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BCH 486.01: Biochemistry Research Laboratory

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Recommended Citation

Thomas, Celestine J., "BCH 486.01: Biochemistry Research Laboratory" (2015). *Syllabi*. 3328.

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Biochemistry 486 Spring 2015

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Summary

The purpose of this course is to teach current molecular biology and protein biochemistry techniques as an integrated part of a research project that is suitable for publication. In this way, not only will the student become familiar with the technical aspects of techniques such as PCR, cloning, and protein purification, but he or she will experience the fundamental process of scientific research. The course format will break with the traditional model of undergraduate lab courses (performing discreet, unrelated experiments) and instead provide a research-like experience where the semester is devoted to the achievement of one long-term goal. **Lectures will be integrated into the lab time and will cover both the principles behind the daily experiments as well as the technical details.** Should a particular experiment fail for a student, backup supplies will be available to enable the student to continue with the scheduled research. As much as possible, students will work individually rather than in pairs.

The main research goal is to understand how mutations in amino acid sequence may affect the biochemical properties of a protein. Each student will prepare a Ric-8a, construct. Ric-8A is a soluble G-protein nucleotide exchange factor (GEF) that binds to G-proteins and elicits GDP to GTP exchange. Different constructs of Ric-8A will be characterized for G-protein binding and GEF activity. A set of Nanobodies (very small antibodies) that were raised against Ric-8A will be tested for binding to these Ric-8A constructs.

Students will gain experience in recombinant protein expression in bacteria, site-directed mutagenesis, PCR techniques, protein purification, and protein characterization, including several types of spectroscopic and thermodynamic techniques.

Students will read an article from current biochemistry literature that is related to their projects. This article will serve as a template for describing their own research efforts. They will, through a series of written exercises, describe their work in the typical format used in scientific journals. *This course will count for 2/3 of the 'W' upper division writing requirement for majors associated with the Division of Biological Sciences or the Biochemistry program.*

Grading

Attendance is mandatory. Students will be allowed to miss only one class per semester and must arrange to make up the work. Any additional classes that are missed without a validated excuse will lower the student's grade (one full letter grade per missed class).

Summary of Article from Current Literature: 10% of final grade. There will be one related journal article assigned that will be discussed in class; students will then write up a 2-page summary of that article. The first draft will be worth 6 points and will be graded for both content and writing style and then returned to the student for revision. The revision will be worth an additional 4 points for a total of 10 points.

Write-ups of Research Results: 30%

Students will be asked to hand in three written assignments (double spaced), each counting toward the final grade. The first two will be edited and handed back for revision. For these, the grade will be based on the revised assignment, which will be due one week after it is returned. The assignments will cover the main parts of scientific writing: (1) Introduction, (2) Methods, and (3) Results and Conclusions. The article summarized in the previous assignment will serve as a stylistic template. Each student will write:

1. 1-page Introduction describing the protein being investigated for this course and the reason the particular mutant was selected. Worth 10 points (10%) after revision
2. 2-page Methods Paper describing the methods used to make the mutant, and then a longer discussion of one of the spectroscopic techniques used in class (each student will select a unique method) Worth 10 points (10%) after revision
3. 4-Page Summary Paper containing the Introduction, Methods, Results and Conclusions sections. The focus of this paper will be the last experiment of the semester, which will be designed by the student to probe the stability of the mutant protein. Assistance with protocol development will be available before the assignment is due. Worth 10 points (10%)

Laboratory Notebooks: 10%

Students will be asked to keep a research-type laboratory notebook that will be checked 3x per semester. Students will be provided with specific examples of excellent and poor notebooks during class; these will be available throughout the semester. The notebooks will be graded and returned, usually with copious notations in the first round of grading. While students are not asked to re-write these sections, they are expected to adapt their writing styles in future weeks to include instructor comments and to conform with the notebook guidelines discussed during class. The grade will be assigned based on the last review. The goal is to learn the art of keeping a research notebook:

- a. to write clearly and with enough detail that someone will be able to reproduce your experiments, or to adapt your procedure to another problem

- b. to describe your results both quantitatively and qualitatively – if something didn't work very well, what went wrong? What would you modify for the next time?
- c. to show the connection from the results of one day's experiments to the next.

Homework Assignments: 40%

Students will be given two short-answer (but difficult) take-home homework assignments (20% each) covering the theory and/or interpretation of the techniques used in class.

Final Presentation: 10%

During finals week each student will do a short (15 minute) individual oral presentation using a program like PowerPoint. The presentation will describe the project – the background, experiments, results, and conclusions. The presentations will be open to all UM faculty and staff; you may also invite guests. The times for presentations will be scheduled to accommodate other commitments you may have.

Graduate Increment

Graduate students who take the course will be expected to fulfill the requirements listed above and to perform one additional assignment. Graduate students will (a) write a 5 page critique of a relevant paper chosen with input from the instructor and (b) propose a novel experiment or set of experiments that is suggested from the results of that paper. This assignment will count for 10% of the grade; for graduate students the notebook grade will count for 5% and the final presentation for 5% of the final grade.

General Policies

University policies on drops, adds, changes of grade option, or change to audit status will be strictly enforced in this course. These policies are described in the current catalog. Students should specifically note that after the 30th day of the semester, such changes are NOT automatically approved. They may be requested by petition, but the petition MUST be accompanied by documentation of extenuating circumstances. Requests to drop a course or change the grade basis to benefit a student's grade point average will not be approved.

Note:

- If you are taking the course for a non-traditional grade (credit/no credit), university policy states that a "CR" grade is given in lieu of A through D- grade; an "NCR" grade is given in lieu of an F grade.

In working through assignments, students are encouraged to work together to solve problems, to share information or resources, and to test each other's understanding of the material. Those are all acceptable forms of collaboration. However, the written work that each student turns in must be his or her own. Only in this way can faculty judge individual understanding of concepts or information. A good rule of thumb for students to follow is to work together up to the point of

committing words to paper. At that stage, each student must work independently. A second key guideline is that once a student has written an out-of-class assignment, it must not be shown to or discussed with another student in the course. Assignments from two or more students that have significant overlap, in the professional judgment of the faculty member, will be regarded as reflecting a violation of the expectation that students turn in independent assignments. **Please note that direct copying of sentences from any published source without proper citation is considered plagiarism.** THIS INCLUDES THE INTERNET. Additionally, excessive quoting is generally unacceptable in the sciences. Be sure to put the information in your own words and be aware that the instructor will check literary and Internet resources. Violations will be dealt with according to the Student Conduct Code. *All students must practice academic honesty. Academic misconduct is subject to an academic penalty by the course instructor and/or a disciplinary sanction by the University. All students need to be familiar with the Student Conduct Code. The Code is available for review online http://life.umt.edu/vpsa/student_conduct.php.*

Special accommodations: If you are registered with Disability Student Services and require special accommodations, service requirements such as jury duty, military/national guard, or if a class period falls on a religious holiday and you wish to reschedule, please contact Dr. Celestine Thomas.