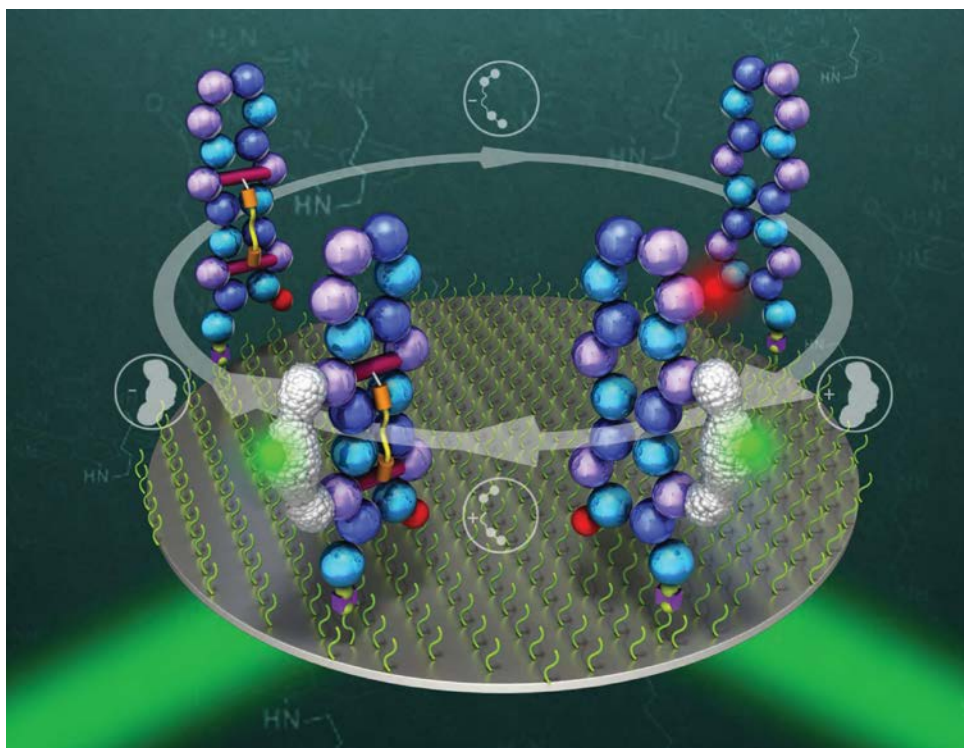


University of Iowa
Undergraduate Programs
in Biochemistry

Undergraduate Student Handbook
2016-2017



Director of Undergraduate Studies & Honors Advisor: **Dr. Marc S. Wold**
marc-wold@uiowa.edu

Undergraduate Coordinator: **Judy Means**
judy-means@uiowa.edu
319-335-8993

Department of Biochemistry
Carver College of Medicine
51 Newton Road
4-403 Bowen Science Building
Iowa City, IA 52242-1109

biochem.uiowa.edu

Introduction

The Department of Biochemistry is a unit of the Carver College of Medicine (CCOM). Undergraduate degrees in biochemistry are administered by the College of Liberal Arts and Sciences (CLAS). Biochemistry faculty are located in the Bowen Science Building (BSB) and the Medical Education Research Facility (MERF), on the west side of the Iowa River. Biochemistry classes are taught primarily in these buildings. The main office is located in 4-403 BSB.

Biochemistry is the study of chemical processes in living things. Biochemists investigate the structures and functions of molecules in cells, the chemical reactions necessary for life and the molecular basis of disease. Students with degrees in biochemistry go on to careers in research, medicine or biopharmaceutical/biotechnology industries. Many graduates obtain professional degrees in medical, graduate or other professional schools. Others pursue employment in research labs in academic institutions or industry.

The Department of Biochemistry offers Bachelor of Science and Bachelor of Arts degrees. Students majoring in biochemistry must satisfy the general course requirements and grade point minima set by CLAS, as well as the requirements for biochemistry majors. Students wishing to earn Honors in Biochemistry have additional requirements (see page 7).

Students with a declared major in a CLAS department may declare (or change to) a biochemistry major through the Academic Programs and Student Development office at 120 Schaeffer Hall or online via your MyUI account. Declared majors will receive updates about advising and other departmental announcements via their university email account. Students advised at the Academic Advising Center (C210 Pomerantz Center) may declare or change majors within that office.

Degrees in Biochemistry

The Department of Biochemistry offers two Bachelor's degrees: a Bachelor's of Arts (BA) and a Bachelor's of Science (BS). To maximize student flexibility, the curriculum in the first two years is identical for both the BA and the BS degrees. Students can obtain honors in biochemistry in either degree program.

All students majoring in biochemistry will initially be placed in the BA degree program. Students in good academic standing can switch to BS degree after completing one semester of organic chemistry (CHEM:2230 or CHEM:2210). Students who wish to change to the BS degree should do so by filling out a change of degree form at the Office of Academic Programs & Student Development, 120 Schaeffer Hall.

The BA degree provides a rigorous education in biochemical concepts and practice in the laboratory while allowing the flexibility to specialize in additional disciplines or obtain clinical volunteer experiences. The BA degree in biochemistry is intended for most students, including those with pre-medicine, pre-pharmacy, pre-dental and other pre-health professional interests and for students with double majors.

The BS degree is intended primarily for students planning a career in research including those with a long-term goal of attending graduate school (PhD, MS or MD/PhD) or obtaining a job as a research scientist or technician. The BS degree requires twelve additional semester hours of science and laboratory electives.

Note to students admitted before the Summer of 2013

Starting in the Summer 2013 session, the Department of Biochemistry revised its degree requirements. Students admitted in this session or after will follow the requirements in this handbook. Students admitted prior to Summer 2013 will continue to follow the degree requirements listed in the 2012-2013 General Catalog, which can be accessed on page 109 of this document: [University of Iowa 2012-13 General Catalog](#)

Cover: This figure was on the cover of *Nucleic Acids Research* and accompanied an article by Amin Haghghat Jahromi, Masayoshi Honda, Steven C. Zimmerman and Maria Spies entitled: "Single-molecule study of the CUG repeat-MBNL1 interaction and its inhibition by small molecules." (2013, *Nucleic Acids Research*, Vol. 41(13), 6687-6697)

Advising

Freshmen entering the University of Iowa are assigned an advisor from the Academic Advising Center (AAC). AAC advisors are able to provide a broad perspective on many courses and majors.

Students who declare biochemistry as a major are advised by biochemistry faculty after they have earned 24 s.h. (usually in the spring of the freshman year). The advisor in biochemistry will advise on biochemistry coursework and make the final decisions about what coursework will be accepted for completion of the major.

Students who have declared a pre-professional emphasis (e.g., pre-medicine, pre-pharmacy), will also have a Pre-professional Advisor in the AAC.

Each semester, students are expected to meet with their advisors to discuss courses for the upcoming semester. If biochemistry is your primary major, your advisor will also authorize you to register for classes. If you are a double-major, you may obtain authorization to register from another advisor, but you are encouraged to have a semi-annual meeting with your biochemistry advisor.

To determine who your advisor is, please log into MyUI and select “Student Records” and “Program of Study and Advisor.” Students with questions about advisor assignments should contact the Undergraduate Coordinator (email: judy-means@uiowa.edu).

To set up an advising appointment, contact the Undergraduate Coordinator (email: judy-means@uiowa.edu), and make sure to include the word “advising” in the subject line of your email. Please note that students are expected to use their University of Iowa email to request appointments.

For additional questions regarding advisors, please contact:

- Dr. Marc Wold, Director of Undergraduate Studies & Honors Advisor, at marc-wold@uiowa.edu
- Judy Means, Undergraduate Coordinator, judy-means@uiowa.edu

Advisor Signatures (Change in Registration form)

Students often need to obtain signatures from their advisor on the Change in Registration form around deadlines. Signatures on these forms will be obtained through the Undergraduate Coordinator.

Please drop your form in the Biochemistry office (4-403 BSB), and plan to pick it up the following day. Note that some changes to your schedule may require discussion with your advisor. If that is the case, the Undergraduate Coordinator will contact you.

Please be aware that faculty may have professional obligations that take them off campus; plan ahead in order to obtain your signatures in advance of the deadline.

Useful Links:

Change of Registration Form (course add/drop form): <http://registrar.uiowa.edu/changes-registration>

University of Iowa General Catalog: <http://www.registrar.uiowa.edu/registrar/catalog/>

General Education Program: <http://clas.uiowa.edu/students/students-graduation-requirements/general-education-program-requirements>

Biochemistry site: <http://www.medicine.uiowa.edu/biochemistry/>

Biochemistry-Advanced Science Electives and Labs: <http://www.medicine.uiowa.edu/biochemistry/electives/>

Biochemistry Undergraduate Research: <http://www.medicine.uiowa.edu/biochemistry/undergrad/research>

Biochemistry Lata Symposium: <http://www.medicine.uiowa.edu/biochemistry/undergrad/lata>

Degree Requirements

Liberal Arts General Education (GE) Program

All students must satisfy the General Education requirements for the College of Liberal Arts and Sciences (as listed in the table).

Many GE requirements can be satisfied in part or entirely by examinations. The GEs for Quantitative or Formal Reasoning and for Natural Science are automatically satisfied in the structure of the biochemistry program.

The foreign language requirements, as explained in the [University of Iowa General Catalog](http://www.registrar.uiowa.edu/registrar/catalog/) (<http://www.registrar.uiowa.edu/registrar/catalog/>), are the same for both BA and BS degrees. Depending on previous course work and placement tests, the foreign language requirement is 0-16 s.h. Some students find that taking a foreign language at a community college eases the scheduling strain.

| GE Requirements | |
|---|----------|
| <i>Communication and Literacy</i> | |
| Rhetoric | 4 s.h. |
| Interpretation of Literature | 3 s.h. |
| World Languages | variable |
| <i>Natural, Quantitative, & Social Sciences</i> | |
| Natural Science | 7 s.h. |
| Quantitative or Formal Reasoning | 3 s.h. |
| Social Science | 3 s.h. |
| <i>Culture, Society & the Arts</i> | |
| Historical Perspectives | 3 s.h. |
| International and Global Issues | 3 s.h. |
| Literary, Visual and Performing Arts | 3 s.h. |
| Values, Society, and Diversity | 3 s.h. |

BA and BS Degrees in Biochemistry

The following science coursework is required for a bachelor's degree in Biochemistry. Additional specific requirements for BA and BS degrees are indicated at right.

| | Required Courses | Total s.h. | BA Total s.h. | BS Total s.h. |
|--|--|-------------------|------------------------------|------------------------------|
| Required Courses for Bachelor's Degree in Biochemistry | | | | |
| Calculus | Calculus I (MATH 1850) & II (MATH 1860) | 8 | | |
| Chemistry | Principles of Chemistry I (CHEM 1110) & II (CHEM 1120) | 8 | | |
| Biology | Foundations of Biology (BIOL 1411) & Diversity of Form and Function (BIOL 1412) | 8 | | |
| Organic Chemistry | Recommended: Organic Chemistry I, II, and Lab for majors (CHEM 2230, 2240, 2420) Also accepted: Organic Chemistry I, II, and Lab (CHEM 2210, 2220, 2410) | 9 | | |
| Physics | Recommended: Introductory Physics I (PHYS 1611) & II (PHYS 1612 with the lab*) Also accepted: College Physics I (PHYS 1511) & II (PHYS 1512) | 8 | | |
| Biochemistry | Biochemistry & Molecular Biology I (BIOC 3120) & II (BIOC 3130), Experimental Biochemistry (BIOC 3140) | 8 | | |
| Additional Course Requirements Specific for BA and BS Degrees | | | | |
| Advanced Chemistry or Biochemistry | Principles of Physical Chemistry (CHEM 4430), Physical Chemistry I (CHEM 4431), Physical Chemistry II (CHEM 4432), Biophysical Chemistry I (BIOC 4241), or Biophysical Chemistry II (BIOC 4242) | – | 3 | 6 |
| Advanced Science Electives | Many courses satisfy this requirement (see examples on page 6) | – | 6 | 9 |
| Research or Advanced labs | Biochemistry Research (BIOC 4999)** or Advanced Laboratory Courses (see page 6) | – | – | 6 |
| | * Biochemistry majors should take PHYS 1612 with the laboratory (4 s.h.) ** Development of Senior Research Project (BIOC 3150) is a prerequisite for BIOC 4999. This course was formerly BIOC 3101 Technical Communication in Biochemistry. | | – | 2* |

The Bachelor of Arts with a major in biochemistry requires a minimum of 120 s.h., including 58 s.h. of work for the major. The Bachelor of Science with a major in biochemistry requires a minimum of 120 s.h., including 70-72 s.h. of work for the major. They also must complete the College of Liberal Arts and Sciences General Education Program. (<http://clas.uiowa.edu/students/students-graduation-requirements/general-education-program-requirements>)

In order to be granted a degree from CLAS, students must have satisfactory grade-point averages. Candidates for a BA or BS degree must earn at least a 2.00 (C) in the following GPA calculations:

- All college work attempted
- All work undertaken at the University of Iowa
- All work attempted in the major
- All University of Iowa work in the major

The GPA calculation for courses undertaken in the biochemistry major includes all BIOC courses, as well as the required calculus, biology, chemistry and physics courses. This does not include courses used to satisfy the Advanced Science Elective requirement, which draws from many departments.

Pursuing a Double Major or Minor

Students attempting to satisfy requirements for a double major or major/minor are especially encouraged to discuss their Advanced Science Electives with their advisor for the greatest economy in registration.

Note that a minor in chemistry is particularly compatible with the biochemistry major. Please check with the Department of Chemistry (chem.uiowa.edu) about course requirements for a minor if you are interested in pursuing this option.

U2G Fast Track PhD Program (a PhD early admit program)

This highly selective program allows BS majors in biochemistry to be admitted early and transition into the PhD program in biochemistry during their senior year. This program is intended to provide a research-intensive experience and shorten the training time for students interested in pursuing a career in independent biochemistry research. Students will need advanced standing for this program (see below.) Students interested in this program should speak with the biochemistry Honors Advisor or their academic advisor during the freshman year or at beginning of the sophomore year. Students participating in this program are provided financial support during the second half of their senior year and throughout their PhD study.

To be eligible for this program, students must be BS biochemistry majors and have, at the beginning of the fall semester of their senior year:

- completed 108 s.h. of undergraduate coursework;
- a minimum GPA of 3.50;
- completed four semesters of research experience (summer research counts as one semester);
- and completed BIOC 3120, 3130 and 3140.

Students should apply for admission to this program in the spring of their junior year (applications are due at the beginning of the spring semester). The application includes a letter of application/statement of purpose; official GRE scores; and three letters of recommendation, at least one of which must be from a research advisor.

Please consult the biochemistry honors advisor if you are interested in pursuing this option.

Examples of Advanced Science Electives accepted for BA and BS Degrees

Advanced Science Electives (BA & BS degrees): The requirement for advanced science electives is intended to help students expand their education by pursuing courses outside the standard biochemistry undergraduate curriculum. The requirement usually is fulfilled by taking classes that are 3000-level or higher (though some lower-level classes may be acceptable). Independent study and research credits do NOT count toward this requirement.

Research or Advanced Labs (BS degree only): The BS degree in Biochemistry requires six semester hours of either BIOC 4999 (Research Independent Study) or advanced laboratory courses. Research credit taken in other science departments can also count for this requirement (subject to approval by a Biochemistry advisor). Only 6 s.h. of BIOC 4999 can count toward the requirements for the BS degree in Biochemistry.

Examples of Advanced Science Electives are listed below. *Many* other courses may be taken; students should check with their advisor about whether or not a specific course not listed below will fulfill this requirement. It may be necessary for the student to obtain a syllabus or other information from the instructor before the advisor can make this decision. More courses are listed on the departmental website: [biochemistry advanced science electives](http://www.medicine.uiowa.edu/biochemistry/electives/). (<http://www.medicine.uiowa.edu/biochemistry/electives/>)

| Anatomy and Cell Biology | | |
|---|---|---------------|
| ACB 3110 | Principles of Human Anatomy | 3 s.h. |
| Biology | | |
| BIOL 3233 | Intro to Developmental Biology | 3 s.h. |
| BIOL 2346 | Vertebrate Zoology | 4 s.h. |
| BIOL 2723 | Cell Biology | 3 s.h. |
| BIOL 3343 | Animal Physiology | 3 s.h. |
| BIOL 2512 | Fundamental Genetics | 4 s.h. |
| BIOL 3172 | Evolution | 4 s.h. |
| BIOL 3626 | Cell Biology Lab | 3 s.h. |
| BIOL 2673 | Ecology | 3 s.h. |
| BIOL 3736 | Developmental Biology Lab | 3 s.h. |
| BIOL 3716 | Genetics & Biotechnology Lab | 3 s.h. |
| BIOL 3244 | Animal Behavior | 4 s.h. |
| BIOL 2254 | Endocrinology | 3 s.h. |
| BIOL 4333 | Genes & Development | 3 s.h. |
| BIOL 3253 | Fundamental Neurobiology | 4 s.h. |
| BIOL 3743 | Basic Biology of Human Disease | 2 s.h. |
| Biomedical Engineering | | |
| BME 4310 | Computational Biochemistry | 3 s.h. |
| Biostatistics | | |
| BIOS 4120 | Introduction to Biostatistics | 3 s.h. |
| Chemical and Biochemical Engineering | | |
| CBE 3150 | Thermodynamics/Transport Lab | 3 s.h. |
| Chemistry | | |
| CHEM 2021 | Basic Measurements | 3 s.h. |
| CHEM 3110 | Analytical Chemistry I | 3 s.h. |
| CHEM 3120 | Analytical Chemistry II | 3 s.h. |
| CHEM 3250 | Inorganic Chemistry | 2-3 s.h. |
| CHEM 3430 | Analytical Measurements | 3 s.h. |
| CHEM 3440 | Physical Measurements | 3 s.h. |
| CHEM 3530 | Inorganic Chemistry Lab | 3 s.h. |
| CHEM 4270 | Advanced Inorganic Chemistry | 3 s.h. |
| CHEM 4372 | Advanced Organic Chemistry | 3 s.h. |
| CHEM 4450 | Synthesis and Measurement | 3 s.h. |
| CHEM 5328 | Mechanisms of Organic Reactions | 3 s.h. |
| Civil and Environmental Engineering | | |
| CEE 4153 | Environmental Chemistry Lab | 3 s.h. |
| Engineering | | |
| ENGR 1300 | Engineering Problem Solving II | 3 s.h. |

| Environmental Sciences | | |
|---|--|---------------|
| ENVS 2673 | Ecology | 3 s.h. |
| Health and Human Physiology | | |
| HHP 1100 | Human Anatomy | 3 s.h. |
| HHP 1310 | Human Physiology Lab | 1 s.h. |
| HHP 3500 | Human Physiology | 3 s.h. |
| Mathematics, Statistics and Computer Science | | |
| MATH 2700 | Introduction to Linear Algebra | 4 s.h. |
| MATH 2850 | Calculus III | 4 s.h. |
| MATH 3600 | Intro to Ordinary Differential Equations | 3 s.h. |
| MATH 4060 | Discrete Mathematical Models | 3 s.h. |
| STAT 3510 | Biostatistics | 3 s.h. |
| STAT 4153 | Introduction to Statistical Methods | 3 s.h. |
| STAT 3120 | Probability and Statistics | 4 s.h. |
| Microbiology | | |
| MICR 3112 | Pharmacy Microbiology | 4 s.h. |
| MICR 3147 | Survey of Immunology | 3 s.h. |
| MICR 2157 | General Microbiology | 3 s.h. |
| MICR 2158 | General Microbiology Lab | 2 s.h. |
| MICR 3159 | Pathogenic Bacteriology | 5 s.h. |
| MICR 3160 | Microbial Physiology | 3 s.h. |
| MICR 4163 | Seminar Microbiology | 2 s.h. |
| MICR 3164 | Nursing Microbiology | 4 s.h. |
| MICR 3168 | Introduction to Animal Viruses | 3 s.h. |
| MICR 3170 | Microbial Genetics | 3 s.h. |
| MICR 3175 | Microbial Genetics Laboratory | 3 s.h. |
| MICR 7217 | Integrated Topics in Infectious Diseases | 1 s.h. |
| Pharmacology | | |
| PCOL 4130 | Drug Mechanisms and Actions | 3 s.h. |
| Physics and Astronomy | | |
| PHYS 3850 | Electronics | 4 s.h. |
| Psychology | | |
| PSY 3451 | Infant Development | 3 s.h. |
| PSY 4020 | Laboratory in Psychology | 4 s.h. |
| PSY 3220 | Behavioral Neuroscience | 3 s.h. |
| PSY 3230 | Psychopharmacology | 3 s.h. |
| PSY 3060 | Visual Perception and Cognition | 3 s.h. |
| PSY 3320 | Abnormal Psychology | 3 s.h. |
| PSY 3330 | Childhood Psychopathology | 3 s.h. |

Courses in Bold can be used to satisfy either Advanced Science Electives (BA or BS) or the 6 s.h. research/advanced lab requirement for the BS degree.

Note that some of these courses are offered only in the spring or fall semesters and may require other courses as prerequisites; be sure to consult MyUI when selecting electives.

Research Opportunities

On Campus Research

All biochemistry majors are encouraged to become affiliated with a laboratory in the Department of Biochemistry early in their undergraduate career (prior to taking BIOC 4999). Many options are available for academic credit for research prior to BIOC 4999, including Undergraduate Independent Study (BIOC 3993), and Honors Research Practicum (HONR 3994). During the Fall and Spring semesters, 1 s.h. of research is equal to 5 hours/week in the lab; in the Summer session, 1 s.h. is equal to 10 hours/week in the lab. Students may also enroll in 1 s.h. of research during the winter session, which will be equal to 40 hours/week in the lab. Part-time jobs in the department are also available and an application for research opportunities is provided at the end of this brochure. Students are encouraged to discuss research opportunities with their advisor at any point during their biochemistry major.

The best way to get started in research is to review the research interests of the faculty and then contact faculty via email to discuss the possibility of conducting research with them. You may also indicate your interest in conducting research in biochemistry by submitting the [application for part-time research](#).

Honors in Biochemistry

To receive a biochemistry degree (BA or BS) with honors, a student must:

- Maintain a GPA in the major of 3.33 (B+).
- Complete at least 6 s.h. of BIOC 4999 (Research Independent Study).
- Write an Honors Thesis summarizing the research completed in BIOC 4999. The thesis should be formatted as a scientific paper, suitable for publication in a research journal (actual publication not required).
- Present research results orally at a departmental seminar, arranged by the Undergraduate Coordinator at the end of each semester, and attended by members of the biochemistry community ([Lata Symposium](#)).

Students can also join the Honors Program and obtain University Honors by fulfilling the requirements of the University Honors Program (honors.uiowa.edu). The Honors Program website is an invaluable resource for students who wish to pursue honors. Students can sign up for a listserv that advertises various scholarships (e.g. Rhodes Dunlap, Goldwater), volunteer opportunities, and enrichment activities. Students in the Honors Program are eligible to conduct research under Honors Practicum (HONR 3994) before they have satisfied the prerequisites for BIOC 4999.

Research Independent Study (BIOC 4999)

To be eligible for BIOC 4999, students must have:

1. Grades of B- or better in each of the following: BIOC 3120, 3130 and 3140; *and an average grade of B or better in the three courses*
2. Completed BIOC 3150, Development of Senior Research Project (previously BIOC: 3101)
3. Have previous experience in a research course (such as BIOC 3993) or lab practicum (such as a HONR 3994 or a summer internship)

Under special circumstances, exceptions to these requirements may be made, in consultation with the Honors Advisor and with consent of the instructor. Please note that once you are assigned to a laboratory for BIOC 4999 research, you will need to make sure you select that instructor's name when registering for this course.

Students who enroll in BIOC 4999 are expected to conduct research in the laboratory of a biochemistry faculty member. Exceptions to this rule are made on an individual basis in consultation with the biochemistry honors advisor. Students who wish to pursue biochemical research in a lab outside the biochemistry department will be required to provide a brief description of the research project to document that the student will have principal responsibility for his/her project, and that the project is biochemical in focus.

Teaching Opportunities

Biochemistry Teaching Practicum (BIOC:3800) will train qualified junior or senior undergraduates majoring in Biochemistry or a related field to contribute to undergraduate courses. Roles of teaching interns vary dependent on the course, but interns may hold review sessions, offer regular office hours, draft questions for homework or exams, assist in proctoring exams, assist students in a laboratory setting, and help with course implementation. Guidance will come from the faculty director and instructors in each course. Interns are expected to work approximately 3 hours per week for each semester hour of credit earned. For BIOC:3140, interns are expected to register for at least 2 s.h. This course qualifies for experiential learning in the Honors Program.

Interested students are required to meet with the Course Director for the class they are interesting in assisting in. The Course Director will serve as the student's instructor in BIOC:3800 and will work with the student to define the responsibilities and grading criteria of their teaching practicum. Students should then print and complete the Biochemistry Teaching Practicum Form, due in the Biochemistry office (4-403 BSB) by 4 PM on the Friday prior to the start of the semester, to complete the registration process.

Undergraduate Biochemistry Courses

| | | |
|---|--------|---|
| <p>BIOC 3110 (99:110) <i>Introduction to Biochemistry</i></p> <p>One-semester survey of basic concepts in modern biochemistry and molecular biology. Course will emphasize the application of biochemical concepts to human metabolism and is appropriate for students who plan to pursue a career in healthcare or want an overview of the biochemistry discipline.</p> <p>Prerequisite: One year of college-level biology and chemistry.</p> <p>Recommended: One semester of organic chemistry.</p> <p><i>This course is not intended for biochemistry majors.</i></p> | 3 s.h. | All Semesters <i>Online in Spring and Summer semesters</i> |
| <p>*BIOC 3993 (BIOC 3115 or 99:115) <i>Undergraduate Independent Study</i></p> <p>Independent study with a biochemistry faculty member. May be arranged as a tutorial or as a commitment to experimental work. Serves as preparation for BIOC 4999.</p> <p>Prerequisites: None. Consent of the instructor is required.</p> | arr. | All Semesters |
| <p>BIOC 3120 (99:120) <i>Biochemistry & Molecular Biology I</i></p> <p>Physical and chemical foundations of biochemistry, structure of biological molecules, catalysis, transport, and oxidative reactions in biology. This is the first course of a two-semester sequence that concludes with BIOC 3130.</p> <p>Prerequisites: Two semesters of general chemistry, one semester of organic chemistry.</p> <p>Recommended: BIOL 1411 and 1412, and an additional organic chemistry course.</p> | 3 s.h. | Fall & Spring <i>Online in Spring semester</i> |
| <p>BIOC 3130 (99:130) <i>Biochemistry and Molecular Biology II</i></p> <p>Metabolism of lipids and nitrogen-containing compounds; regulation and integration of metabolism; information transfer in prokaryotes and eukaryotes; recombination DNA techniques; chemistry and enzymology of replication, transcription, translation, cell transformation and regulation of gene expression.</p> <p>Prerequisite: BIOC 3120 with a <i>minimum grade of C-</i></p> | 3 s.h. | Fall & Spring <i>Online in Fall semester</i> |
| <p>BIOC 3140 (99:140) <i>Experimental Biochemistry</i></p> <p>Quantitative and qualitative experiments on identification, fractionation, and characterization of constituents of biochemical systems; use of modern instruments and techniques for spectrophotometry, chromatography, electrophoresis, centrifugation and radioisotope studies; emphasis on experimental design and interpretation.</p> <p>Prerequisite: Grade of <i>C or better</i> in BIOC 3120.</p> | 2 s.h. | Spring |
| <p>BIOC 3150 (BIOC: 3101 or 99:101) <i>Development of Senior Research Project</i></p> <p>Preparation for biochemistry majors pursuing a senior research project in BIOC:4999; communicating technical information through writing and speaking; presenting scientific journal articles and writing experimental protocols; developing detailed proposal for one-year senior research project. <i>Open to junior and senior biochemistry majors only. This course is a prerequisite for BIOC4999.</i></p> <p>Prerequisite: BIOC 3120 or BIOC 3130 or BIOC 3140 or with consent of instructor.</p> | 2 s.h. | Spring |
| <p>BIOC 3800 <i>Biochemistry Teaching Practicum</i></p> <p>Independent study teaching practicum to train qualified junior or senior undergraduates majoring in Biochemistry or related field to contribute to undergraduate courses. Prior permission from the instructor/course direct to enroll is required. This course qualifies for experiential learning in the Honors Program.</p> <p>Prerequisites: Completion of course covering the same (or equivalent) material with a grade of B or better, and must arrange for a short interview with the appropriate Course director prior to registering. Once permission is obtained, student must complete the Biochemistry Teaching Practicum Form. Each semester hour of BIOC 3800 corresponds to 3 hours of work per week. For BIOC 3140, a minimum of 2 s.h. are required.</p> | arr. | Fall, Spring |
| <p>*BIOC 4999 (BIOC 4155 or 99:155) <i>Research Independent Study</i></p> <p>Independent study and research in areas of interest to the student. Laboratory assignments are made by the Honors Advisor, in consultation with the student and faculty member, in advance of enrollment in this course.</p> <p>Prerequisites: BIOC 3120, 3130 and 3140 with grades of B- or better, and an overall average of B or better in the three courses, BIOC 3150, and <i>previous research experience (such as BIOC 3993)</i> or consent of instructor. Each semester hour of BIOC 4999 corresponds to 5 hrs of effort per week in fall or spring semesters (15 weeks), and 10 hrs per week in the summer (8 weeks).</p> <p>Required to graduate with honors.</p> | arr. | All Semesters |
| <p>BIOC 4241 (99:241) <i>Biophysical Chemistry I</i></p> <p>Principles and experimental approaches used to study structure and function of biological macromolecules; protein structure, stability, and dynamics; ligand binding and macromolecular interactions; common biophysical methods.</p> <p>Prerequisites: BIOC 3120, 3130 <i>with a minimum grade of C- in each course</i></p> <p>Recommended: Physical chemistry course and one semester of calculus</p> | 3 s.h. | Fall |
| <p>BIOC 4242 (99:242) <i>Biophysical Chemistry II</i></p> <p>Principles and experimental approaches used to study structure and function of biological macromolecules; enzyme kinetics and mechanisms; x-ray crystallography and other diffraction and scattering techniques; NMR spectroscopy.</p> <p>Prerequisites: BIOC 3120, 3130 <i>with a minimum grade of C- in each course</i></p> <p>Recommended: Physical chemistry course and one semester of calculus.</p> | 3 s.h. | Spring |
| <p>* Students should expect to commit 5 hours of lab time for each s.h. of credit taken in the fall or spring semester, and 10 hours per s.h. in the summer. It is extremely important to discuss expectations with the instructor before embarking on a project.</p> | | |

Four-year Graduation Plan

Bachelor of Arts (BA)

The following schedule is a suggested plan of study for the BA degree in biochemistry. It lists the science courses required for the degree following the degree requirements on page 4 of the undergraduate handbook. This list does not include the courses needed to meet the General Education requirements. Some of these courses are also offered during the summer session. There are multiple options to graduate in four years; classes should be chosen in consultation with the biochemistry advisor.

Freshman Year

| <i>Fall Semester</i> | | | <i>Spring Semester</i> | | |
|----------------------|---------------------------|--------|------------------------|----------------------------|--------|
| CHEM 1110 | Principles of Chemistry I | 4 s.h. | CHEM 1120 | Principles of Chemistry II | 4 s.h. |
| MATH 1850 | Calculus I | 4 s.h. | MATH 1860 | Calculus II | 4 s.h. |

Students may begin research in biochemistry at any time; please consult your advisor.

Sophomore Year

| <i>Fall Semester</i> | | | <i>Spring Semester</i> | | |
|----------------------|---|--------|------------------------|---|--------|
| BIOL 1411 | Foundations of Biology | 4 s.h. | BIOL 1412 | Diversity of Form and Function | 4 s.h. |
| CHEM 2230 | Organic Chemistry I for Majors ⁴ | 3 s.h. | CHEM 2240 | Organic Chemistry II for Majors ⁴ | 3 s.h. |
| PHYS 1611 | Introductory Physics I ⁴ | 4 s.h. | CHEM 2420 | Organic Chemistry Lab for Majors ⁴ | 3 s.h. |

Junior Year

| <i>Fall Semester</i> | | | <i>Spring Semester</i> | | |
|------------------------------|---|---|------------------------|---|---------|
| BIOC 3120 | Biochem & Molecular Biology I | 3 s.h. | BIOC 3130 | Biochemistry & Molecular Biology II | 3 s.h. |
| PHYS 1612 | Introductory Physics II (with lab) ⁴ | 4 s.h. | BIOC 3140 | Experimental Biochemistry | 2 s.h. |
| | | | <i>BIOC 3150</i> | <i>Development of Senior Research Project³</i> | 2 s.h. |
| | Science Elective ¹ | tbd | <i>BIOC 3993</i> | <i>Undergraduate Independent Study</i> | tbd |
| <i>Summer Session</i> | | | | | |
| | BIOC 4999 | Research Independent Study ³ | | | 2-3s.h. |

Senior Year

| <i>Fall Semester</i> | | | <i>Spring Semester</i> | | |
|----------------------|---|----------|------------------------|---|----------|
| CHEM 4430 | Principles of Physical Chemistry ² | 3 s.h. | <i>BIOC 4999</i> | <i>Research Independent Study³</i> | 2-3 s.h. |
| <i>BIOC 4999</i> | <i>Research Independent Study³</i> | 2-3 s.h. | | Science Elective ¹ | tbd |
| | Science Elective ¹ | tbd | | | |

Courses listed in *italics* are optional but may be required in certain cases (e.g. for Honors in Biochemistry).

¹Six s.h. of Advanced Science Electives are required for the BA degree. Science electives may be taken at any time; some of the courses may have prerequisites.

²Students in BA program are required to take one of the following courses: CHEM 4430, CHEM 4431, CHEM 4432, BIOC 4241, BIOC 4242.

³Students in the BA Program who wish to graduate with honors must also take a total of 6 s.h. of BIOC 4999. The number of semester hours of research, in any given semester, will depend upon arrangements between student and research advisor. Prerequisites are Biochemistry & Molecular Biology I and II (BIOC 3120 and BIOC 3130) and Experimental Biochemistry (BIOC 3140), at an average grade of B or better and with B- or better in each course. They also must have completed Development of Senior Research Project (BIOC 3150) and should have prior research experience or Honors Research Practicum or consent of the instructor.

⁴Students in the BA program can take either the organic sequence for majors (CHEM:2230, 2240, 2420-recommended) or organic chemistry (CHEM:2210,2220,2410). They can also take either two semesters of Introductory Physics (PHYS:1611,1612 with lab-recommended) or College Physics (PHYS:1511,1512). Most students take Physics during either their sophomore or junior year or take one semester each year.

Four-year Graduation Plan

Bachelor of Science (BS)

The following schedule is a suggested plan of study for the BS degree in biochemistry. It lists the science courses required for the degree following the degree requirements on page 4 of the undergraduate handbook. This list does not include the courses needed to meet the General Education requirements. Some of these courses are also offered during the summer session. There are multiple options to graduate in four years; classes should be chosen in consultation with the biochemistry advisor.

Freshman Year

| <i>Fall Semester</i> | | | <i>Spring Semester</i> | | |
|----------------------|---------------------------|--------|------------------------|----------------------------|--------|
| CHEM 1110 | Principles of Chemistry I | 4 s.h. | CHEM 1120 | Principles of Chemistry II | 4 s.h. |
| MATH 1850 | Calculus I | 4 s.h. | MATH 1860 | Calculus II | 4 s.h. |

Students may begin research in biochemistry at any time; please consult your advisor.

Sophomore Year

| <i>Fall Semester</i> | | | <i>Spring Semester</i> | | |
|----------------------|---|--------|------------------------|---|--------|
| BIOL 1411 | Foundations of Biology | 4 s.h. | BIOL 1412 | Diversity of Form and Function | 4 s.h. |
| CHEM 2230 | Organic Chemistry I for Majors ⁵ | 3 s.h. | CHEM 2240 | Organic Chemistry II for Majors ⁵ | 3 s.h. |
| PHYS 1611 | Introductory Physics I ⁵ | 4 s.h. | CHEM 2420 | Organic Chemistry Lab for Majors ⁵ | 3 s.h. |

Junior Year

| <i>Fall Semester</i> | | | <i>Spring Semester</i> | | |
|-----------------------|---|---|------------------------|---|----------|
| BIOC 3120 | Biochem & Molecular Biology I | 3 s.h. | BIOC 3130 | Biochemistry & Molecular Biology II | 3 s.h. |
| PHYS 1612 | Introductory Physics II (with lab) ⁵ | 4 s.h. | BIOC 3140 | Experimental Biochemistry | 2 s.h. |
| | Science Elective ¹ | tbd | BIOC 3150 | Development of Senior Research Project ⁴ | 2 s.h. |
| BIOC 3993 | Undergraduate Independent Study | tbd | BIOC 3993 | Undergraduate Independent Study | tbd |
| <i>Summer Session</i> | | | | | |
| | BIOC 4999 | Research Independent Study ³ | | | 2-3 s.h. |

Senior Year

| <i>Fall Semester</i> | | | <i>Spring Semester</i> | | |
|----------------------|---|----------|------------------------|---|----------|
| BIOC 4241 | Biophysical Chemistry I ² | 3 s.h. | BIOC 4242 | Biophysical Chemistry II ² | 3 s.h. |
| BIOC 4999 | Research Independent Study ³ | 2-3 s.h. | BIOC 4999 | Research Independent Study ³ | 2-3 s.h. |
| | Science Elective ¹ | tbd | | Science Elective ¹ | tbd |

¹Nine s.h. of Advanced Science Electives and six s.h. of Advanced Research or Laboratory courses are required for the BS degree. Students usually take BIOC 4999 to fulfill the Advanced Laboratory requirement; however, any advanced lab course will satisfy the requirement. Science electives may be taken at any time during the curriculum.

²Students in BS program are required to take two of the following courses: CHEM 4430, CHEM 4431, CHEM 4432, BIOC 5241, BIOC 5242.

³A total of 6 s.h. of BIOC 4999 are required for honors. The number of semester hours of research, in any given semester, will depend upon arrangements between student and research advisor. Prerequisites are Biochemistry & Molecular Biology I and II (BIOC 3120 and BIOC 3130) and Experimental Biochemistry (BIOC 3140), at an average grade of B or better and with B- or better in each course. They also must have completed Development of Senior Research Project (BIOC 3150) and should have prior research experience or Honors Research Practicum or consent of the instructor. This requirement can also be satisfied by advanced lab courses.

⁴Prerequisite for BIOC 4999.

⁵Students in the BS program can take either the organic sequence for majors (CHEM:2230, 2240, 2420-recommended) or organic chemistry (CHEM:2210,2220,2410). They can also take either two semesters of Introductory Physics (PHYS:1611,1612 with lab-recommended) or College Physics (PHYS:1511,1512). Most students take Physics during either their sophomore or junior year or take one semester each year.