

# **BB 493/593 Biochemistry Laboratory Molecular Techniques 1 Fall 2017 (3 credits)**

## **Class meetings**

**Laboratory sections (all sections meet in ALS 0023, basement)**

MW 9:00-11:50      MW 14:00-16:50

TR 9:00-11:50      TR 13:00-15:50

**Lecture (common to all sections) T 16:00-16:50, LINC 210**

## **Instructors**

Dr. Kari van Zee

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Office Hours: Wed 10:00-11:00 and by appointment

Dr. Adrian Gombart

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Dr. Gary Merrill

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Office Hours: Tues 12:00-1:00 and by appointment

## **Teaching Assistants:**

Heather Forsythe [forsythh@oregonstate.edu](mailto:forsythh@oregonstate.edu)

Thaddeus Golbek [golbekt@oregonstate.edu](mailto:golbekt@oregonstate.edu)

Phil Zhu [zhuph@oregonstate.edu](mailto:zhuph@oregonstate.edu)

**Prerequisites:** Completion of BB 451 or BB 492 or departmental approval.

## **Course Description**

BB 493/593 is a laboratory course that focuses on nucleic acid biochemistry and making students familiar with and proficient in the use of molecular biology techniques to investigate the functional relationship between nucleic acid sequence, gene expression, and gene function. Critical analysis of data and a clear understanding of the theory behind these techniques will be emphasized.

## **Learning Outcomes:**

After completing this course, students will be able to:

1. Define specialized language of the biochemistry laboratory with an emphasis on molecular biology.
2. Describe concepts fundamental to biochemistry techniques, focusing on the functional relationship between nucleic acid sequence, gene expression, and gene function.

3. Record their experimental procedures and results in a notebook, in a manner that allows the work to be reproduced by others with a similar level of training.
4. Operate safely biochemistry laboratory equipment, including micropipets, thermocyclers, centrifuges, gel electrophoresis chambers, power supplies, incubators, and autoclaves.
5. Understand and comply with rules of safety and waste disposal.
6. Demonstrate quantitative skills by preparing accurately and reproducibly reagents and solutions for experiments.
7. Design experiments, including the proper controls, to isolate, modify, and characterize nucleic acids.
8. Follow and adapt protocols and procedures described in manuals.
9. Organize and analyze experimental data. Interpret data presented as tables, graphs or figures.
10. Describe core concepts in nucleic acid structure and function in written tests.
11. Evaluate experimental findings in the context of scientific literature and communicate an understanding of core concepts, experimental details, and calculations used in each experiment in written tests, manuscripts, and oral presentations.

### **Additional Learning Outcomes for BB 593 graduate students**

Graduate students gain additional experience in critical analysis and problems solving skills through a literature-based term proposal project. After completing the course graduate students will be able to

1. Evaluate scientific contributions of recent publications in molecular biology and biochemistry.
2. Defend their analysis in written and oral communications.
3. Propose next-step approaches to advancing the area of research.

### **Molecular Biology Techniques Covered include**

- Sterile technique and media preparation
- Plasmid Isolation and Restriction Analysis/Agarose Gels
- Polymerase Chain Reaction (PCR)
- Molecular Cloning
- Site-Directed Mutagenesis
- DNA Sequencing
- Molecular Barcoding
- Isolation and analysis of RNA
- Quantitative PCR
- Immunoblot analysis of expressed proteins

**Learning Resources:** A laboratory manual, additional materials to read, lecture slides, data sets, and homework assignments will be posted on the Canvas learning portal under the lecture CRN that is accessible to students in all laboratory sections. Students are

expected to make their own printed copy or have access to an electronic copy in lab. Please contact Dr. van Zee if this poses any challenges for you.

### **Evaluation of Student Performance**

Your grade will be based on the distribution of points as follows:

#### **BB493:**

Experimental flow chart and pre-lab write-up 10%

Safety training 5%

In-lab work and lab technique assessments 10%

Lab notebook 20%

Lab calculations test 10%

Problem sets/homework assignments 20%

Exams 1 and 2: 25%

#### **BB593:**

In-lab work, safety training, punctuality and lab etiquette 10%

Lab notebook 20%

Short lab calculations exam 10%

Problem sets/homework assignments 20%

Exams 1 and 2: 25%

Term paper 15%

**Experimental Flow Chart and Pre-lab write-ups:** At the beginning of each experimental module 1-4, students should read the entire experiment (not just that day's work) and prepare in their lab notebook a flow chart for the entire module. In addition for each lab period, students should read the appropriate sections of the lab manual and prepare in advance of the day's work a short pre-lab in their lab notebook for that day's work. TAs will check the flow chart and pre-labs at the start of each class period. You will receive instructions in lecture on what the flow chart and pre-labs should cover. Students should be prepared in advance to perform the laboratory work that day. The lab will not be open early for students to do the pre-lab on site.

**In-lab work and lab techniques assessment:** Each student will need to demonstrate mastery of core laboratory techniques to TAs at designated times throughout the term. More information on the format and timing of this assessment component will be provided in lecture and lab.

Students are expected to be punctual and prepared for class, and to conduct their experiments safely, efficiently and with consideration for others in the lab. Students will be expected to complete all assigned work, including safety training modules, follow lab rules, demonstrate care in carrying out protocols, keep track of samples, store them appropriately with clear labels, be responsible for the fate of plates, digests, etc., ensure proper disposal of waste and maintain a clean and tidy workspace.

Arriving late for class, departing early and leaving completion of the lab up to your partner on a regular basis, failure to follow instructions or keep track of experimental

materials, as well as leaving workspaces or instruments messy are grounds for losing points. Safety or disposal violations will also lead to significant loss of points.

**Lab notebooks:** Students are required to maintain a lab notebook as outlined in the lab manual. Electronic notebooks will not be accepted. Refer to the lab manual chapters posted on Canvas for detailed instructions on how to keep a lab notebook. Entries in the lab notebook must be made in class in **non-erasable pen**. Lab notebooks that are rewritten at the end of term to improve legibility will not be accepted.

Lab notebooks will be graded as follows: During the term, each student will receive a grading rubric. Using the rubric provided as a guide, each student will then grade her own notebook, noting what needs improvement and what was done well. TAs will review the completed rubrics and provide feedback so students can improve future entries. At the end of the term, after students have had ample opportunity to perfect their notebook-keeping skills, the lab notebooks will be collected by the instructors/TAs who will assign a grade.

**Calculations Test:** There will be a test during one of the lab periods on simple calculations that are used in the lab. A sample test will be posted at the beginning of the quarter, so that you have an idea of what this test will be like.

**Problem sets/homework:** Students will be assigned sets of problems/homework questions. These must be answered and turned in according to the indicated schedule. Problem-sets will be posted at the Canvas site together with the due date for the assignment.

**Exams 1 and 2:** There will be two 50-minute exams held during the lecture time in Week 5 and Week 10. Exam 1 will cover material presented in weeks 1-4 and Exam 2 in Weeks 5-9.

**Resources:**

Information pertaining to the class will be posted at the course portal/site for the lecture. It is your responsibility to check the web site regularly so that you do not miss anything.

**General Class Policies:**

All students will be expected to be in the lab on time and prepared for the experiment that is to be conducted. If, for some unavoidable reason, you need to be absent for a class period, *it is your responsibility to speak to the instructor ahead of time and arrange to make up the work that you miss*. Please keep in mind that materials for a given experiment may or may not be available outside of class hours, and if you cannot make up the work you will lose the points associated with the pre-lab and notebook for that day.

Assignments must be turned in by 5 p.m. on the due date indicated when the assignment is posted; this is generally one week from the day the assignment goes up on the website.

*Assignments that are turned in late lose 10% of the total points for that assignment for each day (including week-ends) that they are late.*

## **General OSU and Departmental Policies**

### **Statement Regarding Students with Disabilities**

Accommodations for students with disabilities are determined and approved by Disability Access Services (DAS). If you, as a student, believe you are eligible for accommodations but have not obtained approval please contact DAS immediately at 541-737-4098 or at <http://ds.oregonstate.edu>. DAS notifies students and faculty members of approved academic accommodations and coordinates implementation of those accommodations. While not required, students and faculty members are encouraged to discuss details of the implementation of individual accommodations. The DAS Statement is posted online at: <http://ds.oregonstate.edu/faculty-advisors> (4/14/16).

### **Student Conduct**

The Department of Biochemistry/Biophysics and the Biology Program follow the university policies on student conduct. These can be found at <http://studentlife.oregonstate.edu/studentconduct/offenses-0>

Cheating or plagiarism by students is subject to the disciplinary process outlined in the Student Conduct Regulations. Students are expected to be honest and ethical in their academic work. Academic dishonesty is defined as an intentional act of deception in one of the following areas:

- \* cheating- use or attempted use of unauthorized materials, information or study aids
- \* fabrication- falsification or invention of any information
- \* assisting- helping another commit an act of academic dishonesty
- \* tampering- altering or interfering with evaluation instruments and documents
- \* plagiarism- representing the words or ideas of another person as one's own

Behaviors disruptive to the learning environment will not be tolerated and will be referred to the Office of Student Conduct for disciplinary action.

*“The goal of Oregon State University is to provide students with the knowledge, skill and wisdom they need to contribute to society. Our rules are formulated to guarantee each student's freedom to learn and to protect the fundamental rights of others. People must treat each other with dignity and respect in order for scholarship to thrive. Behaviors that are disruptive to teaching and learning will not be tolerated, and will be referred to the Student Conduct Program for disciplinary action. Behaviors that create a hostile, offensive or intimidating environment based on gender, race, ethnicity, color, religion, age, disability, marital status or sexual orientation will be referred to the Affirmative Action Office.*

## **BB593 Graduate Student Term Paper**

Graduate students will select and write a critical analysis of a recent (within the last 2 years) primary research article that uses novel techniques and molecular approaches to study gene expression. These techniques must be described explicitly in this paper's methods section or supplementary materials available on-line. The selection of the article should be discussed with the instructors prior to week 5. Your term paper should be written in your own words and include a clear summary and critical analysis of the article, cite additional literature to support the analysis, and address the following questions:

- Does this paper significantly advance the field?
- How are these experimental methods novel? What are the limitations of this approach?
- How does this compare to other existing approaches?
- Does the experimental evidence provided in the paper support the authors' conclusions?
- What future directions will this technique open up/advance?

### **Guidelines:**

The written report **must** be < 3 pages, single-spaced and typed in 12 point Times, Times New Roman, or in 11 point Arial font. A separate page may be used for literature citations. You are expected to use clear and coherent writing with correct use of grammar, punctuation etc.

### **Submission Deadlines:**

Friday of Week 5 by 5 pm—approval of scientific paper

Friday of Week 10 by 5 pm- submission of report to BB main office. Late submissions will receive a 10% deduction in points for each day late.

**Grading:** 100 points total assigned as follows:

Meeting selection/approval deadline (10), overall grammar and style report (10), summary (20), use and citation of supporting literature (10), addressing each of the questions above (50)