BIOCHEMISTRY (CASNR)

Description
The Department of Biochemistry offers studies leading to a bachelor of science (BS) or a combined bachelor's and masters degree (BS and MS) in biochemistry. The training offered is suitable for a professional career in biochemistry which may lead to employment in various industries involved in the manufacture or processing of chemicals, foods, feeds, and pharmaceuticals; or federal agencies such as the Food and Drug Administration, U.S. Department of Agriculture, U.S. Public Health Service, and Environmental Protection Agency. The program is also suitable as preparation for graduate studies leading to academic careers in biochemistry and for professional careers in medicine, dentistry, veterinary medicine and health-related fields. The Department is accredited by the American Society of Biochemistry and Molecular Biology (ASBMB), meaning seniors who sit for the ASBMB certification exam are recognized as earning a certified degree if they receive a qualifying score.

The combined bachelors and masters degree in biochemistry is especially tailored for highly motivated undergraduate students with superior ability who seek additional training to further their career goals. This research thesis-based program is designed to provide opportunities to students to carry out and interpret contemporary research.

Graduate Work. Advanced degrees of master of science and doctor of philosophy are available. For details, consult the Graduate Studies Catalog.

Laboratory Fee and Deposit. Students who enroll in laboratory courses in the Department of Biochemistry may be required to pay a small nonrefundable cash fee to defray the cost of materials consumed in the course and a deposit to cover the cost of replacing or repairing equipment the student may damage in the laboratory.

College Requirements
College Admission
Requirements for admission into the College of Agricultural Sciences and Natural Resources (CASNR) are consistent with general University admission requirements (one unit equals one high school year): 4 units of English, 4 units of mathematics, 3 units of natural sciences, 3 units of social studies, and 2 units of foreign language. Students must also meet performance requirements (ACT composite of 20 or higher OR combined SAT score of 950 or higher OR rank in the top one-half of graduating class; transfer students must have a 2.0 (on a 4.0 scale) cumulative grade point average and 2.0 on the most recent term of attendance. For students entering the PGA Golf Management degree program, a certified golf handicap of 12 or better (e.g., USGA handicap card) or written ability (MS Word file) equivalent to a 12 or better handicap by a PGA professional or high school golf coach is required. For more information, please visit: http://pgm.unl.edu/requirements.

Admission Deficiencies/Removal of Deficiencies
Students who are admitted to CASNR with core course deficiencies must remove these deficiencies within the first 30 credit hours at UNL, or within the first calendar year at UNL, whichever takes longer, excluding foreign languages. Students have up to 60 credit hours to remove foreign language deficiencies. College-level course work taken to remove deficiencies may be used to meet degree requirements in CASNR.

Deficiencies in the required entrance subjects can be removed by completion of specified courses in the University or by correspondence.

The Office of Admissions, Alexander Building (south entrance), City Campus, provides information to new students on how deficiencies can be removed.

College Degree Requirements
Curriculum Requirements
The curriculum requirements of the College consist of three areas: ACE (Achievement-Centered Education); College of Agricultural Sciences and Natural Resources Core; and Degree Program requirements and electives. All three areas of the College Curriculum Requirements are incorporated within the description of the Major/Degree Program sections of the catalog. The individual major/degree program listings of classes insures that a student will meet the minimum curriculum requirements of the College.

Foreign Languages/Language Requirement
Two units of a foreign language are required. This requirement is usually met with two years of high school language.

Minimum Hours Required for Graduation
The College grants the bachelors degree in programs associated with agricultural sciences, natural resources and related programs. Students working toward a degree must earn at least 120 semester hours of credit. A minimum cumulative grade point average of C (2.0 on a 4.0 scale) must be maintained throughout the course of studies and is required for graduation.

Grade Rules
Removal of C-, D and F Grades
Only the most recent letter grade received in a given course will be used in computing a student’s cumulative grade point average if the student has completed the course more than once and previously received a grade or grades below C in that course.

The previous grade (or grades) will not be used in the computation of the cumulative grade point average, but it will remain a part of the academic record and will appear on any transcript.

A student can remove from his/her cumulative average a course grade of C, D+, D, D- or F if the student repeats the same course at the University of Nebraska and receives a grade other than P (pass), I (incomplete), N (no pass), W (withdrawn), or NR (no report). If a course is no longer being offered, it is not eligible for the revised grade point average computation process.

For complete procedures and regulations, see the Office of the University Registrar website at http://www.unl.edu/regrec/course-repeats.

Pass/No Pass
Students in CASNR may take any course offered on a Pass/No Pass basis within the 24-hour limitation established by the Faculty Senate. However, a department may specify that the Pass/No Pass status of its courses be limited to non-majors or may choose to offer some courses for letter grades only.

GPA Requirements
A minimum cumulative grade point average of C (2.0 on a 4.0 scale) must be maintained throughout the course of studies and is required for graduation.
Transfer Credit Rules
To be considered for admission, a transfer student, Nebraska resident or nonresident, must have an accumulated average of C (2.0 on a 4.0 scale) and a minimum C average in the last semester of attendance at another college. Transfer students who have completed less than 12 credit hours of college study must submit either ACT or SAT scores.

Ordinarily, credits earned at an accredited college are accepted by the University. The College, however, will evaluate all hours submitted on an application for transfer and reserves the right to accept or reject any of them. Sixty is the maximum number of hours UNL will accept on transfer from a two-year college. Ninety is the maximum number of hours UNL will accept from a four-year college. Transfer credit in the degree program must be approved by the degree program advisor on a Request for Substitution Form to meet specific course requirements, group requirements, or course level requirements in the major. At least 9 hours in the major field, including the capstone course, must be completed at UNL regardless of the number of hours transferred.

The College will accept no more than 10 semester hours of C-, D+, D and D- grades from other schools. The C-, D+, D and D- grades can only be applied to free electives. This policy does not apply to the transfer of grades from UNO or UNK to UNL.

Joint Academic Transfer Programs
The College of Agricultural Sciences and Natural Resources has agreements with many institutions to support joint academic programs. The transfer programs include dual degree programs and cooperative degree programs. Dual degree programs offer students the opportunity to receive a degree from a participating institution and also to complete requirements for a bachelor of science degree in CASNR. Cooperative programs result in a single degree from either UNL or the cooperating institution.

Dual Degree Programs
A to B Programs
The A to B Program, a joint academic program offered by the CASNR and participating community colleges, allows students to complete the first two years of a degree program at the participating community college and continue their education and study in a degree program leading toward a bachelor of science degree.

The A to B Program provides a basic knowledge plus specialized coursework. Students transfer into CASNR with junior standing.

Depending on the community college, students enrolled in the A to B Program may complete the requirements for an associate of science at the community college, transfer to UNL, and work toward a bachelor of science degree.

Participating community colleges include:

- Central Community College
- Metropolitan Community College
- Mid-Plains Community College
- Nebraska College of Technical Agriculture
- Northeast Community College
- Southeast Community College
- Western Nebraska Community College

3+2 Programs
Two specialized degree programs in animal science and veterinary science are offered jointly with an accredited college or school of veterinary medicine. These two programs permit CASNR animal science or veterinary science students to receive a bachelor of science degree from UNL with a degree in animal science or veterinary science after successfully completing two years of the professional curriculum in veterinary medicine at an accredited veterinary school. Students who successfully complete the 3+2 Program, must complete the “Application for Degree” form and provide transcripts to the Credentials Clerk, Office of the University Registrar, 107 Canfield Administration Building, UNL. Students should discuss these degree programs with their academic advisor.

Cooperative Degree Programs
Academic credit from UNL and a cooperating institution is applied towards a four-year degree from either UNL (UNL degree-granting program) or the cooperating institution (non UNL degree-granting program). All have approved programs of study.

UNL Degree-Granting Programs
A UNL degree-granting program is designed to provide students the opportunity to complete a two-year program of study at one of the four-year institutions listed below; transfer to CASNR and complete the requirements for a bachelor of science degree.

Chadron State College. Chadron State College offers a 2+2 program leading to a grassland ecology and management degree program and a transfer program leading to a Bachelor of Science in Agricultural Education in the teaching option.

Wayne State College. Wayne State College offers a 3+1 program leading to a Bachelor of Science in Plant Biology in the ecology and management option.

University of Nebraska at Kearney. Transfer programs are available for students pursuing degree programs leading to a bachelor of science degree.

University of Nebraska at Omaha. The University of Nebraska at Omaha (UNO) cooperates with CASNR in providing four-semester pre-agricultural sciences, pre-natural resources, pre-food science and technology, pre-horticulture and pre-turfgrass and landscape management transfer programs.

A student enrolled in these programs may transfer all satisfactorily completed academic credits identified in the suggested program of study, and enter CASNR to study toward a degree program leading to a bachelor of science degree. The total program would require a minimum of four years or eight semesters (16 credit hours/semester or 120 credit hours).

UNL CASNR faculty teach horticulture and food science and technology courses at UNO to assist an urban population in better understanding the food processing, horticulture, and landscape horticulture industries.

For more information, contact the CASNR Dean’s Office, 800-472-8800, ext. 2541.

Non UNL Degree-Granting Programs
The CASNR cooperates with other institutions to provide course work that is applied toward a degree at the cooperating institution. Pre-professional programs offered by CASNR allow students to complete the first two or three years of a degree program at UNL prior to transferring and completing a degree at the cooperating institution.

Chadron State College—Range Science. The 3+1 Program in range science allows Chadron State College students to pursue a range science degree through Chadron State College. Students complete three years of
course work at Chadron State College and one year of specialized range science course work (32 credit hours) at CASNR.

Dordt College (Iowa) – Agricultural Education: Teaching Option. This program allows students to pursue an Agricultural Education Teaching Option degree leading toward a bachelor of science in agricultural education. Students at Dordt College will complete 90 credit hours in the Agricultural Education: Teaching Option Transfer Program.

Residency
Students must complete at least 30 of the total hours for their degree using UNL credits. At least 18 of the 30 credit hours must be in courses offered through CASNR\(^1\) (+299) including the appropriate ACE 10 degree requirement or an approved ACE 10 substitution offered through another UNL college and excluding independent study regardless of the number of hours transferred. Credit earned during education abroad may be used toward the residency requirement if students register through UNL and participate in prior-approved education abroad programs. UNL open enrollment and summer independent study courses count toward residence.\(^1\)

Includes courses taught by CASNR faculty through interdisciplinary prefixes (e.g., LIFE, MBIO, ENVR, SCIL, EAEP, HRTM, ENSC) and CASNR crosslisted courses taught by non-CASNR faculty.

Online and Distance Education
There are many opportunities to earn college credit online through the University of Nebraska–Lincoln. Some of these credits may be applicable not only as elective credits, but also toward the fulfillment of the College’s education requirements. Credits earned online may count toward residency. However, certain offerings may not be counted toward scholarship requirements or academic recognition criteria.

For further information, contact:
Office of Online and Distance Education
University of Nebraska–Lincoln
305 Brace Labs
Lincoln, NE 68588-0109
402-472-4681
http://online.unl.edu/

Independent Study Rules
Students wishing to take part in independent studies must obtain permission; complete and sign a contract form; and furnish copies of the contract to the instructor, advisor, departmental office, and the Dean’s Office. The contract should be completed before registration. Forms are available in 103 Agricultural Hall or online at the CASNR website.

Independent study projects include research, literature review or extension of course work under supervision and evaluation of a departmental faculty member.

Students may only count 12 hours of independent study toward their degrees and no more than 6 hours can be counted during their last 36 hours earned, excluding senior thesis, internships, and courses taught under an independent study number.

Other College Degree Requirements
Capstone Course Requirement
A capstone course is required for each CASNR degree program. A capstone course is defined as a course in which students are required to integrate diverse bodies of knowledge to solve a problem or formulate a policy of societal importance.

ACE Requirements
All students must fulfill the Achievement Centered Education (ACE) requirements. Information about the ACE program may be viewed at www.ace.unl.

The minimum requirements of CASNR reflect the common core of courses that apply to students pursuing degrees in the college. Students should work with an advisor to satisfy ACE outcomes 1, 2, 3, 4, 6 and 10 with the college requirements.

Catalog Rule
Students must fulfill the requirements stated in the catalog for the academic year in which they are first admitted to UNL or when they were first admitted to a Joint Academic Transfer Program. In consultation with advisors, a student may choose to follow a subsequent catalog for any academic year in which they are admitted to and enrolled as a degree-seeking student at UNL in the College of Agricultural Sciences and Natural Resources. Students must complete all degree requirements from a single catalog year. The catalog which a student follows for degree requirements may not be more than 10 years old at the time of graduation.

Learning Outcomes
Majors in biochemistry will be able to:

1. Apply the basic principles of the physical sciences to the study of biological systems to explain how organisms consume and convert energy to enable the processes of life.
2. Attribute the function and regulation of biomolecules to specific macromolecular structures through the use of quantitative and analytical computational techniques.
3. Explain the flow of information through biological systems and predict the impact of environmental or biological variables on system output.
4. Analyze, interpret, critique and communicate data and ideas concerning topics at the forefront of biochemistry.

Major Requirements
Specific Major Requirements

Biochemistry Core

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>SCIL 101</td>
<td>Science and Decision-Making for a Complex World</td>
<td>3</td>
</tr>
<tr>
<td>BIOC 101</td>
<td>Career Opportunities in Biochemistry</td>
<td>1</td>
</tr>
<tr>
<td>BIOC 205</td>
<td>Scientific Analysis and Technical Writing</td>
<td>2</td>
</tr>
<tr>
<td>BIOC 431 / BIOS 431 / CHEM 431</td>
<td>Structure and Metabolism</td>
<td>3</td>
</tr>
<tr>
<td>BIOC 432 / BIOS 432 / CHEM 432</td>
<td>Metabolism and Biological Information</td>
<td>3</td>
</tr>
<tr>
<td>BIOC 433 / BIOS 433 / CHEM 433</td>
<td>Biochemistry Laboratory</td>
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<tr>
<td>BIOC 435</td>
<td>Advanced Topics in Biochemistry (ACE 10)</td>
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Natural Sciences

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<td>LIFE 120</td>
<td>Fundamentals of Biology I (ACE 4)</td>
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<td>Course</td>
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<td>LIFE 120L</td>
<td>Fundamentals of Biology I laboratory (ACE 4)</td>
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<td>LIFE 121</td>
<td>Fundamentals of Biology II</td>
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<td>LIFE 121L</td>
<td>Fundamentals of Biology II Laboratory</td>
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</tr>
<tr>
<td>BIOS 206</td>
<td>General Genetics</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>or AGRO 215 / HORT 215 / TLMT 215</td>
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<tr>
<td>BIOS 312</td>
<td>Microbiology</td>
<td>3</td>
</tr>
<tr>
<td>BIOS 313</td>
<td>Molecular Microbiology Laboratory</td>
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<tr>
<td>CHEM 109</td>
<td>General Chemistry I</td>
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<tr>
<td></td>
<td>&amp; CHEM 110</td>
<td></td>
</tr>
<tr>
<td></td>
<td>&amp; CHEM 221</td>
<td></td>
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<tr>
<td></td>
<td>&amp; CHEM 221</td>
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</tr>
<tr>
<td></td>
<td>&amp; ELEMENTARY QUANTITATIVE ANALYSIS</td>
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<tr>
<td>CHEM 113</td>
<td>Fundamental Chemistry I</td>
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</tr>
<tr>
<td></td>
<td>&amp; CHEM 114</td>
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</tr>
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<td></td>
<td>&amp; CHEM 221</td>
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<td>&amp; ELEMENTARY QUANTITATIVE ANALYSIS</td>
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<td>CHEM 251</td>
<td>Organic Chemistry I</td>
<td></td>
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<td></td>
<td>&amp; CHEM 253</td>
<td></td>
</tr>
<tr>
<td></td>
<td>&amp; CHEM 263</td>
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<tr>
<td></td>
<td>&amp; CHEM 263</td>
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<td>Select one sequence of the following:</td>
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<tr>
<td>CHEM 252</td>
<td>Organic Chemistry II</td>
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<td>&amp; CHEM 254</td>
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<tr>
<td></td>
<td>&amp; CHEM 264</td>
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<td>&amp; CHEM 264</td>
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<tr>
<td>CHEM 262</td>
<td>Organic Chemistry</td>
<td></td>
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<tr>
<td></td>
<td>&amp; CHEM 262</td>
<td></td>
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<td></td>
<td>&amp; CHEM 262</td>
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<tr>
<td>CHEM 471</td>
<td>Physical Chemistry</td>
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<td>Select one sequence of the following:</td>
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<td>PHYS 141</td>
<td>Elementary General Physics I</td>
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<td>&amp; PHYS 142</td>
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<tr>
<td>PHYS 211</td>
<td>General Physics I</td>
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<tr>
<td></td>
<td>&amp; PHYS 212</td>
<td></td>
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<tr>
<td></td>
<td>&amp; PHYS 221</td>
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<td></td>
<td>&amp; PHYS 222</td>
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</tr>
<tr>
<td></td>
<td>&amp; General Physics Laboratory</td>
<td></td>
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<tr>
<td></td>
<td>&amp; General Physics Laboratory</td>
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</tr>
<tr>
<td></td>
<td>&amp; General Physics Laboratory</td>
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<td>&amp; General Physics Laboratory</td>
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### Mathematics and Statistics

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<tbody>
<tr>
<td>MATH 106</td>
<td>Calculus I (ACE 3)</td>
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<tr>
<td>MATH 107</td>
<td>Calculus II</td>
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### Communications

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<tr>
<td>ENGL 150</td>
<td>Writing and Inquiry</td>
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<tr>
<td>ENGL 151</td>
<td>Writing and Argument</td>
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<tr>
<td>ENGL 254</td>
<td>Writing and Communities</td>
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</tr>
<tr>
<td>JGEN 120</td>
<td>Basic Business Communication</td>
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</tr>
<tr>
<td>JGEN 200</td>
<td>Technical Communication I</td>
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<td>JGEN 300</td>
<td>Technical Communication II</td>
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<td>Select one sequence of the following:</td>
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<td>ALEC 102</td>
<td>Interpersonal Skills for Leadership</td>
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<td>Select one sequence of the following:</td>
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<td>COMM 101</td>
<td>Communication in the 21st Century</td>
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<tr>
<td>COMM 209</td>
<td>Public Speaking</td>
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<td>COMM 210</td>
<td>Communicating in Small Groups</td>
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<td>COMM 215</td>
<td>Visual Communication</td>
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<td>COMM 286</td>
<td>Business and Professional Communication</td>
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<td>JGEN 300</td>
<td>Technical Communication II</td>
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<td>MRKT 257</td>
<td>Sales Communication</td>
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<tr>
<td>NRES 301</td>
<td>Environmental Communication Skills</td>
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<tr>
<td>TMFD 121</td>
<td>Visual Communication and Presentation</td>
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### Economics, Humanities, and Social Sciences

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<tr>
<td>ECON 200</td>
<td>Economic Essentials and Issues</td>
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<tr>
<td>ECON 211</td>
<td>Principles of Macroeconomics</td>
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<tr>
<td>ECON 212</td>
<td>Principles of Microeconomics (ACE 8)</td>
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<tr>
<td>Select one course each from ACE outcomes 5, 6, 7, and 9</td>
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</table>

### Free Electives

Select 20-24 credits

| Credit Hours Subtotal:                          | 24      |
| Credit Hours Subtotal:                          | 120     |

**NOTE:** Within the same subject matter area, students may request a more advanced course be substituted for a required course.

### Advanced Placement and International Baccalaureate Credit

Students who earned AP or IB credit for general chemistry in high school are still required to complete a freshman-level chemistry sequence at an accredited post-secondary institution. These students are encouraged, but not required, to take CHEM 113 Fundamental Chemistry I/ CHEM 114 Fundamental Chemistry II rather than CHEM 109 General Chemistry I/ CHEM 110 General Chemistry II. High school dual enrollment credit is not included in this policy.

### Additional Major Requirements

#### Grade Rules

No C- or D grades can be applied toward the biochemistry minor or biochemistry degree requirements in any of the courses listed under the following sections of **Specific Major Requirements**: Biochemistry Core, Natural Sciences, and Mathematics and Statistics.

#### Pass/No Pass

Students in biochemistry must take the courses listed under **Specific Major Requirements** as graded only. Pass/No Pass is not allowed in: Biochemistry Core, Natural Sciences, and Mathematics and Statistics.

### Requirements for Minor Offered By Department

Select a minimum of 18 credit hours of graded course work to include the following courses:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOC 431 / BIOS 431 / CHEM 431</td>
<td>Structure and Metabolism</td>
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<tr>
<td>Course Code</td>
<td>Course Title</td>
<td>Credits</td>
</tr>
<tr>
<td>-------------</td>
<td>--------------------------------------------------</td>
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</tr>
<tr>
<td>BIOC 432 /</td>
<td>Metabolism and Biological Information</td>
<td>3</td>
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<tr>
<td>BIOS 432 /</td>
<td></td>
<td></td>
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<tr>
<td>CHEM 432</td>
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<tr>
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<tr>
<td>BIOS 312</td>
<td>Microbiology</td>
<td>3</td>
</tr>
<tr>
<td>BIOS 313</td>
<td>Molecular Microbiology Laboratory</td>
<td>1-2</td>
</tr>
<tr>
<td>or BIOS 314</td>
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<tr>
<td>CHEM 252</td>
<td>Organic Chemistry II</td>
<td>3</td>
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<td>or CHEM 262</td>
<td>Organic Chemistry</td>
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<tr>
<td>CHEM 254</td>
<td>Organic Chemistry II Laboratory</td>
<td>1-2</td>
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<tr>
<td>or CHEM 264</td>
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Total Credit Hours: 18-20

**BIOC 101 Career Opportunities in Biochemistry**

**Prerequisites:** Interest in becoming a biochemistry major.

**Description:** Introduction to the field of biochemistry and faculty research interests in the Center for Biochemistry. Exploration of careers in biochemistry.

**Credit Hours:** 1

**Max credits per semester:** 1

**Max credits per degree:** 1

**Format:** LEC

**BIOC 205 Scientific Analysis and Technical Writing**

**Prerequisites:** Biochemistry major or minor. LIFE 120 and CHEM 109.

**Notes:** BIOC 101 and CHEM 110 suggested to be taken prior to this course or concurrent enrollment.

**Description:** Data analysis and presentation, hypothesis-driven research execution and various types of scientific writing with detailed examination of high impact biochemistry research literature.

**Credit Hours:** 2

**Max credits per semester:** 2

**Max credits per degree:** 2

**Format:** LEC

**BIOC 305 Reflective Approach to Graduate/Professional School Application**

**Prerequisites:** Junior standing or senior standing; BIOC 431.

**Description:** Focuses on preparing students for graduate/professional school application through reflective writing and application specific activities.

**Credit Hours:** 1

**Max credits per semester:** 1

**Max credits per degree:** 1

**Format:** LEC

**Offered:** SPRING

**BIOC 321 Elements of Biochemistry**

**Prerequisites:** CHEM 255 (preferred) or CHEM 251; BIOS 101 and BIOS 101L or LIFE 120 and LIFE 120L

**Notes:** BIOC 321 will not count towards a biochemistry major.

**Description:** Structure and function of proteins, carbohydrates, lipids and nucleic acids; enzymes; principal metabolic pathways; and biochemical expression of genetic information.

**Credit Hours:** 3

**Max credits per semester:** 3

**Max credits per degree:** 3

**Format:** LEC

**Prerequisite for:** BSEN 416, BSEN 816; VBMS 410

**BIOC 321L Laboratory for Elements of Biochemistry**

**Prerequisites:** Parallel BIOC 321

**Credit Hours:** 1

**Max credits per semester:** 1

**Max credits per degree:** 1

**Format:** LAB

**BIOC 431 Structure and Metabolism**

**Crosslisted with:** BIOC 831, BIOS 431, BIOS 831, CHEM 431, CHEM 831

**Prerequisites:** LIFE 120 with a grade of C or better; CHEM 252 or CHEM 262 with a grade of C or better.

**Notes:** BIOS 206 or AGRO 215 is recommended. First course of a two-semester, comprehensive biochemistry course sequence.

**Description:** Structure and function of proteins, nucleic acids, carbohydrates and lipids; nature of enzymes; major metabolic pathways of catabolism; and biochemical energy production.

**Credit Hours:** 3

**Max credits per semester:** 3

**Max credits per degree:** 3

**Format:** LEC

**Offered:** FALL/SPR

**Prerequisite for:** BIOC 305; BSEN 416, BSEN 816; VBMS 410

**BIOC 432 Metabolism and Biological Information**

**Crosslisted with:** BIOC 832, BIOS 432, CHEM 432, CHEM 832, BIOS 832

**Prerequisites:** BIOC 431/831 with a grade of C or better; BIOS 206 or AGRO 215 with a grade of C or better.

**Notes:** Continuation of BIOC 431/831.

**Description:** Major metabolic pathways of anabolism, structural and biochemical aspects of biological information flow and use in biotechnology.

**Credit Hours:** 3

**Max credits per semester:** 3

**Max credits per degree:** 3

**Format:** LEC

**Offered:** FALL/SPR

**Prerequisite for:** BIOC 435; BIOS 934, BIOS 934, CHEM 934

**BIOC 433 Biochemistry Laboratory**

**Crosslisted with:** BIOC 833, BIOS 433, BIOS 833, CHEM 433, CHEM 833

**Prerequisites:** BIOC 431/831 or parallel; or CHEM 435/835.

**Description:** Introduction to techniques used in biochemical and biotechnology research, including measurement of pH, spectroscopy, analysis of enzymes, chromatography, fractionation of macromolecules, electrophoresis, and centrifugation.

**Credit Hours:** 2

**Max credits per semester:** 2

**Max credits per degree:** 2

**Format:** LEC

**Offered:** FALL/SPR
BIOC 434 Plant Biochemistry
Crosslisted with: AGRO 434, BIOS 434, CHEM 434, AGRO 834, BIOC 834, BIOS 834, CHEM 834
Prerequisites: BIOC/BIOS/CHEM 431/831.
Description: Biochemical metabolism unique to plants. Relationships of topics previously acquired in general biochemistry to biochemical processes unique to plants. Biochemical mechanisms behind physiological processes discussed in plant or crop physiology.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC

BIOC 435 Advanced Topics in Biochemistry
Prerequisites: BIOC/BIOS/CHEM 432/832 with a grade of C or better
Description: Application of general biochemistry knowledge to current topics in the life sciences; literature research and seminar.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC

BIOC 486 Advanced Topics in Biophysical Chemistry
Crosslisted with: BIOC 886, BIOS 486, BIOS 886, CHEM 486, CHEM 886
Prerequisites: CHEM 471/871 or 481/881.
Description: Applications of thermodynamics to biochemical phenomena, optical properties of proteins and polynucleotides, and kinetics of rapid reactions.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC

BIOC 498 Undergraduate Research
Prerequisites: Permission
Description: Research on a specific biochemical project under the supervision of a biochemistry faculty member.
Credit Hours: 1-6
Min credits per semester: 1
Max credits per semester: 6
Max credits per degree: 6
Format: IND

BIOC 499H Honors Thesis
Prerequisites: Good standing in the University Honors Program or by invitation. AGRI 299H recommended.
Description: Conduct a scholarly research project and write a University Honors Program or undergraduate thesis.
Credit Hours: 1-6
Min credits per semester: 1
Max credits per semester: 6
Max credits per degree: 6
Format: IND

PLEASE NOTE
This document represents a sample 4-year plan for degree completion with this major. Actual course selection and sequence may vary and should be discussed individually with your college or department academic advisor. Advisors also can help you plan other experiences to enrich your undergraduate education such as internships, education abroad, undergraduate research, learning communities, and service learning and community-based learning.

Icon Legend: Critical

16 HR TERM 1

Biochemistry Core
complete BIOC 101 1hr

ACE 4 Chemistry
complete CHEM 109 4hr

College Algebra Reqt
complete MATH 106

BIOC 437 Research Techniques in Biochemistry
Crosslisted with: BIOC 837, BIOS 437, BIOS 837
Prerequisites: BIOC/BIOS/CHEM 433/833, or permission
Description: Methods approach to systems biology analysis. Molecular identification and quantification employing techniques such as mass spectrometry, chromatography, electrophoretic fractionation, transcriptomics, proteomics and metabolomics. Data and pathway analysis with computational methods.
Credit Hours: 4
Max credits per semester: 4
Max credits per degree: 4
Format: LEC

ACE: ACE 10 Integrated Product

BIOC 439 Dynamics of Biochemical and Biological Networks
Crosslisted with: BIOC 839, BIOS 439, BIOS 839
Prerequisites: BIOS 206 or AGRO 215; BIOC 321 or BIOC 431
Description: To introduce and integrate, students in biochemistry and other life sciences, to the field of computational modeling of biochemical and biological network systems into a seamless curriculum.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC

Offered: SPRING

BIOC 442 Computational Biology
Crosslisted with: BIOC 842, STAT 842, STAT 442
Prerequisites: Any introductory course in biology, or genetics, or statistics.
Description: Databases, high-throughput biology, literature mining, gene expression, next-generation sequencing, proteomics, metabolomics, system biology and biological networks.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC
ACE 1 Written Comm
complete 1 from ENGL 150, ENGL 151, ENGL 254, JGEN 120, JGEN 200, JGEN 300

College Course
complete SCIL 101

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15 HR TERM 2

ACE 4 Chemistry
complete CHEM 110

ACE 3 Mathematics
complete MATH 107

ACE 4 Life Science
complete LIFE 120, LIFE 120L

Completion of the Life Sequence becomes critical to your success in the major if not completed by the fourth term of enrollment.

ACE 2 Comm Skills
complete 1 from NRES 260, ALEC 102, COMM 101, COMM 209, COMM 215, COMM 286, JGEN 300, MRKT 257, TMFD 121, NRES 301

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16 HR TERM 4

Organic Chem I And Lab
complete CHEM 251, CHEM 253

Genetics
complete either BIOS 206 or AGRO 215

Completion of the Life Sequence becomes critical to your success in the major if not completed by the fourth term of enrollment.

ACE 5 Humanities
complete 1 from ACE5

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14 HR TERM 3

Organic Chem I And Lab
complete CHEM 251, CHEM 253

ACE 4 Life Science
complete BIOC 205

Completion of the Life Sequence becomes critical to your success in the major if not completed by the fourth term of enrollment.
14 HR TERM 5

Biochemistry Core
complete BIOC 431

C

ACE 9 Global/Human Divers
complete 1 from ACE9
3hr

C

Electives
complete Any Course
3hr

14 HR TERM 6

Biochemistry Core
complete BIOC 432

C

Microbiology
complete BIOS 314
3hr

C

ACE 7 Arts
complete 1 from ACE7
3hr

16 HR TERM 7

ACE 4 Physics
complete PHYS 141

5hr

C

ACE 6 Social Sciences
complete 1 from ACE6
3hr

C

Microbiology
complete BIOS 312
3hr

C

Electives
complete Any Course
3hr

14 HR TERM 8

Biochemistry Capstone
complete BIOC 435
3hr

Physical Chemistry
complete CHEM 471
3hr

C

ACE 4 Physics
complete PHYS 142
5hr

Electives
Graduation Requirements
1. Performance Measure: 2.00 GPA required for graduation.
2. ***Total Credits Applying Toward 120 Total Hours***