Colorado State University - Department of Biochemistry
BC 404 Comprehensive Biochemistry Lab (BC-404-L02)
Fall Semester 2023

Instructor:	Marc Nishimura, Ph.D.
Office:	Biology 446
E-mail:	marc.nishimura@colostate.edu
Office Hours:	TBD and by appointment
Teaching Assistant:	Leah Dixon
E-mail:	leah.dixon@colostate.edu
Office Hours:	TBD

Schedule: 307 and 308 Yates, TR 9:00 – 11:50 AM

Textbook: Digital notebook via Benchling

Course goal:

Learning goal #1: *Students will be able to plan, execute, and problem solve common molecular biology and protein chemistry techniques that may include: PCR, agarose and polyacrylamide electrophoresis, bacterial transformation, vector and PCR restriction digestion, protein expression, protein purification, enzymatic characterization, and site-directed mutagenesis.*

Learning goal #2: *Students will understand the underpinning theory and experimental design for the experimental techniques listed above leading to the transfer of such knowledge in future research that the student may perform.*

Learning goal #3: *Students will demonstrate proficiency in working with a partner to plan and direct a "mini" research project.*

Learning goal #4: *Students will learn to carry-out "hypothesis-driven" research. From their project students will present data and argue for whether their data supports or refutes their hypothesis.*

Canvas: I will use Canvas to post all the protocols and procedures you will be using to successfully execute the biochemical technique. I also plan to use this site to post weekly quizzes and your current grade.

Textbook: In lieu of a paper notebook, we will be using Benchling as a solution for on-line lab notebooks. We will post more detailed Benchling instructions on Canvas.

Assessment: Your grade will be derived from a number of assessments some of which are wrapped up in your ability to perform the experiments and take clear notes.

1. ***Primer Design- 10 points***
    a. In order to mutate LDHa you will need to design PCR primers for site-directed mutagenesis. This will be done in class and your design will be handed in and graded.
2. ***Weekly quizzes - 90 points (15 x 6)***
    a. Weekly quizzes/exercises are designed to test your (1) preparation for the upcoming week's labs, and (2) understanding of theory for particular techniques, your skill in working with data, exercises using Benchling or other software.
3. ***Notebooks- 60 points***
    a. 30 of these points will be given for you final online Benchling notebook at the end of the semester. Points will be given for:
        i. Whether it is complete or not including, written objectives, methods ("a diagram of the setup with sufficient detail for reproducibility"), results (data including graphs, gel images, etc.), and conclusions for each day in lab.
        ii. Legibility and organization.
        iii. Accuracy of calculations.
        iv. Line of reasoning for your conclusions based on results.
        v. Dates consistent with the course layout. In other words, it was being completed as you worked, not at the end of the semester.
    b. 30 of these points will be given in at least two online Benchling notebook checks. KEEP THEM UPDATED and you won't lose points. The following criteria will be assessed:
        i. 3 points for written objectives of all the labs from the last check up to the current lab (that day).
        ii. 3 points for written methods of all the labs from the last check up to the current lab (that day).
        iii. 3 points for written results of all the labs from the last check up to the last lab fully executed.
        iv. 3 points for written conclusion of all the labs from the last check up to the last lab fully executed.
        v. 3 points for legibility and organization.
4. ***Oral Report – 50 points***
    a. At the end of the semester each group will present the results of their research in a short 10-minute (max) presentation. Details on the aspects of the report will be given later in the semester.
5. ***Lab participation – 20 points***

a. Attendance is necessary to ensure that your project progresses on schedule. **If you are unable to attend due to an excused absence or health-related concerns you need to email Professor Nishimura before missing class.** You should also contact your lab partner.
b. Lab participation includes an assessment of your effort and ability to organize your reagents, samples, and data. Research involves mistakes and failures, your participation score is not based on the "success" of your experiments, but on your engagement with the process of science.

To be Successful: Here are some ways to be successful:

1. Come prepared knowing what you are going to do.
    a. Read the student protocol in advance.
    b. LISTEN at the beginning of class for changes and additional instructions. Your project may require unpredictable troubleshooting or schedule changes.

2. Be careful in the way you proceed, do not rush through experiments.

3. Carefully label your reagents and your samples. Make sure you know where you have stored them.
    a. Never throw away something unless you are sure you don't need it.
    b. It is best practice in molecular biology to hold onto samples until you have verified that you experiment has succeeded.
    c. Each student protocol should tell you what to keep and what to throw away upon the completion of the lab, ask if unclear.

4. Talk to your fellow classmates about things you are confused about.

5. Ask questions about anything you are confused about! No matter what happens we are here to help you succeed in the lab. It's very important to us that you understand the theory and practice behind your project.

Grades: The following is a complete breakdown of point accumulation:

Assignment	Points	
Primer Design	10	
Quizzes	90	(6 x 15 points)
Notebooks	60	
Reports	50	
Lab participation	20	
Total	230	

Grade	Percentage
A+	97 - 100%
A	93 - < 97%
A-	90 - < 93%
B+	87 - < 90%
B	83 - < 87%
B-	80 - < 83%
C+	77 - < 80%
C	70 - < 77%
D	60 - < 70%
F	below 60%

Attendance: Attendance is mandatory for each experiment and the lectures. You must perform the experiments with your partner or you will start to lose points. There are obvious exceptions to this rule like a death in the family, extreme illness or a University excused absence. If you need to miss a class talk to me and we can talk about whether it is a valid reason and how we can arrange to make it right. In the case of an emergency deal with it first and then come see me.

Lab Safety: Some general policies regarding lab safety:

1) No open toed shoes (shorts are fine). ***clothing and PPE rules are typically in flux at CSU, if there are changes we will discuss in lecture.
2) No "horse-play" in the lab.
3) No eating or drinking in the lab.
4) Place Backpacks on racks.

Academic Integrity: This course will adhere to the Academic Integrity Policy found in the Colorado State University General Catalog.

End of the Semester: ***I WILL NOT NEGOTIATE GRADES AT THE END OF THE SEMESTER.*** It is my expectation that you will accept the grade assigned to you and take responsibility for YOUR work throughout the semester. Grade negotiation always leads to someone receiving special treatment and is a policy that I cannot abide as I desire to maintain an atmosphere of academic honesty and integrity. If you are concerned about your grade please come and talk to me ***DURING*** the semester when something ***can be done*** about it.

The Class Schedule: Below is a class schedule detailing each day and the experiment we will be running on that particular day. BC404 is an "authentic research experience" some weeks will require short visits to the lab outside of T/Th hours. We will work with you to get this done.

BC404-FA23 Daily Schedule – **Subject to change, research is unpredictable**	
Date	**Experiment/Schedule**
Day One - 8/24	**Lab Check-in, Introduction**
Day Two - 8/24	**Pymol and Primer Design**
Day Three – 8/29 (Monday Quiz 1)	**PCR Experiment and Pouring an Agarose gel**
Day Four – 8/31	**Agarose Gel and Transformation**
Day Five – 9/5 (Monday Quiz 2)	**Plasmid Isolation and DNA sequencing**
Day Six - 9/7	**Sequence analysis and BL21 transformation**
Day Seven – 9/12 (Monday Quiz 3)	**Start of Protein Expression**
Day Eight - 9/14	**BL21 Expression Harvest**
Day Nine - 9/19 (Monday Quiz 4)	**Introduction to Chromatography**
Day Ten - 9/21	**Enzyme Kinetics Theory**

Day Eleven – 9/26 (Monday Quiz 5)	**Protein Purification**
Day Twelve – 9/28	**Enzyme Kinetics**
Day Thirteen - 10/3 (Monday Quiz 6)	**Enzyme Kinetics – LDH control**
Day Fourteen - 10/5	**Protein Quantitation & SDS-PAGE**
Day Fifteen - 10/10	**Lab Group presentations**
Day Sixteen – 10/12	**Clean up and Check out**