BIOCHEMISTRY (CASNR)

Description
The Department of Biochemistry offers studies leading to either a bachelor of science (BS) or a combined bachelors and masters degree (BS and MS) in biochemistry. There are two options available for the undergraduate program: Standard Biochemistry Option, which is the traditional biochemistry major, and the Computational and Systems Biochemistry Option, which integrates concepts and skills from the core biochemistry requirements with additional study in mathematics, statistics, and computer science. The training offered through both options 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. Both options are suitable as preparation for graduate studies leading to academic careers in biochemistry and professional careers in medicine, dentistry, veterinary medicine, and health-related fields. The Computational and Systems Biochemistry Option aims at preparing students to address questions using quantitative and multidisciplinary approaches in fields such as health, agriculture, and biotechnology. 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 non-refundable 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

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 sciences, and 2 units of world language. Students must also meet performance requirements: a 3.0 cumulative high school grade point average OR an ACT composite of 20 or higher, writing portion not required OR a score of 1040 or higher on the SAT Critical Reading and Math sections 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 the University of Nebraska–Lincoln, or within the first calendar year at Nebraska, whichever takes longer, excluding foreign languages. Students have up to 60 credit hours to remove world language deficiencies. College-level coursework taken to remove deficiencies may be used to meet degree requirements in CASNR.

Deficiencies in the required entrance subjects can be removed by the 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 ensures that a student will meet the minimum curriculum requirements of the College.

World Languages/Language Requirement
Two units of a world 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. Some degree programs have a higher cumulative grade point average required for graduation. Please check the degree program on its graduation cumulative grade point average.

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 (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. Some degree programs have a higher cumulative grade point average required for graduation. Please check the degree program on its graduation cumulative grade point average.

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 (60) is the maximum number of hours the University will accept on transfer from a two-year college. Ninety (90) is the maximum number of hours the University 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 the University of Nebraska—Lincoln 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 the University of Nebraska—Lincoln.

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 the University of Nebraska—Lincoln 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 the University of Nebraska—Lincoln, 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
- Nebraska Indian Community College
- 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 the University of Nebraska—Lincoln 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 provide transcripts and complete the Application for Degree form via MyRED. Students without MyRED access may apply for graduation in person at Husker Hub in the Canfield Administration Building, or by mail. Students should discuss these degree programs with their academic advisor.

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

UNL Degree-Granting Programs
A University of Nebraska—Lincoln 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 and a 3+1 program leading to a bachelor of science in Applied Science.

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. Transfer programs are available for students pursuing degree programs leading to a bachelor of science degree.

Non University of Nebraska–Lincoln Degree-Granting Programs
CASNR cooperates with other institutions to provide coursework that is applied towards a degree at the cooperating institution. Preprofessional programs offered by CASNR allow students to complete the first two or three years of a degree program at the University 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 coursework at Chadron State College and one year of specialized range science coursework (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 University of Nebraska–Lincoln 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 Nebraska 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 the University of Nebraska–Lincoln and participate in prior-approved education abroad programs. University of Nebraska–Lincoln 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 coursework 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 ace.unl.edu (https://ace.unl.edu/).

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 the University of Nebraska–Lincoln 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 Nebraska 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
Graduates of biochemistry in the Standard Biochemistry Option 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.

Graduates of biochemistry in the Computational and Systems Biochemistry Option will be able to:

1. Explain the origin, rationale, and uses of large datasets used to study biological processes in living organisms.
2. Perform computational analyses of biological datasets and relate the results to core principles in biochemistry and biology.
3. Use existing computational methods and software to help execute a research plan.
4. Address a scientific problem by exploiting biological datasets and creating simple computational biology and/or bioinformatics tools.
5. Use discipline-specific tools and content knowledge to analyze and interpret scientific data, evaluate the significance of the data, and articulate conclusions supportable by the data.
6. Independently and collaboratively formulate testable scientific hypotheses and design approaches to obtain data to test the respective hypotheses.
7. Work in multidisciplinary and culturally diverse teams.

**Major Requirements**

**Standard Biochemistry Option**

**Specific Major Requirements**

<table>
<thead>
<tr>
<th>Biochemistry Core</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOC 101</td>
<td>Foundational Concepts &amp; Career Opportunities in Biochemistry 1</td>
</tr>
<tr>
<td>BIOC 205</td>
<td>Scientific Analysis and Technical Writing 2</td>
</tr>
<tr>
<td>BIOC 431 / BIOS 431 / CHEM 431</td>
<td>Biochemistry I: Structure and Metabolism 3</td>
</tr>
<tr>
<td>BIOC 432 / BIOS 432 / CHEM 432</td>
<td>Biochemistry II: Metabolism and Biological Information 3</td>
</tr>
<tr>
<td>BIOC 433 / BIOS 433 / CHEM 433</td>
<td>Biochemistry Laboratory 2</td>
</tr>
<tr>
<td>BIOC 435</td>
<td>Advanced Topics in Biochemistry (ACE 10) 3</td>
</tr>
<tr>
<td>SCIL 101</td>
<td>Science and Decision-Making for a Complex World 3</td>
</tr>
</tbody>
</table>

Credit Hours Subtotal: 17

**Natural Sciences**

| LIFE 120 & LIFE 120L | Fundamentals of Biology I and Fundamentals of Biology I laboratory (ACE 4) 4 |
| LIFE 121 & LIFE 121L | Fundamentals of Biology II and Fundamentals of Biology II Laboratory 4 |
| BIOS 206 or AGRO 215 / HORT 215 / TLMT 215 | General Genetics 4 |
| BIOS 312            | Microbiology 3 |
| BIOS 313 or BIOS 314 | Molecular Microbiology Laboratory and Microbiology Laboratory 1-2 |

Select one sequence from the following: 10-11

| CHEM 109A & CHEM 109L & CHEM 110A & CHEM 110L & CHEM 221 | General Chemistry I and General Chemistry I Laboratory and General Chemistry II and General Chemistry II Laboratory and Elementary Quantitative Analysis |
| CHEM 113A & CHEM 113L & CHEM 114 & CHEM 221 | Fundamental Chemistry I and Fundamental Chemistry I Laboratory and Fundamental Chemistry II and Elementary Quantitative Analysis |

Select one sequence from the following: 4-5

| CHEM 251 & CHEM 253 | Organic Chemistry I and Organic Chemistry I Laboratory |
| CHEM 261 & CHEM 263 | Organic Chemistry and Organic Chemistry Laboratory |
| CHEM 471 or CHEM 481 | Physical Chemistry |

Select one sequence from the following: 10

| PHYS 141 & PHYS 142 | Elementary General Physics I and Elementary General Physics II |
| PHYS 211 & PHYS 212 & PHYS 221 & PHYS 222 | General Physics I and General Physics II and General Physics Laboratory I and General Physics Laboratory II |

Credit Hours Subtotal: 49

**Mathematics and Statistics**

| MATH 106 | Calculus I (ACE 3) 5 |
| MATH 107 | Calculus II 4 |

Credit Hours Subtotal: 9

**Communications**

**Written Communication (ACE 1)**

Select one of the following: 3

| ENGL 150 | Writing and Inquiry |
| ENGL 151 | Writing and Argument |
| ENGL 254 | Writing and Communities |
| JGEN 120 | Basic Business Communication |
| JGEN 200 | Technical Communication I |
| JGEN 300 | Technical Communication II |

Select one of the following: 3

| ALEC 102 | Interpersonal Skills for Leadership |
| COMM 101 | Communication in the 21st Century |
| COMM 209 | Public Speaking |
| COMM 210 | Communicating in Small Groups |
| COMM 215 | Visual Communication |
| COMM 286 | Business and Professional Communication |
| JGEN 300 | Technical Communication II |
| MRKT 257 | Sales Communication |
| NRES 301 | Environmental Communication Skills |
| TMFD 121 | Visual Communication and Presentation |

Credit Hours Subtotal: 6

**Economics, Humanities, and Social Sciences**

| ECON 200 | Economic Essentials and Issues (ACE 8) 3 |

Select one course each from ACE outcomes 5, 6, 7, and 9 12

Credit Hours Subtotal: 15

**Free Electives**

Select 20-24 credits 20-24
### Biochemistry (CASNR)

<table>
<thead>
<tr>
<th>Credit Hours Subtotal:</th>
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<tbody>
<tr>
<td>Total Credit Hours</td>
<td>120</td>
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**NOTE:** Within the same subject matter area, students may request a more advanced course be substituted for a required course.

### Computational and Systems Biochemistry Option

#### Specific Major Requirements

**Biochemistry Core**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credit Hours</th>
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<tbody>
<tr>
<td>BIOC 101</td>
<td>Foundational Concepts &amp; 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>Biochemistry I: Structure and Metabolism</td>
<td>3</td>
</tr>
<tr>
<td>BIOC 432 / BIOS 432 / CHEM 432</td>
<td>Biochemistry II: Metabolism and Biological Information</td>
<td>3</td>
</tr>
<tr>
<td>BIOC 433 / BIOS 433 / CHEM 433</td>
<td>Biochemistry Laboratory</td>
<td>2</td>
</tr>
<tr>
<td>BIOC 435</td>
<td>Advanced Topics in Biochemistry (ACE 10, specific section in place for Option students)</td>
<td>3</td>
</tr>
<tr>
<td>SCIL 101</td>
<td>Science and Decision-Making for a Complex World</td>
<td>3</td>
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**Natural Sciences**

<table>
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<tr>
<th>Course</th>
<th>Title</th>
<th>Credit Hours</th>
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<tbody>
<tr>
<td>LIFE 120 &amp; LIFE 120L</td>
<td>Fundamentals of Biology I and Fundamentals of Biology I laboratory (ACE 4)</td>
<td>4</td>
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<tr>
<td>LIFE 121 &amp; LIFE 121L</td>
<td>Fundamentals of Biology II and Fundamentals of Biology II Laboratory</td>
<td>4</td>
</tr>
<tr>
<td>BIOS 206</td>
<td>General Genetics</td>
<td>4</td>
</tr>
<tr>
<td>or AGRO 215 / HORT 215 / TLMT 215</td>
<td>Genetics</td>
<td>4</td>
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**Select one sequence from the following:**

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<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credit Hours</th>
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</thead>
<tbody>
<tr>
<td>CHEM 109A &amp; CHEM 109L</td>
<td>General Chemistry I and General Chemistry I Laboratory</td>
<td>4</td>
</tr>
<tr>
<td>&amp; CHEM 110A &amp; CHEM 110L</td>
<td>General Chemistry II and General Chemistry II Laboratory</td>
<td>4</td>
</tr>
<tr>
<td>CHEM 113A &amp; CHEM 113L</td>
<td>Fundamental Chemistry I and Fundamental Chemistry I Laboratory</td>
<td>4</td>
</tr>
<tr>
<td>&amp; CHEM 114</td>
<td>Fundamental Chemistry II</td>
<td>4</td>
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**Select one sequence from the following:**

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<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 251 &amp; CHEM 253</td>
<td>Organic Chemistry I and Organic Chemistry I Laboratory</td>
<td>4</td>
</tr>
<tr>
<td>CHEM 261 &amp; CHEM 263</td>
<td>Organic Chemistry and Organic Chemistry Laboratory</td>
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**Select one sequence from the following:**

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<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credit Hours</th>
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</thead>
<tbody>
<tr>
<td>CHEM 252 &amp; CHEM 254</td>
<td>Organic Chemistry II and Organic Chemistry II Laboratory</td>
<td>4</td>
</tr>
<tr>
<td>CHEM 262 &amp; CHEM 264</td>
<td>Organic Chemistry and Organic Chemistry Laboratory</td>
<td>4</td>
</tr>
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</table>

**Select one sequence from the following:**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHYS 141 &amp; PHYS 142</td>
<td>Elementary General Physics I and Elementary General Physics II</td>
<td>4</td>
</tr>
<tr>
<td>PHYS 211 &amp; PHYS 212 &amp; PHYS 221 &amp; PHYS 222</td>
<td>General Physics I and General Physics II and General Physics Laboratory I and General Physics Laboratory II</td>
<td>4</td>
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**Mathematics and Statistics**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credit Hours</th>
</tr>
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<tbody>
<tr>
<td>MATH 106</td>
<td>Calculus I (ACE 3)</td>
<td>5</td>
</tr>
<tr>
<td>MATH 107</td>
<td>Calculus II</td>
<td>4</td>
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**Communications**

**Written Communication (ACE 1)**

Select one of the following:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENGL 150</td>
<td>Writing and Inquiry</td>
<td>3</td>
</tr>
<tr>
<td>ENGL 151</td>
<td>Writing and Argument</td>
<td>3</td>
</tr>
<tr>
<td>ENGL 254</td>
<td>Writing and Communities</td>
<td>3</td>
</tr>
<tr>
<td>JGEN 120</td>
<td>Basic Business Communication</td>
<td>3</td>
</tr>
<tr>
<td>JGEN 200</td>
<td>Technical Communication I</td>
<td>3</td>
</tr>
<tr>
<td>JGEN 300</td>
<td>Technical Communication II</td>
<td>3</td>
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**Communication and Interpersonal Skills (ACE 2)**

Select one of the following:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credit Hours</th>
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<tbody>
<tr>
<td>ALEC 102</td>
<td>Interpersonal Skills for Leadership</td>
<td>3</td>
</tr>
<tr>
<td>COMM 101</td>
<td>Communication in the 21st Century</td>
<td>3</td>
</tr>
<tr>
<td>COMM 209</td>
<td>Public Speaking</td>
<td>3</td>
</tr>
<tr>
<td>COMM 210</td>
<td>Communicating in Small Groups</td>
<td>3</td>
</tr>
<tr>
<td>COMM 215</td>
<td>Visual Communication</td>
<td>3</td>
</tr>
<tr>
<td>COMM 286</td>
<td>Business and Professional Communication</td>
<td>3</td>
</tr>
<tr>
<td>JGEN 300</td>
<td>Technical Communication II</td>
<td>3</td>
</tr>
<tr>
<td>MRKT 257</td>
<td>Sales Communication</td>
<td>3</td>
</tr>
<tr>
<td>NRES 301</td>
<td>Environmental Communication Skills</td>
<td>3</td>
</tr>
<tr>
<td>TMFD 121</td>
<td>Visual Communication and Presentation</td>
<td>3</td>
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</table>

**Economics, Humanities, and Social Sciences**

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>ECON 200</td>
<td>Economic Essentials and Issues (ACE 8)</td>
<td>3</td>
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</tbody>
</table>

Select one course each from ACE outcomes 5, 6, 7, and 9

**Computer Science & Systems Biochemistry Requirements**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOC 437 / BIOS 437</td>
<td>Research Techniques in Biochemistry</td>
<td>4</td>
</tr>
<tr>
<td>BIOS 337</td>
<td>Applications of Bioinformatics</td>
<td>4</td>
</tr>
<tr>
<td>CSCE 155T</td>
<td>Computer Science I: Informatics Focus</td>
<td>3</td>
</tr>
<tr>
<td>CSCE 156</td>
<td>Computer Science II</td>
<td>3</td>
</tr>
<tr>
<td>CSCE 311</td>
<td>Data Structures and Algorithms for Informatics</td>
<td>3</td>
</tr>
<tr>
<td>CSCE 361</td>
<td>Software Engineering</td>
<td>3</td>
</tr>
<tr>
<td>CSCE 413</td>
<td>Database Systems</td>
<td>3</td>
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<tr>
<td>STAT 380</td>
<td>Statistics and Applications</td>
<td>3</td>
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**Computational Internship, needs 2 terms**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credit Hours</th>
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<tbody>
<tr>
<td>BIOC 95</td>
<td>Biochemistry Internship</td>
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**Free Electives**

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<th>Course</th>
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Select 8 hours from the following:

- ASCI 432 Genome Analysis
- BIOS 213 Human Physiology
- BIOS 213L Human Physiology Laboratory
- BIOS 426 Systems Biology
- BIOS 427 Practical Bioinformatics Laboratory
- BIOS 429 Phylogenetic Biology
- BIOS 456 / NRES 456 Mathematical Models in Biology
- BIOS 477 Bioinformatics and Molecular Evolution
- CSCE 423 Design and Analysis of Algorithms
- CSCE 458 Molecular and Nanoscale Communication
- CSCE 459 Genetically Engineered Systems
- CSCE 471 Computational Methods in Bioinformatics
- CSCE 492 Special Topics in Computer Science
- ECEN 453 Computational and Systems Biology
- MATH 439 Mathematical Biology

Credit Hours Subtotal: 8

Total Credit Hours 120

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 113A Fundamental Chemistry I and CHEM 113L Fundamental Chemistry I Laboratory/CHEM 114 Fundamental Chemistry II rather than CHEM 109A General Chemistry I and CHEM 109L General Chemistry I Laboratory/CHEM 110A General Chemistry II and CHEM 110L General Chemistry II Laboratory. High school dual enrollment credit is not included in this policy.

Additional Major Requirements

Grade Rules

C- and D Grades
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 coursework to include the following courses:

- BIOC 431 / BIOS 431 / CHEM 431 Biochemistry I: Structure and Metabolism 3
- BIOC 432 / BIOS 432 / CHEM 432 Biochemistry II: Metabolism and Biological Information 3
- BIOS 206 General Genetics 4
- or AGRO 215 / HORT 215 / TLMT 215 Genetics
- BIOS 312 Microbiology 3
- BIOS 313 Molecular Microbiology Laboratory 1-2
- or BIOS 314 Microbiology Laboratory
- CHEM 252 Organic Chemistry II 3
- or CHEM 252 Organic Chemistry
- CHEM 254 Organic Chemistry II Laboratory 1-2
- or CHEM 254 Organic Chemistry Laboratory

Total Credit Hours 18

Grade Rules

C- and D Grades
A grade of C or above is required for all courses in the major or minor.

Pass/No Pass
Courses taken Pass/No Pass will not count toward the major or minor.

BIOC 95 Biochemistry Internship
Prerequisites: Biochemistry Major; Junior or Senior standing; Permission
Notes: Permission to enroll will be granted upon review of the proposed internship by the supervising UNL faculty.
Description: Provides an opportunity for a practical experience and career exploration/development in a selected business, industry, agency or educational institution. Activities must include a significant biochemistry and/or computational/systems biology component.
Credit Hours: 0
Max credits per semester: 6
Max credits per degree: 6
Grading Option: Pass No Pass

BIOC 101 Foundational Concepts & Career Opportunities in Biochemistry
Notes: Interest in becoming a biochemistry major.
Description: Introduction to the field of biochemistry and exploration of biochemistry related careers.
Credit Hours: 1
Max credits per semester: 1
Max credits per degree: 1
Grading Option: Graded with Option
Offered: FALL/SPR

BIOC 205 Scientific Analysis and Technical Writing
Prerequisites: Biochemistry major or minor. LIFE 120 and CHEM 109 or CHEM 109A and 109L or CHEM 113 or CHEM 113A and 113L
Notes: BIOC 101 and CHEM 110A/110L 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
Grading Option: Graded with Option
**BIOC 305 Reflective Approach to Graduate/Professional School Application**

**Prerequisites:** Biochemistry major; junior standing or senior standing; BI0C 431. Biochemistry minor, with permission.

**Notes:** Letter grade only.

**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

**Grading Option:** Graded

**Offered:** SPRING

**BIOC 401 Elements of Biochemistry**

**Crosslisted with:** BI0C 801

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

**Notes:** 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

**Grading Option:** Graded with Option

**Prerequisite for:** NUTR 450; NUTR 455; VBMS 410

**BIOC 401L Laboratory for Elements of Biochemistry**

**Prerequisites:** Parallel BI0C 401

**Description:** Laboratory exercises and experiments that complement material covered in BI0C 401.

**Credit Hours:** 1

**Max credits per semester:** 1

**Max credits per degree:** 1

**Grading Option:** Graded with Option

**Offered:** SPRING

**BIOC 431 Biochemistry I: Structure and Metabolism**

**Crosslisted with:** BI0C 831, BI0C 431, BI0C 831, CHEM 431, CHEM 831

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

**Notes:**BI0C 206 or AGRO 215 is recommended.

**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

**Grading Option:** Graded with Option

**Offered:** FALL/SPR

**Prerequisite for:** BI0C/BI0S/CHEM 431/831.

**Prerequisite for:** AGRO 434, BI0C 434, BI0C 834, CHEM 434, AGRO 834, BI0C 834, BI0S 834, CHEM 834

**Prerequisite for:** AGRO 834, BI0S 834, CHEM 834

**Prerequisite for:** AGRO 834, BI0C 834, CHEM 834

**Prerequisite for:** AGRO 434, BI0C 434, CHEM 434, AGRO 834, BI0C 834, BI0S 834, CHEM 834

**Prerequisite for:** BI0C/BI0S/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

**Grading Option:** Graded with Option

**BIOC 432 Biochemistry II: Metabolism and Biological Information**

**Crosslisted with:** BI0C 832, BI0C 432, CHEM 432, CHEM 832, BI0C 832

**Prerequisites:** BI0C 431/831 with a grade of C or better; BI0C 206 or AGRO 215 with a grade of C or better.

**Notes:** Continuation of BI0C 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

**Grading Option:** Graded with Option

**Offered:** FALL/SPR

**Prerequisite for:** ASCI 949, BI0C 949, BI0S 949, NUTR 949; BI0C 435; BI0C 932, BI0S 932, CHEM 932; BI0C 933, BI0S 933, CHEM 933; BI0C 934, BI0S 934, CHEM 934; BI0C 935, BI0S 935, CHEM 935; BI0C 998; BI0S 950, VBMS 950; VBMS 919; VBMS 951

**BIOC 433 Biochemistry Laboratory**

**Crosslisted with:** BI0C 833, BI0C 433, BI0C 833, CHEM 433, CHEM 833

**Prerequisites:** BI0C 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

**Grading Option:** Graded with Option

**Offered:** SPRING

**Prerequisite for:** BI0C 437, BI0C 837, BI0S 437, BI0S 837; BI0C 898

**BIOC 433H Honors: Inquiry-based Biochemistry Laboratory**

**Prerequisites:** BI0C 206, Parallel BI0C 431

**Description:** A course-based research experience. Hypothesis-driven design of experiments. Data collection and analysis employing techniques used in spectroscopy, bioinformatics, mutagenesis, recombinant DNA, chromatography, enzyme analysis.

**Credit Hours:** 3

**Max credits per semester:** 3

**Max credits per degree:** 3

**Grading Option:** Graded

**Offered:** FALL

**BIOC 434 Plant Biochemistry**

**Crosslisted with:** AGRO 434, BI0C 434, CHEM 434, AGRO 834, BI0C 834, BI0S 834, CHEM 834

**Prerequisites:** BI0C/BI0S/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

**Grading Option:** Graded with Option
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
Grading Option: Graded with Option
ACE: ACE 10 Integrated Product

BIOC 437 Research Techniques in Biochemistry
Crosslisted with: BIOC 837, BIOS 437, BIOS 837
Prerequisites: BIOC/BIOS/CHEM 433/833.
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
Grading Option: Graded with Option
Prerequisite for: VBMS 919

BIOC 439 Dynamics of Biochemical and Biological Networks
Crosslisted with: BIOC 839, BIOS 439, BIOS 839
Prerequisites: BIOS 206 or AGRO 215; BIOC 401 or BIOC 431
Notes: Letter grade only.
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
Grading Option: Graded
Offered: SPRING
Prerequisite for: ASCI 949, BIOC 949, BIOS 949, NUTR 949; BIOC 932, BIOS 932, CHEM 932; BIOC 933, BIOS 933, CHEM 933; BIOC 998

BIOC 440 Structural Biology and Biophysical Chemistry
Prerequisites: BIOC/BIOS/CHEM 431; MATH 107; PHYS 142 or PHYS 212.
Description: Introduction and development of structural and physical ideas for students interested in addressing biological and biochemical questions through quantitative, analytical, and structure-based approaches.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded with Option
Offered: FALL/SPR

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
Grading Option: Graded with Option

BIOC 486 Advanced Topics in Biophysical Chemistry
Crosslisted with: BIOC 886, BIOS 486, BIOS 886, CHEM 486, CHEM 886
Prerequisites: CHEM 471/871 or CHEM 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
Grading Option: Graded with Option

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
Grading Option: Graded with Option

BIOC 499 Undergraduate Thesis
Prerequisites: Permission.
Description: Conduct a scholarly research project and write an undergraduate thesis.
Credit Hours: 1-3
Min credits per semester: 1
Max credits per semester: 3
Max credits per degree: 6
Grading Option: Graded

BIOC 499H Honors Undergraduate Thesis
Prerequisites: Permission.
Description: Conduct a scholarly research project and write a University Honors Program undergraduate thesis.
Credit Hours: 1-3
Min credits per semester: 1
Max credits per semester: 3
Max credits per degree: 6
Grading Option: Graded

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.

Biochemistry - Standard
Biochemistry - Computational and Systems Biochemistry