

CH444 – Advanced Methods in Biochemistry

Spring, 2019

Instructor: Kevin Rice – kevin.rice@colby.edu (Keyes 313, x5763)
Office Hours: open or by appointment

Course website: <http://wiki.colby.edu/display/CH444>

Required text: “Principles and Techniques of Biochemistry and Molecular Biology”, 8th Ed. (2018), Wilson & Walker, Cambridge

- *Reading assignments will be posted weekly on the course website.*
- *Supplemental reading from the literature will also be assigned regularly.*

Course description: CH444 will transcend the fundamentals established in BC367 to investigate modern problem solving strategies in experimental biochemistry. The course will begin with a systematic overview of biochemical research methodology, including biochemical separations, molecular cloning, spectroscopic techniques, and enzyme analyses. We will then look at how research strategies have evolved and how new approaches can be used to address challenging questions. We will attempt to rethink traditionally singular approaches to research science – reflecting an experimentalist’s approach to “do what’s necessary” rather than “do what I’m used to doing”. We will use examples from the recent literature to illustrate this paradigm. Writing skills in the discipline will be of principal focus in this course and intended to build from the technical writing you learned in BC367. Problem solving approaches will be developed as research proposals. The culminating experience of this course will be for each student to identify an unresolved problem from the literature and propose an experimental strategy to address it in the form of a grant proposal.

CH444 student learning goals:

1. To comprehensively understand the standard experimental tools of biochemical research.
2. To apply knowledge of biochemical experimental techniques to specific problems.
3. To understand and critique the primary biochemical literature.
4. To strengthen writing skills in the discipline and learn how to write effective grant proposals.
5. To strengthen oral communication skills and gain confidence in their abilities to present science to their peers.
6. To learn how to identify unresolved problems in the biochemical literature and develop experimental strategies for solving them.

CH444 responsibilities, assignments, and means of assessment:

- Lecture videos, discussions, and reading assignments for much of the course will be focused on learning the biochemist’s experimental “toolkit”. Using the textbook and sources in the primary and secondary literature, we will discuss a wide range of experimental concepts and approaches. Lectures will be posted online as videos, which you are to watch before Monday’s class each week. The latter part of the course will examine more modern and integrative approaches to experimental biochemistry, which will rely almost entirely on current literature. As the course progresses, there will be an increasing focus on identifying the kinds of experiments that are appropriate for certain research problems. Students will be expected to watch every lecture video and attend every class section and be engaged in all discussions. (Learning goals 1, 2, 3)
 - **Completion of lecture videos (including embedded quizzes) – 5% of your grade**
 - **Instructor’s assessment of student engagement – 10% of your grade**

- Following the primary literature is an important part of being a well-prepared research scientist. During the first half of the semester, we will be reading papers every week from the *Journal of Biological Chemistry* (www.jbc.org). During the second half, we will explore other biochemistry publications. Students will be asked to identify papers that use methodology discussed in that week's lecture and either present the paper to the class for discussion or write brief reviews of the chosen paper. Every student will present two papers, one by herself and the other in collaboration with another student. Every student will also write five reviews/synopses. The oral presentations will include critical analyses of the methods used, original interpretations of the paper's significance, and judgment on logical subsequent steps, including the techniques necessary for these steps. The reviews/synopses should be no more than a half page (single-spaced) and include an summary/analysis of the experimental approach. The presentations will be assessed according to a rubric (on the website) and the written reviews will be assessed for demonstrative effort. Please refer to the schedule posted on the course website for details. (Learning goals 1, 3, 4, 5)
 - **Literature presentations – 10% of your grade**
 - **Literature reviews/synopses – 10% of your grade.**
- The first writing project will assess students' ability to propose experimental solutions to assigned biochemical problems. This project will be assigned in several stages, culminating in a final revision. Significant class time will be devoted to writing instruction including peer review. (Learning goals 1-4)
 - **First writing project – 20% of your grade.**
- There will be one, midterm examination (on or around Monday, April 1st) that will have the same intent as the first writing project. This exam will be short answer / essay format. There will be no make-up exam if not explicitly approved by the Instructor. (Learning goals 1, 2, 4)
 - **Midterm exam – 10% of your grade.**
- A summative project will be assigned to all students in which they will be expected to identify an unresolved problem in the biochemical literature and develop a proposal to address it. The problem to be investigated must be thoroughly explained and justified by citing the relevant literature. A thorough experimental plan must also be described that incorporates several different experimental techniques, anticipates potential pitfalls, and explains the significance of the results. A brief Executive Summary, in which the problem and the overall strategy to solve it will be introduced, will be due on April 3rd. The student will meet with the instructor one-on-one to discuss the proposal after which the instructor will either approve the proposal or ask to student to revise and resubmit it. A first draft of the introduction will be due on April 12th and a first draft of the entire assignment will be due on April 24th. Students will present their proposals orally during the final week of the semester and will have to defend it to the class and to the Instructor. A revised, final version of the proposal is due by May 18th. Both the oral and written proposals will be assessed for students' understanding of the chosen problem and its underlying scientific principles, the validity and complexity of the proposed experiments, and the quality of the presentations/proposals themselves. (Learning goals 1-6)
 - **Final proposal – 35% of your grade.**

Academic dishonesty will not be tolerated. Please refer to the Student Handbook as well as the Chemistry Department policy on academic dishonesty and accommodations for students with learning differences (www.colby.edu/chemistry/AttendExam.html).