Evolutionary Biology (4 credits)	
RLST-104: The Religious Imagination		Core Religious Studies 200-Level Requirement	
Mathematics Elective		GLST-201: Global Awareness Seminar	
Physical Education Requirement #2 (1 credit non-academic)		Statistics Elective	
Year Three/Fall	17 academic credits	Year Three/Spring	16 academic credits
BIOL-322: Terrestrial Ecology (4 credits)		BIOL-217: Genetics (4 credits)	
Core Arts Requirement		300-level Biology Elective	
Core Ethics Requirement		Core Literature Requirement	
Core History Requirement		Core Social Science Requirement	
PHYS-121: Principles of Physics I (4 credits)		Mathematics/Physics Elective	
Year Four/Fall	16 academic credits	Year Four/Spring	12 academic credits
400-level Biology Elective		BIOL-498: Senior Seminar in Biology	
BIOL-312: Watersheds and Freshwater Ecology (4 credits)		Biology or General Elective	
CHEM-242: Environmental Chemistry		General Elective	
Biology or General Elective		General Elective	
Biology or General Elective			

Minor in Environmental Science

Students must earn a grade of C- (1.70) or better to successfully complete the requirements for the minor. Courses are 3 credits unless indicated and may not be offered every semester.

Requirements for the Minor in Environmental Science

BIOL-101: Inquiry into Life I

or BIOL-III: Principles of Biology I (4 credits; *Fulfills the Core Natural Science Requirement*)

BIOL-106: Ecology and Environmental Issues (4 credits)

Four Biology Electives (*at least two courses not included in the Major*)

Biology Electives:

BIOL-125: Ponds and Streams (4 credits)

BIOL-145: Forests and Fields

BIOL-206: General Zoology (4 credits)

BIOL-215: Biological and Medical Ethics (*Fulfills Core Ethics Req*)

BIOL-233: Ecology and Evolutionary Biology (4 credits)

BIOL-312: Watersheds and Freshwater Ecology (4 credits)

BIOL-322: Terrestrial Ecology (4 credits)

BIOL-325: Marine Biology (4 credits)

BIOL-333: Evolution

BIOL-413: Conservation/Restoration Biology

Forensic Biology

The Major in Forensic Biology prepares students for entry into the field of forensics with an emphasis on the analysis of evidence of biological origin. Students may perform independent study (*BIOL-490: Independent Study in Biology*) during the Junior or Senior year under the direction of a department member, an established scientist, or a physician at a graduate school or major research center.

Major in Forensic Biology

A minimum Career GPA of 2.00 and a minimum Major GPA of 2.00 are required for graduation. Students must earn a grade of C- (1.70) or better to successfully complete the requirements for the Major. Courses are 3 credits unless indicated and may not be offered every semester.

Requirements for the Major in Forensic Biology

BIOL-111: Principles of Biology I (4 credits; *Fulfills the Core Natural Science Requirement*)

BIOL-201: Cell Biology (4 credits)

BIOL-203: Human Anatomy and Physiology I (4 credits)

BIOL-217: Genetics (4 credits)

BIOL-300: Experimental Methods and Design (4 credits; *Writing Intensive*)

BIOL-303: Human Anatomy and Physiology II (4 credits)

BIOL-324: Microbiology (4 credits)

or BIOL-410: Immunology (4 credits)

BIOL-351: Molecular Biology

or BIOL-360: Biotechnology

BIOL-430: Forensic Medicine

BIOL-498: Senior Seminar in Biology

CHEM-106: Introduction to Forensic Science (4 credits)

CHEM-131: Principles of Chemistry I (4 credits)

CHEM-132: Principles of Chemistry II (4 credits)

CHEM-215: Organic Chemistry I (4 credits)

CHEM-322: Toxicology

or CHEM 216: Organic Chemistry II (4 credits)*

One Biology or Chemistry Elective

CRJU-122: Introduction to Criminal Justice

CRJU-223: Criminal Law

or CRJU-224: Criminal Investigation

MATH-202: Math for Management II/Applied Calculus

PHYS-121: Principles of Physics I (4 credits)

One Statistics Elective (3 credits)

*Graduate degree programs in Forensic Science typically require two semesters of Organic Chemistry for admission.

Statistics Electives:

MATH-227: Introduction to Probability and Statistics

MATH-262: Probability and Statistics

PSYC-216: Quantitative Methods in Psychology

Recommended, but not required:

PHYS-122: Principles of Physics II (4 credits)

Sample Academic Plan

Major in Forensic Biology

This is a *suggested academic plan only*; it is not meant to address each student's individual requirements or interests. Students will develop a personalized plan with a Faculty Advisor; however, it is the student's responsibility to be aware of, register for, and successfully complete all of the requirements for graduation in the Major. The minimum number of Academic Credits required for graduation is 120.

Year One/Fall	14 academic credits/15 credits total	Year One/Spring	14 academic credits/15 credits total
BIOL-111: Principles of Biology I (4 credits)		BIOL/CHEM Elective	
CHEM-131: Principles of Chemistry I (4 credits)		CHEM-132: Principles of Chemistry II (4 credits)	
FILA-120: Foundations in the Liberal Arts		ENGL-101: College Writing	
Foreign Language Requirement		Foreign Language Requirement or General Elective	
FYIN-120: First Year Initiative (1 credit non-academic)		Physical Education Requirement #1 (1 credit non-academic)	
Year Two/Fall	17 academic credits/18 credits total	Year Two/Spring	16 academic credits
BIOL-201: Cell Biology (4 credits)		200-level Biology Elective	
CHEM-215: Organic Chemistry I (4 credits)		BIOL-217: Genetics (4 credits)	
RLST-104: The Religious Imagination		Core Religious Studies 200-Level Requirement	
Mathematics Elective		Elective Area #1	
General Elective #1		Statistics Elective	
Physical Education Requirement #2 (1 credit non-academic)			

Year Three/Fall	16 academic credits	Year Three/Spring	15 academic credits
300-level Biology Elective #1 Core Arts Requirement Core Ethics Requirement Core History Requirement PHYS-121: Principles of Physics I (4 credits)		300-level Biology Elective #2 CRJU-223: Criminal Law OR CRJU-227: Criminal Investigations Core Literature Requirement Core Social Science Requirement Elective Area #2	
Year Four/Fall	15 academic credits	Year Four/Spring	15 academic credits
400-level Biology Elective #1 GLST-201: Global Awareness Seminar Minor #1 or Biology or General Elective Minor #2 or Biology or General Elective Minor #3 or Biology or General Elective		400-level Biology Elective #2 BIOL-498: Senior Seminar in Biology Minor #4 or Biology or General Elective Minor #5 or Biology or General Elective Minor #6 or Biology or General Elective	

Molecular Biology

The Major in Molecular Biology places a strong emphasis on the study of life processes at the molecular and biochemical level. A minimum Career GPA of 2.00 and a minimum Major GPA of 2.00 are required for graduation. Students may perform independent study (BIOL-490: *Independent Study in Biology*) during the Junior or Senior year under the direction of a department member, an established scientist, or a physician at a graduate school or major research center.

Major in Molecular Biology

A minimum Career GPA of 2.00 and a minimum Major GPA of 2.00 are required for graduation. Students must earn a grade of C- (1.70) or better to successfully complete the requirements for the Major. An *Independent Study* may be available with appropriate permissions; *Special Topics* courses are repeatable for credit; as is BIOL-401: *Internship in Biology*. Courses are 3 credits unless indicated and may not be offered every semester.

Requirements for the Major in Molecular Biology

BIOL-111: Principles of Biology I (4 credits; *Fulfills the Core Natural Science Requirement*)

BIOL-201: Cell Biology (4 credits)

BIOL-217: Genetics (4 credits)

BIOL-351: Molecular Biology

BIOL-360: Biotechnology

BIOL-410: Immunology (4 credits)

BIOL-498: Senior Seminar in Biology

CHEM-131: Principles of Chemistry I (4 credits)

CHEM-132: Principles of Chemistry II (4 credits)

CHEM-215: Organic Chemistry I (4 credits)

PHYS-121: Principles of Physics I (4 credits)

One Biology or Chemistry Elective (3 credits minimum)

One 200-level Biology Elective (3 credits minimum)

One 300-level Biology Elective (3 credits minimum)

One 400-level Biology Elective (3 credits minimum)

One Mathematics Elective (3 credits)

One Statistics Elective (3 credits)

One additional Mathematics/Physics Elective (3 credits minimum)

200-level Biology Electives:

BIOL-203: Human Anatomy and Physiology I (4 credits)

BIOL-206: General Zoology (4 credits)

BIOL-210: Nutrition (4 credits)

BIOL-215: Biological and Medical Ethics (*Fulfills Core Ethics Req*)

BIOL-233: Ecology and Evolutionary Biology

BIOL-281: Special Topics in Biology

300-level Biology Electives:

BIOL-300: Experimental Mths/Design (*Writing Intensive*) (4 credits)

BIOL-303: Human Anatomy and Physiology II (4 credits)

BIOL-312: Watersheds and Freshwater Ecology (4 credits)

BIOL-322: Terrestrial Ecology (4 credits)

BIOL-324: Microbiology (4 credits)

BIOL-325: Marine Biology (4 credits)

BIOL-333: Evolution

400-level Biology Electives:

BIOL-401: Internship in Biology

BIOL-405: Environmental Study Tour (4 credits)

BIOL-410: Immunology (4 credits)

BIOL-413: Conservation and Restoration Biology

BIOL-430: Forensic Medicine

BIOL-481: Advanced Special Topics in Biology

Mathematics Electives:

MATH-202: Math for Management II

MATH-203: Analytic Geometry and Calculus I

MATH-211: Calculus and Modern Analysis I

Statistics Electives:

MATH-227: Introduction to Probability and Statistics
 MATH-262: Probability and Statistics

PSYC-216: Quantitative Methods in Psychology

Mathematics/Physics Electives*:

MATH-204: Analytic Geometry and Calculus II
 MATH-212: Calculus and Modern Analysis II

PHYS-122: Principles of Physics II (4 credits)

* For students considering graduate study, a course from each of the areas (MATH and PHYS) is highly recommended

Sample Academic Plan**Major in Molecular Biology**

This is a *suggested academic plan only*; it is not meant to address each student's individual requirements or interests. Students will develop a personalized plan with a Faculty Advisor; however, it is the student's responsibility to be aware of, register for, and successfully complete all of the requirements for graduation in the Major. **The minimum number of Academic Credits required for graduation is 120.**

Year One/Fall	14 academic credits/15 credits total	Year One/Spring	14 academic credits/15 credits total
BIOL-111: Principles of Biology I (4 credits)		BIOL/CHEM Elective	
CHEM-131: Principles of Chemistry I (4 credits)		CHEM-132: Principles of Chemistry II (4 credits)	
FILA-120: Foundations in the Liberal Arts		ENGL-101: College Writing	
Foreign Language Requirement		Foreign Language Requirement or General Elective	
FYIN-120: First Year Initiative (1 credit non-academic)		Physical Education Requirement #1 (1 credit non-academic)	
Year Two/Fall	14 academic credits/15 credits total	Year Two/Spring	16 academic credits
BIOL-201: Cell Biology (4 credits)		200-level Biology Elective	
CHEM-215: Organic Chemistry I (4 credits)		BIOL-217: Genetics (4 credits)	
RLST-104: The Religious Imagination		Core Religious Studies 200-Level Requirement	
Mathematics Elective		Core Literature Requirement	
Physical Education Requirement #2 (1 credit non-academic)		Statistics Elective	
Year Three/Fall	16 academic credits	Year Three/Spring	16 academic credits
300-level Biology Elective		BIOL-351: Molecular Biology	
Core Arts Requirement		BIOL-360: Biotechnology	
Core Ethics Requirement (BIOL-215)		BIOL-410: Immunology (4 credits)	
Core History Requirement		or BIOL-411: Developmental Biology (4 credits)	
PHYS-121: Principles of Physics I (4 credits)		Core Social Science Requirement	
		Mathematics/Physics Elective	
Year Four/Fall	15 academic credits	Year Four/Spring	15 academic credits
400-level Biology Elective		BIOL-498: Senior Seminar in Biology	
GLST-201: Global Awareness Seminar		Minor #4 or Biology or General Elective	
Minor #1 or Biology or General Elective		Minor #5 or Biology or General Elective	
Minor #2 or Biology or General Elective		Minor #6 or Biology or General Elective	
Minor #3 or Biology or General Elective		Biology or General Elective	

Minor in Molecular Biology

This minor is designed for Science, Mathematics, or Computer Science majors who have an interest in Molecular Biology and Bioinformatics. Students must earn a grade of C- (1.70) or better to successfully complete the requirements for the minor. Courses are 3 credits unless indicated and may not be offered every semester.

Requirements for the Minor in Molecular Biology

BIOL-111: Principles of Biology I (4 credits; *Fulfills the Core Natural Science Requirement*)

BIOL-201: Cell Biology (4 credits)

BIOL-217: Genetics (4 credits)

BIOL-351: Molecular Biology

BIOL-360: Biotechnology

One Biology or Chemistry Elective

CHEMISTRY, BIOCHEMISTRY, FORENSIC CHEMISTRY and PHYSICS

Kelly Butler, PhD, Professor of Chemistry

-Coordinator of Chemistry

Kathleen Duffy, SSJ, PhD, Professor of Physics

-Coordinator of Physics

Kimberly Mullane, PhD, Assistant Professor of Chemistry

Elliott Tammaro, PhD, Assistant Professor of Physics

Karen Wendling, PhD, Associate Professor of Chemistry

Chestnut Hill College offers a Bachelor of Science (BS) in Chemistry, a Bachelor of Science (BS) in Biochemistry, and a Bachelor of Science (BS) in Forensic Chemistry. The Department also offers minors in Chemistry and Biochemistry. Interested students should contact Dr. Kelly Butler, Room 540, St. Joseph Hall. Telephone: 215.242.7988. Email: Butler@chc.edu. Students majoring in Chemistry, Biochemistry, or Forensic Chemistry may not minor in Chemistry or Biochemistry.

The Secondary Education Co-Major and Special Education Minor are available to Chemistry Majors as part of the Secondary Education Certification Preparation Program in Chemistry (Grades 7-12). Students interested in the Co-Major/Minor should contact the Education Office at 215.248.7129.

Advanced Placement Test Information

Generally, a score of 3 or above on an *Advanced Placement Test* earns academic credit at the College. Scores on the following tests are equivalent to the course/credit indicated; however, the Department reserves the right to require the student to demonstrate sufficient laboratory skills to award credit. Evidence of such skills may consist of a detailed description of the laboratory exercises performed or a detailed laboratory notebook signed by the High School Instructor.

AP TEST	SCORE	EQUIVALENT COURSE
Chemistry	5	CHEM-132: Principles of Chemistry II (4 credits)
Chemistry	4	CHEM-131: Principles of Chemistry I (4 credits)
Chemistry	3	Natural Science elective – fulfills the <i>Core Natural Sciences Requirement</i> (3 credits)
Mechanics	4 or 5	PHYS-121: Principles of Physics I (4 credits)
Electricity and Magnetism	4 or 5	PHYS-122: Principles of Physics II (4 credits)
Mechanics	3	Natural Science elective – fulfills the <i>Core Natural Sciences Requirement</i> (3 credits)
Electricity and Magnetism	3	Natural Science elective – fulfills the <i>Core Natural Sciences Requirement</i> (3 credits)
Physics C	3, 4, or 5	Natural Science elective – fulfills the <i>Core Natural Sciences Requirement</i> (3 credits)

General Course Options/Core Natural Science Requirement

Several Chemistry and Physics courses are available to students in any major either looking to fulfill the *Core Natural Science Requirement*, or expand on interests without pursuing a minor. The following courses are open to students in any major; however, they may not be offered every semester and may have a Prerequisite. Courses are 3 credits unless indicated. Check the *Course Descriptions* section for information on the following courses:

Chemistry/Core Natural Science Requirement:

CHEM-103: Science and Public Policy (4 credits)

CHEM-106: Introduction to Forensic Science (4 credits)

CHEM-131: Principles of Chemistry I (4 credits)

Physics/Core Natural Science Requirement:

PHYS-104: Astronomy

PHYS-107: The Science of Music

PHYS-105: Physical/Earth/Space Science

PHYS-121: Principles of Physics I (4 credits)

Departmental Mission

The mission of the Chemistry, Biochemistry, Forensic Chemistry and Physics Department is to engage students in critical and creative inquiry related to the concepts and practice of the Chemistry discipline. Chemistry students develop strong critical thinking and problem solving skills both in the classroom and the laboratory setting, particularly through the use of the scientific method. The Department also fosters creative inquiry: students are encouraged to design their own experiments and synthesize their understanding of Chemistry with other fields to develop unique approaches to solving scientific problems. The flexibility in the majors and minors prepares students for graduate study, health professional programs, and research careers in industry, government, and law enforcement laboratories.

Departmental Honors

Eligibility is determined by mastery of the major field and by general ability. To be eligible a student must have declared a major, have achieved a grade point average of 3.6 or higher in the major and an overall grade point average of 3.5 or higher, and completed 60 semester hours toward his/her degree (12 of which must be credits in the major). In addition, the student must have the recommendation of the faculty in the major department. Students not meeting this criteria might be recommended for the program by the major department.

ment. In most instances, students will receive a formal, written invitation early in the Fall semester of their Junior year. The Departmental Honors program provides an opportunity for independent study and research culminating in an Honors thesis submitted in the spring of Senior year. All students who have successfully completed the Honors Program will be recognized with Honors in their Major at the annual Honors Convocation and on their academic transcripts. In addition, the title of the completed *Honors Thesis* will appear on the academic transcript.

Honor Societies

Sigma Zeta is a national science and mathematics honor society founded in 1925. The society is dedicated to encouraging and fostering the attainment of knowledge in Mathematics, Computer Science, and the Natural Sciences. Membership in the society recognizes and honors scholarly achievement in the Major. Criteria for eligibility for membership include completion of 25 credits towards the degree, with a minimum of 15 credits in the Major, a grade point average of 3.00 in the Major, and a 3.00 grade point average overall. Eligible students must be approved by the Department. Students majoring in Chemistry, Biochemistry, or Forensic Chemistry may be invited by the department to join Sigma Zeta.

Articulation Agreements

Chestnut Hill College and Arcadia University have entered into an articulation agreement concerning the early consideration for acceptance of Chestnut Hill College graduates into Arcadia's Master's program in Forensic Science and early consideration for financial aid in this program. Certain requirements must be met by the Chestnut Hill College graduate including, but not limited to: certain course requirements, GPA of 3.30 in Prerequisite courses, and a GRE combined total score on verbal and quantitative area of 1,050 with a 4.0 or higher on the analytic portion. Please note that the course requirements of this articulation agreement are met by successful graduates majoring in the Forensic Chemistry program at Chestnut Hill College. Further details of this agreement can be obtained from the Chemistry Department.

Attendance Modification:

Since Chemistry, Biochemistry, and Forensic Chemistry are lab-based programs, many courses in these majors are not open to attendance modification. Please see the Chemistry Coordinator for specific information.

Career Connections, Public Speaking and Technology Requirements

In the field of chemistry, technology is used in three fundamental ways: to locate chemical information, to acquire data using analytical instrumentation, and to analyze acquired data. Students are taught to locate chemical information using discipline-specific search engines in CHEM-30I: Analytical Chemistry. Students are taught to acquire chemical data using a variety of analytical instrumentation throughout the chemistry curriculum. (Specific instruction is provided in CHEM-132L, CHEM-215L, CHEM-216L, CHEM-30IL, CHEM-307L, CHEM-313L, CHEM-314L, CHEM-340L.) Similarly, students are instructed to analyze and graph data throughout the curriculum using MS Excel. Initial training is provided in CHEM-131L and 132L, while advanced training is provided in CHEM-30IL.

Students majoring in Chemistry, Biochemistry or Forensic Chemistry are required to take COMM 253: Public Speaking to fulfill this core requirement. Career Connections is fulfilled by students completing research internships, which become the basis for their senior seminar presentations.

Chemistry

Major in Chemistry

A minimum Career GPA of 2.00 and a minimum Major GPA of 2.00 are required for graduation. Students must earn a grade of C- (1.70) or better in every course required for the major to successfully complete the requirements for the Major. An *Independent Study* may be available with appropriate permissions; *Special Topics* courses are repeatable for credit; as is *CHEM-401: Internship in Chemistry*. Courses are 3 credits unless indicated and may not be offered every semester.

Requirements for the Major in Chemistry

CHEM-131: Principles of Chemistry I (4 credits; *Fulfills the Core Natural Science Requirement*)

CHEM-132: Principles of Chemistry II (4 credits)

CHEM-215: Organic Chemistry I (4 credits)

CHEM-216: Organic Chemistry II (4 credits)

CHEM-301: Analytical Chemistry (5 credits) (*Writing Intensive*)

CHEM-313: Physical Chemistry I (4 credits)

CHEM-314: Physical Chemistry II (4 credits)

CHEM-340: Inorganic Chemistry (4 credits)

CHEM-498: Senior Seminar in Chemistry

PHYS-121: Principles of Physics I (4 credits)

PHYS-122: Principles of Physics II (4 credits)

Two Chemistry Electives at the 300 or 400 level (6 credits minimum)

Two Mathematics Courses (6 credits.)

Chemistry Electives:

CHEM-303: Instrumental Analysis (5 credits)

CHEM-307: Biochemistry I (5 credits)

CHEM-308: Biochemistry II

CHEM-322: Toxicology

CHEM-405: Advanced Organic Chemistry

CHEM-481: Advanced Special Topics in Chemistry

Mathematics Courses (Choose one sequence):

MATH-203: Analytic Geometry and Calculus I

AND MATH-204: Analytic Geometry and Calculus II

MATH-211: Calculus and Modern Analysis I

AND MATH-212: Calculus and Modern Analysis II

Sample Academic Plan

Major in Chemistry

This is a *suggested academic plan only*; it is not meant to address each student's individual requirements or interests. Students will develop a personalized plan with a Faculty Advisor; however, it is the student's responsibility to be aware of, register for, and successfully complete all of the requirements for graduation in the Major. The minimum number of Academic Credits required for graduation is 120.

Year One/Fall	13 academic credits/14 credits total	Year One/Spring	16 academic credits
CHEM-131: Principles of Chemistry I (4 credits)		CHEM-132: Principles of Chemistry II (4 credits)	
FILA-120: Foundations in the Liberal Arts		RLST-104: The Religious Imagination	
FYIN-120: First Year Initiative (1 credit non-academic)		ENGL-101: College Writing	
Foreign Language Requirement		Foreign Language Requirement or General Elective	
MATH-203: Analytic Geometry and Calculus I or MATH-211: Calculus and Modern Analysis I		MATH-204: Analytic Geometry and Calculus II or MATH-212: Calculus and Modern Analysis II	
Year Two/Fall	14 academic credits/15 credits total	Year Two/Spring	15 academic credits/16 credits total
CHEM-215: Organic Chemistry I (4 credits)		CHEM-216: Organic Chemistry II (4 credits)	
Core Religious Studies 200-Level Requirement		Core Ethics Requirement	
Core Social Science Requirement		Core History Requirement	
PHYS-121: Principles of Physics I (4 credits)		PHYS-122: Principles of Physics II (4 credits)	
Physical Education Requirement #1 (1 credit non-academic)		Physical Education Requirement #2 (1 credit non-academic)	
Year Three/Fall	15 academic credits	Year Three/Spring	16 academic credits
CHEM-301: Analytical Chemistry (5 credits)		CHEM-313: Physical Chemistry I (4 credits)	
CHEM-340: Inorganic Chemistry (4 credits)		Chemistry Elective #1	
Core Arts Requirement		Core Literature Requirement	
GLST-201: Global Awareness Seminar		Minor #1 or Chemistry or General Elective	
		Minor #2 or Chemistry or General Elective	
Year Four/Fall	16 academic credits	Year Four/Spring	15 academic credits
CHEM-314: Physical Chemistry II (4 credits)		CHEM-498: Senior Seminar in Chemistry	
Chemistry Elective #2		Minor #6 or Chemistry or General Elective	
Minor #3 or Chemistry or General Elective		Chemistry or General Elective	
Minor #4 or Chemistry or General Elective		Chemistry or General Elective	
Minor #5 or Chemistry or General Elective		Chemistry or General Elective	

Major in Chemistry with Co-Major in Secondary Education and Minor in Special Education

The *Secondary Education Certification Preparation Program in Chemistry (Grades 7-12)* is available to Chemistry Majors seeking Pennsylvania Department of Education (PDE) Certification. The Program integrates educational theory and practice with field experiences that include practicum and student teaching, as well as opportunities to develop teaching competence through innovative and effective approaches to the educational process with focus on students at the Secondary Level. Students interested in the Co-Major/Minor should contact the Education Office at 215.248.7129.

The PDE requires that all *Secondary Education Certification Preparation Program* participants have 9 credits of Special Education and 3 credits of Teaching English as a Second Language, in addition, students must meet field experience before Student Teaching: EDSC-203 provides 20 hours; EDSC-201 provides 20 hours; EDSC-327 provides 75; and Student Teaching, EDSC-420, is 14 weeks in duration.

Stage I and Stage II Portfolios are completed in the following courses:

EDSC-203: Foundations of High School Education

EDSC-201: Adolescent Development and Learning

Stage IIIA Portfolio is completed in the following course:

EDSC-327: Special Methods in Chemistry/Field Experience IIIA

Stage IV Portfolio is completed in the following courses:

EDSC-420: Clinical Field Experience/Student Teaching

EDSC-421: Clinical/Student Teaching Seminar

By 60 credits candidates must pass a basic skills test (PAPA or CORE) if not SAT/ACT exempt as required by PDE. An overall GPA of 3.0 or above is required for formal acceptance into the Education Department and for graduation. Students must successfully complete all required coursework, clinical field experiences, and student teaching.

Students must earn a grade of C- (1.70) or better to successfully complete the requirements for the Major unless an exception is noted. Majors may need to re-take courses with C- grades if their Career GPA is less than the Career GPA required by the PDE for Certification or if a higher grade is required to demonstrate competency as identified by the department. *Special Topics* courses are repeatable for credit. Courses are 3 credits unless indicated and may not be offered every semester.

Requirements for the Major in Chemistry with Co-Major in Secondary Education and Minor in Special Education

CHEM-131: Principles of Chemistry I (4 credits; *Fulfills the Core Natural Science Requirement*)

CHEM-132: Principles of Chemistry II (4 credits)

CHEM-215: Organic Chemistry I (4 credits)

CHEM-216: Organic Chemistry II (4 credits)

CHEM-301: Analytical Chemistry (5 credits) (*Writing Intensive*)

CHEM-313: Physical Chemistry I (4 credits)

CHEM-314: Physical Chemistry II (4 credits)

CHEM-340: Inorganic Chemistry (4 credits)

CHEM-498: Senior Seminar in Chemistry

EDSC-201: Adolescent Development and Learning (*Fulfills the Core Social Science Requirement*) (m) FE I Portfolio Rqd.

EDSC-203: The Foundations of High School (e) FE II Portfolio Rqd.

EDSC-315: General Methods and Assessment (e)

EDSC-327: Special Methods in Chemistry/Field Experience IIIA /Stage IIIA Portfolio (e)(m)

EDSC-420: Clinical Field Experience/Student Teaching /Stage IV Portfolio (9 credits) (e)

EDSC-421: Clinical/Student Teaching Seminar (e)

EDSP-340: Introduction to Special Education (m)

EDSP-347: Assessments & Interventions for all Learners (m)

EDSP-362: Teaching Reading for All Learners (m)

EDSP-390: ESL Foundations and Methods (m)

ENGL-101: College Writing (e)*

PHYS-121: Principles of Physics I (4 credits)

PHYS-122: Principles of Physics II (4 credits)

Two Chemistry Electives at the 300 or 400 Level (6 credits minimum)

Two Mathematics Courses (6 credits) (e)*

One American or British Literature Elective (e) *

(e) = courses required for Secondary Education Co-Major

(m) = courses required for Special Education Minor

*Student must earn grade of C or better

Chemistry Electives:

CHEM-303: Instrumental Analysis (5 credits)

CHEM-307: Biochemistry I (5 credits)

CHEM-308: Biochemistry II

CHEM-322: Toxicology

CHEM-405: Advanced Organic Chemistry

CHEM-481: Advanced Special Topics in Chemistry

Mathematics Courses (Choose one sequence):

MATH-203: Analytic Geometry and Calculus I
AND MATH-204: Analytic Geometry and Calculus II

MATH-211: Calculus and Modern Analysis I
AND MATH-212: Calculus and Modern Analysis II

Sample Academic Plan**Major in Chemistry with Co-Major in Secondary Education and Minor in Special Education**

This is a *suggested academic plan only*; it is not meant to address each student's individual requirements or interests. Students will develop a personalized plan with a Faculty Advisor; however, it is the student's responsibility to be aware of, register for, and successfully complete all of the requirements for graduation in the Major. The minimum number of Academic Credits required for graduation is 120.

Year One/Fall	16 academic credits/17 credits total	Year One/Spring	16 academic credits
Take Basic Skill Series (reading, math, writing) if not exempt CHEM-131: Principles of Chemistry I (4 credits) FILA-120: Foundations in the Liberal Arts Foreign Language Requirement FYIN-120: First Year Initiative (1 credit non-academic) MATH-203: Analytic Geometry and Calculus I <u>or</u> MATH-211: Calculus and Modern Analysis I RLST-104: The Religious Imagination		CHEM-132: Principles of Chemistry II (4 credits) Core Arts Requirement or Foreign Language Requirement EDSC-201: Adolescent Development and Learning FE I ENGL-101: College Writing MATH-204: Analytic Geometry and Calculus II <u>or</u> MATH-212: Calculus and Modern Analysis II Retake Basic Skills as needed. Must pass all before 60 credits	
Year Two/Fall	17 academic credits/18 credits total	Year Two/Spring	14 academic credits/15 credits total
American or British Literature Elective CHEM-215: Organic Chemistry I (4 credits) Core Religious Studies 200-Level Requirement EDSC-203: The Foundations of High School FE II PHYS-121: Principles of Physics I (4 credits) Physical Education Requirement #1 (1 credit non-academic)		CHEM-216: Organic Chemistry II (4 credits) EDSC-315: General Methods and Assessment GLST-201: Global Awareness Seminar PHYS-122: Principles of Physics II (4 credits) Physical Education Requirement #2 (1 credit non-academic)	
Complete Pre-Professional Benchmark		Apply for formal admission to Education Dept. after 48 credits and before 60 credits	
Year Three/Fall	18 academic credits	Year Three/Spring	17 academic credits
CHEM-301: Analytical Chemistry (5 credits) CHEM-314: Physical Chemistry II (4 credits) EDSC-327: Sp Mth Chem/Field Exp IIIA /Stage IIIA Portfolio EDSP-340: Introduction to Special Education EDSP-362: Teaching Reading for All Learners		CHEM-313: Physical Chemistry I (4 credits) Chemistry Elective #1 (4 credits) Core Ethics Requirement (BIOL-215) EDSP-347: Assessments & Interventions for all Learners EDSP-390: ESL Foundations and Methods	
Year Four/Fall	12 academic credits	Year Four/Spring	13 academic credits
EDSC-420: Clinical Field Exp/St Tch /Stage IV Ptf (9 credits) EDSC-421: Clinical/Student Teaching Seminar		CHEM-340: Inorganic Chemistry (4 credits) CHEM-498: Senior Seminar in Chemistry Chemistry Elective #2 (3 credits) Core History Requirement	

Minor in Chemistry

Students must earn a grade of C- (1.70) or better to successfully complete the requirements for the minor. *Special Topics* courses are repeatable for credit. Courses are 3 credits unless indicated and may not be offered every semester.

Requirements for the Minor in Chemistry

CHEM-131: Principles of Chemistry I (4 credits; *Fulfills the Core Natural Science Requirement*)
 CHEM-132: Principles of Chemistry II (4 credits)
 CHEM-215: Organic Chemistry I (4 credits)
 CHEM-216: Organic Chemistry II (4 credits)
 Two Chemistry Electives (6 credits minimum)

Chemistry Electives:

CHEM-242: Environmental Chemistry
 CHEM-250: Introduction to Biochemistry
 CHEM-301: Analytical Chemistry (5 credits)
 CHEM-303: Instrumental Analysis (5 credits)
 CHEM-307: Biochemistry I (5 credits)
 CHEM-308: Biochemistry II

CHEM-313: Physical Chemistry I
 CHEM-314: Physical Chemistry II
 CHEM-322: Toxicology
 CHEM-340: Inorganic Chemistry
 CHEM-405: Advanced Organic Chemistry
 CHEM-481: Advanced Special Topics in Chemistry

Biochemistry

Major in Biochemistry

A minimum Career GPA of 2.00 and a minimum Major GPA of 2.00 are required for graduation. Unless indicated, students must earn a grade of C- (1.70) or better to successfully complete the requirements for the Major. An *Independent Study* may be available with appropriate permissions. Courses are 3 credits unless indicated and may not be offered every semester.

Requirements for the Major in Biochemistry

BIOL-111: Principles of Biology I (4 credits)
BIOL-201: Cell Biology (4 credits)
BIOL-217: Genetics (4 credits)
CHEM-131: Principles of Chemistry I (4 credits)
CHEM-132: Principles of Chemistry II (4 credits)
CHEM-215: Organic Chemistry I (4 credits)
CHEM-216: Organic Chemistry II (4 credits)
CHEM-301: Analytical Chemistry (5 credits) (Writing Intensive)
CHEM-307: Biochemistry I (5 credits)
CHEM-308: Biochemistry II
CHEM-313: Physical Chemistry I (4 credits)
CHEM-314: Physical Chemistry II (4 credits)
CHEM-498: Senior Seminar in Chemistry
MATH-262: Probability and Statistics
PHYS-121: Principles of Physics I (4 credits)
PHYS-122: Principles of Physics II (4 credits)
Two Mathematics Courses (6 credits)

Mathematics Courses (Choose one sequence):

MATH-203: Analytic Geometry and Calculus I
AND MATH-204: Analytic Geometry and Calculus II

MATH-211: Calculus and Modern Analysis I
AND MATH-212: Calculus and Modern Analysis II

Sample Academic Plan

Major in Biochemistry

This is a *suggested academic plan only*; it is not meant to address each student's individual requirements or interests. Students will develop a personalized plan with a Faculty Advisor; however, it is the student's responsibility to be aware of, register for, and successfully complete all of the requirements for graduation in the Major. The minimum number of Academic Credits required for graduation is 120.

Year One/Fall	15 academic credits/16 credits total	Year One/Spring	16 academic credits
BIOL-111: Principles of Biology I (4 credits)		CHEM-132: Principles of Chemistry II (4 credits)	
CHEM-131: Principles of Chemistry I (4 credits)		RLST-104: The Religious Imagination	
FILA-120: Foundations in the Liberal Arts		ENGL-101: College Writing	
FYIN-120: First Year Initiative (1 credit non-academic)		Foreign Language Requirement or General Elective	
MATH-203: Analytic Geometry and Calculus I or MATH-211: Calculus and Modern Analysis I		MATH-204: Analytic Geometry and Calculus II or MATH-212: Calculus and Modern Analysis II	
Year Two/Fall	14 academic credits/15 credits total	Year Two/Spring	14 academic credits/15 credits total
CHEM-215: Organic Chemistry I (4 credits)		Core Social Science Requirement	
Core Religious Studies 200-Level Requirement		CHEM-216: Organic Chemistry II (4 credits)	
Foreign Language Requirement		Core Ethics Requirement	
PHYS-121: Principles of Physics I (4 credits)		PHYS-122: Principles of Physics II (4 credits)	
Physical Education Requirement #1 (1 credit non-academic)		Physical Education Requirement #2 (1 credit non-academic)	
Year Three/Fall	14 academic credits	Year Three/Spring	16 academic credits
CHEM-301: Analytical Chemistry (5 credits)		BIOL-217: Genetics (4 credits)	
CHEM-307: Biochemistry I (5 credits)		CHEM-308: Biochemistry II	
MATH-262: Probability and Statistics		Core Arts Requirement	
General Elective (1 credit)		Core History Requirement	
		GLST-201: Global Awareness Seminar	
Year Four/Fall	16 academic credits	Year Four/Spring	16 academic credits
CHEM-313: Physical Chemistry I (4 credits)		CHEM-314: Physical Chemistry II (4 credits)	
Core Literature Requirement		CHEM-498: Senior Seminar in Chemistry	
BIOL-201: Cell Biology		General Elective	
General Elective		General Elective	
General Elective		General Elective	
General Elective			

Minor in Biochemistry

Students must earn a grade of C- (1.70) or better to successfully complete the requirements for the minor. Courses are 3 credits unless indicated and may not be offered every semester.

Requirements for the Minor in Biochemistry

CHEM-131: Principles of Chemistry I (4 credits)

CHEM-132: Principles of Chemistry II (4 credits)

CHEM-215: Organic Chemistry I (4 credits)

CHEM-216: Organic Chemistry II (4 credits)

CHEM-307: Biochemistry I (5 credits)

CHEM-308: Biochemistry II (3 credits)

Forensic Chemistry

Major in Forensic Chemistry

A minimum Career GPA of 2.00 and a minimum Major GPA of 2.00 are required for graduation. Unless indicated, students must earn a grade of C- (1.70) or better to successfully complete the requirements for the Major. An *Independent Study* may be available with appropriate permissions; *Special Topics* courses are repeatable for credit; as is *CHEM-401: Internship in Chemistry*. Courses are 3 credits unless indicated and may not be offered every semester.

Requirements for the Major in Forensic Chemistry

BIOL-111: Principles of Biology I (4 credits; *Fulfills the Core Natural Science Requirement*)

CHEM-131: Principles of Chemistry I (4 credits)

CHEM-132: Principles of Chemistry II (4 credits)

CHEM-215: Organic Chemistry I (4 credits)

CHEM-216: Organic Chemistry II (4 credits)

CHEM-301: Analytical Chemistry (5 credits) (*Writing Intensive*)

CHEM-303: Instrumental Analysis (5 credits)

CHEM-307: Biochemistry I (5 credits)

CHEM-308: Biochemistry II

CHEM-314: Physical Chemistry II (4 credits)

CHEM-322: Toxicology

CHEM-401: Internship in Chemistry

CHEM-498: Senior Seminar in Chemistry

MATH-262: Probability and Statistics

PHYS-121: Principles of Physics I (4 credits)

PHYS-122: Principles of Physics II (4 credits)

One Chemistry Elective at the 300 or 400 level (3 credits minimum)

OR BIOL-410: Immunology (4 credits)

Two Mathematics Courses (6 credits)

Chemistry Electives:

CHEM-313: Physical Chemistry I (4 credits)

CHEM-340: Inorganic Chemistry (4 credits)

CHEM-405: Advanced Organic Chemistry

CHEM-481: Advanced Special Topics in Chemistry

Mathematics Electives (Choose one sequence):

MATH-203: Analytic Geometry and Calculus I

AND MATH-204: Analytic Geometry and Calculus II

MATH-211: Calculus and Modern Analysis I

AND MATH-212: Calculus and Modern Analysis II

Recommended, but not required:

CRJU-223: Criminal Law

Recommended for students considering graduate school in Chemistry:

CHEM-313: Physical Chemistry I

CHEM-340: Inorganic Chemistry

Sample Academic Plan

Major in Forensic Chemistry

This is a *suggested academic plan only*; it is not meant to address each student's individual requirements or interests. Students will develop a personalized plan with a Faculty Advisor; however, it is the student's responsibility to be aware of, register for, and successfully complete all of the requirements for graduation in the Major. The minimum number of Academic Credits required for graduation is 120.

Year One/Fall	12 academic credits/13 credits total	Year One/Spring	16 academic credits
BIOL-111: Principles of Biology I (4 credits)		CHEM-132: Principles of Chemistry II (4 credits)	
CHEM-131: Principles of Chemistry I (4 credits)		RLST-104: The Religious Imagination	
FILA-120: Foundations in the Liberal Arts		ENGL-101: College Writing	
FYIN-120: First Year Initiative (1 credit non-academic)		Foreign Language Requirement or General Elective	
MATH-203: Analytic Geometry and Calculus I		MATH-204: Analytic Geometry and Calculus II	
or MATH-211: Calculus and Modern Analysis I		or MATH-212: Calculus and Modern Analysis II	
Year Two/Fall	14 academic credits/15 credits total	Year Two/Spring	14 academic credits/15 credits total
CHEM-215: Organic Chemistry I (4 credits)		Core Social Science Requirement	
Core Religious Studies 200-Level Requirement		CHEM-216: Organic Chemistry II (4 credits)	
Foreign Language Requirement		Core Ethics Requirement	
PHYS-121: Principles of Physics I (4 credits)		PHYS-122: Principles of Physics II (4 credits)	
Physical Education Requirement #1 (1 credit non-academic)		Physical Education Requirement #2 (1 credit non-academic)	

Year Three/Fall	16 academic credits	Year Three/Spring	17 academic credits
CHEM-301: Analytical Chemistry (5 credits)		CHEM-303: Instrumental Analysis (5 credits)	
CHEM-307: Biochemistry I (5 credits)		CHEM-308: Biochemistry II	
Core Arts Requirement		CHEM-322: Toxicology	
MATH-262: Probability and Statistics		Core History Requirement	
		GLST-201: Global Awareness Seminar	
Year Four/Fall	13 academic credits	Year Four/Spring	16 academic credits
CHEM-314: Physical Chemistry II (4 credits)		CHEM-498: Senior Seminar in Chemistry	
CHEM-401: Internship in Chemistry		Chemistry Elective (4 credits)	
Core Literature Requirement		Chemistry or General Elective	
Chemistry or General Elective		Chemistry or General Elective	
		Chemistry or General Elective	