CMB580: Protein Basics for Computer Scientists and Engineers

Time: Tuesday-Friday (1:00p - 1:50p), Fall Semester (November 7- December 8 2017) (1 Credit)

Location: Yates (Room 308)

Instructors: Principal Instructor
Dr. Brian Geiss
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Course Overview: Proteins are complex molecular machines that are involved in almost every function in cells and can be engineered to perform numerous tasks in laboratory settings. The goal of this course is to provide a conceptual understanding of the basic biochemistry of proteins and how they are used in biomedical research to computer science and engineering students involved in interdisciplinary projects with biomedical scientists. This course will help students understand how proteins are coded by the genome and produced, the structures of proteins and how they move, and how recombinant proteins are obtained for experimental usage so they can better interface with biologists.

Course Learning Objectives:
At the end of this course, students will be able to:

- Explain the basic biochemical characteristics of cells and proteins
- Describe how protein structure is determined
- Understand why enzymes are important
- Describe how protein structure is determined
- Discuss how proteins are produced in eukaryotic and prokaryotic cells
- Describe how proteins are purified for use *in vitro*

Course Requirements: Students are required to attend classes and participate in class discussions. I reserve the right to modify this syllabus and schedule as needed. I will announce changes in class, e-mail, or via Blackboard. This course will require two hours of outside work for each class hour through readings.

Grading: Students enrolled in this graduate level course will have one comprehensive exam (100%). No extra credit will be offered during this course.

Grading will be traditional:

A (90-100)
B (80-89)
C (70-79)
D (60-69)
F (below 60)

Examinations will focus on demonstrating that students understand a clearly explain concepts discussed in class. Exams will be short answer and will be given during the final class period.

Attendance. Students will be excused for up to three classes. Students should notify the instructor prior to their absence if possible.

Special Needs: Students with disabilities are encouraged to contact the Resources for Disabled Students' office to arrange for accommodation and support services. The RDS office is located at room 100 General Services Building, (970) 491-6385, http://rds.colostate.edu/.

Conduct: Student and faculty member conduct in this class shall conform with and be guided by the policy on academic integrity (http://www.conflictresolution.colostate .edu/academic-integrity) and shall also conform to the expectations of the student conduct code (http://www.conflictresolution.colostate.edu/conduct-code) for Colorado State. Specific examples of expected conduct relative to homework assignments and examinations will be discussed in class. You may be dismissed from a class period for unprofessional or inappropriate conduct or may be dismissed from the course if similar conduct would recur.

Course Materials
The content for this course has been developed in part from the textbook "Principals of Biochemistry" (Lehninger, Sixth Edition) and primary literature articles. The above textbook is not required for this course. References to further information will be provided where necessary.

Office Hours: Class announcements will be made through Canvas. I will be available from 2-3 pm on Wednesdays and Fridays for Office Hours (Microbiology room B409). If you have questions that are of interest to the entire class, please post them on Canvas and I will address them there.

Daily Course Topics

Section 1: Basic cell and molecular biology

Week 1

- November 7 – Introduction / Basic structure of cells
- November 8 – Basic structure and function of cells
- November 9 – Central Dogma of molecular biology
- November 10 – Central Dogma of molecular biology

Section 2: Protein structure

Week 2

- November 14 – Amino acids / Peptide backbone
- November 15 – Alpha helices / beta sheets
- November 16 – Higher order protein structures / Determining protein structure
- November 17 – Determining protein structure

Fall Break (November 20-24)

Section 3: Enzymes: Molecular Machines

Week 3

- November 28 – Enzymes: What they are and why we care
- November 29 – Substrate binding
- November 30 – Enzyme kinetics
- December 1 – Enzyme kinetics

Section 4: How to make recombinant proteins for research

Week 4

- December 5 – Prokaryotic protein production
- December 6 – Prokaryotic protein production / Eukaryotic protein production
- December 7 – Eukaryotic protein production
- December 8 – Exam