Course Description: This advanced-level laboratory focuses on protein biochemistry. Proteins play vital roles in most biological processes as catalysts for physiological reactions, as regulators for those reactions, or as structural framework around which these processes can occur. Students will work in small interdisciplinary teams to design, execute, evaluate, and communicate a guided-research project focusing on protein structure and function.

Prerequisites: BB 493/593 Biochemistry Laboratory Molecular Techniques 1, BB 315 or Instructor permission. It is expected that students have mastered the simple organic chemistry of functional groups, general chemistry problem solving in stoichiometry, pH and equilibrium calculations and simple algebraic skills such as equation solving and use of logarithms. Students should understand basics of plasmid expression vectors for expression of recombinant proteins in *E. coli*, antibiotic selection.

Minimum technology and devices needed in BB 494
- **Personal cellphone cameras** that can be mounted on cellphone tripods (provided). In the event that a team member is ill or needs to quarantine, this will allow the in-person team member to show the remote team member(s) the experimental set-up and carry them to different work stations.
- **OSU WiFi** Students will connect to the OSU Wi-Fi.
- **Charging cord** for cellphone.
- **Ear buds** or headphones are really helpful in cutting down background noise.

Credits and Meeting Times: 3 credits.
Lecture Tu 16:00-16:50, LINC 200

Instructional Team
- MWAM 8:30-11:20 am
  - Dr. Ryan Mehl
  - ryan.mehl@oregonstate.edu
- MWPM 14:00-16:50 pm
  - Dr. Kari van Zee,
  - vanzeek@science.oregonstate.edu
Sections 010 in ALS 0023
- Section 014 in ALS 2034
  - TRAM 9:00-11:50 am
  - Phil Zhu
  - zhuph@oregonstate.edu
  - Moriah Longhurst
  - longhurm@oregonstate.edu
  - TRPM 13:00-15:50 pm
  - Jesse Howe
  - howejess@oregonstate.edu
  - Melinda Rydberg
  - rydbergm@oregonstate.edu

Office hours: TBA and will be communicated through Canvas.

Learning Resources:
*Chemical Biology and Biochemistry Laboratory using Genetic Code Expansion Manual* by Ryan Mehl, Kelsey Kean, and Kari van Zee [Posted as pdf on Canvas](https://canvas.oregonstate.edu). Students are expected to have access to the laboratory manual by either printing a copy or by bringing with them to lab laptops/tablets to access materials during lab. We will have several copies on hand for reference.

Primary literature readings will be available through the Canvas course portal.

**Lab Notebook:** Students should keep a physical bound or spiral lab notebook and bring a USB drive to collect data and a laptop for accessing literature, protocols, and analyzing molecular structures.

**Pymol (free educational version)** [https://pymol.org/edu/?q=educational/](https://pymol.org/edu/?q=educational/)

**Safety glasses and gloves will be provided for the term.**

**Lab Coat:** Students should bring their own lab coat—we have a limited number to check out for the term.
OSU COVID POLICIES

Masks: Properly work masks (preferably KN 95 or N95 masks) will be required at all times for all students, teaching assistants, and instructors in the BB teaching lab.

Due to the ongoing COVID-19 pandemic, instructors, teaching assistants, and students in BB 494 will follow the guidelines of Oregon State University which are aligned with directives from the Governor, the Oregon Health Authority and local health authority. COVID-19 Safety and Success policies and resources https://covid.oregonstate.edu/

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 494 gain hands-on laboratory experience in biochemistry. Zoom links to the lab sections and breakout rooms will be used in cases where students are ill or in quarantine and cannot attend lab.

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 will clearly communicate all changes through Canvas announcements and emails. We expect students to communicate changes in their own situations with the instructional team.

Measurable Learning Outcomes

After completing this course students will be able to:

1. Define specialized language of the biochemistry laboratory.
2. Describe concepts fundamental to biochemistry techniques, including concepts relating to protein purification, spectrophotometry, assay design, and characterization of proteins.
3. Operate safely biochemistry laboratory equipment, including micropipets, centrifuges, gel electrophoresis chambers, power supplies, and incubators.
4. Demonstrate quantitative skills by preparing accurately and reproducibly reagents and solutions for experiments.
5. Design experiments, including the proper controls, to express, purify, and characterize recombinant proteins.
6. Collect and analyze experimental data.
7. Evaluate their 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, proposals, and oral presentations.

Course Content and Schedule: posted as a separate document. Assignments and due dates will be posted in Canvas

The schedule posted is tentative and is subject to change to better meet the needs of this particular class and our experimental progress.

Communication: please use direct email (rather than Canvas email) to instructional team members.

Deadlines and Late Work: Unless students have communicated with the instructor to request an extension in advance of the deadline, thorough preparation for lab documented in the notebook must be completed prior to lab. Laboratory and lecture deliverables will not be graded if submitted more than 24 hours late. For other assignments that are submitted late without prior approval for an extension, 10% of total assignment points will be deducted for every 24-hour delay of submission up to 4 days. After 4 days, late work will not be graded. It is up to students to be aware of and meet deadlines.
Evaluation of Student Performance:
In the OSU online catalog, refer to AR 18 and AR 19 (https://catalog.oregonstate.edu/regulations/) regarding assignment of final grades based on the following graded course components.

**BB 494**
- Laboratory and Lecture Deliverables: 20%
- Laboratory Notebooks: 25%
- Oral presentation of group research: 10%
- Scientific proposal draft 1: 10%
- Scientific proposal draft 2: 10%
- Peer reviews of proposal draft 2: 5%
- Final Proposal: 20%

All students are expected to meet the lecture, laboratory, and project deliverables assigned on Canvas, described on the 2022 Weekly Schedule and clarified below and adhere to the submission deadlines. Lab and lecture deliverables are worth a total of 20% of the final grade. Project deliverables include drafts of the scientific proposal, peer review and proposal presentation.

**Laboratory Deliverables:** Weekly lab deliverables are outlined on the 2022 BB 494 Schedule. Each student is expected to upload a lab deliverable handout according to the schedule to receive credit for meeting the deliverable. Deliverables submitted more than 24 hours late will not receive credit. In addition, students are expected to be punctual and prepared for class and to conduct their experiments safely, efficiently and with consideration for others on their team and in the lab. Students are expected to plan effectively and complete all experimental work during assigned lab periods. Students are also expected to 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, proteins, etc., ensure proper disposal of waste and maintain a clean and tidy workspace.

**Lecture Deliverables:** Students will complete weekly literature assignments and be expected to participate in discussions. The first four weeks there will be a common paper for all students to read. For the first four lectures you will submit a typed short summary, a single question you would want to ask on this paper and the proper citation of this paper. We will discuss the paper as part of weekly lectures. Weeks 5-9 there will be literature assignments relevant to the group research project as well as the individual proposals. Each group will select a paper related to their research direction that they find interesting and useful. Each group member will write a summary and question at the end of their notebook with the citation of the paper. TAs will look for these literature assignments in a designated section when they grade the notebooks.

**Laboratory Notebooks:**
Notebooks must be maintained in a notebook in printed or pen an ongoing basis throughout the term and submitted at the end of the term per instructions. Teams are allowed to prepare components of the notebooks together but each student will hand in an individual notebook for an individual grade. Notebooks will be graded by the TAs according to the rubric posted on Canvas. Keeping and maintaining an accurate and complete laboratory notebook is an essential part of experimental science. The lab stations do not have space for all students to use laptops safely because of chemicals and biological materials. While you can prepare lab in a digital document we suggest using a physical lab notebook and not relying on using your laptop in lab.

*All notebooks must contain:*
- Number pages
- Clear, meaningful, scientifically detailed headings
- Purpose, prior to lab—also scientifically specific and detailed
- Dated experiments throughout the notebook
Syllabus: BB 494 Biochemistry Laboratory Molecular Techniques 2  
Winter 2022

Pre-lab (planning write-up), completed prior to lab
Procedures as carried out during the lab
Calculations clearly shown
Notes and observations made during the experiment
Data (including data collected by teammates)
Clearly presented and well-labeled results in the form of photos, figures, tables
Analysis and conclusions clearly stated
Quality of the results: The professors consider the ability to successfully execute, rather than just understand, experiments a key component of experimental science.

Remember, function trumps form. We are not looking for beautiful notebooks, but will be looking for well-organized notebooks that allow relevant information to be retrieved easily. Another scientist should be able to repeat the experiment based on your notebook. Neatness naturally helps in this endeavor. Refer to the Lab Notebook Grading Rubric posted on the course portal. Lab notebooks must be maintained regularly throughout the term. Notebooks rewritten at the end of the term to improve neatness or organization will not be graded.

Scientific Research Proposal:
One goal for this course will be for each student to write an individual research proposal on a protein of interest using GCE technology to address a specific biological question. The only protein you cannot use for your proposal is the protein you study in lab. The proposal will include significance with specific aims, innovation, approach, and preliminary data sections. This proposal will be built in stages moving toward the final draft. Details for what should be covered in each draft will be provided on Canvas.

Each student in the course is expected to write and submit their own drafts and final proposal. We understand that you are working in the laboratory in teams and your team members will be able to provide valuable feedback on your proposal. However, each student must understand what is going on in all aspects of the project and must write a proposal in their own words. Thus, we will allow the sharing of figures/graphs/gel photos as preliminary data among team members, but the written figure captions, significance, aims, approach, and innovation sections must be written by each student in their own words. If you have questions, please ask your instructor and TA.

Draft one: This will focus primarily on two sections: (1) significance: the introduction of your protein, rationale of your proposal, and what you hope to learn about your protein and (2) the experimental aims. Reference section with complete citations should be included. Due date is listed in Canvas.

Draft two: This will include all the information and revisions from draft one and in addition, approach, innovation and preliminary results with figures, captions, and references sections of the proposal. Due date is listed in Canvas.

Peer Review: Peer review of scientific manuscripts and grant proposals is standard for all scientists. This functions to maintain quality and clarity of all reviewed scientific work. This process also helps the reviewer learn how to present information clearly. Each student will be given proposals from two classmates to review and provide feedback. You will be given the proposals at the beginning of week 8 and return your feedback at the end of the week. You will be evaluated on how thoroughly you review the proposals.

Final Proposal: Due as an upload to Canvas. Due date will be listed in Canvas.

Research Presentation:
Week 10 will be dedicated to group presentations of research progress for the term. Each team will present their experimental work and lead a class discussion about how it will advance this discipline of science. Students must attend their schedule lab session both days in order to receive credit for their presentation unless an excused absence has been approved in advance.
Safety: Protective eye wear, lab coats, and gloves are required at all times when working with chemicals and equipment in the lab. The safe handling and proper disposal of toxic chemicals, biological waste, and broken glass in a biochemistry laboratory is required. Professors and TAs will answer questions regarding the location and methods of disposal. Safety or disposal violations will also lead to significant loss of points.

Absences: If, for some unavoidable reason, you need to be absent for a class period, it is your responsibility to speak to or email the instructor ahead of time and arrange with your lab partners to make up the work that you miss. Students who miss more than three laboratory sessions without obtaining prior special permission from the instructors will fail the class. We understand that graduate school interviews and possible job interviews are occurring in this time-frame. Please let us know well in advance so we can help you advance your research project. Travel back from winter break is not an excused absence—the term starts January 3rd. We will work to accommodate COVID-19 related absences by setting up zoom links for each lab section.

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 ad 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 494, 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.