

**BC 404 Comprehensive Biochemistry Lab (BC-404-L01)**  
**Colorado State University Department of Biochemistry**  
Fall Semester 2023

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Schedule: 307 and 308 Yates, TR 2:00 – 4:50 PM

Textbook: None: You must keep an electronic notebook on Benchling. We will post more detailed Benchling instructions on Canvas.

Course format: Students will be randomly assigned lab partners and it is expected that you each perform the protocol(s). Most days will start with a short lecture unless I tell you to start directly in the lab. Typically, I will give tips about that day's experiments, and I will also lecture about what we will be doing the following week, so take notes. You will then need to finish a Canvas Quiz regarding that material before the following Monday night (I will try to get the quizzes out on Tuesday and no later than Thursday). Each day, students must familiarize themselves with the day's protocols before starting lab. The labs are a series of steps that each depend on the last, so a mistake can be a pain to recover from. So, please come in with a plan.

Course vibe: Mostly chill. This stuff is fun! Take it seriously and you will do fine.

Course goal: **Learning goal #1:** *Students will be able to plan, execute, and problem solve common molecular biology and protein chemistry techniques including: 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 post all the protocols and procedures you will need to read before coming to lab. I also post weekly quizzes. **Note:** this lab can be hectic, requiring last minute announcements, changes, and accommodations. Make sure your Canvas notifications are on for announcements!
- Textbook: In lieu of a paper notebook, we will be using Benchling for electronic notebooks.
- Assessment: Your grade will be derived from a number of places some of which is wrapped up in your ability to perform the experiments.

**1. Hypothesis-15 points**

- a. You will design a mutation in the LDH enzyme. You will work with your partner to develop a structure-based hypothesis on how this mutation will affect the enzyme. The rest of the lab relies on this, so make it count!

**2. Primer Design- 15 points**

- a. In order to mutate LDH you will need to design a point mutagenesis primer. This will be done in class and your design will be graded.

**3. Weekly quizzes - 90 points (15 x 6)**

- a. Weekly quizzes are designed to test your (1) preparation for the upcoming week's labs, and (2) knowledge of theory for particular techniques as well as your skill in working with data. Consider these as a prerequisite to each lab.

**4. Notebooks- 60 points**

- a. 30 of these points will be given for your 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 when the notebooks are collected.
  - 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 comprehensiveness and organization.

**5. Oral Report – 40 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 – 30 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 me before missing class.** You should also contact your lab partner.
- b. Poor effort resulting in “lousy” data or slow progress will result in points being lost.
- c. Poor organization resulting in loss of samples will result in points being lost.

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

1. Come prepared knowing exactly what you are going to do.
  - a. Read the protocol in advance.
  - b. Attend the lectures and ask questions to understand what will happen in each class.
  - c. Listen at the beginning of class for changes and additional instructions.
2. Be careful in the way you proceed, do not rush through experiments.
  - a. Rushed science is usually bad science.
3. Carefully label your reagents and your products. Make sure you know where you have stored them.
  - a. Never throw away something unless you are sure you don't need it. Each lab procedure will tell you what to keep and what to throw away upon the completion of the lab.
4. Talk to your fellow classmates about things you are confused about.

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

<u>Assignment</u>	<u>Points</u>
Hypothesis	15
Primer Design	15
Quizzes	90 (6 x 15 points)
Notebooks	60
Reports	40
<u>Lab participation</u>	<u>30</u>
<b>Total</b>	<b>250</b>

<u>Grade</u>	<u>Percentage</u>
A+	97 - 100%
A	93 - < 97%
A-	90 - < 93%
B+	87 - < 90%
B	83 - < 87%
B-	80 - < 83%
C+	77 - < 80%
C	73 - < 77%
C-	70 - < 73%
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 or a tragedy 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).
- 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](#).

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**

Date	Experiment/Schedule
<b>Week 1</b> – Tues 8/22	Lab Check-in, Introduction
Thurs 8/24	Hypothesis, Pymol, and Primer Design
<b>Week 2</b> – Tues 8/29 (Monday Quiz 1)	PCR Experiment and Pouring an Agarose gel
Thurs 8/31	Agarose Gel and Transformation
<b>Week 3</b> – Tues 9/5 (Monday Quiz 2)	Plasmid Isolation and DNA sequencing
Thurs 9/7	Sequence analysis and BL21 transformation
<b>Week 4</b> – Tues 9/12 (Monday Quiz 3)	Start of Protein Expression
Thurs 9/14	BL21 Expression Harvest
<b>Week 5</b> – Tues 9/19 (Monday Quiz 4)	Introduction to Chromatography
Thurs 9/21	Protein Purification
<b>Week 6</b> – Tues 9/26 (Monday Quiz 5)	Enzyme Kinetics Theory
Thurs 9/28	Enzyme Kinetics
<b>Week 7</b> – Tues 10/3 (Monday Quiz 6)	Enzyme Kinetics – LDH control
Thurs 10/5	Protein Quantitation & SDS-PAGE
<b>Week 8</b> – Tues 10/10	Lab Group presentation