

BB 493/593 Biochemistry Laboratory Molecular Techniques 1, Fall 2020 (3 credits)
CRN 15186/15188

Course Description

BB 493/593 is a laboratory course that introduces students to molecular biology, biochemistry and biophysical techniques and making students familiar with and proficient in the use of these techniques in the production and secondary structural characterization of recombinant proteins. Critical analysis of data and a clear understanding of the theory behind these techniques will be emphasized.

Learning activities are focused on foundational concepts and techniques in molecular biology, biochemistry, and biophysics. Activities include experimental sessions in lab, background lectures, video demonstrations of techniques, pre-lab exercises, reading primary literature, gene and protein analysis using online databases and software, data analysis, and experimental planning. The Canvas course portal and the resources posted there will be the nucleus for your learning.

Class meetings

Laboratory sessions –these are scheduled with students **alternating in-person and remote/zoom in**. Instructors will provide a schedule for in-person attendance prior to week 1 of class. Students will be assigned to attend in person on alternative days. Weeks 9 and 10 are fully remote. If requested, accommodations can be made for students who need to be 100% remote Fall 2020. Students will be asked to complete a scheduling questionnaire prior to the beginning of the term.

Location: ALS 0023 for in person sessions (enter through main entrance under sky bridge and go downstairs to right in atrium).

Time: MW 14:00-16:50 ALS 0023

Lecture section: T 16:00-16:50 via Zoom

Instructor: Dr. Afua Nyarko; E-mail: nyarkoa@oregonstate.edu

Office Hours: by appointment

Teaching Assistant: Kasie Baker bakerkas@oregonstate.edu

Office Hours: Mondays 9 -10 am via Zoom

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

Minimum technology and devices: Students will need reliable internet connection and video capability so that they can participate when scheduled for synchronous remote lab session. Preference in lab is to use personal cellphone cameras that can be mounted on cellphone tripods (provided in lab) with flexible legs. This will allow the “in person” student to show the remote student team member the experimental set-up. Students will be able to connect to the OSU Wi-Fi. More information on this will be provided prior to the term. The instructional team will work to provide equipment for students needing it so they can fully participate. Students should bring a charging cord for their cellphone. Ear buds will be helpful and are strongly recommended.

Learning Resources: Laboratory manual chapters, 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 the instructor if this poses any challenges for you.

COVID-Policy Overlay for BB 493—Masks will be required at all times for all students, teaching assistants, and instructors in the BB teaching lab. Persons not wearing masks will be required to attend the lab sessions remotely.

Due to the ongoing COVID-19 pandemic, instructors, teaching assistants, and students in BB 493 will follow the guidelines of Oregon State University which are aligned with directives from the Governor, the Oregon Health Authority and local health authority.

Prioritize Safety and Wellness: As an instructional team, we prioritize the safety and wellness of all members of our community. We expect that you as students also prioritize the safety and wellness of all members of our OSU community as well as members of your family, friend network, and community at large.

Our goal is to help students in BB 493 gain hands-on laboratory experience in biochemistry, molecular biology and biophysics—we recognize that most of you are seniors intending to graduate by June 2021, this course is required for your major, and we only offer this course Fall term. We will be as flexible as possible in accommodating each student's needs.

Laboratory Modality: To meet the social distancing requirements, we plan that laboratory sessions will include a combination of alternating **in-person + synchronous Zoom sessions**. Students will be assigned to teams of 2-3, and one member of the team will attend lab in person while the other 1-2 team members zoom in synchronously. The instructors will provide a schedule for team rotations. Custom plexiglass stations have been installed in the BB Teaching Lab and physical distancing will be maintained per OSU policy outlined below.

Requesting alternate modality: If a student has concerns that in-person lab sessions will compromise their safety and well-being or if a student is not able to come to campus, the instructional team can arrange for the student to participate in the lab sessions entirely remotely-though still synchronously.

Clear Communication: All members of the course will need to be vigilant about their own health as well as nimble in responding to changes in the community health situation. We may need to change the modality of delivery to 100% remote learning with little advanced notice. We will clearly communicate all changes through Canvas announcements and emails. We expect students to communicate changes in their own situations with the instructional team.

OSU COVID POLICIES

To contribute to the health and safety of all OSU community members during the ongoing COVID-19 pandemic, and to align with federal and state regulations, executive orders, and guidance, the university has adopted two policies all community members are expected to observe:

- (1) Policy on Face Coverings in Public and Common Settings (https://policy.oregonstate.edu/UPSM/04-041_COVID19_face_covering)

This policy requires faculty, staff, students and visitors across all OSU locations to use masks or cloth face coverings, or an appropriate alternative, when in enclosed OSU public and common areas, unless an exception is met; and

- (2) Policy on Physical Distancing During Covid-19 Pandemic (https://policy.oregonstate.edu/UPSM/04-040_covid19_social_distancing)

This policy requires faculty, staff, students and visitors across all OSU locations to maintain six feet of physical distance between others when in enclosed OSU public and common areas, unless an exception is met.

Please review and familiarize yourself with these policies and supplemental guidance (https://covid.oregonstate.edu/sites/covid.oregonstate.edu/files/face_covering_guidance_6-3-20.pdf).

Thank you for contributing to the health and safety of the community. If you have questions about these policies, please contact me or you may submit further inquiries to the Coronavirus Question form (https://oregonstate.qualtrics.com/jfe/form/SV_cTpAHJzw4P3zyQd).

Learning Outcomes:

After completing this course, students will be able to:

1. Define specialized language of the biochemistry laboratory with emphasis on molecular biology and protein biochemistry and biophysics.
2. Describe concepts fundamental to molecular biology, biochemistry and biophysical techniques, focusing on the relationship between the DNA sequence, Protein sequence, and Protein structure.
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. Safely operate molecular biology, biochemistry and biophysics laboratory equipment, including micro-pipets, centrifuges, gel electrophoresis, power supplies, incubators, and autoclaves, UV-VIS spectrophotometer, circular dichroism spectropolarimeter and Fluorimeter
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 produce and characterize proteins.
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. Evaluate experimental findings in the context of scientific literature and communicate an understanding of core concepts, in written and/or oral presentations.

Biochemistry and Biophysics Techniques Covered include

- Sterile technique and media preparation
- DNA transformation
- Expression of recombinant protein
- Affinity column chromatography
- Ion-exchange chromatography
- Polyacrylamide gel electrophoresis
- Fluorescence spectroscopy
- Use of relevant software and databases

Course schedule: This schedule is tentative and is subject to change to meet the needs of the class

Date	Monday --Day 1	Wednesday--Day 2
9/23- 9/25	On-line training only—do not come to lab until Week 1. Complete on-line safety training and read assigned material (Pedelacq et al).	
Getting started (Week 1)		
9/28 -10/2	Orientation & Safety review Pipetting exercise Streak LB agar plates	Orientation & Safety review Pipetting exercise Start liquid culture
Part I: Molecular cloning (Weeks 2 – 4)		
10/5 - 9	Plasmid DNA isolation Set-up PCR reactions Prepare LB media & LB+Agar plates	Restriction digest of pET 28 vector Prepare agarose in 1X TBE Agarose gel purification of PCR product Determine PCR product concentration
10/12 - 16	Prepare agarose in 1X TBE Agarose gel purification of pET28. Determine vector concentration	Gibson assembly Transformation
10/19 - 23	Plasmid DNA isolation (TA does step 1) Determine DNA concentration Plan for sequencing	Transformation into BL21-DE3 cell lines
Part II: Protein Expression and Purification (Weeks 5 – 7)		
10/26 - 30	Growth and induction Prepare SDS-PAGE gels	Sonication Affinity column purification
11/2 - 6	Ion-exchange purification	Run SDS-PAGE gels of Affinity column samples, stain and destain
11/9 - 13	Run SDS-PAGE gels of Ion-exchange samples, stain and destain	Veteran's day no lab Work on Class project
Part III: Biophysical characterization (Week 8)		
11/16 - 20	Prepare & run Fluorescence samples Chlorophyll fluorescence experiment	Prepare & run Fluorescence samples Chlorophyll fluorescence experiment
11/23 - 27	Thanksgiving week: no in-person lab (Week 9): Presentation of class project	
11/30-12/2	Wrap-up and submit class project (Week 10)	

Communication: Lab teams' groups will be assigned in Canvas. The discussion page is a good place to communicate about group assignments

Evaluation of Student Performance

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

- Safety training 5%
- Experimental Flow Chart and Pre-lab assignments 15%
- In-lab and online participation 20 %
- Lab notebook 20 %
- Problem sets/homework assignments 20%
- Term project 20%

Final grades will be determined based on the following scale:

A > 93%, A- 92-90%, B+ 89-88, B 87-83, B- 82-80, C+ 79-78, C 77-73, C- 72-70, D 69-60 D, F below 60.

Experimental Flow Chart and Pre-labs: Experimental flow charts and pre-lab assignments are designed to help students understand important background material, prepare for laboratory sessions, and be ready to work efficiently during the lab time. Pre-labs assignments must be completed and submitted in advance, and late submissions will receive zero points. Be aware of the due dates—they are in advance of your scheduled lab day so that students have to prepare ahead of time. Assignments will be posted on Canvas. In addition to Canvas pre-lab submissions, in advance of each lab session, students are expected to read the appropriate sections of the lab manual and set up their lab notebook with headings and prepare in advance to work efficiently in lab.

In-lab work and on-line collaborative work/participation: All students are expected to be in the lab on time and prepared for the experiment that is to be conducted that session. If, for some unavoidable reason, you need to be absent for a class period, **it is your responsibility to speak to/email the instructor and your lab partner(s) ahead of time.** It is not possible to attend a different section.

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 lab. Students will need to collaborate with team members both on-line through discussion boards and in-lab through synchronous sessions.

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, complete safety training modules, follow lab rules, demonstrate care in performing protocols, ensure proper disposal of waste, maintain a clean and tidy workspace and be responsible for the fate of bacterial plates, plasmid digests, and all other experimental materials through proper labeling and storage.

Arriving late for class, departing early and leaving completion of the lab up to the TAs 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 result in significant loss of points.

Students attending remotely to the Zoom synchronous lab sessions are also expected to be on time and engaged fully in the experiments. Remote students should expect to have **video camera turned on** and be working collaboratively with the in-lab student to record data, troubleshoot, and provide input. Participation will be monitored.

Lab notebooks: Students are required to maintain a lab notebook. Detailed guidelines on how to keep a lab notebook will be posted on Canvas. Separate dated entries need to be made at least three times per week (pre-lab, during lab, and post lab analysis + pre-lab for following week). Lab notebooks will be assessed several times during the term. TAs will provide feedback, so students can improve future entries.

Homework and Deliverables: Students will be assigned homework/deliverables throughout the term. These must be answered and turned in according to the indicated schedule. Deliverable/homework instructions will be posted at the Canvas site together with the due date for the assignment.

University Policies

Regarding Students with Disabilities: 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.

Academic Integrity and Expectations for Student Conduct: Students are expected to adhere to the OSU Student Conduct Regulations described at <https://beav.es/codeofconduct>

Reach Out for Success: University students encounter setbacks from time to time. If you encounter difficulties and need assistance, it is important to reach out. Consider discussing the situation with an instructor or academic advisor. Learn about resources that assist with wellness and academic success at oregonstate.edu/ReachOut. If you are in immediate crisis, please contact the Crisis Text Line by texting OREGON to 741-741 or call the National Suicide Prevention Lifeline at 1-800-273-TALK (8255)

Diversity Commitment: As faculty and teaching assistants of BB 453, we strive to create an equitable and inclusive community in which all members are welcome, heard, and treated with respect. We uphold the value that science should be accessible to all who want to learn with us and that our greatest strengths and most innovative ideas come from collaborations, discussions, and disagreements among people with diverse perspectives, lived experiences, and expertise. Please reach out to us if you have questions, concerns, or ideas about how to make our learning spaces for biochemistry more inclusive.

Course Policies

Zoom Classroom Norms

Students who are participating in the lab sessions remotely are expected to attend the scheduled synchronous meetings in Zoom. To assist your lab partner who is attending in person you should plan on having your video camera on. We recognize that there may be reasons you may not be able to always use your camera such as not having reliable internet access, internet problems at any particular moment, or reasons pertaining to where you are sitting. Please communicate with your instructor if you are experiencing these issues.

When participating in Class Time or other virtual discussions please consider the following tips. These will help us have a smooth and enjoyable session.

- Set your name and add pronoun or pronunciation.
- Make eye contact with the camera.
- Mute mics when you are in the main Zoom session and unmute in the breakout rooms.
- Find your light! Make sure there is a light source in front of you, not behind.
- If you cannot share video because of internet bandwidth issues, please add your name and a picture under settings. It will help when you ask a question or share a response to be able to use your name.
- Alternatively, you may ask questions or add comments in chat.
- You will enter the meeting with your video feed on.
- Be respectful in your spoken words, chat, and videos.
- Do not screen-share unless you have permission.
- Do not annotate on the whiteboard unless you have permission.
- Click raise your hand in Zoom if you want to share.
- Be kind online.

Zoom Breakout Room Norms:

Student-to-student interaction is highly valued and required as a component of this course. We will use Zoom breakout room functionality to split the class into lab teams. Teams will be assigned at the beginning of the term. The instructor and TAs can move between breakout rooms to provide needed support and answers to your questions. Students are expected to be professional in their behavior and conversations in the breakout rooms just as they would in the main zoom room and in-person in lab.