

# COMPUTATIONAL BIOLOGY & BIOINFORMATICS MINOR (ENGR)

## 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 Entrance Requirements

Students must have high school credit for (one unit is equal to one high school year):

1. Mathematics – 4 units: 2 of algebra, 1 of geometry, 1 of precalculus and trigonometry
2. English – 4 units
3. Natural sciences – 3 units that must include 1 unit of physics and 1 unit of chemistry (chemistry requirement waived for students in construction management)
4. Foreign language – 2 units of a single foreign language
5. Social studies – 3 units
6. Students having a composite ACT score of 28 or greater (or equivalent SAT score) will be admitted to the College of Engineering even if they lack any one of the following: trigonometry, chemistry, or physics.
7. Students having an ACT score of 19 or less in English (or equivalent SAT score) must take ENGL 150 Writing and Inquiry or ENGL 151 Writing and Argument.

A total of 16 units is required for admission.

Students must have an ACT (enhanced) score of 24 or greater (or equivalent SAT). Students who lack entrance requirements may be admitted based on ACT scores, high school rank and credits, or may be admitted to pre-engineering status in the Exploratory and Pre-Professional Advising Center. Pre-engineering students are advised within the College of Engineering.

Students for whom English is not their language of nurture must meet the minimum English proficiency requirements of the University.

Students who lack entrance units may complete precollege training by Independent Study through the University of Nebraska–Lincoln Office of On-line and Distance Education, in summer courses, or as a part of their first or second semester course loads while in the Exploratory and Pre-Professional Advising Center or other Colleges at Nebraska.

Students should consult their advisor, their department chair, or Engineering Student Services if they have questions on current policies.

### Other Admission Requirements

Students who transfer to the University of Nebraska–Lincoln from other accredited colleges or universities and wish to be admitted to the College of Engineering (COE) must meet COE freshman entrance requirements and have a minimum cumulative GPA of 2.5, and be calculus-ready. Students not meeting either of these requirements must enroll in the Explore Center or another University college until they meet COE admission requirements. Students transferring from UNO, UNL, or UNK to the College of Engineering must be in good academic standing with their institution.

The COE accepts courses for transfer for which a C or better grade was received. Although the University of Nebraska–Lincoln accepts D grades from the University of Nebraska at Kearney and at Omaha, not all majors in the COE accept such low grades. Students must conform to the requirements of their intended major and, in any case, are strongly encouraged to repeat courses with a grade of C- or less.

All transfer students must adopt the curricular requirements of the undergraduate catalog current at the time of transfer to the COE—not that in use when they entered the University of Nebraska–Lincoln. Upon admission to Nebraska, students wishing to pursue degree programs in the COE will be classified and subject to the policies defined in the subsequent section.

Students who were previously admitted to COE and are returning to the College of Engineering must demonstrate a cumulative GPA of 2.5 in order to be readmitted to COE.

## College Degree Requirements

### Grade Rules

#### Grade Appeals

In the event of a dispute involving any college policies or grades, the student should appeal to his/her instructor, and appropriate department chair or school director (in that order). If a satisfactory solution is not achieved, the student may appeal his/her case through the College Academic Appeals Committee on his/her campus.

## Catalog Rule

Students must fulfill the requirements stated in the catalog for the academic year in which they are first admitted 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 Nebraska in the College of Engineering. 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.

## 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**<sup>1</sup>

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 <sup>2</sup>	3
or STAT 380	Statistics and Applications	
Credit Hours Subtotal:		13

**Life Science Course**<sup>3</sup>

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**<sup>4</sup>

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	Computational Methods in Bioinformatics	
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**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 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

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

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

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

<sup>4</sup> 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.