

Biol 390: Molecular Techniques, spring, 2022

Instructor and Office Hours:

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M (12 - 1:30 pm, zoom or drop-in)

<https://geneseo.zoom.us/j/89269929715?pwd=WTBOY0xTbXZpZGRuWDVEVjQ1L1liQT09>

Meeting ID: 892 6992 9715

Passcode: 747549

F (10:00- 11:30 am, zoom)

<https://geneseo.zoom.us/j/86078095694?pwd=dmhpZ2NBMkREZTNXbnczdWptVjUrdz09>

Meeting ID: 860 7809 5694

Passcode: 692910

Or e-mail for appointments

Learning Outcomes:

You might have learned various molecular techniques from related courses previously. To deepen your understanding of the subject, this lab will provide you with hands-on experience on molecular techniques commonly used in research. Three major learning outcomes are:

To learn and practice commonly used molecular techniques in research

Each laboratory consists of a pre-laboratory lecture and discussion followed by a three-hour wet lab. In addition to developing skills in working with chemicals i.e. making solutions and dilutions, you will complete four lab units dealing with DNA, RNA, and protein. *For protein*, you will perform a Bradford assay, SDS-PAGE, Western blot, and immunodetection. *For RNA*, you will practice techniques on total RNA isolation and quantification, reverse transcription, and real-time PCR. *For DNA*, you will learn techniques in genomic DNA isolation and quantification, degenerate PCR cloning, agarose gel electrophoresis, restriction mapping, web-based sequence analysis of cloned DNA, and associated techniques on microbial culture. Your understanding of the background information and the efforts you put into the course are as important as the experimental results obtained. *After completing this course, you should know each topic covered, be able to carry out the associated techniques independently, and apply them to similar experiments.*

To gain skills in collecting, analyzing, interpreting, and communicating experimental results with others.

You are required to keep an electronic version WELL-WRITTEN weekly lab notebook that includes all the information and data of each lab. To communicate the results with others, you will use the content to write up three lab reports following the format of primary scientific research papers.

To be able to work as a team

Most if not all biological studies, particularly in the field of molecular biology, are done through teamwork. In this lab, you will work as a group of two. The joint effort between you and your partner is required for the successful completion of each lab.

Grading:

Three Tests	30%
Weekly Individual Lab Note	15%
In-class Group Assignment and Homework	20%
Three Group Lab Reports	30%
Participation/Performance	5%

Your grade is based on the scale listed below.

A (100 - 93%)	A ⁻ (92 - 90%)	B ⁺ (89 - 87%)	B (86 - 83%)	B ⁻ (82.9 - 80%)
C ⁺ (79 -77%)	C (76 -73%)	C ⁻ (72 -70%)	D (69 - 60%)	

Three Tests

Each lab unit includes several exercises extending over multiple weeks with each exercise building on the foundation established in the previous week(s). Before coming to the lab, you need to review what you learned from the previous week and read the materials for the week. At the end of each lab unit, there will be a test on the content of the unit.

Weekly Lab Note (LN)¹

Each student should write up a weekly lab note with detailed information about the week's lab immediately after completion. Five of the weekly lab notes will be collected at the BEGINNING of the following weeks' labs (See the due date on the next page). Since the information can be used to write up lab reports later, keeping up well-written weekly lab notes should be an ongoing activity throughout the semester. For each weekly lab note, you need to START with a NEW word document in a PROPER ORDER as follows:

1. DATE, TITLE, NAME, and LAB PARTNER on the FIRST page if not every page.
2. PURPOSE/OBJECTIVES including overall and specific objectives
3. RESULTS:
 - a. Record the RAW DATA, and organize/convert them into TABLES with TITLES at the TOP and/or FIGURES with proper LABELS and FIGURE LEGENDS at the BOTTOM/ on ONE SIDE. You need to incorporate both RAW DATA and organized TABLES and FIGURES into the lab notebook.
 - b. Show all your CALCULATIONS which can be handwritten.
 - c. Briefly describe what you did when you record OBSERVATIONS. You may also record the step number of the procedure followed by your observation.
4. INTERPRETATION and DISCUSSION
You should interpret and/or discuss but NOT repeat your results. For example, what do they mean? Do you get the expected results? Why? Why not? *etc.*

In-class Group Assignment (GA) and Homework (H)¹

In-class group assignments and homework are to help you better understand the lab and its applications. GA is due at the END of the lab period. H is due at the BEGINNING of the following lab.

Three Group Laboratory Reports (LR)²

The reports should be written in the format of PRIMARY scientific research papers, which should include TITLE, ABSTRACT, INTRODUCTION, RESULTS, DISCUSSION, and REFERENCES. After completing each unit, the report is due at the **BEGINNING** of the following lab.

Participation/Lab Performance

Although we meet for regularly scheduled laboratory periods, some labs will be started the night before, finished the following day, or run over the allotted time (usually not). Thus, at least one group member needs to be present to complete the experiment if the other cannot. To reduce your stress level, you probably should NOT have another class, meeting, or work scheduled immediately after the lab.

¹No late weekly lab note or homework is allowed unless for legitimate reasons. "Too busy" is NOT legitimate.

²Online submission. There will be a 10% penalty per day for late reports.

All submissions need to be in hard copies unless specified.

Course Materials and Supplies:

A 3-ring binder, a Sharpie fine point permanent marker, and a lab coat are required. Lab protocols will be posted in Canvas. On Sunday or Monday each week, you should PRINT, READ and PLACE protocol in a 3- ring binder before bringing them to the lab. Doing so will help you understand the pre-lab lecture. Searching to follow protocols in your electronic devices while carrying out the steps often results in experimental errors. It is also a good practice to **make a physical mark** as you complete each step in a multi-step procedure. The PowerPoint prelab lecture will be posted right after the lab.

Lab policy (attendance requirement) and Your Health:

We will meet once a week for a total of fourteen in-person labs, ten wet labs plus one for sequence analysis, and three for data analyses, discussions, and quizzes. **Attendance is mandatory.** If you anticipate missing a lab, please let me know as early as possible. While absences with legitimate reasons are allowed, you can't miss more than two labs during the semester because you would fall behind too much and should consider withdrawing.

The changes caused by COVID-19 have affected all of us in various ways and will continue, maybe to different degrees. Your health and wellbeing are critical to your ability to learn. The learning environment is different from that of the pre-pandemic era and the indicators showing you something wrong may not be as obvious to you or those around you. However, it's never too late to ask for help. If you are feeling unwell (physically or mentally) and it affects your ability to complete your coursework, please reach out. Similarly, the pandemic affects faculty as well and creates demands that would not be present in an ordinary semester. If I am late to post materials in Canvas, please send me an e-mail to request them. I would appreciate your reminder.

Accommodations:

SUNY Geneseo will make reasonable accommodations for persons with documented physical, emotional, or learning disabilities. Students should consult with the Office of Disability Services (Erwin 22, Email: access@geneseo.edu, Phone: 585-245-5112) and individual faculty regarding any needed accommodations as early as possible in the semester.

Academic Policies of the Biology Department-ACADEMIC DISHONESTY:

You should be aware of and obey the College policies concerning academic dishonesty. Any alleged cheating and/or plagiarism may be dealt with by the school as a disciplinary problem in accord with College policies as stated in the Bulletin. Be especially aware that **academic dishonesty** includes *putting your name on a group project that you did not contribute to* and *turning in lab reports where the material is copied from reports from previous semesters' classes*. *Group partner beware-if your name is on a project you need to be sure that the work is authentic and properly referenced; you are responsible if one member of the group has plagiarized material.* The faculty of the college will take all necessary steps to deter academic dishonesty, all cases of which will be reported to the Dean of the School for possible disposition as a College disciplinary matter.

Tentative Schedule:

DATE	LAB EXERCISE	MATERIAL DUE
	<i>Unit 1 Exploring the Sensitivity and Specificity of Western blot</i>	
2/1	1-1 Bradford Assay; Preparation of Protein Samples for SDS-PAGE	In-class GA 1
2/8	1-2 Protein Separation by SDS-PAGE; Western Blotting	
2/15	1-3 Immunodetection of anti-BSA on Western Blot	LN 1-2, H 1-2
2/22	1-4 Data Analysis and Discussion; Quiz 1: Unit 1	H 1-3
	<i>Unit 2 Studying Gene Expressions by RT-qPCR</i>	
3/1	2-1 Total RNA Isolation and quantification	LR: Unit 1
3/8	2-2 Reverse Transcription; Realtime PCR	LN 2-1, H 2-1
3/15	<i>Spring Break</i>	
3/22	2-3 Data Analysis and Discussion; Preview on Unit 3; Quiz 2: Unit 2	H 2-2
	<i>Unit 3 Cloning Genomic NBS-containing Sequences by Degenerate PCR</i>	
3/29	3-1 Genomic DNA Isolation; Degenerate PCR	LR: Unit 2
4/5	3-2 Agarose Gel Electrophoresis; Degenerate PCR Primer Design	LN 3-1, H 3-1
4/12	3-3 DNA Ligation and Bacterial Transformation (<i>Take care of plates next day</i>)	LN 3-2, H 3-2
4/19	3-4 Streak bacterial Colonies; Data Analysis and Discussion; Quiz 3: Unit 3 <i>(Take care of plate next day)</i>	H 3-3
	<i>Unit 4 Analyzing Cloned Recombinant Plasmid DNA</i>	
4/26	4-1 Plasmid DNA Isolation; Restriction Enzyme Digests <i>(Start bacterial culture the night before)</i>	LR: Unit 3
5/3	4-2 Agarose Gel Electrophoresis; Restriction mapping	LN 4 -1, H 4-1 In-class GA 2
5/10	4-3 Web-based Sequence Analysis (<i>Laptop is required</i>)	In-class GA 3

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