BIOCHEMISTRY (ASC)

Description
The Department of Biochemistry offers studies leading to either a bachelor of science (BS) or to a combined bachelors 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 professional careers in medicine, dentistry, veterinary medicine, pharmacy, 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.

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.

Program Assessment. In order to assist the department in evaluating the effectiveness of its programs, selected courses are assessed and majors are required to participate in an exit interview in their senior year. The interview will be conducted in the BIOC 435 Advanced Topics in Biochemistry course and results of participation in the interview will in no way affect a students GPA or graduation.

College Requirements

College Admission

College Admission
The entrance requirements for the College of Arts and Sciences are the same as the UNL General Admission Requirements. Students who are admitted through the Admission by Review process may have certain conditions attached to their enrollment at UNL. These conditions are explained under “Removal of Deficiencies.”

In addition to these requirements, the College of Arts and Sciences strongly recommends a third and fourth year of one foreign language. Four years of high school coursework in the same language will fulfill the College of Arts and Sciences’ language requirement. It will also allow students to continue language study at a more advanced level at UNL, and provide more opportunity to study abroad.

Transfer Students
To be considered for admission as a transfer student, Nebraska resident or nonresident, students 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 graduated from high school January 1997 and after must also meet the UNL General Admission Requirements. Those transfer students who graduated before January 1997 must have completed in high school, 3 years of English, 2 years of the same foreign language, 2 years of algebra, and 1 year of geometry. Transfer students who have completed less than 12 credit hours of college study must also submit either their ACT or SAT scores.

Ordinarily, hours earned at a similarly accredited college or university are applicable to the UNL degree. The College, however, will evaluate all hours submitted on an application for transfer, and reserves the right to accept or reject any of them, based upon its exclusion and restriction policies. Sixty is the maximum number of hours the University will accept on transfer from a two-year college or international institution. Transfer credit in the major or minor must be approved by the departmental advisor on a Request for Substitution Form to meet specific course requirements, group requirements, or course level requirements in the major or minor. At least half of the hours in the major field must be completed at the University regardless of the number of hours transferred.

The College of Arts and Sciences will accept no more than 15 semester hours of C- and D grades from other schools. The C- and D grades cannot be applied toward requirements for a major or minor. This policy does not apply to the transfer of grades from UNO or UNK to UNL. All D grades may be transferred from UNO or UNK, but they are not applicable to a major or minor.

Readmitted Students
UNL students who choose not to take courses for more than 2 consecutive terms, must reapply to UNL. Students readmitted to the College of Arts and Sciences will follow the requirements stated in the catalog for the academic year of readmission and re-enrollment as a degree-seeking student in Arts and Sciences. In consultation with advisors, a student may choose to follow a catalog for any academic year in which they are admitted to and enrolled as a degree-seeking student at UNL in the College of Arts and Sciences. Students must complete all degree requirements from a single catalog year. Beginning in 1990-1991, the catalog which a student follows for degree requirements may not be more than 10 years old at the time of graduation.

Admission Deficiencies/Removal of Deficiencies
Students must remove entrance deficiencies in geometry and foreign language as soon as possible, and before graduating from the College of Arts and Sciences. For questions and more information, students should consult a college advisor in the Academic and Career Advising Center in 107 Oldfather Hall.

Removing Foreign Language Deficiencies
Students must complete the second semester of a first year language sequence to clear the deficiency and the second semester of the second year language sequence to complete the college graduation requirement in language.

Removing Geometry Deficiencies
A deficiency of one year of geometry can be removed by taking high school geometry courses through an approved independent study program, or by completing a geometry course from an accredited community college or a four-year institution. Neither of these options will count for college credit.

College Degree Requirements

College Distribution Requirements
Bachelor of Arts or Bachelor of Science (16 hours + Language)
The College of Arts and Sciences distribution requirements are designed to further the purposes of liberal education by encouraging study in
several different areas within the College. All requirements are in addition to University ACE requirements. A student may not use a single course to satisfy more than one of the following five distribution requirements. A student cannot use a single course to satisfy both an ACE outcome and a College distribution requirement. A student cannot use a course from their primary major to satisfy the Breadth Requirement (F), but may apply an ancillary requirement of the primary major or a course from their second major toward this requirement. Independent study or reading courses and internships cannot be used to satisfy distribution requirements. To see a complete list of excluded courses, run a degree audit through MyRED.

Courses from interdisciplinary programs will count in the same area as courses from the home/cross-listed department(s).

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>College Distribution Requirements</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CDR A - Written Communication</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>Select from courses approved for ACE outcome 1.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CDR B and BL - Natural, Physical, and Mathematical Sciences with Lab</td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>Select from biochemistry, biological sciences, chemistry, computer science, geology, meteorology, mathematics, physics and statistics. Must include one lab in the natural or physical sciences. Lab courses may be selected from biochemistry, biological sciences, chemistry, geology, meteorology and physics. Some courses from geography and anthropology may also be used to satisfy the lab requirement above.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CDR C - Humanities</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>Select from classics, English, history, modern languages and literatures, philosophy, and religious studies.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CDR D - Social Science</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>Select from: anthropology, communication studies, geography, political science, psychology, or sociology.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CDR E - Language</td>
<td></td>
<td>0-16</td>
</tr>
<tr>
<td>Fulfilled by the completion of the 6-credit-hour second-year sequence in a single foreign language in one of the following departments: Classics and religious studies, modern languages and literatures, or anthropology. Instruction is currently available in Arabic, Chinese, Czech, French, German, Greek, Japanese, Latin, Omaha, Russian, and Spanish. A student who has completed the fourth-year level of one foreign language in high school is exempt from the languages requirement.</td>
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<td></td>
</tr>
<tr>
<td>CDR F - Additional Breadth</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>Select from: natural, physical and mathematical sciences (Area B), humanities (Area C), or social sciences (Area D). Cannot be a course from the primary major.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Credit Hours Subtotal: 16-32

1. See degree audit or College of Arts and Sciences advisor for approved geography and anthropology courses that apply as natural science.
2. Language courses numbered 210 or below apply only for the foreign language requirement.
3. See degree audit or College of Arts and Sciences advisor for list of natural/physical science courses in anthropology, geography, and psychology that do not apply as social science.

Scientific Base

Bachelor of Science Only (60 hours)
The bachelor of science degree requires students to complete 60 hours in mathematical, physical and natural sciences. Approved courses for scientific base credit come from the following College of Arts and Sciences disciplines: actuarial science, anthropology (selected courses), astronomy, biochemistry (excluding BIOC 101), biological sciences (excluding BIOS 203), chemistry (excluding CHEM 101), computer science (excluding CSCE 10), geography (selected courses), geology, life sciences, mathematics (excluding courses below MATH 104), meteorology, microbiology, physics and statistics.

See your degree audit or a College of Arts and Sciences advisor for a complete list including individual classes that fall outside of the disciplines listed above. Up to 12 hours of scientific and technical courses offered by other colleges may be accepted toward this requirement with approval of a college advisor.

Foreign Languages/Language Requirement

Languages Exemption Policy
UNL and the College of Arts and Sciences will exempt or waive students from the UNL entrance requirement of two years of the same foreign language or from the College’s language distribution requirement based on documentation only. The following are the options and procedures for documentation:

High School Transcripts

For the University entrance requirement, students must show an official high school transcript with two or more years of the same foreign language.

For the College of Arts and Sciences College Distribution Requirement E-Language, students must show an official high school transcript with four or more years of the same foreign language in high school, or show evidence of graduation from a non-English-speaking foreign high school. Students whose native language is not English must show English as a Second Language study on an official high school transcript. Four years of ESL at the high school level (9th, 10th, 11th and 12th grades) will be the basis for a waiver of the CDR E Language requirement.

Proficiency Examination at UNL

For the University entrance requirement, students who do not have transcript documentation can request to take a proficiency exam in the language. (This is not the same test as the Modern Languages Placement Exam.) However, UNL will provide testing only in the languages it teaches. Currently, these languages are: Arabic, French, German, Spanish, Russian, Czech, Japanese, Chinese.

For the College of Arts and Sciences College Distribution Requirement E-Language, the Department of Modern Languages will oversee the test at the 202 level. If the student passes the test, the department will sign the College Request for Waiver form and indicate the level of proficiency. The form is then forwarded to the Arts and Sciences Advising Center for approval.

The Department of Modern Languages will oversee the test and provide written documentation to the Arts and Sciences Advising Center the level of proficiency passed.
Distance Education
For the University entrance requirement, students without transcript documentation who claim proficiency in a language not taught at UNL, have the option of seeking out a distance education program in languages. If the student completes the equivalent of 102 from an approved distance education program, the student will meet the UNL entrance requirement. The student must have the course work approved before he/she takes/completes the course as equivalent to 102 by a College advisor. The student then completes the course and has the distance education program send the transcript to the Admissions Office.

For the College of Arts and Sciences College Distribution Requirement E-Language, the student can seek out a distance education program and complete the equivalent of the 202-level course. The student must submit the request on the College Request for Substitution form and have the course work approved by a College advisor. The student then completes the course and has the distance education program send the transcript to the Admissions Office.

Third Language Option
If a student demonstrates knowledge of two foreign languages at the 102 level, the College of Arts and Sciences may consider waiving two semesters of the four semester College Distribution Requirement E-Languages requirement. If this waiver were granted, the student would then be required to complete 101 and 102 in another, 3rd foreign language at UNL.

Minimum Hours Required for Graduation
A minimum of 120 semester hours of credit is required for graduation from the College of Arts and Sciences. A total grade point average of at least 2.0 is required.

Grade Rules
Restrictions on C- and D Grades
The College will accept no more than 15 semester hours of C- and D grades from other schools except for UNO and UNK. No transfer C- and D grades can be applied toward requirements in a major or a minor. No UNL C- and D grades can be applied toward requirements in a major or a minor.

Pass/No Pass Privilege
University regulations for the Pass/No Pass (P/N) privilege state:

1. The Pass/No Pass option is designed for your use by seeking to expand your intellectual horizons by taking courses in areas where you may have had minimal preparation.
2. Neither the P nor the N grade contribute to your GPA.
3. P is interpreted to mean C or above.
4. A change to or from a Pass/No Pass may be made until mid-term (see academic calendar for specific dates per term).
5. The Pass/No Pass or grade registration cannot conflict with the policy of the professor, department, college, or University governing the grading option.
6. Changing to or from Pass/No Pass requires using the MyRED system to change the grading option or filing a Drop/Add form with the Office of the University Registrar, 107 Canfield Administration Building. After mid-term of the course, a student registered for Pass/No Pass cannot change to a grade registration unless the Pass/No Pass registration is in conflict with the policy of the professor, department, college, or University governing Pass/No Pass.
7. The Pass/No Pass grading option cannot be used for the removal of C- or D or F grades.

Pass/No Pass privileges in the College of Arts and Sciences are extended to students according to the following additional regulations:

1. Pass/No Pass hours can count toward fulfillment of University ACE requirements and college distribution requirements up to the 24-hour maximum.
2. Most Arts and Sciences departments and programs do not allow courses graded Pass/No Pass to apply to the major or minor. Students should refer to the department's or program's section of the catalog for clarification. By college rule, departments can allow up to 6 hours of Pass/No Pass in the major or minor.
3. Departments may specify that certain courses of theirs can be taken only on a P/N basis.
4. The college will permit no more than a total of 24 semester hours of P/N grades to be applied toward degree requirements. This total includes all Pass grades earned at UNL and other U.S. schools. NOTE: This 24-hour limit is more restrictive than the University regulation.

Grading Appeals
A student who feels that he/she has been unfairly graded must ordinarily take the following sequential steps in a timely manner, usually by initiating the appeal in the semester following the awarding of the grade:

1. Talk with the instructor concerned. Most problems are resolved at this point.
2. Talk to the instructor’s department chairperson.
3. Take the case to the Grading Appeal Committee of the department concerned. The Committee should be contacted through the department chairperson.
4. Take the case to the College Grading Appeals Committee by contacting the Dean’s Office, 1223 Oldfather Hall.

Course Level Requirements
Courses Numbered above 299
Thirty of the 120 semester hours of credit must be in courses numbered above 299. Of the 30 hours above 299, 15 hours (1/2) must be completed in residence at UNL.

Graduate Courses
Seniors in the University who have obtained in advance the approval of the dean for Graduate Studies may receive up to 12 hours credit for graduate courses taken in addition to the courses necessary to complete their undergraduate work, provided that such credits are earned within the calendar year prior to receipt of the baccalaureate. For procedures, inquire at the Office of Graduate Studies.

Course work taken prior to receipt of the baccalaureate may not always be accepted for transfer to other institutions as graduate work.

Residency
Residency Requirement and Open Enrollment and Summer Independent Study Courses
Students must complete at least 30 of the 120 total hours for their degree at UNL. Students must complete at least 1/2 of their major course work including 6 hours above 299 in their major, and 15 of the 30 hours required above 299 in residence. 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.

**ACE Requirements**

Consistent with the mission and values of the University, ACE is based on a shared set of four institutional objectives and ten student learning outcomes. The ACE program was approved by faculty in all eight undergraduate colleges and endorsed by the Faculty Senate, the student government, and the Academic Planning Committee in January 2008 for implementation in the fall 2009. ACE aligns with current national initiatives in general education.

Key characteristics of ACE demonstrate the benefits of the program to students:

- Students receive a broad education with exposure to multiple disciplines, critical life skills and important reasoning, inquiry, and civic capacities.
- ACE is simple and transparent for students, faculty and advisors. Students complete the equivalent of 3 credit hours for each of the ten student learning outcomes.
- Students connect and integrate their ACE experiences with their selected major.
- Students can transfer all ACE certified courses across colleges within the institution to meet the ACE requirement and any course from outside the institution that is directly equivalent to a UNL ACE-certified course. Courses from outside institutions without direct equivalents may be considered with appropriate documentation for ACE credit (see academic advisor).

ACE allows faculty to assess and improve their effectiveness and facilitate students’ learning.

**ACE Institutional Objectives and Student Learning Outcomes**

To meet the ACE Program requirement, a student will complete a minimum of 3 credit hours for each of the ten ACE Student Learning Outcomes (a total of 30 ACE credit hours). See the ACE website at: http://ace.unl.edu for the most current information and the most recently certified courses.

**Catalog Rule**

Students must fulfill the requirements stated in the catalog for the academic year in which they are first admitted to and enrolled as a degree-seeking student at UNL. 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 Arts and Sciences. Students must complete all degree requirements from a single catalog year. Beginning in 1990-1991 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**

**Core Requirements**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<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</td>
<td>Biochemistry Laboratory</td>
<td>2</td>
</tr>
<tr>
<td>BIOC 435</td>
<td>Advanced Topics in Biochemistry (ACE 10)</td>
<td>3</td>
</tr>
<tr>
<td><strong>Total Credit Hours</strong></td>
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<td>14</td>
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</table>

**Specific Major Requirements**

**Mathematics and Statistics**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credit Hours</th>
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</thead>
<tbody>
<tr>
<td>MATH 106</td>
<td>Calculus I</td>
<td>5</td>
</tr>
<tr>
<td>MATH 107</td>
<td>Calculus II</td>
<td>4</td>
</tr>
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<td><strong>Credit Hours Subtotal:</strong></td>
<td></td>
<td>9</td>
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</table>

**Biological/Life Sciences**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>LIFE 120 &amp; LIFE 120L</td>
<td>Fundamentals of Biology I and Fundamentals of Biology I laboratory</td>
<td>4</td>
</tr>
<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>
</tr>
<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>
<td>Microbiology Laboratory</td>
<td>1-2</td>
</tr>
<tr>
<td><strong>Credit Hours Subtotal:</strong></td>
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<td>16-17</td>
</tr>
</tbody>
</table>

**Chemistry**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 109 &amp; CHEM 110 &amp; CHEM 221</td>
<td>General Chemistry I and General Chemistry II and Elementary Quantitative Analysis</td>
<td>11-12</td>
</tr>
<tr>
<td>or CHEM 111: Fundamental Chemistry I and CHEM 114 and Fundamental Chemistry II &amp; CHEM 221 and Elementary Quantitative Analysis</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Select one sequence from:</strong></td>
<td></td>
<td>8-10</td>
</tr>
<tr>
<td>CHEM 251 &amp; CHEM 253 &amp; CHEM 252 &amp; CHEM 254</td>
<td>Organic Chemistry I and Organic Chemistry I Laboratory and Organic Chemistry II and Organic Chemistry II Laboratory</td>
<td>8-10</td>
</tr>
<tr>
<td>or CHEM 261: Organic Chemistry</td>
<td></td>
<td></td>
</tr>
<tr>
<td>or CHEM 263 &amp; Organic Chemistry</td>
<td></td>
<td></td>
</tr>
<tr>
<td>or CHEM 262 &amp; Organic Chemistry</td>
<td></td>
<td></td>
</tr>
<tr>
<td>or CHEM 264 &amp; Organic Chemistry</td>
<td></td>
<td></td>
</tr>
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</table>
Select one course from:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 471</td>
<td>Physical Chemistry</td>
<td>4</td>
</tr>
<tr>
<td>or CHEM 481</td>
<td>Physical Chemistry I</td>
<td>4</td>
</tr>
</tbody>
</table>

Credit Hours Subtotal: 23-26

Physics
Select one sequence from:

<table>
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<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHYS 141</td>
<td>Elementary General Physics I</td>
<td>4</td>
</tr>
<tr>
<td>&amp; PHYS 142</td>
<td>Elementary General Physics II</td>
<td>4</td>
</tr>
<tr>
<td>or PHYS 211</td>
<td>General Physics I</td>
<td>4</td>
</tr>
<tr>
<td>&amp; PHYS 212</td>
<td>General Physics II</td>
<td>4</td>
</tr>
<tr>
<td>&amp; PHYS 221</td>
<td>General Physics Laboratory I</td>
<td>1</td>
</tr>
<tr>
<td>&amp; PHYS 222</td>
<td>General Physics Laboratory II</td>
<td>1</td>
</tr>
</tbody>
</table>

Credit Hours Subtotal: 10

Total Credit Hours 58-62

\(^1\) AP and IB 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 111 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.

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

Additional Major Requirements

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.

Requirements for Minor Offered by Department

Eighteen (18) credit hours of graded course work to include the following courses:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOC 431</td>
<td>Structure and Metabolism</td>
<td>3</td>
</tr>
<tr>
<td>BIOC 432</td>
<td>Metabolism and Biological Information</td>
<td>3</td>
</tr>
<tr>
<td>BIOS 206</td>
<td>General Genetics</td>
<td>4</td>
</tr>
<tr>
<td>or AGRO 215</td>
<td></td>
<td></td>
</tr>
<tr>
<td>or HORT 215</td>
<td></td>
<td></td>
</tr>
<tr>
<td>or TLMT 215</td>
<td></td>
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</tr>
<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>
<td>Microbiology Laboratory</td>
<td></td>
</tr>
<tr>
<td>CHEM 252</td>
<td>Organic Chemistry II</td>
<td>3</td>
</tr>
<tr>
<td>or CHEM 262</td>
<td>Organic Chemistry</td>
<td></td>
</tr>
<tr>
<td>CHEM 254</td>
<td>Organic Chemistry II Laboratory</td>
<td>1-2</td>
</tr>
<tr>
<td>or CHEM 264</td>
<td>Organic Chemistry Laboratory</td>
<td></td>
</tr>
</tbody>
</table>

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 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 321 Elements of Biochemistry
Prerequisites: CHEM 255 (preferred) or CHEM 251; BIOS 101 and BIOS 101L or LIFE 120 and LIFE 120L
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: 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 431, CHEM 431, CHEM 831
Prerequisites: CHEM 252 or CHEM 262 with a grade of C or better. LIFE 120 and BIOS 206 are recommended.
Notes: 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
Prerequisite for: 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.
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
Prerequisite for: BIOC 435, 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 concurrent enrollment) 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

BIOC 434 Plant Biochemistry
Crosslisted with: AGRO 434, BIOS 434, CHEM 434, AGRO 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 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

BIOC 439 Dynamics of Biochemical and Biological Networks
Crosslisted with: BIOC 839, BIOS 439, BIOS 839
Prerequisites: BIOS 206, BIOC 321 or BIOC 431 (or equivalent)
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

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

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.
# Biochemistry (B.S.)

**16 HR TERM 1**

**Biochemistry Core**
- complete BIOC 101

**Calculus**
- complete MATH 106

**General Chemistry**
- complete CHEM 109

**ACE 1 Written Texts**
- complete 1 from ACE1

**CDR E: Language**
- recommend 1 or more courses

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<th>Credit Hours</th>
<th>Requirement</th>
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<tr>
<td>Biochemistry Core</td>
<td>4 hr</td>
<td>Critical</td>
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<tr>
<td>Calculus</td>
<td>1 hr</td>
<td>C</td>
</tr>
<tr>
<td>General Chemistry</td>
<td>4 hr</td>
<td>C</td>
</tr>
<tr>
<td>ACE 1 Written Texts</td>
<td>3 hr</td>
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</tr>
<tr>
<td>CDR E: Language</td>
<td>3 hr</td>
<td>If not complete, choose a language course according to your placement and proficiency. CDR E is met after 4th level (202) of most languages.</td>
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**17 HR TERM 2**

**Life Science**
- complete LIFE 120, LIFE 120L

**Calculus**
- complete MATH 107

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<tr>
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<td>4 hr</td>
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<tr>
<td>Calculus</td>
<td>4 hr</td>
<td>C</td>
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**17 HR TERM 3**

**Biochemistry Core**
- complete BIOC 205

**Organic Chem I And Lab**
- complete 2 from CHEM 251, CHEM 253, CHEM 261, CHEM 263

**Life Science**
- complete LIFE 121, LIFE 121L

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<tr>
<td>TERM 3</td>
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<td>Biochemistry Core</td>
<td>2 hr</td>
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<tr>
<td>Organic Chem I And Lab</td>
<td>5 hr</td>
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<td>Life Science</td>
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<td>C</td>
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<tr>
<td>CDR A: Writing</td>
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**ACE 6 Social Sciences**
- complete 1 from ACE6

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Math 107 will fulfill the CDR F (Additional Breadth) requirement.

CHEM 109 will fulfill the ACE 4 requirement.

LIFE 121 and 121L are ideally completed in the third term of enrollment. They become critical to your success in the major if not completed by the fourth term of enrollment.
complete 1 from ACE1

Complete an additional course approved as ACE 1.

**11 HR TERM 4**

**Organic Chem II And Lab**

complete 2 from CHEM 252, CHEM 254, CHEM 262, CHEM 264

Complete either CHEM 252 and 254 OR CHEM 262 and 264. CHEM 252 or 262 is ideally completed in the fourth term of enrollment. It becomes critical to your success in the major if not completed by the fifth term of enrollment.

**Genetics**

complete BIOS 206

BIOS 206 is ideally completed by the fourth term of enrollment. It becomes critical to your success in the major if not completed by the sixth term of enrollment.

**ACE 2 Communication Skill**

complete 1 from ACE2

**CDR D: Social Sciences**

complete 1 from any Anthropology Course, any Communications Course, any Geography Course, any National Securities Studies Course, any Political Science Course, any Psychology Course, any Sociology Course

Complete an approved course from a Social Science discipline: ANTH, COMM, GEOG, NSST, POLS, PSYC, SOCI.

**15 HR TERM 6**

**Biochemistry Core**

complete BIOC 432

BIOC 432 is ideally completed in the sixth term of enrollment. It becomes critical to your success in the major if not completed by the seventh term of enrollment.

**Physics**

complete 1 from PHYS 141, PHYS 211, PHYS 221

Complete PHYS 141 OR PHYS 211 and 221.

**Microbiology And Lab**

complete 1 from BIOS 312, BIOS 314, BIOS 313

Complete one or more, either BIOS 312 and 314 OR BIOS 313.

**ACE 5 Humanities**

complete 1 from ACE5

**Electives**

complete Any Course

In consultation with your advisor, select elective courses or courses that meet a 2nd major, minor, sci-base or upper level requirement.
15 HR TERM 7

Chemistry

complete CHEM 221

4hr

C

Physical Chemistry

complete CHEM 471

4hr

C

Biochemistry Core

complete BIOC 433

2hr

C

ACE 7 Arts

complete 1 from ACE7

3hr

Electives

complete Any Course

3hr

In consultation with your advisor, select elective courses or courses that meet a 2nd major, minor, sci-base or upper level requirement.

14 HR TERM 8

Biochemistry Capstone

complete BIOC 435

3hr

C

BIOC 435 fulfills the ACE 10 requirement.

Complete an approved course from a Humanities discipline: ARAB, CLAS, CZEC, ENGL, FILM, FREN, GERM, GREK, HEBR, HIST, JAPN, LATN, PHIL, RELG, RUSS, SPAN.

Electives

complete Any Course

4hr

In consultation with your advisor, select elective courses or courses that meet a 2nd major, minor, sci-base or upper level requirement.

Graduation Requirements

1. A minimum 2.00 GPA required for graduation.
2. ***Total Credits Applying Toward 120 Total Hours***
3. Complete 30 hours in residence at UNL.

Career Information

The following represents a sample of the internships, jobs and graduate school programs that current students and recent graduates have reported.

Transferable Skills

- Comprehend and critically evaluate complex information
- Use quantitative & analytical computational techniques
- Make predictions using mathematical, statistical, and scientific modeling methods
- Understand and use proper laboratory and technical skills and instruments
- Define problems and identifying causes
- Support and communicate claims using clear evidence
- Simplify complex information and present it to others
- Apply mathematical and scientific skills to solve real-world problems
- Document and replicate processes and procedures
- Design and implement research experiments

Jobs of Recent Graduates

- Application Scientist, Advanced Analytical Technologies - Ankeny IA
- Science Writer, LI-COR Biosciences - Lincoln NE
- Neuromonitoring Technologist, Biotronic Neuronetwork - Columbia MO
- Lab Technician II, Geneseeek -
- Research Assistant, University of Nebraska-Lincoln - Lincoln NE
- Lab Technician I, GeneSeek/Neogen Corporation - Lincoln NE
- Researcher, UNMC - Omaha NE
• Research Scientist, Vajra Instruments - Lincoln NE
• Scientist I, Aerotek - Chicago IL
• Chemical Engineer I, Black & Veatch - Kansas City KS

Internships
• Advanced Research Intern, Li-COR Biosciences - Lincoln NE
• Facilities Coordinator, UNL CBA Information Tech Services - Lincoln NE
• R&D Summer Intern, Estee Lauder Companies - Melville NY
• Anatomy/Physiology Internship, -
• Associate Management Intern, Cargill - Kansas City, MO
• Undergrad Student Research Intern, UNL Mid-America Transportation Center - Lincoln NE
• Beckman Research Scholar, College of Arts and Sciences - Lincoln NE
• Distinguished Life Sciences Scholar, College of Arts and Sciences - Lincoln NE
• Project Manager Assistant/Engineering Assistant, LI-COR Biosciences - Lincoln NE
• Undergrad Student Research Intern, UNL Mid America Transportation Center - Lincoln NE

Grad Schools
• College of Medicine, University of Nebraska - Medical Center - Omaha NE
• Dentistry, University of Nebraska Medical College - Lincoln NE
• PhD Biochemistry, University of Nebraska-Lincoln - Lincoln NE
• Doctorate of Pharmacy, University of Missouri-Kansas City - Kansas City MO
• Clinical Perfusion/Masters, University of Nebraska Medical Center - Omaha NE
• PhD in Molecular and Cell Biology, University of California-Berkeley -
• Ph. D in Genetics, University of California-San Diego - San Diego CA
• JD, Texas Wesleyan University School of Law -
• Doctor of Optometry, Southern College of Optometry - Memphis TN
• Ph.D. Biomedical Science, University of Iowa - Iowa City IA