TEXAS A&M UNIVERSITY
SAN ANTONIO

College of Natural Sciences

Biochemistry Laboratory - CHEM 4141-01L

Syllabus Instructor: Sambuddha Banerjee

Email: sbanerjee@tamusa.edu

Office: SCI 311Y

Class Hours: Wed 11.00 am

Class Location: CAB-307

Office Hours: T, R 9 am-12 pm (by appointment only)

Course Description:

This course covers experiments designed to reinforce topics covered in the lecture. Topics include column purification, polymerase chain reaction, gel electrophoresis analysis, and enzyme activity.

Prerequisites: CHEM 2325 with a C or better.

Corequisites: CHEM 4341. TSI Restriction(s): Reading, Writing, and Math

Course Materials:

Laboratory protocols:

Protocols will be posted on blackboard before each lab session. All data should be collected with BLUE or BLACK PEN. Refer to attached schedule for the sequential list of labs.

Laboratory notebook:

Data/information should be recorded in such a way that it can be understood by a third party without you being present. You will need a laboratory notebook (hard bound) for this class. Recording data/information on spiral bound

notebooks/lose papers/electronic devices is not allowed. You should write directly (with a pen) in this notebook during class hours, recording all information. If you make a mistake while writing, just put a line through the wrong statement and rewrite. Do not write over/use white ink to erase any information.

Data sharing/storage: You might use computer programs (like Microsoft Excel) for data analysis. Any electronic data must be shared with your instructor and should be available for use after the course is completed. Use OneDrive (you have access to this cloud space using your university email) for electronic data storage and sharing.

Scientific calculator: You would require a scientific calculator for this course. It does not need to be a graphing calculator.

Proper Clothing for lab: A) Closed-toe shoes that cover your foot in its entirety. B) The following list is not appropriate lab attire: shorts, skirts, mid-riff shirts. tank tops. ¾ length pants. pants with large holes. C) Lab coats D) Approved safety googles THIS POLICY WILL BE STRICTLY ENFORCED AND STUDENT IN NONCOMPLIANCE WILL BE DISMISSED FROM THE LABORATORY AND WILL RECEIVE NO CREDIT FOR THAT WEEK'S EXPERIMENT. We take YOUR safety in the laboratory very seriously and we expect the same from you. Goggles and laboratory coats are ALWAYS worn properly in the laboratory. Your instructor may change goggle/lab coat wear depending on the laboratory activity.

AI use policy: Use of Generative AI Permitted Under Some Circumstances or With Explicit Permission

There are situations and contexts within this course where you may be asked to use artificial intelligence (AI) tools to explore how they can be used. Outside of those circumstances, you should not use AI tools to generate content (text, video, audio, images) that will end up in any student work (assignments, activities, discussion responses, etc.) that is part of your evaluation in this course. Any student work submitted using AI tools should clearly indicate with attribution what work is the student's work and

what part is generated by the AI. In such cases, no more than 25% of the student work should be generated by AI. If any part of this is confusing or uncertain, students should reach out to their instructor for clarification before submitting work for grading. Use of AI-generated content without the instructor's permission and/or proper attribution in this course qualifies as academic dishonesty and violates Texas A&M-San Antonio's standards of academic integrity.

CURE Laboratory

This laboratory course is taught as a CURE (Course-based Undergraduate Research Experience) class. Course-based Undergraduate Research Experience (CURE) labs give students the opportunity to participate in authentic scientific research as part of a regular course. Unlike traditional labs with predetermined outcomes, CURE labs engage students in investigating real questions, analyzing original data, and contributing to discoveries that may be relevant beyond the classroom. Key features include collaboration, hands-on problem solving, iterative experimentation, and communication of findings. Research has shown that CURE labs can increase student engagement, confidence, scientific skills, and sense of belonging in STEM, while providing valuable research experience to a broader range of students than traditional apprenticeship-based research opportunities.

This CURE lab will investigate the **ligand binding specificity and affinity of a siderophore to its cognate periplasmic binding protein (PBP)**. Students in this class will learn recombinant protein purification, quality control/purity check, and ligand binding assays under different experimental conditions.

Learning Objectives & CURE Lab Student Expectations

Outcome 1: *Develop a good functional understanding of biological molecules using computational analysis and computational resources.*

- Come to class prepared and ready to participate actively.
- Read and utilize scientific literature to support research activities.

- Contribute ideas, ask questions, and engage in scientific discussions.
- Use computational tools and databases to analyze biological molecules and interpret research data.

Outcome 2: *Learn basic biochemical laboratory skills deemed important to biochemical research and industry.*

- Follow all laboratory safety rules and procedures.
- Maintain an accurate and organized laboratory notebook.
- Collect, analyze, and record data honestly and carefully.
- Understand that unexpected or negative results are a normal part of research.
- Demonstrate professionalism, integrity, and accountability at all times.

Outcome 3: *Communicate and question scientific information through working in teams and giving presentations.*

- Work collaboratively and respectfully with classmates.
- Contribute ideas, ask questions, and engage in scientific discussions.
- Communicate research findings effectively through written and oral presentations.
- Meet deadlines and complete assigned tasks responsibly.

Outcome 4: *Compose a full laboratory report that includes introduction, methods, results, and conclusion sections.*

- Maintain an accurate and organized laboratory notebook.
- Communicate research findings effectively through written and oral presentations.
- Prepare a scientific laboratory report that includes Introduction, Methods, Results, and Conclusion sections.

TEXAS A&M UNIVERSITY
SAN ANTONIO

Assignments:

This laboratory course has five major assignments, team communication plan; literature review + AI journaling; hypotheses + experimental plans; final presentation; and laboratory notebook recording. Some of these assignments are individual and the rest are group assignments (see below). Instructions for writing these assignments will be provided closer to the submission date.

In addition to these assignments, there will be several pop-quizzes (administered during the lab class) throughout the semester to assess your engagement and preparedness for the laboratory class. Pop-quizzes will be evaluated based on engagement and scientific reasoning, rather than correctness of the final answer.

Late work: You will be given 3 "grace" days for one assignment (except the lab notebook assignment). That is, throughout the whole semester you can turn your work a total of 3 days late for one of these assignments without any penalty. After these 3 grace days are gone, late work will be reduced by 33% per day.

Lab Notebooks: All laboratory records and write-ups must be in ink in a bound laboratory notebook. Leave the first two pages blank as a place for the Table of Contents. Begin the write-up for each new experiment on a new page. The outline for the notebook record follows. Although experiments will be performed in teams, each student must record data and maintain their own lab notebook and submit it periodically for evaluation. Writing research information/experimental data on lose sheets/on iPad or other electronic devices is not allowed.

Office hours:

Attending office hours is required for this laboratory course. Each research team must meet with the instructor at least twice for office hour meetings during the entire semester. If the assigned office hours do not work out for a team, they must talk with the instructor to determine an alternative time. Not attending office hour meetings can negatively affect a team's ability to engage with the project.

TEXAS A&M UNIVERSITY SAN ANTONIO

Grading:

Final Lab Presentation	100	Team assignment
Team communication plan	100	Team assignment
Lab Notebook	100	Individual assignment
Hypotheses + Experimental Design	100	Team assignment
Literature Review + AI journaling	100	Individual assignment
Lab work	100	Individual assignment
Pop-quizzes	100	Individual assignment
Total:	700	

Your grade: $(\frac{Your\ total\ earned\ points}{700})$x 100

A: 90.00 - 100%

B: 80.00 - 89.99%

C: 70.00 - 79.99%

D: 60.00 - 69.99%

F: 0 - 59.99%

Representative research articles relevant to this research project:

The following are some research materials that students in this CURE lab are required to read to be able to understand the project + write hypotheses + experimental plans. If the article is not available in the TAMUSA digital library, students will learn how to use the Interlibrary Loan system to obtain materials. Students must identify other relevant materials relating to this project.

1. Siderophore uptake in bacteria and the battle for iron with the host.

2. Bacterial siderophores: diversity, uptake pathways and applications
3. Investigating the Role of the Periplasmic Binding Protein, FatB, in the Binding Interaction of Fe(III)-Siderophore Complexes in *Brucella* spp.

Tentative pacing

Aug. 26th	Introduction, Safety training, Introduction to CURE lab, Team communication plan
Sep. 2nd	Introduction to Research Topic
Sep. 9th	Use of library and AI resources for literature review and hypothesis building
Sep. 16th	Bioinformatics
Sep. 23rd	Research group meeting-Theories behind experiments, Buffer lab
Sep. 30th	Affinity Column Chromatography + Digestion of His tag
Oct. 7th	Affinity Column Chromatography + SDS PAGE
Oct. 14th	Protein + apo-siderophore binding study
Oct. 21st	Protein + Inorganic Fe3+ binding study
Oct. 28th	Protein + Fe3+-siderophore binding study
Nov. 4th	Additional experiments + Data analysis
Nov. 11th	Additional experiments + Data analysis
Nov. 18th	Draft presentation preparation
Nov. 25th	No lab
Dec. 2nd	Final presentations

The above schedule is tentative and can change based on the progress of the project

TEXAS A&M UNIVERSITY
SAN ANTONIO

Online assignment due dates

Sep. 2nd	Team communication plan
Sep. 23rd	Literature review + AI journaling
Sep. 30th	Hypothesis + experimental plan