

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 through these 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. 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 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 specially 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 for 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 (<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, 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.

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 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 (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.

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 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, 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 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 and Argument	
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 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
Economics, Humanities, and Social Sciences		
ECON 200	Economic Essentials and Issues (ACE 8)	3
Credit Hours Subtotal:		3
Mathematics and Statistics		
MATH 106	Calculus I (ACE 3)	5
MATH 107	Calculus II	4
Credit Hours Subtotal:		9
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	General Genetics	4
Credit Hours Subtotal:		12
ACE		
Select one course each from ACE outcomes 5, 6, 7, and 9		12
Credit Hours Subtotal:		12
Total Credit Hours		59

Biochemical Analysis Option

Biochemical Analysis Option Courses

BIOS 312	Microbiology	3
BIOS 314	Microbiology Laboratory	1
CHEM 113A & CHEM 113L	Fundamental Chemistry I and Fundamental Chemistry I Laboratory	4
CHEM 114	Fundamental Chemistry II	3
CHEM 221A & CHEM 221L	Elementary Quantitative Analysis and Elementary Quantitative Analysis Laboratory	5
CHEM 261 & CHEM 263	Organic Chemistry and Mechanistic Organic Chemistry I Laboratory	5
CHEM 262 & CHEM 264	Organic Chemistry and Mechanistic Organic Chemistry II Laboratory	5
PHYS 211 & PHYS 221	General Physics I and General Physics Laboratory I	5
PHYS 212 & PHYS 222	General Physics II and General Physics Laboratory II	5
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
Electives		
Select 21-22 hours of electives		21-22
Credit Hours Subtotal:		21
Total Credit Hours		61

Cellular Biochemistry Option

Cellular Biochemistry Option Courses

BIOS 312	Microbiology	3
BIOS 314	Microbiology Laboratory	1
BIOC 440	Structural Biology and Biophysical Chemistry	3
Select one sequence from the following:		7-8
CHEM 109A & CHEM 109L & CHEM 110A & CHEM 110L	General Chemistry I and General Chemistry I Laboratory and General Chemistry II and General Chemistry II Laboratory	
CHEM 113A & CHEM 113L & CHEM 114	Fundamental Chemistry I and Fundamental Chemistry I Laboratory and Fundamental Chemistry II	
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 Mechanistic Organic Chemistry I Laboratory	
Select one sequence from the following:		4-5
CHEM 252 & CHEM 254	Organic Chemistry II and Organic Chemistry II Laboratory	

CHEM 262 & CHEM 264	Organic Chemistry and Mechanistic Organic Chemistry II Laboratory
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Select one sequence from the following: 10

PHYS 141 & PHYS 142	Elementary General Physics I and Elementary General Physics II
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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
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Select one from the following: 2-4

BIOS 205	Genetics, Molecular and Cellular Biology Laboratory
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BIOS 427	Practical Bioinformatics Laboratory
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BIOS 213 & BIOS 213L	Human Physiology and Human Physiology Laboratory
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BIOS 478	Plant Anatomy
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PLAS 325	Introductory Plant Physiology
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PLAS 429	Plant Biotechnology Applications
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Select one from the following: 3

BIOS 302	Cell Biology
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BIOS 442	Endocrinology
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BIOS 443	Immunology
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BIOS 402	Cancer Biology
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BIOC 434	Plant Biochemistry
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Credit Hours Subtotal: 40

Electives

Select 21-22 hours of electives 21-22

Credit Hours Subtotal: 21

Total Credit Hours 61

Computational and Systems Biochemistry Option

Computational and Systems Biochemistry Option Courses

Select one sequence from the following: 7-8

CHEM 109A & CHEM 109L & CHEM 110A & CHEM 110L	General Chemistry I and General Chemistry I Laboratory and General Chemistry II and General Chemistry II Laboratory
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CHEM 113A & CHEM 113L & CHEM 114	Fundamental Chemistry I and Fundamental Chemistry I Laboratory and Fundamental Chemistry II
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Select one sequence from the following: 4-5

CHEM 251 & CHEM 253	Organic Chemistry I and Organic Chemistry I Laboratory
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CHEM 261 & CHEM 263	Organic Chemistry and Mechanistic Organic Chemistry I Laboratory
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Select one sequence from the following: 4-5

CHEM 252 & CHEM 254	Organic Chemistry II and Organic Chemistry II Laboratory
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CHEM 262 & CHEM 264	Organic Chemistry and Mechanistic Organic Chemistry II Laboratory
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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:		26
Computer Science & Systems Biochemistry Requirements		
BIOC 437 / BIOS 437	Research Techniques in Biochemistry	4
BIOS 337	Applications of Bioinformatics	4
CSCE 155T	Computer Science I: Informatics Focus	3
CSCE 311	Data Structures and Algorithms for Informatics	3
CSCE 361	Software Engineering	3
CSCE 413	Database Systems	3
STAT 380	Statistics and Applications	3
Credit Hours Subtotal:		23
Computational Internship - needs 2 terms		
BIOC 95	Biochemistry Internship	0
Credit Hours Subtotal:		0
Computational Biology Bioinformatic Electives		
Select 12 hours from the following:		12
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:		12
Total Credit Hours		61

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, 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 206 or PLAS 215	General Genetics Genetics	4
BIOS 312	Microbiology	3
BIOS 314	Microbiology Laboratory	1
CHEM 252 or CHEM 262	Organic Chemistry II Organic Chemistry	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.

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:

Max credits per degree:

Grading Option: Pass No Pass

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

Notes: BIOC 101 and CHEM 110A/CHEM 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; BIOC 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 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 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: FDST 867; NUTR 450; NUTR 455; VBMS 410

BIOC 401L Laboratory for Elements of Biochemistry

Prerequisites: Parallel BIOC 401

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 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 206 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: AGRO 810, BIOC 810, HORT 810; 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 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 206 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 206, Parallel BIOC 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:** 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/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**Course and Laboratory Fee:** \$65**BIOC 439 Dynamics of Biochemical and Biological Networks****Crosslisted with:** BIOC 839, BIOS 439, BIOS 839**Prerequisites:** BIOS 206 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

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