Instructor: Erica Jacobs, Ph.D. (ejacobs16@fordham.edu)
TA: Holiwell Sumakmur (hsumakmur@fordham.edu)
Lab Meeting Time: Mon. 1:00-5:55 pm
Classroom: Lowenstein 816
Office Hours: by appointment
(I can be reached via e-mail for assistance or to arrange an appointment usually within 24 hours.)

Course Prerequisites

- You should be familiar with major concepts in biology (ex. mechanisms of inheritance)
- You should be familiar with major concepts in chemistry (ex. molarity)
- You should have basic algebra/numerical analysis skills, strength in writing and reasoning, and an open but critical mind.

Course Goals: To learn biochemistry by doing it

- To become familiar with techniques including:
  - Protein purification
  - Protein characterization
  - Enzymatic analysis
- To forge connections between basic biochemical concepts and lab and research applications upon which they are based.
- To practice quantitative skills, develop writing abilities, and strengthen competence in data analysis.

Undergraduate Research Experience

- We will develop a set of tools to address fundamental questions relevant to human health.
- We will purify and characterize proteins that are vaccine candidates.
- These experiments have never been done before!
- Success is not assured, but the potential rewards are great:
  - You will be acknowledged in any publications resulting from your work.
  - You can use your experiences in this lab to distinguish yourself to future employers or graduate/professional programs.
  - Students who excel may request a letter of recommendation.
Course Policies

- Please call me either Dr. Jacobs or Professor Jacobs.
- **Lab meets Mondays from 1:00-5:55. Students are expected to attend all labs.**
  - If there is a conflict (religious holiday or a university-sponsored event) that will prevent your attendance, please bring it to my attention **at least two weeks** before the date.
  - Unforeseen absences (personal illness or a death in the family) require an excuse from your class dean.
  - For conflicts reported at least two weeks in advance and approved by me, or unforeseen absences excused by the dean, alternate assignments may be provided; however, for logistical reasons **labs cannot be made up.**
- You are expected to be on time to lab. Tardiness disrupts the class, and reduces time available for experiments. All lab partners are expected to work for the entire lab period, unless you complete your experiment early.
- Cell phones, laptops, ipads, etc. are not permitted **unless used for a lab activity.**
- **Eating or drinking in lab is a potential health hazard, and is not permitted.** Food and drink (including water bottles) may not be brought into lab, and if any are visible, you will be asked to remove them.
- You are expected to be dressed safely and appropriately for lab, and to use safety equipment as indicated. **Sandals or other open-toed shoes and shorts are not allowed.**
- Late work is not accepted without approval in advance. Contact me to ask if an extension is possible if you have difficulty submitting an assignment on time.
- Students will work in groups for lab activities. Group work will constitute a significant part of your lab grade. I may reassign lab partners at any time.
- Quizzes can occur at any time, they may be announced or unannounced.
- Students are encouraged to collaborate, but plagiarism from fellow students or any other source (like unattributed copying and pasting from the textbook or from the internet) will result in a failing grade on the assignment or exam and will be reported to the Academic Integrity Committee, as will any other form of violation of the Fordham standards for academic integrity ([https://www.fordham.edu/info/25380/undergraduate_academic_integrity_policy](https://www.fordham.edu/info/25380/undergraduate_academic_integrity_policy))
  - When in doubt, cite: your textbook, lab protocol, lab partner, instructor’s slides, web page, or whatever source you got your information from.

Note: Under the Americans with Disabilities Act and Section 504 of the Vocational Rehabilitation Act of 1973, all students, with or without disabilities, are entitled to equal access to the programs and activities of Fordham University. If you believe that you have a disabling condition that may interfere with your ability to participate in the activities, coursework, or assessment of the object of this course, you may be entitled to accommodations. Please schedule an appointment to speak with someone at the Office of Disability Services (at Lincoln Center – Room 207, x6282).

Also: Research suggests that gender is not a simple binary to be determined by the appearance of the genitals at birth. The Department of Natural Sciences affirms as part of our mission that we value and accord respect to all of our students. Therefore, as a matter of policy, we call students by their preferred names and preferred pronouns. Please let me know your preferred name and preferred pronouns in person or over email.
Course Learning Objectives

You will learn to:

1. Formulate solutions used for basic biochemical techniques.
2. Use micropipettors to accurately uptake and deliver small volumes of liquids.
3. Execute common lab procedures used for the isolation, purification, modification and examination of proteins cooperatively, correctly, safely, and efficiently.
4. Record information in lab notebook format such that work can be readily followed, assessed, and replicated.
5. Successfully purify proteins.
6. Analyze protein sequences to predict structural and other parameters.
7. Explain the roles of individual reagents/steps in lab protocols.
8. Troubleshoot procedures and experiments that do not yield expected results.
9. Evaluate data from gel images and other sources.
10. Pinpoint plausible sources of variability/error and pose alternative interpretations of data.

Grading

Students will be evaluated on the following:

1. Quizzes/Assignments (20%)
2. Attendance/Safety/Group Function (20%)
3. Lab Notebook and Lab Reports (60%)
   - Lab notebook prelabs will be due Saturdays by 5:00 pm so that the TA has time to grade them.
   - Full lab notebooks will be due by 5:00 pm on Tuesdays after lab.

Materials

- blue or black Sharpie marker (fine or extra fine), pen, pencil
- assignments completed in lab may be handwritten—please make it legible!—but other assignments must be typed.
- account on Benchling (electronic lab notebook platform)
- a computer with Microsoft Office or equivalent software, and internet access.
  *note that some videos/assignments do not work with smart phones or tablets.
**Questions**

- How do you make a 25 mM solution of MgCl$_2$?
- When do you use w/w versus w/v?
- How do you analyze protein sequences?
- How do you produce and purify proteins?
- How can you efficiently plan your time in lab?
- How do you analyze proteins?
- How can you adapt pre-existing protocols?
- What can you do when it doesn’t work?

**Skills**

- Writing
- Data Analysis
- Communication and Discussion
- Common Lab Procedures

**Content**

- Molecular biology
- Cell biology
- Biochemistry
- Lab safety
### Provisional Course Outline

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<th>Topic</th>
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<td>Sept. 4</td>
<td>Lab 1, Introduction, lab safety, micropipetting</td>
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<td>Sept. 9</td>
<td>Lab 2, Protein purification and buffer exchange</td>
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<td>Sept. 16</td>
<td>Lab 3, Protein quantitation (BCA assay), PAGE</td>
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<td>Sept. 23</td>
<td>Lab 4, Enzymatic deglycosylation analysis</td>
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<td>Sept. 30</td>
<td>Lab 5, Protein bioinformatics tools</td>
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<td>Oct. 7</td>
<td>Lab 6, Domain analysis by partial proteolysis</td>
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<td>Oct. 14</td>
<td>no lab, Draft of first lab report due</td>
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<td>Oct. 21</td>
<td>Lab 7, First lab report due, O-linked glycosylation analysis</td>
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<td>Oct. 28</td>
<td>Lab 8, Lectin affinity purification</td>
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<td>Nov. 4</td>
<td>Lab 9, Crosslinking analysis</td>
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<td>Lab 10, Disulfide bond analysis</td>
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<td>Nov. 18</td>
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<td>Lab 12, Protein solubility analysis</td>
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<td>Dec. 2</td>
<td>Lab 13, Draft of final lab report due, Homology modeling</td>
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<td>Dec. 9</td>
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