Syllabus

CHEM 530L - Techniques in Biochemistry

COURSE DESCRIPTION: Primarily this is a course about how to do science. How to develop scientific hypothesis, perform experiments, analyze data, write manuscripts, and publish results in a peer-reviewed journal. Along the way students will develop laboratory and general science skills and learn about molecular biology and protein-nucleic acid biochemistry. This course is meant to be an introduction to research: students are not expected to have any prior research experience.

The science will focus on DNA helicase II (UvrD), which is involved in nucleotide excision repair and DNA mismatch repair. *E. coli* UvrD is well characterized and expresses well. Dr. Erie's lab has been working on reconstituting mismatch repair from *Thermus aquaticus (Taq)*, and they have cloned, expressed and purified most of the proteins, but not UvrD. UvrD has been expressed and characterized for a couple of other thermophiles but not *Taq*. Consequently, the research part of this course will focus on cloning/mutating, expressing, purifying and characterizing *Taq* UvrD.

Students will begin by comparing *E. coli* UvrD to *Taq* UvrD virtually using bioinformatics tools. You will then use the information from your comparison to develop a hypothesis on how to alter the behavior of *Taq* UvrD. You will then spend some time trying to characterize wild-type (*not* mutated) *Taq* UvrD using a host of biochemical and analytical tools, and comparing your results to those obtained in the previous semester. This experience is equivalent to what a research scientist would do as they began a new project; *i.e.*, demonstrate that they can reproduce published (or previously obtained) results. You will then characterize your mutant *Taq* UvrD to validate – or refute – your hypothesis.

The spring semester will build upon the work from the fall semester, which focused on cloning, expressing, purifying, and characterizing *Taq* UvrD. You will advance that work by further characterization of wild-type, and the generation and characterization of mutants. The discovery of function-altering mutations of *Taq* UvrD, along with the previous characterization should constitute a solid *Biochemistry* publication. We will create a running set of figures and data, with write-ups from the students, which will set us up to write the paper. We will use the best figures, and the students will write and critique the associated text as part of the course. In the following semesters, the students will read and examine the work from previous semesters at the beginning of the class so they can build on that work.

COURSE MEETINGS:

All Sections: Monday 12:20-1:10 Kenan B121
Section 401: Tuesday and Thursday 1:00-5:00 PM in Morehead 203

Section 402: Wednesday and Friday 1:20-5:20 PM in Morehead 203

INSTRUCTOR: Thomas Freeman freeman@unc.edu, Kenan Labs A227, Office hours: M: 2:00-300 PM

INSTRUCTOR	Section	Email	Office Hours
Thomas Freeman	All	freeman@unc.edu	M 2:00-3:00 PM in Kenan Labs A227

TAs	Section	Email	Office Hours
Nolan Brown	401	njbrown@email.unc.edu	TBD
Hunter Wilkins	401	hwilkins@unc.edu	TBD
Sarah Marks	402	markssa@email.unc.edu	TBD
Matthew Satusky	402	satusky@unc.edu	TBD

We are also available by appointment. Please contact us if you cannot meet us during the times listed here. We would love to meet with you!

SAKAI and ONENOTE: You need an onyen to log on. Everything will be either on the Sakai site and/or in Onenote. The syllabus, schedule, readings, links to training videos, updates and announcements, etc. All protocols and lab procedures can be found in the Content Library in your Class Notebook in Onenote. It is your responsibility to check it regularly. At least daily.

TEXT: There is no textbook required for this course. Instead, reading assignments will come from the primary literature, news articles, and the instructor.

ADDITIONAL REQUIREMENTS: Basic knowledge of molecular biology and biochemistry as covered in BIOL 202 and CHEM 430.

LAB NOTEBOOK: All of your prelabs and notes from lab must be either entered or uploaded to your Onenote Notebook titled “Lab Notebook”. All prelab work, including your planned protocols for the day must be uploaded into Onenote **prior** to the beginning of each lab meeting. Your lab notes and results obtained during lab can either be entered directly into Onenote, or they can be uploaded immediately after class. **Your lab notes must be uploaded to OneNote no later than one hour after the end of lab (i.e., TuTh class by 6:00 PM & MW class by 6:20 PM).**

LAB EXERCISES: **All assignments, prelabs, etc. must be uploaded to the appropriate section of your Class Notebook in Onenote.** Your Notebook will be graded regularly. Lab exercises will often be based on the discussions we have about scientific literature in the field but could also relate directly to your research project. You will also be expected to present scientific literature to the group and you will receive points for actively participating each week in discussions and lab work as well as points for maintaining a lab notebook.

PARTICIPATION: We will award participation points each week to those that remain actively engaged in class each week. While we will require you to use your computers during class time throughout the semester and recognize that you are excellent multi-taskers, research suggests that your peers are not. We expect you to be respectful of your classmates and restrict your use of digital devices to course content. It is wonderful that your devices connect you to family and friends but the classroom should be a place apart from the outside world and distractions. In addition, we expect that you will complete any homework for other courses outside of our class meetings. We will take participation points away if we see that you are distracted by your device, doing homework, etc.

FINAL PAPER AND PRESENTATION: You will write up your results in a manuscript/paper at the end of the semester. This final paper will take the place of a final exam in the course. In addition, you will give a scientific talk on your findings.

WHAT YOU SHOULD BRING TO CLASS EVERY DAY:

1. Your lab notebook
2. Computer
3. Writing utensil
4. Enthusiasm and creativity!

COURSE GOALS (DO, SHARE, TOGETHER)

1. **To help students develop the process skills of synthesizing and testing scientific predictions.**
   When you "DO" the Science you will acquire basic laboratory techniques and skills needed to examine the properties of proteins and protein-nucleic acid interactions. You will develop a novel, hypothesis driven question, design an experiment that allows you to answer it, collect data, and interpret your findings.
2. **To clearly and effectively communicate scientific findings.**
   The purpose of science is to create or discover, and share new knowledge. When you "SHARE" the science, you will write a paper/manuscript and give a talk with your lab partners to the class about your science. You will also present your work at a symposium/showcase at the end of the semester
3. **To effectively collaborate within a team.**
   Modern science is a collaborative process that demands teamwork to find the best solutions to a problem. Your future success depends on your ability to work with others, and science is better when we do it "TOGETHER".

The lecture and the reading material will provide the basic content. You will gain hands on experience with techniques in molecular biology, learn how to formulate testable hypotheses, and design experiments to test them. You will read scientific literature and learn to write like a scientist. After this class, you will be prepared to do research in a lab on campus and to build upon this content with other upper level courses, graduate school, and/or medical school.

EXAM: There will be one exam given during the session. Test material to study: lab note book, lab exercises, reading, homework, power point slides, learning objectives, and problem sets. To succeed in this class, it behooves you to take each reading/homework seriously and actively engage in all class discussions.

GRADING: Your final average is calculated:

Prelab (+, check, -): 10%

General participation (general lab citizenship) (+, check, -):10%

Post lab (+, check, -): 10%

Group Notebook: 10%

Presentations/Progress reports: (1 or 2 person per group (building formal presentation): 15%

Formal group presentation: (late in semester, in lab, background and significance, methods, results, conclusion): 10%

QEP Research and Making Expo (Present a poster with your group on April 26th from 3-5pm): 5%

Final Exam (final written report): 15%

Final exam on techniques (tentatively Apr. 10/11): 15%

GRADE SCALE

In general, the scale for each letter grade comes very close to a 10 point scale; however we reserve the right to change that scale since it is impossible to predict the difficulty level of any particular test. We will keep you updated about the estimated scale as the course moves along.

100-90	A
89-85	B+
84-80	B
79-75	C+
74-70	C
69-60	D
<60	F

CLASS MEETINGS

The laboratory and non-laboratory portions of the course will occur back to back and will intermingle (there will not be a distinct break between the two; students might start a lab experiment, move on to another activity, such as a short lecture or paper discussion or group project, then go back to the laboratory work to complete the task). COPYRIGHT POLICY

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