

BIOCHEMISTRY (CAS)

Description

The Department of Biochemistry offers studies leading to a bachelor of science (BS) in the College of Arts and Sciences. 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).

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.

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 option 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 advanced cellular/molecular course in their area of interest.

Computational Biochemistry

The Computational Biochemistry option uses more computational/bioinformatics courses to complement the biochemistry requirements for the major. Students who want to work with data in a scientific context like biochemistry or other natural sciences will benefit from this option.

Learning Outcomes

Graduates with a major in biochemistry, regardless of option will be able to:

1. Explain how biological systems consume and convert energy for life's metabolic processes using the principles of the physical and chemical sciences.
2. Relate the structure of macromolecules to their function in order to illustrate how the physical properties of macromolecules enable the dynamic assembly of biological systems.
3. Predict how the flow of information in biological systems allows organisms to respond and adapt to environmental stimuli.
4. Articulate the process of science, integrating hypothesis generation, experimental design, quantitative analysis, and data interpretation.

Graduates with the biochemistry analysis option will also be able to:

- Quantitatively describe biochemical reactions and equilibria.

Graduates with the cellular biochemistry option will also be able to:

- Use the combination of molecular genetics and cellular biology to explain disruptions in cellular systems.

Graduates with the computational biochemistry option will also be able to:

- Use computational tools to analyze and interpret biological datasets.

Academic and Career Advising

Academic and Career Advising Center

Not sure where to go or who to ask? The Advising Center team in 107 Oldfather Hall can help. The Academic and Career Advising Center is the undergraduate hub for CAS students in all majors. Centrally located and easily accessed, students encounter friendly, knowledgeable people who are eager to help or connect students to partner resources. Students also visit the Advising Center in 107 Oldfather Hall to:

- Choose or change their major, minor, or degree program.
- Check on policies, procedures, and deadlines.
- Get a college approval signature from the Dean's representatives.

CAS Career Coaches are available by appointment (in-person or Zoom) and located in the CAS Academic and Career Advising Center, 107 Oldfather Hall. They help students explore majors and minors, gain experience, and develop a plan for life after graduation.

Assigned Academic Advisors

Academic advisors are critical resources dedicated to students' academic, personal, and professional success. Every CAS student is assigned an academic advisor based on their primary major. Since most CAS students have more than just a single major, it is important to get to know the advisor for any minors or additional majors. Academic advisors work closely with the faculty to provide the best overall support and the discipline specific expertise. They are available for appointments (in-person or Zoom) and through weekly virtual drop-ins. Assigned advisors

are listed in MyRED (<https://its.unl.edu/myunl/>) and their offices may be located in or near the department of the major for which they advise.

Students who have declared a pre-health or pre-law area of interest will also work with advisors in the Exploratory and Pre-Professional Advising Center (Explore Center) in 127 Love South, who are specially trained to guide students preparing to enter a professional school.

For complete and current information on advisors for majors, minors, or pre-professional areas, visit <https://cas.unl.edu/major-advisors> (<https://cas.unl.edu/major-advisors/>), or connect with the Arts and Sciences Academic and Career Advising Center, 107 Oldfather Hall, 402-472-4190, casadvising@unl.edu.

Career Coaching

The College believes that **Academics + Experience = Opportunities** and encourages students to complement their academic preparation with real-world experience, including internships, research, education abroad, service, and leadership. Arts and sciences students have access to a powerful network of faculty, staff, and advisors dedicated to providing information and support for their goals of meaningful employment or advanced education. Arts and sciences graduates have unlimited career possibilities and carry with them important career competencies—communication, critical thinking, creativity, context, and collaboration. They have the skills and adaptability that employers universally value. Graduates are prepared to effectively contribute professionally and personally with a solid foundation to excel in an increasingly global, technological, and interdisciplinary world.

Students should contact the career coaches in the Arts and Sciences Academic and Career Advising Center in 107 Oldfather Hall, or their assigned advisor, for more information. The CAS career coaches help students explore career options, identify ways to build experience and prepare to apply for internships, jobs, or graduate school, including help with resumes, applications, and interviewing.

ACE Requirements

Students must complete one course for each of the ACE Student Learning Outcomes below. Certified course choices are published in the degree audit, or visit the ACE (<http://ace.unl.edu>) website (<http://ace.unl.edu>) for the most current list of certified courses.

ACE Student Learning Outcomes

ACE 1: Write texts, in various forms, with an identified purpose, that respond to specific audience needs, integrate research or existing knowledge, and use applicable documentation and appropriate conventions of format and structure.

ACE 2: Demonstrate competence in communication skills.

ACE 3: Use mathematical, computational, statistical, logical, or other formal reasoning to solve problems, draw inferences, justify conclusions, and determine reasonableness.

ACE 4: Use scientific methods and knowledge to pose questions, frame hypotheses, interpret data, and evaluate whether conclusions about the natural and physical world are reasonable.

ACE 5: Use knowledge, historical perspectives, analysis, interpretation, critical evaluation, and the standards of evidence appropriate to the humanities to address problems and issues.

ACE 6: Use knowledge, theories, and research perspectives such as statistical methods or observational accounts appropriate to the social sciences to understand and evaluate social systems or human behaviors.

ACE 7: Use knowledge, theories, or methods appropriate to the arts to understand their context and significance.

ACE 8: Use knowledge, theories, and analysis to explain ethical principles and their importance in society.

ACE 9: Exhibit global awareness or knowledge of human diversity through analysis of an issue.

ACE 10: Generate a creative or scholarly product that requires broad knowledge, appropriate technical proficiency, information collection, synthesis, interpretation, presentation, and reflection.

College Degree Requirements

College Distribution Requirements

The College of Arts and Sciences distribution requirements are designed to ensure a range of courses across disciplines within the College. Students develop the ability to learn in a variety of ways and apply their knowledge from a variety of perspectives. All requirements are in addition to University ACE requirements, and no course can be used to fulfill both an ACE outcome and a College Distribution Requirement.

- A student may not use a single course to satisfy more than one College Distribution Requirement, with the exception of CDR Diversity. Courses used to meet CDR Diversity may also meet CDR Writing, CDR Humanities, or CDR Social Science.
- Internship (395 or 495), independent study or readings (396 or 496), research (398 or 498), and thesis (399, 399H, 499, or 499H) will not satisfy distribution requirements.
- Other courses with a 9 in the middle number (ex. PSYC 292) will not satisfy distribution requirements unless approved by an advisor.
- Cross-listed courses from interdisciplinary programs will be applied in the same area as courses from the lead department.

CDR: Written Communication

Select from courses approved for ACE outcome 1.

CDR: Natural, Physical, and Mathematical Sciences ¹

Select a course from ASTR, BIOS, CHEM, GEOL, LIFE, METR, MATH, PHYS, or ANTH 242, GEOG 155, GEOG 281, POLS 250, or PSYC 273.

CDR: Laboratory ²

Laboratory courses may be embedded in a 4-5 credit course used in CDR Natural, Physical, and Mathematical Science (example GEOG 155), or stand alone (example LIFE 120L).

CDR: Humanities ³

Select a course from ARAB, CHIN, CLAS, CSEC, ENGL, FILM, FREN, GERM, GREK, HIST, JAPN, LATN, PHIL, RELG, RUSS, or SPAN.

CDR: Social Science ⁴

Select a course from ANTH, COMM, GEOG, NSST, POLS, PSYC, or SOCI.

CDR: Human Diversity in U.S. Communities

Select from the following approved courses also listed in your degree audit: ANTH 130, ANTH 412, ANTH 447, ANTH 473, ARAB/RELG 313, COMM 311, COMM 315, COMM/ETHN 335, COMM 364, COMM/ETHN 365, COMM 465, ENGL/WMNS 212, ENGL/ETHN 245N, ENGL/WMNS 312, ENGL/ETHN 345D, ENGL/ETHN/WMNS 345N, ENGL/ETHN 346, ENGL 376, ENGL 380, ENGL/ETHN 445, ETHN 100, ETHN 201, ETHN 202, ETHN 204, ETHN 484, FILM/ETHN 344, GEOG 271, GEOG 403, GLST/ANTH/MODL 214, GLST 350, HIST/ETHN/WMNS 115, HIST/ETHN 234, HIST/ETHN 246, HIST 251, HIST/ETHN 340, HIST 351/ETHN 341, HIST/ETHN/WMNS 356, HIST/ETHN 357, HIST/WMNS 402, HRHA 350, MODL 260, PHIL 105, PHIL 106, PHIL/WMNS 218, PHIL 323, PHIL 325, POLS/ETHN 333, POLS/WMNS 338, POLS 340, POLS 347, POLS 433, PSYC/ETHN 310, PSYC 330, PSYC/WMNS 421, PSYC/ETHN 425, RELG/HIST 134, RELG/ETHN/HIST 226, RELG/HIST 227, SOCI 101, SOCI 180, SOCI/WMNS 200, SOCI/ETHN 217, SPAN 206, SPAN 486, WMNS 101, WMNS 201, WMNS 202, WMNS 210

CDR: Language

BA Students⁵

Fulfilled by the completion of the 4th level of a single language (either in H.S. or in college). Language study at UNL is available in: ARAB, CHIN, CZEK, FREN, GERM, GREK, JAPN, LATN, SPAN, or SLPA.

BS Students⁶

Fulfilled by the completion of the 2nd level of a single language (either in H.S. or in college). Language study at UNL is available in: ARAB, CHIN, CZEK, FREN, GERM, GREK, JAPN, LATN, SPAN, or SLPA.

¹ Excluded courses: BIOC 101, BIOS 100, BIOS 180, CHEM 101, MBIO 101, PHYS 201, MATH 100A, MATH 101, MATH 101P, MATH 102, MATH 103, and MATH subject area credit at the 100 level or below.

² ANTH 242L, ASTR 224, BIOS 101L, BIOS 110L, BIOS 111, BIOS 116, BIOS 213L, BIOS 214, CHEM 105L, CHEM 106L, CHEM 109L, CHEM 110L, CHEM 113L, GEOG 155, GEOL 101, GEOL 103, LIFE 120L, LIFE 121L, METR 100, PHYS 141, PHYS 142, PHYS 153, PHYS 221, or PHYS 222.

³ ARAB, CHIN, CZEK, FREN, GERM, GREK, JAPN, LATN, and SPAN courses must be numbered 300 or above. ENGL courses must be ENGL 170, ENGL 180, or ENGL 200 level and above. Excluded courses: CLAS 116, ENGL 254, ENGL 300, ENGL 354, SPAN 300A, SPAN 303, and SPAN 304.

⁴ Excluded courses: ANTH 242/ANTH 242L, GEOG 155, GIST 111, GIST 311, POLS 101, POLS 250, PSYC 100, PSYC 273.

⁵ ARAB 202, CHIN 202, CZEK 202, FREN 202 or FREN 210, GERM 202, GREK 301 and GREK 302, JAPN 201 and JAPN 202, LATN 301 and LATN 302, SPAN 202 or SPAN 210 or SPAN 300A or SLPA 202.

⁶ ARAB 102, CHIN 102, CZEK 102, FREN 102, GERM 102, GREK 102 or GREK 151, JAPN 102, LATN 102, SPAN 102 or SPAN 110 or SPAN 300A, or SLPA 102.

Language Requirement

The University of Nebraska–Lincoln and the College of Arts and Sciences place great value on academic exposure and proficiency in a second language. The University of Nebraska–Lincoln entrance requirement is successful completion of two levels of the same world language, and the College of Arts and Sciences degree requirement (CDR: Language) is proficiency through 4 levels for BA students, or 2 levels for BS students.

Levels are defined as years in High School, or semesters in college as documented on an official transcript.

Students who believe they are proficient in a language, but who do not have academic records of that proficiency, should consult with their academic advisor to explore alternative assessments which may include a proficiency examination by a UNL faculty member for languages taught at UNL, or through an approved private service for languages not taught at UNL (expenses for this service would be the student's responsibility.)

Experiential Learning Requirement

All undergraduates in the College of Arts and Sciences must complete an Experiential Learning (EL) designated course. This may include 0-credit courses designed to document co-curricular activities recognized as Experiential Learning. Students should consult their assigned Academic Advisor and Career Coach for assistance identifying experiential learning opportunities relevant to their academic program, interests and goals.

The bachelor of science degree requires students to complete 60 hours in mathematical, physical, and natural sciences from disciplines within the College of Arts and Sciences or required in its majors: ACTS, ASTR, BIOC, BIOS, CHEM, CSCE, GEOL, LIFE, MBIO, METR, MATH, PHYS, STAT or ANTH 242 , ANTH 242L, ANTH 341, ANTH 385, ANTH 386, ANTH 389, ANTH 416, ANTH 422, ANTH 430, ANTH 442, ANTH 443, ANTH 444, ANTH 448, ANTH 473, ANTH 484, ANTH 487D, ENVR 201, GEOG 155, GEOG 217, GEOG 281, GEOG 308, GEOG 317, GEOG 408, GEOG 417, GEOG 418, GEOG 419, GEOG 421, GEOG 422, GEOG 425, GEOG 427, GEOG 432, GEOG 444, GEOG 461, GEOG 467, PHIL 211, POLS 250, PSYC 273, PSYC 368, PSYC 370, PSYC 450, PSYC 451, PSYC 456, PSYC 458, PSYC 460, PSYC 461, PSYC 463, PSYC 464, or PSYC 465.

Excluded courses include: BIOC 101, BIOS 100, BIOS 180, CHEM 101, MATH 100A, MATH 101, MATH 101P, MATH 102, MATH 103, MBIO 101, PHYS 201 as well as any course numbered 395, 495, 399, 399H, 499, or 499H. MATH subject area credit at the 100 level or below is also excluded.

Up to 12 hours of scientific and technical courses offered by other colleges may be accepted toward this requirement with approval of the College of Arts and Sciences. See your assigned academic advisor to start the approval process.

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 cumulative 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 domestic institutions except for UNO and UNK. All courses taken at UNO and UNK impact the UNL transcript. No transfer of C- and D grades can be applied toward requirements in a major or a minor. No University of Nebraska–Lincoln C- and D grades can be applied toward requirements in a major or a minor. International coursework (including education abroad) with a final grade equivalent to a C- or lower will not be validated by the College of Arts and Sciences departments to be degree applicable.

Pass/No Pass Privilege

University policy for the Pass/No Pass (P/N) privilege:

- Neither the P nor the N grade factor into your GPA.
- 'P' is interpreted to mean a grade of C or above. A grade of C- or lower results in a "N".
- A change to or from a Pass/No Pass may be made until mid-term (1/2 of the course - see the academic calendar for specific dates per term).
- The Pass/No Pass or grade registration cannot conflict with the policy of the professor, department, college, or University policy governing the grading options.
- Changing to or from the Pass/No Pass grading option requires using MyRED, or processing a Schedule Adjustment Form.
- For undergraduates, the University maximum of 24 'Pass' credit hours and/or college and department limits will apply. These limits do not include courses offered on a 'Pass/No Pass' basis only. Consult your advisor or the Undergraduate Catalog (<https://catalog.unl.edu/undergraduate/>) for restrictions on the number of 'Pass' hours you can apply toward your degree.
- The 'Pass/No Pass' grading option cannot be used for the removal of 'C-', 'D+', 'D', 'D-', or 'F' grade factors.

NOTE: See Course Repeats (<https://registrar.unl.edu/academic-standards/course-repeats/>)

College of Arts and Sciences policy on the Pass/No Pass (P/N) privilege:

- Pass hours can count toward fulfillment of University ACE requirements and college distribution requirements up to the 24-hour maximum.
- Most arts and sciences majors and minors do not permit any courses graded Pass/No Pass to apply, or limit them to no more than 6 hours. Students should refer to the major section of the catalog for clarification.
- Departments may specify that certain courses of theirs can be taken on a P/N-only or on a graded-only basis.

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 at the 300 or 400 Level

Thirty (30) of the 120 semester hours of credit must be in courses numbered at the 300 or 400 level. Of those 30 hours, 15 hours (1/2) must be completed in residence at the University of Nebraska–Lincoln.

Residency Requirement

The term "Residency" refers to courses taken at UNL. Students must complete at least 30 of the 120 total hours for their degree at the University of Nebraska–Lincoln. Students must complete at least 18

hours of their major coursework, and 15 of the 30 hours required at the 300 or 400 level, at UNL.

Catalog to Use

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 the University of Nebraska–Lincoln. 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 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.

Transfer Students: Students who have transferred from a community college 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. Students must complete all degree requirements from a single catalog year and within the time frame allowable for that catalog year.

Major Requirements

Complete the Core Requirements, Ancillary Requirements, and one of the following Options: Biochemical Analysis, Cellular Biochemistry, or Computational Biochemistry.

Core Requirements

Required Courses

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
Total Credit Hours		14

Ancillary Requirements

Mathematics		5
MATH 106	Calculus I	
Biological Sciences		12
LIFE 120 & 120L	Fundamentals of Biology I and Fundamentals of Biology I laboratory	

LIFE 121 & 121L	Fundamentals of Biology II and Fundamentals of Biology II Laboratory	
BIOS 201	General Genetics	
Total Credit Hours		17

Specific Major Requirements

Biochemical Analysis Option

MATHEMATICS

MATH 107	Calculus II	4
Credit Hours Subtotal:		4

CHEMISTRY ¹

General Chemistry

Select one sequence (CHEM 113/114 Recommended).		7-8
---	--	-----

CHEM 113A Fundamental Chemistry I
& CHEM 113L and Fundamental Chemistry I Laboratory
& CHEM 114 and Fundamental Chemistry II
or CHEM 109A General Chemistry I
and General Chemistry I Laboratory
& CHEM 109L and General Chemistry II
and General Chemistry II Laboratory
& CHEM 110A

& CHEM 110L

Quantitative Chemistry

CHEM 221A & CHEM 221L	Elementary Quantitative Analysis and Elementary Quantitative Analysis Laboratory	5
--------------------------	--	---

Organic Chemistry

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
------------------------	--	---

Credit Hours Subtotal:		22-23
------------------------	--	-------

STRUCTURAL BIOLOGY OR PHYSICAL CHEMISTRY

Select one course from the following:		3-4
---------------------------------------	--	-----

BIOC 440 Structural Biology and Biophysical
Chemistry
or CHEM 471 Physical Chemistry
or CHEM 481 Physical Chemistry I

Credit Hours Subtotal:		3-4
------------------------	--	-----

PHYSICS ²

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
------------------------	---	---

Credit Hours Subtotal:		10
------------------------	--	----

MICROBIOLOGY

BIOS 312 & BIOS 314	Microbiology and Microbiology Laboratory	4
------------------------	---	---

Credit Hours Subtotal:		4
------------------------	--	---

Total Credit Hours		43-45
---------------------------	--	--------------

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 included 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.

Cellular Biochemistry Option

MATHEMATICS

MATH 107	Calculus II	4
Credit Hours Subtotal:		4

CHEMISTRY ¹

General Chemistry

Select one sequence.		7-8
----------------------	--	-----

CHEM 109A General Chemistry I
& CHEM 109L and General Chemistry I Laboratory
& CHEM 110A and General Chemistry II
& CHEM 110L and General Chemistry II Laboratory
or CHEM 113A Fundamental Chemistry I
and Fundamental Chemistry I Laboratory
& CHEM 113L and Fundamental Chemistry II

& CHEM 114

Organic Chemistry

Select one sequence.		8-10
----------------------	--	------

CHEM 251 Organic Chemistry I
& CHEM 253 and Organic Chemistry I Laboratory
& CHEM 252 and Organic Chemistry II
& CHEM 254 and Organic Chemistry II Laboratory
or CHEM 261 Mechanistic Organic Chemistry I
and Mechanistic Organic Chemistry I Laboratory
& CHEM 263 and Mechanistic Organic Chemistry II
and Mechanistic Organic Chemistry II Laboratory
& CHEM 262

& CHEM 264

Credit Hours Subtotal:		15-18
------------------------	--	-------

STRUCTURAL BIOLOGY

BIOC 440	Structural Biology and Biophysical Chemistry	3
----------	---	---

Credit Hours Subtotal:		3
------------------------	--	---

PHYSICS

Select one sequence.		10
----------------------	--	----

PHYS 141 Physics for Life Sciences I
& PHYS 142 and Physics for Life Sciences II
or PHYS 211 General Physics I
and General Physics Laboratory I
& PHYS 221 and General Physics II
and General Physics Laboratory II
& PHYS 212

& PHYS 222

Credit Hours Subtotal:		10
------------------------	--	----

ADDITIONAL COURSES

Microbiology

¹ **AP and IB Credit.** Students who earned AP, IB, or CLEP credit for general chemistry in high school are still required to complete a general chemistry

BIOS 312 & BIOS 314	Microbiology and Microbiology Laboratory	4
Advanced Cell/Molecular Electives		
Select one of the following lab courses:		2-4
BIOS 213 & 213L	Human Physiology and Human Physiology Laboratory	
or BIOS 202 Genetics, Molecular and Cellular Biology Laboratory		
or BIOS 427 Practical Bioinformatics Laboratory		
or BIOS 478 Plant Anatomy		
or PLAS 325 Introductory Plant Physiology		
or PLAS 429 Plant Biotechnology Applications		
Select one of the following advanced courses:		3
BIOC 410	Plant Molecular Biology	
BIOS 302	Cell Biology	
BIOS 402	Cancer Biology	
BIOS 434	Plant Biochemistry	
BIOS 442	Endocrinology	
BIOS 443	Immunology	
CHME 473	Biochemical Engineering	
CHME 477	Molecular Bioengineering	
PLPT 418	Microbial Genetics & Genomics	
Credit Hours Subtotal:		9-11
Total Credit Hours		41-46

¹ **AP and IB Credit.** Students who earned AP, IB, or CLEP 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 included in this policy.

Computational Biochemistry Option

STATISTICS

STAT 218	Introduction to Statistics	3
Credit Hours Subtotal:		3

CHEMISTRY ¹

General Chemistry

Select one sequence.		7-8
CHEM 109A & CHEM 109L	General Chemistry I and General Chemistry I Laboratory	
CHEM 110A & CHEM 110L	General Chemistry II and General Chemistry II Laboratory	
or CHEM 113A Fundamental Chemistry I and Fundamental Chemistry I Laboratory		
& CHEM 113L and Fundamental Chemistry II		
& CHEM 114		

Organic Chemistry

Select one sequence.		8-10
CHEM 251 & CHEM 253 & CHEM 252 & CHEM 254	Organic Chemistry I and Organic Chemistry I Laboratory and Organic Chemistry II and Organic Chemistry II Laboratory	

or CHEM 261 Mechanistic Organic Chemistry I and Mechanistic Organic Chemistry I Laboratory		
& CHEM 263 and Mechanistic Organic Chemistry II and Mechanistic Organic Chemistry II Laboratory		
& CHEM 262		
& CHEM 264		
Credit Hours Subtotal:		15-18
PHYSICS		
PHYS 141 & PHYS 142	Physics for Life Sciences I and Physics for Life Sciences II	10
Credit Hours Subtotal:		10
COMPUTATIONAL BIOCHEMISTRY		
CSCE 155T	Computer Science I: Informatics Focus	3
CSCE 311	Data Structures and Algorithms for Informatics	3
BIOS 337	Applications of Bioinformatics	4
CSCE 413	Database Systems	3
Credit Hours Subtotal:		13
Experiential Learning (Two Semesters required)		
BIOC 95	Biochemistry Internship	0
BIOC 98	Biochemistry Research Experience	0
Credit Hours Subtotal:		0
Total Credit Hours		41-44

¹ **AP and IB Credit.** Students who earned AP, IB, or CLEP 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 included in this policy.

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

Complete the following required courses.

BIOC 431	Biochemistry I: Structure and Metabolism	3
BIOC 432	Biochemistry II: Metabolism and Biological Information	3
BIOS 201 or PLAS 215	General Genetics 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	Organic Chemistry II Laboratory	1-2

or CHEM 264 Mechanistic Organic Chemistry II Laboratory

or CHEM 264A Mechanistic Organic Chemistry II Laboratory

Total Credit Hours 18

Grade Rules

C- and D Grades

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

Pass/No Pass

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

BIOC 95 Biochemistry Internship

Prerequisites: Biochemistry Major; 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

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

- Read, understand, and critically review scientific information
- Understand and use proper laboratory and technical skills and instruments
- Design and implement research experiments
- Document and replicate processes and procedures
- Understand fundamental life processes
- Define problems and identifying causes
- Demonstrate ethical conduct in research activities
- Develop and defend evidence based arguments

Jobs of Recent Graduates

- Engineering Technician, Invitae – San Francisco, CA
- Ophthalmology Clinical Researcher, Ocular Imaging Research and Reading Center – Sunnyvale, CA
- Research Assistant, University of Nebraska-Lincoln – Lincoln, NE
- Patient Care Technician, Dermatologist Specialist of Omaha – Omaha, NE
- Clinical Services Technician, Celerion – Lincoln, NE
- Medication Aide, Lexington Assisted Living – Lincoln, NE
- Research Assistant, University of Texas – Houston, TX

- Lab Technician, University of Nebraska-Lincoln – Lincoln, NE
- Neuromonitoring Technologist, Biotronic Neuronetwork – Columbia, MO
- Chemical Engineer, 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, University of Nebraska-Lincoln - Lincoln NE
- Associate Management Intern, Cargill - Kansas City, MO
- Undergrad Student Research Intern, UNL Mid-America Transportation Center - Lincoln NE
- Intern, Monsanto - Gothenburg NE
- Construction Management Intern, Nemaha Landscape Construction - Lincoln NE
- Project Manager Assistant/Engineering Assistant, LI-COR Biosciences - Lincoln NE
- Undergrad Student Research Intern, UNL Mid America Transportation Center - Lincoln NE

Graduate & Professional Schools

- Master's Degree, Public Health and Epidemiology, University of Pittsburgh – Pittsburgh, PA
- Master's Degree, Physician's Assistant, Union College – Lincoln, NE
- Master's Degree, Medical Science, University of Texas – Austin, TX
- Master's Degree, Biostatistics, University of Michigan – Ann Arbor, MI
- Master's Degree, Conservation of Archeological and Museum Objects, Durham University – Durham, England
- Master's Degree, Genetic Counseling, Northwestern University – Chicago, IL
- Doctoral Degree, Optometry, Midwestern University – Glendale, AZ
- Doctoral Degree, Dentistry, University of Nebraska Medical Center – Lincoln, NE
- Doctoral Degree, Plant Biology, Iowa State University – Ames, IA
- Doctoral Degree, Neuroscience, University of North Carolina-Chapel Hill – Chapel Hill, NC