CHBE 497/BIOE 489R/ENCH 648P: Protein Engineering

Department of Chemical and Biomolecular Engineering
University of Maryland

Course description

This course will cover the fundamentals of protein engineering and its applications in medicine, chemical processes, and energy. Topics will include the structure and function of biological molecules, rational design and directed evolution, construction of protein and peptide libraries, protein screening platforms, methods for characterizing structure and function of biological molecules. Scientific literature will be used to highlight key discoveries and current work in protein engineering.

Prerequisites

Students enrolled in CHBE 497 must have received credit for BIOE 120 (Biology for Engineers), CHBE 302 (Thermodynamics II), and CHBE 440 (Chemical Kinetics and Reactor Design). Students enrolled in BIOE 489R should have completed BIO 120 and BIOE 232 (Bioengineering Thermodynamics) to be successful in this course. Graduate students will find previous courses in biology, biochemistry, kinetics, and/or thermodynamics helpful. Any concerns about your preparation for this course should be discussed with the instructor.

Course objectives

By the end of this course, students will be able to

1. Discuss the relationship between structure and function for biological molecules.
2. Explain methods for engineering biological molecules.
3. Design a protein engineering strategy.
4. Read and critically analyze scientific literature in protein engineering.

Instructor

Dr. Amy J. Karlsson

Textbook

No textbook is required for this course, though a biochemistry textbook will be a useful reference. Required reading material (or references for the material) will be posted on the course website.

Course topics and due dates

The schedule below provides the tentative topics for each class period, along with the due dates of major assignments. Adjustments to this schedule should be expected.

Week	Topic
1	Course introduction Recombinant protein production
2	Protein structure
3	Protein structure Protein folding
4	Protein folding
5	Protein characterization *(student presentations)* Protein interactions

6	Protein characterization *(student presentations)* Combinatorial protein engineering
7	Combinatorial protein engineering
8	Literature: Applications of combinatorial engineering *(student presentations)* Rational design
9	Rational design
10	Literature: Applications of rational design *(student presentations)* Computational protein design **PROPOSAL** specific aims due
11	Computational protein design Literature: Applications of computational design *(student presentations)*
12	To be announced **MIDTERM EXAM**
13	Non-natural amino acids in protein engineering Post-translational modifications in protein engineering
14	Literature: Non-natural amino acids and post-translational modifications in protein engineering *(student presentations)* **PROPOSAL draft due**
15	Literature: Engineering non-protein biomolecules *(student presentations)* To be announced **PROPOSAL** review due
16	**PROPOSAL** due
FINALS	Final exam period: **PROPOSAL** poster presentation

Grading

Final grades will be determined based on the following weighting system:

15% Homework
20% Presentations
25% Midterm exam
25% Project
10% Participation
5% Reading quizzes

Students enrolled in ENCH648P

For some course activities, students enrolled in the graduate section of the course will be given assignments, problems, or expectations that differ from those provided for the students enrolled in the undergraduate sections of the course. These modifications will be noted in class and/or on ELMS.