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. 4 units of mathematics: 2 of algebra, 1 of geometry, 1 of precalculus and trigonometry.
2. 4 units of English.
3. 3 units of natural science that must include 1 unit of physics and 1 unit of chemistry (chemistry requirement waived for students in construction management).
4. 2 units of a single foreign language.
5. 3 units of social studies.
6. Students having a composite ACT score of 28 or greater (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 UNL Office of 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 UNL.

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 for Nebraska residents or 3.0 for non-residents, and be calculus-ready. Students not meeting either of these requirements must enroll in the Explore Center or another UNL college until they meet COE admission requirements.

The COE accepts courses for transfer for which a C or better grade was received. Although UNL 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 UNL. Upon admission to UNL, students wishing to pursue degree programs in the COE will be classified and subject to the policies defined in the subsequent section.

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 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 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

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 109</td>
<td>General Chemistry I (or equivalent)</td>
<td>4</td>
</tr>
<tr>
<td>LIFE 120</td>
<td>Fundamentals of Biology I</td>
<td>4</td>
</tr>
<tr>
<td>LIFE 120L</td>
<td>Fundamentals of Biology I laboratory</td>
<td></td>
</tr>
<tr>
<td>LIFE 121</td>
<td>Fundamentals of Biology II</td>
<td>4</td>
</tr>
<tr>
<td>LIFE 121L</td>
<td>Fundamentals of Biology II laboratory</td>
<td></td>
</tr>
<tr>
<td>MATH 106</td>
<td>Calculus I (or equivalent)</td>
<td>5</td>
</tr>
</tbody>
</table>

Credit Hours Subtotal: 17

Core Courses

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CSCE 155T</td>
<td>Computer Science I: Informatics Focus</td>
<td>3</td>
</tr>
<tr>
<td>CSCE 311</td>
<td>Data Structures and Algorithms for Informatics</td>
<td>3</td>
</tr>
<tr>
<td>BIOS 237</td>
<td>Basic Applications of Bioinformatics</td>
<td>4</td>
</tr>
</tbody>
</table>
Computational Biology & Bioinformatics Minor (ENGR)

STAT 218 Introduction to Statistics 2 or STAT 380 / MATH 380

Credit Hours Subtotal: 13

Life Science Course 3

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

LS 1 - for students in life science majors.

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

LS 2

BIOS 431 / CHM 431 / CHEM 431 Structure and Metabolism
BIOS 432 / BIOS 432 / CHEM 432 Metabolism and Biological Information
BIOS 474 / AGRO 434 / BIOS 434 / CHEM 434 Plant Biochemistry
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.

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.