Advanced Biochemistry I
Biochemical Methods
Chemistry 6770, Fall 2017

Time and location TBD

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Text: There is no required text for the course, but there will be required readings that will be made available by the instructor.

Lecture Overheads - Canvas We will be using Canvas for the management of Chem 6770. Copies of many required readings and some lecture overheads will be posted on Canvas (https://online.usu.edu/).

Course Withdrawal: Refer to the current academic year registration calendar for details and deadlines concerning withdrawal conditions and deadlines.

Provisions: The administration of Chem 6770 will adhere strictly to the academic policies outlined in the most recent USU General Catalog, which can be found here: http://catalog.usu.edu/index.php
Students not enrolled in the course may sit in only with instructor approval.

Late assignments: Late assignments will not be accepted except under extenuating circumstances that will be considered on an individual basis. Missed quizzes cannot be made up unless the absence was approved by the instructor or resulted from an extenuating circumstance that will be considered on an individual basis.

Course Content: Chemistry 6770 is a graduate course and a part of the Biochemistry graduate core curriculum. It will cover the theory and practical approaches for an array of biochemical and biophysical techniques and is designed to provide you with a level of understanding sufficient to guide you in the acquisition and interpretation of appropriate data sets.

Course Assessment: Students in this class are expected to develop an understanding of the techniques and ideas covered in the course. Some will be covered in much greater depth than others and this will be reflected in the testing of the material. While the instructor will guide the course, the students will be responsible for adequately preparing for lecture as well as presenting a significant amount of the material to their peers. Attendance and participation are vital for this type of course and while attendance is not graded, participation is mandatory. A total of 50 points will be assigned based on participation in presentations and class discussions. Again, attendance is not mandatory, but you cannot participate if you are absent. It is the students' responsibility to communicate with the instructor concerning their standing with regard to their participation points.

Quizzes will be administered throughout the course and will cover lecture material as well as any assigned reading. Quizzes will be worth a total of 50 points. Some quizzes will be announced ahead of time while others will not. This is why it is imperative to be prepared and attend class regularly. There will be four "hands on" laboratory sections and each will require a lab write-up at the end. The write-ups will be worth 20 points each (80 points total) and details concerning format will be discussed in class.

1 final exam will be given at the end of the course and it will consist of both in class and take-home material. The final exam will be worth 70 points.

One of the goals of this course is to prepare you for graduate studies in Biochemistry/Chemistry at USU and to help facilitate your graduate research, you will compile a series of short reports detailing methods pertaining to the course. Specific requirements for the reports will be provided, but characteristics including the theory, necessary reagents, specificity, cost, time, and availability of equipment at USU are some of the key aspects to be included. The completed reports are worth a total of 50 points.

Grading:

Class Presentation/participation…....……..50 points
Quizzes…….....50 points
Lab reports…...…….……...80 points
Technique Short report portfolio.....…….……...50 points
Final Exam…….....70 points
Total .....300 points

In terms of final assignment of grades, you are guaranteed the following grades if your final class percentage lies within the indicated ranges.

100-90% A through A- 89.9-78% B+ though B-
77.9-68% C+ through C- 67.9-59% D+ through D-

Based on the overall class average at the END of the semester, the percentage cutoffs may be adjusted to be lower than those above at the instructor's discretion. They will never, however, shift higher.

OBJECTIVE

In planning this course, I have identified three main course objectives:

1. Gaining factual knowledge (terminology, classifications, methods, trends)
2. Learning fundamental principles, generalizations, or theories
3. Learning to apply course materials (to improve rational thinking, problem solving and decisions)

USU welcomes students with disabilities. If you have, or suspect you may have, a physical, mental health, or learning disability that may require accommodations in this course, please contact the Disability Resource Center (DRC) as early in the semester as possible (University Inn # 101, 435-797-2444, drc@usu.edu). All disability related accommodations must be approved by the DRC. Once approved, the DRC will coordinate with faculty to provide accommodations.

Tentative Class Topics

Detection and quantification of proteins and/or nucleic acids

SDS PAGE
Native PAGE
1D vs. 2D

Protein Blots (discuss types)
UV-Vis/Extinction Coefficient (Beer's Law)
Colorimetric assays
Agarose Gel Electrophoresis
Tags (i.e. fluorescent labels and "click" chemistry)

How to Clone, express, and purify protein

General PCR mutagenesis, restriction enzymes, vectors, ligation, transformation
Cell types (codon usage, PTM, etc.)
Purification techniques, solubility tags

How do I characterize my protein?

Stability – (Russ Middaugh Paper)
Cofactors
Gel Filtration
Mass Spec
Structure (i.e. CD, X-Ray, NMR
Sequencing
Is it an enzyme?
Is it modified?

How do I know two proteins interact/measure how well they interact?

Pull-down/immunoprecipitation
FRET
Yeast 2-hybrid
ITC (isothermal titration calorimetry)
SPR (Surface Plasmon Resonance)
Static/Dynamic Light Scattering
Anisotropy
Chemical crosslinking
Analytical ultracentrifugation

Protein/nucleic acid interactions

Measuring them (EMSA, FP, FRET, Microarray)
Interaction mimics (Aptamers)

Microscopy

Light microscopy
    Principles (Numerical aperture, Diffraction limit)
Fluorescence microscopy
    Principles (Jablonski Diagrams)
Electron Microscopy
Scanning techniques
Novel methodologies