Syllabus for Bio 539/739:

Laboratory Techniques in Molecular Biology Fall 2021

Course Info:

Course title: Laboratory Techniques in Molecular Biology
Course number: BIO 539 (undergraduate students) or BIO 739 (graduate students)
Sections: All students must register for LEC (Tues 9:30-10:20am), LAB (T/Th 10:30 am-1:20pm), and DIS (9:30-10:20am Th)

Meeting time: Tues and Thurs 9:30am – 1:20pm Meeting location: LAP466
Mode of course delivery: Face-to-face

Instructors:

Dr. Madhusudan Dey (Madhu)
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Office hours: Tuesday 1-2 or by appointment E-mail: deym@uwm.edu

TA:
Kimberly Ann Mayer
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Office hours: on Wednesdays from 12-2 pm on Collaborate Ultra or by appointment

Course Description: The course is designed around the lab. The lectures in the course will involve the how and why of various techniques, while the lab will concentrate on the actual details of the procedures. other procedural information will be made available as we need it. The lab manual for the course is also available online and in **Molecular Cloning: A Laboratory Manual** (Fourth Edition): Three-volume set (ISBN-10: 1936113422).

There will be reading assignments from the manual, as well as the occasional handout. The handouts are generally laboratory protocols specific to the manufacturer of the reagents we are using (which varies somewhat based on cost and availability). It is important that you do all the assigned reading. The procedures are quite involved, and you will miss a lot if you try to carry them out without reading about them beforehand. It is much better to have a firm grasp of what you are going to do before you do it. There will also be periodic homework assignments. The midterm and final (non-cumulative) will include some of the types of things assigned for homework, so it's important to have a good grasp of these strategies.

Keep a detailed laboratory notebook. We will grade notebooks, so will check periodically to see whether your notebook is sufficiently detailed. This notebook should include procedures, results, and any comments or discussion of results that might be necessary. Anyone should be able to replicate your work by following the steps in your

notebook. Some of your results (the gels) will be digital pictures, which will be posted on Canvas. We would suggest printing small copies of the gel photos for your notebook.

Course learning objectives: Upon completion of the course, students are expected to:

- Demonstrate competence in carrying out molecular experiments using established protocols.
- Explain the rationale behind common laboratory protocols in molecular biology (why do they work?)
- Compare experimental results to those of classmates and to theoretical expectations.
- Maintain a detailed laboratory notebook
- Work effectively in teams, including structuring accountability, assigning roles, responsibilities, and tasks, monitoring progress, and integrating contributions.
- Communicate effectively in writing about molecular biology to a scientific audience
- Recognize health, safety, and environmental issues related to laboratory experiments in molecular biology, and deal with them responsibly.

Required readings: The lab manual for this course is listed below. It will be made available to you electronically. Other readings will be assigned at least 1 week before the experiment is initiated.

Required out-of-class materials: You will need access to a computer with internet access. **Prerequisites:** Graduate standing, with at least one previous laboratory course in biology.

Grading policy:

Grading scale: Grades will be assigned following the scale: A = 93-100%, A- = 90- 92%, B+ = 87-89%, B = 83-86%, B- = 80-82%, C+ = 77-79%, C = 73-76%, C- = 70-72%, D+ = 67-69%, D = 63-66%, D- = 60-62%, F = 0-59%.

Grade schemes

	BIO539 (undergrads)	BIO739 (grads)
Homework assignments	20%	20%
Participation	20%	10%
Final Project	-	30%
Midterm exam	30%	20%
Second exam (non-cumulative)	30%	20%

Final project (grad students only): The final assessment for the BIO739 course (grad students only) will be a final project worth 30% of the final grade. This project will be a written report about any topic in molecular biology technique. The topic should be approved in advance, well before beginning to thoroughly research the topic. Reports should be at least 10 pages in length (1.5 spaced, not including reference, tables, figures), and should contain at least 20 references from the primary peer-reviewed

scientific literature. It should have line numbers and page numbers to make commenting easier. In terms of content, the

paper should review the current state of molecular biology as it relates to the chosen topic, the developments that have been made to lead us to the current state of the field, and any developments that are on the horizon (i.e., what are people looking at today to help address this topic?) that might lead to advances in the field. The due date for the final paper is Monday, December 9. Late papers will be penalized 10% per day.

Homework: Homework assignments for this course are worth a cumulative 20% of the final grade. There are typically 5-7 assignments spaced throughout the semester. Assignments will be based on material covered in class, including DNA sequence alignment, assembly, and analysis, working with BLAST databases, and primer design. Late assignments will be penalized 10% per day.

Participation: Participation in all aspects of this course is critical. In this course, participation will be graded in terms of 1) Frequency of participation, 2) Quality of comments, 3) Listening skills, and 4) Preparedness for lab. Students are expected to contribute their ideas in the discussion portion of the course and to be engaged in all laboratory activities. *Exemplary participation* (90-100%) would include initiating contributions multiple times per class, always providing insightful and constructive comments, undertaking a fair portion of the laboratory activities (some activities are done individually and others in groups of two), using appropriate laboratory terminology, and attentive listening. *Proficient participation* (80-90%) would include less frequent contributions (once per class), occasionally initiating comments that are too general or use inappropriate terminology, occasionally relying on lab partners to do more than their share of lab activities (or insisting on doing more than your share), or needing occasional reminders to stay on task. *Developing participation* (70-80%) would include contribution in at least half of classes, initiating comments that are sometimes constructive but lack relevance or appropriate terminology, or often doing less/more than your share of lab activities. *Unacceptable participation* (<70%) includes contribution to less than half of classes, needing instructor to solicit input, uninformative or disruptive comments, inappropriate terminology, inattentive behavior, reliance on classmates or instructor to complete lab activities.

Time Investment: On average, students should spend 48 hours per credit per semester on in-class activities and activities outside of the classroom (i.e., 192 hours for a 4-credit course). Class meets for 8 hours each week for a total of 120 hours over the 15-week semester. The exact breakdown of hours per week varies by week, but over the course of the 15-week semester we expect students to spend an additional 4-5 hours per week outside of class working on: reading assigned material (~1 hour per week), reviewing their notes and protocols (~1 hour per week), completing homework assignments (~30 min per week), maintaining their laboratory notebook (~1 hour per week), and working on their final project (~1.5 hours per week).

Attendance and missed work: It goes without saying that attendance is important. *We cannot go back and repeat anything that is missed*. Each unexcused absence from class will result in a loss of 5% of the total points in the course. If homework assignments or exams are missed as a result of an excused absence, the student will work with the instructor to arrange an alternative time to make up the missed work. Note this does not apply to laboratory work which cannot be made up. UWM recognizes as excused absences

a family emergency, illness, religious observance or an unavoidable professional obligation. Such absences must be supported by written documentation in order to be accepted.

Incomplete policy: The incomplete policy can be found here: https://catalog.uwm.edu/policies/graduate-policies/ In short, a student can initiate a request for an incomplete, which would be appropriate if 1) the student did satisfactory work in a substantial fraction of the course, and 2) extraordinary circumstances prevented you from finishing the course requirements on time. If approved, the instructor will indicate the conditions for removal of the Incomplete.

University and Departmental policies: The university lists important guidelines for all UWM courses at the following web address: http://uwm.edu/secu/syllabus-links/. The university lists its policy on final examinations here: http://www4.uwm.edu/secu/docs/other/S22.htm.

The department lists important policies at the top of the Biological Sciences section of the Schedule of Classes (e.g., for Fall 2018 https://www4.uwm.edu/schedule/index.cfm?a1=subject_details&subject=BIO%20SCI&strm=2189).

Laboratory Safety: We do not work with many dangerous chemicals in our lab; however, it is important to follow all safety instructions given by the Instructor, Teaching Assistant, or Laboratory Technician. Safety protocols are in your lab manual and will be discussed on the first day of class. Any special handling required for individual experiments are reiterated in the lab manual with that day's experiment and will be discussed prior to initiating the experiment.

Tentative Schedule:

Date	**Topic**	**Reading/Protocol**	**Note**
Week 1:	**Introduction** Group: G1, G2, G3 – G7 2 students in each group* Biosafety by Tammy	Slides in Canvas	Each group will be given a booklet

Week 2	Computer analysis of plasmids SnapGene Software In Sillico cloning using SnapGene		Bring your own computer
Week 3:	Isolation of plasmid DNA		Day before, TA will inoculate bacteria in LB medium containing ampicillin.
	Isolation of genomic DNA Bacteria Yeast Human cells	Slides in canvas on "Genotyping"	Dr Dey will provide yeast strain
Week 4:	Gel electrophoresis Plasmid DNA Genomic DNA PCR	Slides in Canvas on PCR	
	Check PCR on gels, Purify the PCR product		
Week 5:	Open day – **Quiz 1**		
	Cloning a PCR product Digestion Ligation Transformation		
Week 6:	Cloning a PCR product Digestion Ligation Transformation		
	Testing Clone		
Week 7:	Primer design with SnapGene Site-directed Mutagenesis Primary PCR Secondary PCR		
	Site-directed Mutagenesis Primary PCR Secondary PCR Cloning		
Week 8:	Colony PCR Testing Clone		
	Open day		

Week 9:	Theory Primer design with SnapGene In silico cloning		
	Gibson Assembly -theory		
Week 10:	Open day - **Quiz 2**		
	RNA analysis -theories – *RT PCR, RNA sequencing, Polysome analysis and Ribosome profiling* RNA isolation Gel electrophoresis		
Week 11:	RNA analysis - theories RNA isolation Gel electrophoresis		
Week 12:	Open day – **Quiz 3**		
	Protein analyses Protein isolation Gel electrophoresis		
Week 13:	Thanksgiving		
Week 14:	Protein analyses -theories – Protein purification methods – Western blots, Immuno precipitations, Chromatographic techniques, Protein isolation Gel electrophoresis		
	Protein analyses Protein isolation Gel electrophoresis		
Week 15:			
Dec 13	Open day - **Quiz 4**		

This schedule is subject to change depending upon the situation