

COMPUTATIONAL BIOLOGY & BIOINFORMATICS MINOR (ASC)

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.

College Requirements

College Admission

College Admission

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

In addition to these requirements, the College of Arts and Sciences strongly recommends a third and fourth year of languages. Four years of high school language will exempt students from the College of Arts and Sciences' language requirement. It will also allow students to continue language study at a more advanced level, and give more opportunity to study abroad.

Transfer Students

To be considered for admission as a transfer student, Nebraska resident or nonresident, students must have an accumulated average of C (2.0 on a 4.0 scale) and a minimum C average in the last semester of attendance at another college. Transfer students who graduated from high school January 1997 and after must also meet the UNL General Admissions Requirements. Those transfer students who graduated before January 1997 must have completed in high school 3 years of English, 2 years of the same foreign language, 2 years of algebra, and 1 year of geometry. Transfer students who have completed less than 12 credit hours of college study must submit either the ACT or SAT scores.

Ordinarily, hours 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 is the maximum number of hours the University will accept on transfer from a two-year college or international institution. Transfer credit in the major or minor must be approved by the departmental advisor on a Request for Substitution Form to meet specific course requirements, group requirements, or course level requirements in the major or minor. At least half of the hours in the major field must be completed at the University regardless of the number of hours transferred.

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

may be transferred from UNO or UNK, but they are not applicable to a major or minor.

Readmitted Students

Students readmitted to the College of Arts and Sciences will follow the requirements stated in the bulletin for the academic year of readmission and reenrollment as a degree-seeking student in Arts and Sciences. In consultation with advisors, a student may choose to follow a bulletin 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 bulletin year. Beginning in 1990-1991, the bulletin which a student follows for degree requirements may not be more than 10 years old at the time of graduation.

Admission Deficiencies/Removal of Deficiencies

Students must remove entrance deficiencies in geometry and foreign language before graduating from the College of Arts and Sciences and should consult a college advisor in the Academic and Career Advising Center in 107 Oldfather Hall for questions about admission deficiencies.

Removing Foreign Language Deficiencies

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

Removing Geometry Deficiencies

A deficiency of one year of geometry can be removed by taking two high school geometry courses by Independent Study or by completing a geometry course from an accredited community college or a four-year institution. Neither of these options count for college credit.

College Degree Requirements

College General Education Requirements

The College of Arts and Sciences distribution requirements are designed to further the purposes of liberal education by encouraging study in several different areas. Courses satisfying these requirements may impart specialized knowledge or broadly connect the subject matter to other areas of knowledge.

All requirements are in addition to University ACE requirements. A student may not use a single course to satisfy more than one of the following five distribution requirements. A student cannot use a single course to satisfy both an ACE outcome and a College distribution requirement. A student cannot use a course from their major to satisfy the Breadth Requirement (F), but may apply an ancillary requirement of the primary major or a course from their second major toward this requirement. Independent study or reading courses and internships cannot be used to satisfy distribution requirements. To see a complete list of excluded courses, run a degree audit through MyRED.

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

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

A. Written Communication: 3 hours

To be selected from courses approved for ACE outcome 1.

B. Natural, Physical and Mathematical Sciences: 4 hours

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. Select courses from geography¹ and anthropology* may also be used to satisfy the lab requirement.

C. Humanities: 3 hours

Select from: classics², English, history, modern languages and literatures², philosophy, and religious studies².

D. Social Sciences: 3 hours

Select from: anthropology³, communication studies, geography³, political science, psychology³, or sociology.

E. Languages Classical and Modern: 0-6 hours

Fulfilled by the completion of the 6-credit-hour second-year sequence in a single foreign language in one of the following departments: Classics and religious studies, modern languages and literatures, or anthropology. Instruction is currently available in Arabic, Chinese, Czech, French, German, Greek, Japanese, Latin, Omaha, Russian, and Spanish. A student who has completed the fourth-year level of one foreign language in high school is exempt from the languages requirement.

F. Additional Breadth Requirement (may not be used toward the primary major; may apply toward ancillary requirements and second majors): 3 hours

Select from: natural, physical and mathematical sciences (Area B), humanities (Area C), or social sciences (Area D).

¹ See your 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 or below apply only for the foreign language requirement.

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

Scientific Base

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 Career Opportunities in Biochemistry), biological sciences (excluding CASC 160 Introduction to Dentistry and Dental Hygiene, BIOS 160 Introduction to Clinical Laboratory Science, BIOS 203 Bioethics), chemistry (excluding CHEM 101 Career Opportunities in Chemistry), computer science (excluding CSCE 10 Introduction to CSE), geography (selected courses), geology, life sciences, mathematics (excluding courses below MATH 104 Applied Calculus), meteorology, physics and statistics.

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

Foreign Languages/Language Requirement Languages Exemption Policy

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

High School Transcripts

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

Proficiency Examination at UNL

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

Arabic
French
German
Spanish
Russian
Czech
Japanese
Chinese

The Department of Modern Languages will oversee the test and provide written documentation to the Arts and Sciences Advising Center that the student has passed the proficiency test at the 102 level.

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

Distance Education

1. For the University entrance requirement, students without transcript documentation who claim proficiency in a language not taught at UNL, have the option of seeking out a distance education program in languages. If the student completes the equivalent of 102 from an approved distance education program, the student will meet the UNL entrance requirement. The student must have the course work approved before he/she takes/completes the course as equivalent to 102 by a College advisor. The student then completes the course and has the distance education program send the transcript to the Admissions Office.
2. For the College of Arts and Sciences College Distribution Requirement E-Language, the student can seek out a distance education program and complete the equivalent of the 202-level course. The student must submit the request on the College Request for Substitution form and have the course work approved by a College advisor. The student then completes the course and has the distance education program send the transcript to the Admissions Office.

Third Language Option

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

Minimum Hours Required for Graduation

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

Grade Rules**Restrictions on C- and D Grades**

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

Pass/No Pass Privilege

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

- The Pass/No Pass option is designed for your use by seeking to expand your intellectual horizons by taking courses in areas where you may have had minimal preparation.

For students in Arts and Sciences, the University regulations for Pass/No Pass apply as follows:

- Neither the P nor the N grade contribute to your GPA.
- P is interpreted to mean C or above.
- A change to or from a Pass/No Pass may be made until mid-term (1/2 of the course).
- The Pass/No Pass or grade registration cannot conflict with the policy of the professor, department, college, or University governing the grading option.
- Changing to or from Pass/No Pass requires using the MyRED system to change the grading option or filing a Drop/Add form with the Office of the University Registrar, 107 Canfield Administration Building. After mid-term of the course, a student registered for Pass/No Pass cannot change to a grade registration unless the Pass/No Pass registration is in conflict with the policy of the professor, department, college, or University governing Pass/No Pass.
- The Pass/No Pass grading option cannot be used for the removal of C- or D or F grades.

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

- Pass/No Pass hours can count toward fulfillment of University ACE requirements and college distribution requirements up to the 24-hour maximum.
- Many Arts and Sciences departments and programs do not allow courses in the major or minor to be taken Pass/No Pass; students should refer to the department's or program's section of the bulletin 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.

Students who wish to apply P/N hours to their major and minor(s) must obtain approval on a form that is available in the Arts and Sciences Advising Center, 107 Oldfather Hall.

Grading Appeals

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

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

Course Level Requirements**Courses Numbered above 299**

Thirty of the 120 semester hours of credit must be in courses numbered above 299. Of the 30 hours above 299, 15 hours (1/2) must be completed in residence at UNL. **NOTE:** ALEC 397E and ALEC 397K do not count toward these 30 hours.

Graduate Courses

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

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

Residency**Residency Requirement and Open Enrollment and Summer Independent Study Courses**

Students must complete at least 30 of the 120 total hours for their degree at UNL. Students must complete at least 1/2 of their major course work including 6 hours above 299 in their major, and 15 of the 30 hours required above 299 in residence. Credit earned during education abroad may be used toward the residency requirement if students register through UNL and participate in prior-approved education abroad programs. UNL open enrollment and summer independent study courses count toward residence.

ACE Requirements

Consistent with the mission and values of the University, ACE is based on a shared set of four institutional objectives and 10 student learning outcomes. The ACE program was approved by faculty in all eight undergraduate colleges and endorsed by the Faculty Senate, the student government, and the Academic Planning Committee in January 2008 for implementation in the fall 2009. ACE aligns with current national initiatives in general education.

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

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

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

ACE Institutional Objectives and Student Learning Outcomes

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

Bulletin Rule

Students must fulfill the requirements stated in the bulletin 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 bulletin 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 bulletin year. Beginning in 1990-1991 the bulletin 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	Fundamentals of Biology I	4
& LIFE 120L	and Fundamentals of Biology I laboratory	
LIFE 121	Fundamentals of Biology II	4
& LIFE 121L	and Fundamentals of Biology II Laboratory	
MATH 106	Calculus I (or equivalent)	5
Credit Hours Subtotal:		17

Core Courses¹

CSCE 155T	Computer Science I: Informatics Focus	3
CSCE 311	Data Structures and Algorithms for Informatics	3
BIOS 237	Basic Applications of Bioinformatics	4
STAT 218	Introduction to Statistics ²	3
or STAT 380 /	Statistics and Applications	
MATH 380		

Credit Hours Subtotal: 13

Life Science Course³

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 427	Practical Bioinformatics Laboratory
BIOS 428	Perl Programming for Biological Applications
BIOS 456 /	Mathematical Models in Biology
NRES 456	
BIOS 477	Bioinformatics and Molecular Evolution
STAT 442 /	Computational Biology
BIOS 442	

LS 2

BIOS 431 /	Structure and Metabolism
BIOS 431 /	
CHEM 431	
BIOS 432 /	Metabolism and Biological Information
BIOS 432 /	
CHEM 432	
BIOC 434 /	Plant Biochemistry
AGRO 434 /	
BIOS 434 /	
CHEM 434	
BIOS 420 /	Molecular Genetics
MBIO 420	
BIOS 425	Plant Biotechnology
BIOS 429	Phylogenetic Biology
BIOS 472	Evolution

Credit Hours Subtotal: 3-4

Computer Science/Math/Statistics/Engineering (CMSE) Course⁴

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

CMSE 1 - For students in computer science, math, engineering and related majors.

CSCE 471	Introduction to Bioinformatics
CMSE 2	
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 Neural Networks
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 237, 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.