CMB580A1: Protein Basics for Computer Scientists and Engineers

Time: Tuesday-Friday (1:00p - 1:50p), Fall Semester (November 3- December 4 2015) (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, how recombinant proteins are obtained for experimental usage, and the various ways proteins are used in biomedical research and biosensing so they can better interface with biologists.

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

1) Explain the basic biochemical characteristics of proteins
2) Discuss how proteins are produced in eukaryotic and prokaryotic cells
3) Describe how proteins are purified for use *in vitro*
4) Explain how molecular and biophysical techniques are used to analyze proteins
5) Discuss how proteins can be used in diagnostic devices

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 be graded on scores from 2 non-comprehensive exams (50% each). 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 in mixed format (short answer, multiple choice).

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 Blackboard. I will be available from 1pm to 2 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 Blackboard and I will address them there.

Daily Course Topics

Section 1: Basic protein biochemistry

Week 1

- November 3 – Proteins: Biochemical characteristics and functions
- November 4 – How are proteins made: Amino acids, reading the DNA/RNA code, wobble bases
- November 5 – Transcription, translation, and protein structures/dynamics
- November 6 – Protein modifications and decay

Section 2: Protein production

Week 2

- November 10 – Recombinant protein expression (Prokaryotic systems)
- November 11 – Recombinant protein expression (Eukaryotic systems)
- November 12 – Protein chromatography for purification
- November 13 – Exam #1

Section 3: Protein analysis techniques

Week 3

- November 17 – Gel electrophoresis protein detection techniques
- November 18 – Antibody mediated techniques (Western blot / ELISA / immunofluorescence)
- November 19 – Biophysical techniques (ITC / SPR / crystallography)
- November 20 – Mass spectrometry

Fall Break (November 23-27)

Section 4: Chemical and genetic linkages, protein biosensors

Week 4

- December 1 – *In vitro* chemical labeling of proteins and linking proteins to surfaces
- December 2 – Protein tagging for visualization *in vivo*
- December 3 – Protein biosensor arrays for pathogen detection
- December 4 – Exam #2