

BIOCHEMISTRY (CASNR)

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. There are three options available for the undergraduate program: Biochemical Analysis, Cellular Biochemistry, and Computational and Systems 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. All 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 Department is accredited by the American Society of Biochemistry and Molecular Biology (ASBMB).

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

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 a senior exit survey in their senior year. The survey will be administered in the Advanced Topics in Biochemistry (BIOC 435) course and the results of participation in the survey will in no way affect a student's GPA or graduation. As an ASBMB Accredited degree program, students take the ASBMB Exam in their senior year to demonstrate mastery of the major and earn a digital credential from ASBMB.

Options in the Major

Biochemical Analysis. The Biochemical Analysis option is a deeper dive into the basic science that Biochemistry relies on - general chemistry, organic chemistry and physics. Students take the more analytical sequence in those three areas, so they have a better understanding of "how and why" for the major's foundational sciences. In addition, students take more quantitative chemistry courses and less required biology electives. This options works for any career path, but students interested in research or continuing into a PhD in biochemistry, or a related science might find this path is better preparation for their future.

Cellular Biochemistry. The Cellular Biochemistry option incorporates more cellular and molecular content to complement the study of biochemistry. Students can choose between the analytical sequences or general sequences in the foundational sciences (general chemistry, organic chemistry and physics), and take a cellular/molecular lab course and an advance cellular/molecular course in the area of interest.

Computational and Systems Biochemistry. 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.

Graduate Work. Advanced degrees of master of science and doctor of philosophy are available. For details, consult the Graduate Studies Catalog (<https://catalog.unl.edu/graduate-professional/>).

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

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 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.

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. 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 ensure 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.

Experiential Learning

All undergraduates in the College of Agricultural Sciences and Natural Resources must take an Experiential Learning (EL) designated course. This may include 0-credit courses designed to document co-curricular activities recognized as Experiential Learning.

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 their 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 (withdrew), 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 the 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. Pre-professional 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.

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 CASNR¹ (>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. The 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, 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 the 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. Students transferring from a community college, but without admission to a Joint Academic Transfer Program, may be eligible to fulfill the requirements as stated in the catalog for an academic year in which they were enrolled at the community college prior to attending the University of Nebraska-Lincoln. This decision should be made in consultation with academic advisors, provided the student a) was enrolled in a community college during the catalog year they are utilizing, b) maintained continuous enrollment at the previous institution for 1 academic year or more, and c) continued enrollment at the University of Nebraska-Lincoln within 1 calendar year from their last term at the previous institution. 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 the University of Nebraska–Lincoln 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 Biochemical Analysis Option will be able to:

1. Apply the basic principles of the physical and chemical 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.
5. Use quantitative analysis and multifactorial models to analyze and describe biochemical reactions and equilibria.

Graduates of biochemistry in the Cellular Biochemistry Option will be able to:

1. Apply the basic principles of the physical and chemical 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.
5. Use the principles of biochemistry, genetics and molecular biology to analyze and explain perturbations in cellular systems.

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

1. Apply the basic principles of the physical and chemical 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.

5. Use discipline-specific bioinformatics tools, including computational methods and software, and content knowledge to analyze and interpret biological datasets and relate the results to core principles in biochemistry and biology.

Major Requirements

Biochemistry Core Courses

Biochemistry Core

BIOC 101	Foundational Concepts & Career Opportunities in Biochemistry	1
BIOC 205	Scientific Analysis and Technical Writing	2
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
BIOC 433 / BIOS 433 / CHEM 433	Biochemistry Laboratory	2
BIOC 435	Advanced Topics in Biochemistry (ACE 10)	3
Credit Hours Subtotal:		14

College Integrative Course and (ACE 8)

SCIL 101	Science and Decision-Making for a Complex World	3
Credit Hours Subtotal:		3

Written Communication (ACE 1)

Select one of the following:		3
ENGL 150	Writing and Inquiry	
ENGL 151	Writing for Change	
ENGL 254	Writing and Communities	
JGEN 120	Basic Business Communication	
JGEN 200	Technical Communication I	
JGEN 300	Technical Communication II	
Credit Hours Subtotal:		3

Communication and Interpersonal Skills (ACE 2)

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 283	Interpersonal 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 with Animation	
Credit Hours Subtotal:		3

Mathematics and Statistics (ACE 3)

MATH 106	Calculus I	5
MATH 107	Calculus II	4
Credit Hours Subtotal:		9

Natural Sciences (ACE 4)



LIFE 120 & 120L	Fundamentals of Biology I and Fundamentals of Biology I laboratory (ACE 4)	4
LIFE 121 & 121L	Fundamentals of Biology II and Fundamentals of Biology II Laboratory	4
BIOS 201	General Genetics	4
Credit Hours Subtotal:		12
Economics (ACE 6)		
Select one of the following:		3
AECN 141	Introduction to the Economics of Agriculture	3
ECON 200	Economic Essentials and Issues	3
ECON 211	Principles of Macroeconomics	3
ECON 212	Principles of Microeconomics	3
Credit Hours Subtotal:		15
ACE Requirement		
Select one course each from ACE outcomes 5, 7, 8 and 9		12
Credit Hours Subtotal:		12
Total Credit Hours		71

Biochemical Analysis Option

Biochemical Analysis Option Courses

<i>Microbiology</i>		
BIOS 312	Microbiology	3
BIOS 314	Microbiology Laboratory	1
<i>General Chemistry</i>		
Select one sequence from the following:		7-8
CHEM 109A General Chemistry I & CHEM 109L and General Chemistry I Laboratory or CHEM 113A Fundamental Chemistry I and Fundamental Chemistry I Laboratory & CHEM 113L		
CHEM 110A General Chemistry II & CHEM 110L and General Chemistry II Laboratory or CHEM 114 Fundamental Chemistry II		
<i>Quantitative Chemistry</i>		
CHEM 221A & CHEM 221L	Elementary Quantitative Analysis and Elementary Quantitative Analysis Laboratory	5
<i>Organic Chemistry</i>		
CHEM 261 & CHEM 263	Mechanistic Organic Chemistry I and Mechanistic Organic Chemistry I Laboratory	5
CHEM 262 & CHEM 264	Mechanistic Organic Chemistry II and Mechanistic Organic Chemistry II Laboratory	5
<i>Physics</i>		
PHYS 211 & PHYS 221	General Physics I and General Physics Laboratory I ²	5
PHYS 212 & PHYS 222	General Physics II and General Physics Laboratory II	5
<i>Structural Biology or Physical Chemistry</i>		
Select one of the following:		3-4
BIOC 440	Structural Biology and Biophysical Chemistry	

CHEM 471	Physical Chemistry	
CHEM 481	Physical Chemistry I	
Credit Hours Subtotal:		40-41
Electives		
Select 21-22 hours of electives		21-22
Credit Hours Subtotal:		21
Total Credit Hours		61-62

Cellular Biochemistry Option

Cellular Biochemistry Option Courses

<i>Microbiology</i>		
BIOS 312	Microbiology	3
BIOS 314	Microbiology Laboratory	1
<i>Structural Biology</i>		
BIOC 440	Structural Biology and Biophysical Chemistry	3
<i>General Chemistry</i>		
Select one sequence from the following:		7-8
CHEM 109A General Chemistry I & CHEM 109L and General Chemistry I Laboratory or CHEM 113A Fundamental Chemistry I and Fundamental Chemistry I Laboratory & CHEM 113L		
CHEM 110A General Chemistry II & CHEM 110L and General Chemistry II Laboratory or CHEM 114 Fundamental Chemistry II		
<i>Organic Chemistry</i>		
Select one sequence from the following:		4-5
CHEM 251 Organic Chemistry I & CHEM 253 and Organic Chemistry I Laboratory or CHEM 261 Mechanistic Organic Chemistry I and Mechanistic Organic Chemistry I Laboratory & CHEM 263		
CHEM 252 Organic Chemistry II & CHEM 254 and Organic Chemistry II Laboratory or CHEM 262 Mechanistic Organic Chemistry II and Mechanistic Organic Chemistry II Laboratory & CHEM 264		
Select one sequence from the following:		10
<i>Physics</i>		
PHYS 141 Physics for Life Sciences I or PHYS 211 General Physics I and General Physics Laboratory I & PHYS 221		
PHYS 142 Physics for Life Sciences II or PHYS 212 General Physics II and General Physics Laboratory II & PHYS 222		
<i>Cell/Molecular Electives</i>		
Select one of the following lab courses:		2-4
BIOS 202	Genetics, Molecular and Cellular Biology Laboratory	
BIOS 213 & 213L	Human Physiology and Human Physiology Laboratory	
BIOS 427	Practical Bioinformatics Laboratory	

BIOS 478	Plant Anatomy	
PLAS 325	Introductory Plant Physiology	
PLAS 429	Plant Biotechnology Applications	
<i>Advanced Cellular Biochemistry Electives:</i>		
Select one from the following:		3
BIOC 410	Plant Molecular Biology	3
BIOC 434 / BIOS 434	Plant Biochemistry	3
BIOS 302	Cell Biology	3
BIOS 402	Cancer Biology	3
BIOS 442	Endocrinology	3
BIOS 443	Immunology	3
PLPT 418	Microbial Genetics & Genomics	3
CHME 473	Biochemical Engineering	3
CHME 477	Molecular Bioengineering	3
Select 21-22 hours of electives		21-22
Credit Hours Subtotal:		84
Total Credit Hours		84

Computational and Systems Biochemistry Option

Computational and Systems Biochemistry Option Courses

General Chemistry

Select one sequence from the following:¹ 7-8

CHEM 109A & CHEM 109L	General Chemistry I and General Chemistry I Laboratory	
or CHEM 113 & CHEM 113	Fundamental Chemistry I and Fundamental Chemistry I Laboratory	

CHEM 110A & CHEM 110L	General Chemistry II and General Chemistry II Laboratory	
or CHEM 114 & CHEM 114	Fundamental Chemistry II and Fundamental Chemistry II Laboratory	

Organic Chemistry

Select one sequence from the following: 4-5

CHEM 251 & CHEM 253	Organic Chemistry I and Organic Chemistry I Laboratory	
or CHEM 261 & CHEM 263	Mechanistic Organic Chemistry I and Mechanistic Organic Chemistry I Laboratory	

CHEM 252 & CHEM 254	Organic Chemistry II and Organic Chemistry II Laboratory	
or CHEM 262 & CHEM 264	Mechanistic Organic Chemistry II and Mechanistic Organic Chemistry II Laboratory	

Physics

Select one sequence from the following: 10

PHYS 141	Physics for Life Sciences I	
or PHYS 211 & PHYS 221	General Physics I and General Physics Laboratory I	

PHYS 142	Physics for Life Sciences II	
or PHYS 212 & PHYS 222	General Physics II and General Physics Laboratory II	

Computer Science & Systems Biochemistry Requirements

BIOS 337	Applications of Bioinformatics	4
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BIOC 439	Dynamics of Biochemical and Biological Networks	3
CSCE 155T	Computer Science I: Informatics Focus	3
CSCE 311	Data Structures and Algorithms for Informatics	3
CSCE 320	Data Analysis	3
CSCE 413	Database Systems	3
STAT 380	Statistics and Applications	3

Experiential Learning - needs 2 terms

Select from the following:

BIOC 95	Biochemistry Internship	0
BIOC 98	Biochemistry Research Experience	0

Select 13 hours from the following 2 Elective categories 13

Computational/Bioinformatic Electives

ASCI 432	Genome Analysis	
BIOS 426	Systems Biology	
BIOS 427	Practical Bioinformatics Laboratory	
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 471	Computational Methods in Bioinformatics	
CSCE 492	Special Topics in Computer Science	
ECEN 453	Computational and Systems Biology	
MATH 439	Mathematical Biology	

Biology/Biotech Electives

BIOC 410	Plant Molecular Biology	
BIOC 437	Research Techniques in Biochemistry	
BIOS 213	Human Physiology	
BIOS 213L	Human Physiology Laboratory	
BIOS 429	Phylogenetic Biology	
CHME 473	Biochemical Engineering	
CHME 477	Molecular Bioengineering	
CSCE 459	Genetically Engineered Systems	
PLPT 418	Microbial Genetics & Genomics	

Credit Hours Subtotal: 57

Total Credit Hours 57

¹ AP and IB Credit. Students who earned AP or IB credit for general chemistry in high school are still required to complete a general chemistry sequence at an accredited post-secondary institution. These students are encouraged, but not required, to take CHEM 113A/CHEM 113L and CHEM 114 rather than CHEM 109A/CHEM 109L and CHEM 110A/CHEM 110L. High school dual enrollment credit is not including in this policy.

² PHYS 211: Students are expected to have one year of High School Physics. Those who do not, are recommended to take PHYS 151 before PHYS 211.

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, Mathematics and Statistics, and Major Options.

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, Mathematics and Statistics, and Major Options

Requirements for Minor Offered By Department

Select a minimum of eighteen (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 201	General Genetics	4
BIOS 312	Microbiology	3
BIOS 314	Microbiology Laboratory	1
CHEM 252 or CHEM 262	Organic Chemistry II Mechanistic Organic Chemistry II	3
CHEM 254 or CHEM 264	Organic Chemistry II Laboratory Mechanistic Organic Chemistry II Laboratory	1-2
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.

Bachelor of Science in Biochemistry with the Master of Biochemistry

In an accelerated program, a student may count up to 12 credit hours of approved graduate courses toward both the current undergraduate degree and the later graduate degree. Students must apply for graduate admission and be accepted prior to enrollment. For more information, visit <https://graduate.unl.edu/academics/programs/accelerated-masters/> (<https://graduate.unl.edu/academics/programs/accelerated-masters/>).

The following courses are approved for this program:

BIOC 831	Biochemistry I: Structure and Metabolism (replaces BIOC 431)	3
BIOC 832	Biochemistry II: Metabolism and Biological Information (replaces BIOC 432)	3
BIOC 836	Physical Basis of Macromolecular Function (replaces BIOC 440 or CHEM 471)	3
BIOC 898	Research in Biochemistry (replaces BIOC 431)	1-6
BIOC 834	Plant Biochemistry (replaces BIOC 434)	3

BIOS 842	Endocrinology (replaces BIOS 442)	3
BIOS 843	Immunology (replaces BIOS 443)	3

Grading Requirements

Grading rules as defined by the undergraduate degree/major apply. Please consult your academic advisor and/or the department graduate chair for grading policy as it relates to credit applying toward a graduate degree.

BIOC 95 Biochemistry Internship

Prerequisites: Biochemistry Major; Permission

Notes: Permission to enroll will be granted upon review of the proposed internship request by the instructor.

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, computational/systems biology, or biochemistry career related focus.

Credit Hours: 0

Max credits per semester:

Max credits per degree:

Grading Option: Pass No Pass

Offered: FALL/SPR

Experiential Learning: Internship/Co-op

BIOC 98 Biochemistry Research Experience

Prerequisites: Permission

Notes: This course may be repeated four times; research students should enroll in BIOC 498 in subsequent semesters. Permission to enroll will be granted upon review of the Request for Research Experience application by supervising UNL faculty.

Description: An introduction to laboratory or field methods in preparation for independent research.

Credit Hours: 0

Max credits per semester:

Max credits per degree:

Grading Option: Pass No Pass

Experiential Learning: Research

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. LIFE 120 and CHEM 109A and 109L or CHEM 113A and 113L

Notes: BIOC 101 and CHEM 110A/CHEM 110L or CHEM 114 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

Prerequisite for: BIOC 435

BIOC 305 Reflective Approach to Graduate/Professional School**Application****Prerequisites:** Biochemistry major or minor; BIOC 431 or concurrent.**Notes:** Letter grade only.**Description:** Focused preparation 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 390 Seminars in the Life Sciences****Prerequisites:** BIOC 431 or concurrent**Description:** Seminars by UNL faculty, graduate students, and external guests provide a picture of research in biochemistry and the related life sciences**Credit Hours:** 1**Max credits per semester:** 1**Max credits per degree:** 3**Grading Option:** Pass No Pass**Offered:** FALL/SPR**BIOC 401 Elements of Biochemistry****Crosslisted with:** BIOC 801**Prerequisites:** CHEM 251 or CHEM 261; 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:** BIOC 401L; FDST 867; FORS 415; NUTR 450; NUTR 455; VBMS 410**BIOC 401L Laboratory for Elements of Biochemistry****Prerequisites:** BIOC 401 or parallel.**Description:** Laboratory exercises and experiments that complement material covered in BIOC 401.**Credit Hours:** 1**Max credits per semester:** 1**Max credits per degree:** 1**Grading Option:** Graded with Option**Offered:** FALL/SPR**Course and Laboratory Fee:** \$35**BIOC 410 Plant Molecular Biology****Crosslisted with:** AGRO 810, BIOC 810, HORT 810, PLAS 410**Prerequisites:** BIOS 201 or PLAS 215**Notes:** LIFE 120 and BIOC 401 are suggested**Description:** This course covers the molecular genetic basis of biological function in plants. Emphasis is on genetics (genome organization, gene structure and function, regulation of gene expression and genetic engineering) and molecular biology of the plant cell (cell compartments, cell reproduction, energy flow, reproductive development). The course uses published research articles in plant biology as primary learning resources.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded with Option**Offered:** SPRING**BIOC 431 Biochemistry I: 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 201 or PLAS 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**Grading Option:** Graded with Option**Offered:** FALL/SPR**Prerequisite for:** ASCI 820; ASCI 917; ASCI 925, NUTR 925; ASCI 926, NUTR 926; ASCI 927, NUTR 927; BIOC 305; BIOC 390; BIOC 432, BIOC 832, BIOS 432, CHEM 432, CHEM 832, BIOS 832; BIOC 433, BIOC 833, BIOS 433, BIOS 833, CHEM 433, CHEM 833; BIOC 433H; BIOC 440; FDST 470, FDST 870; NUTR 450; NUTR 455; NUTR 820, NUTR 420; NUTR 821; PLAS 434, BIOC 434, BIOS 434, CHEM 434, AGRO 834, BIOC 834, BIOS 834, CHEM 834; VBMS 410; VBMS 805; VBMS 950**BIOC 432 Biochemistry II: 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 201 or PLAS 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**Grading Option:** Graded with Option**Offered:** FALL/SPR**Prerequisite for:** ASCI 949, BIOC 949, NUTR 949; BIOC 435; BIOC 932, BIOS 932, CHEM 932; BIOC 933, BIOS 933, CHEM 933; BIOC 934, BIOS 934, CHEM 934; BIOC 935, BIOS 935, CHEM 935; BIOC 998; VBMS 919; VBMS 950; VBMS 951

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**Grading Option:** Graded with Option**Offered:** FALL/SPR**Prerequisite for:** BIOC 437, BIOC 837, BIOS 437, BIOS 837; BIOC 898**Course and Laboratory Fee:** \$50**BIOC 433H Honors: Inquiry-based Biochemistry Laboratory****Prerequisites:** BIOS 201 or parallel; BIOC 431 or parallel. Credit toward the degree cannot be earned in both BIOC 433 and BIOC 433H.**Notes:** 433H is a course-based research experience (CURE) where students immerse in an authentic research project.**Description:** A discovery-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/SPR**BIOC 434 Plant Biochemistry****Crosslisted with:** PLAS 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**Grading Option:** Graded with Option**BIOC 435 Advanced Topics in Biochemistry****Prerequisites:** BIOC 205 with grade of C or better; 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**Offered:** FALL/SPR**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**Course and Laboratory Fee:** \$50**BIOC 439 Dynamics of Biochemical and Biological Networks****Crosslisted with:** BIOC 839, BIOS 439, BIOS 839**Prerequisites:** BIOS 201 or PLAS 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, 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, 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 in Biochemistry

Prerequisites: Permission.

Notes: Permission to enroll will be granted upon review of the Request for Research Experience application by supervising UNL faculty.

Description: Research on a specific biochemical project under the supervision of a 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

Experiential Learning: Research

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. Credit toward the degree cannot be earned in both BIOC 499 and BIOC 499H.

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