

COMPUTATIONAL BIOLOGY & BIOINFORMATICS MINOR (CAS)

Description

This interdisciplinary minor prepares students to understand, use, and develop advanced computational methods and tools for processing, visualizing, and analyzing biological data and for modeling biological processes. Studies in computational biology and bioinformatics involve biosciences, computer science, engineering, mathematics, and statistics. Students will be prepared for careers in biomedical, biotechnology, agricultural, pharmaceutical, and engineering fields and for related graduate studies.

Admission

College Admission

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

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

Advising

Academic and Career Advising

The Academic and Career Advising Center in 107 Oldfather is a centrally located and easily accessed resource for students in all majors in the College of Arts and Sciences. The professional academic advisors and career coaches offer 1-1 meetings on a walk-in and appointment basis weekdays. Advisors will provide assistance choosing majors and minors, understanding degree requirements and academic policies, completing paperwork, meeting deadlines, adding/dropping courses, and planning for graduation. In addition, career coaches can help students identify career options related to their interests and connect them with experiences like internships, research, and more that will prepare them for those career options. These specially trained advisors and coaches also serve as first point of contact in the College for all incoming freshmen and transfer students during New Student Enrollment.

Students in the College who have declared a major will be assigned an academic advisor who is their first point of contact for a variety of questions. Academic advisors help students be successful in adjusting to UNL overall as well as making progress toward degree completion. The assigned advisor may be located within the department of their primary major, or in the Advising Center. Students can identify their assigned advisor in MyRED on the academics tab. In addition, faculty advisors are experts in their discipline, including advanced coursework and requirements, opportunities for research, student organizations, and considering graduate school in the discipline. 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 Library 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, contact the Arts and Sciences Academic and Career Advising Center, 107 Oldfather Hall, 402-472-4190, <http://cas.unl.edu/advising>.

College Degree Requirements

College Distribution Requirements

Bachelor of Arts or Bachelor of Science (16 hours + Language)

The College of Arts and Sciences distribution requirements are designed to ensure a breadth of courses within the liberal arts degree. By engaging in study in several different areas 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.

- A student may not use a single course to satisfy 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.
- A student may not use a course from their primary major to satisfy the Breadth Requirement (F), but may apply an ancillary requirement of the primary major or a course from their second major toward this requirement.
- Independent study, directed readings, or internship courses cannot be used to satisfy a College Distribution Requirement.
- Cross-listed courses from interdisciplinary programs will be applied in the same area as courses from the home/cross-listed department.

College Distribution Requirements

<i>CDR A - Written Communication</i>	3
Select from courses approved for ACE outcome 1.	
<i>CDR B and BL - Natural, Physical, and Mathematical Sciences with Lab</i>	4
Select from biochemistry, biological sciences, chemistry, computer science, geology, meteorology, mathematics, physics and statistics. Must include one lab in the natural or physical sciences. Lab courses may be selected from biochemistry, biological sciences, chemistry, geology, meteorology and physics.	
Some courses from geography and anthropology may also be used to satisfy the lab requirement above. ¹	
<i>CDR C - Humanities</i>	3
Select from classics, English, history, modern languages and literatures, philosophy, and religious studies. ²	
<i>CDR D - Social Science</i>	3
Select from anthropology, communication studies, geography, political science, psychology, or sociology. ³	
<i>CDR E - Language</i>	0-16
Fulfilled by the completion of the 6-credit-hour second-year sequence in a single foreign language in one of the following departments: Classics and religious studies, or modern languages and literatures. Instruction is currently available in Arabic, Chinese, Czech, French, German, Greek, Japanese, Latin, Russian, and Spanish.	

A student who has completed the fourth-year level of one foreign language in high school is exempt from the languages requirement, but encouraged to continue on in their language study.

CDR F - Additional Breadth 3

Select from natural, physical and mathematical sciences (Area B), humanities (Area C), or social sciences (Area D). Cannot be a course from the primary major.

Credit Hours Subtotal: 16-32

¹ See Degree Audit or a College of Arts and Sciences advisor for approved geography and anthropology courses that apply as natural science.

² Language courses numbered 210 and below do not fulfill the CDR C.

³ See Degree Audit or College of Arts and Sciences advisor for list of natural/physical science courses in anthropology, geography, and psychology that do not apply as social science.

Scientific Base

Bachelor of Science Only (60 hours)

The bachelor of science degree requires students to complete 60 hours in mathematical, physical and natural sciences. Approved courses for scientific base credit come from the following College of Arts and Sciences disciplines: actuarial science, anthropology (selected courses), astronomy, biochemistry (excluding BIOC 101), biological sciences (excluding BIOS 100 or BIOS 203), chemistry (excluding CHEM 101), computer science (excluding CSCE 10), geography (selected courses), geology, life sciences, mathematics (excluding courses below MATH 104), meteorology, microbiology, physics and statistics.

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

Language Requirement

UNL and the College of Arts and Sciences place great value on academic exposure and proficiency in a second language. The UNL entrance requirement of two years of the same foreign language or the College's language distribution requirement (CDR E) will rarely be waived and only with relevant documentation. See the main College of Arts and Sciences page for more details.

Minimum Hours Required for Graduation

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

Grade Rules

Restrictions on C- and D Grades

The College will accept no more than 15 semester hours of C- and D grades from other 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 UNL 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 College of Arts and Sciences departments to be degree applicable.

Pass/No Pass Privilege

The College of Arts and Sciences adheres to the University regulations for the Pass/No Pass (P/N) privilege with the following additional regulations:

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

Grading Appeals

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

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

Course Level Requirements

Courses Numbered 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 UNL.

Residency Requirement

Students must complete at least 30 of the 120 total hours for their degree at UNL. Students must complete at least 1/2 of their major coursework including 6 hours at the 300 or 400 level in their major, and 15 of the 30 hours required at the 300 or 400 level in residence. Credit earned during education abroad may be used toward the residency requirement only if students register through UNL.

ACE Requirements

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

To meet the ACE Program requirement, a student will complete a minimum of 3 credit hours for each of the ten ACE Student Learning Outcomes (a total of 30 ACE credit hours). See the ACE website at: <http://>

ace.unl.edu for the most current information and the most recently certified courses.

Catalog 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 UNL. In consultation with advisors, a student may choose to follow a subsequent catalog for any academic year in which they are admitted to and enrolled as a degree-seeking student at UNL in the College of Arts and Sciences. Students must complete all degree requirements from a single catalog year. Beginning in 1990-1991 the catalog which a student follows for degree requirements may not be more than 10 years old at the time of graduation.

Requirements for Minor Offered by Department

Eighteen (18) hours (not including prerequisites) of core courses and additional courses.

Prerequisite Courses

CHEM 109	General Chemistry I (or equivalent)	4
LIFE 120 & LIFE 120L	Fundamentals of Biology I and Fundamentals of Biology I laboratory	4
MATH 106	Calculus I (or equivalent)	5
Credit Hours Subtotal:		13

Core Courses ¹

CSCE 155T	Computer Science I: Informatics Focus	3
CSCE 311	Data Structures and Algorithms for Informatics	3
BIOS 337	Applications of Bioinformatics	4
STAT 218	Introduction to Statistics ²	3
or STAT 380	Statistics and Applications	
Credit Hours Subtotal:		13

Life Science Course ³

Select a course from either LS 1 or LS 2 choices, depending on your major.	3-4
--	-----

LS 1 - for students in life science majors.

BIOS 426	Systems Biology
BIOS 427	Practical Bioinformatics Laboratory
BIOS 456 / NRES 456	Mathematical Models in Biology
BIOS 477	Bioinformatics and Molecular Evolution

LS 2

BIOC 431 / BIOS 431 / CHEM 431	Structure and Metabolism
BIOC 432 / BIOS 432 / CHEM 432	Metabolism and Biological Information
BIOC 434 / AGRO 434 / BIOS 434 / CHEM 434	Plant Biochemistry
BIOS 418	Advanced Genetics

BIOS 420 / MBIO 420	Molecular Genetics	
BIOS 425	Plant Biotechnology	
BIOS 429	Phylogenetic Biology	
BIOS 472	Evolution	
Credit Hours Subtotal:		3-4
Computer Science/Math/Statistics/Engineering (CMSE) Course ⁴		
Select a course from either CMSE 1 or CMSE 2 choices, depending on your major.		3
<i>CMSE 1 - For students in computer science, math, engineering and related majors.</i>		
CSCE 471	Computational Methods in Bioinformatics	
<i>CMSE 2</i>		
BSEN 414	Medical Imaging Systems	
CHME 473	Biochemical Engineering	
CHME 474	Advanced Biochemical Engineering	
CSCE 410	Information Retrieval Systems	
CSCE 413	Database Systems	
CSCE 421	Foundations of Constraint Processing	
CSCE 423	Design and Analysis of Algorithms	
CSCE 435	Cluster and Grid Computing	
CSCE 456	Parallel Programming	
CSCE 472	Digital Image Processing	
CSCE 474	Introduction to Data Mining	
CSCE 476	Introduction to Artificial Intelligence	
CSCE 478	Introduction to Machine Learning	
CSCE 479	Introduction to Deep Learning	
ECEN 450	Bioinformatics	
MATH 439	Mathematical Models in Biology	
MATH 452	Graph Theory	
STAT 412	Introduction to Experimental Design	
STAT 450	Introduction to Regression Analysis	
Credit Hours Subtotal:		3
Total Credit Hours		19-20

¹ These requirements can be replaced with equivalent courses upon approval except for BIOS 337, which cannot be replaced.

² Students are strongly encouraged to take STAT 218 or STAT 380. However, ECEN 305 can be used to satisfy this requirement, subject to approval.

³ For life science major students, those courses listed as LS Elective 2 cannot be used for CBB requirements.

⁴ For students in computer science, mathematics, engineering, and related majors, those courses listed as CMSE Elective 2 cannot be used for CBB requirements.

Grade Rules

C- and D Grades

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

Pass/No Pass

No course taken Pass/No Pass will be counted toward the minor.