

Department: Biochemistry and Molecular Biology

Course Title: Advanced Molecular Biology Lab, Fall 2021 Syllabus

Course Number: BMB 470

Credit Hours: 4

Course location: BMB 101, BMB 113, BMB 117, Zoom, D2L, LON-CAPA

Course website address: <https://d2l.msu.edu/d2l/home/1493384>

Course Modality: In person

Instructors:

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Course Objective: To train students in modern molecular biological research.

Course Description: Methods of molecular biology and the underlying principles on which these methods are based.

Course Overview: BMB 470 is a laboratory course that provides an introduction into the scientific method in molecular biology, focusing on recombinant DNA technology and protein biochemistry. Students learn to implement and apply basic principles of molecular biology that are commonly used in basic research and in industrial processes. The course has a textbook that contains the objectives, requirements, and procedures to be carried out in each of the laboratory periods. Weekly lectures introduce students to the concepts underlying the corresponding lab period. Weekly lab periods familiarize students with methods of recombinant DNA technology, including properties of different strains, antibiotic selection, nutritional markers, transduction of genes from bacteriophage λ into *E. coli*, DNA digestion, ligation, PCR, and more. Experiments are successive, *i.e.*, they build on one another to reflect a real-world laboratory workflow. These experiments will provide a sound foundation for critical thinking, hypothesis driven experimentation, and a future in science research. Weekly recitations will assist students with data analysis and experimental design. Biweekly quizzes following the Friday recitation will test knowledge from the preceding periods as noted.

Required Textbook & Course Materials

Textbook: Experiments in Molecular Biology: Biochemical Applications, by Drs. Zachary Burton and Jon Kaguni. The textbook and lab manual (coursepack) will be available online (D2L)

Course Meeting days and times

Lectures: Monday, 12:40 to 1:30 p.m., 101 Biochemistry.

Laboratory Periods: Tuesday - Thursday (Sections 1-3): 12:40 to 5:30 p.m.

Recitations: Friday, 12:40 to 1:30 p.m., 101 Biochemistry.

Quizzes: Friday, 1:10 to 1:30 p.m., online, every other Friday as noted.

Lectures: In-person lectures will be held Mondays from 12:40 to 1:30 p.m. EST in Room BMB 101. Lectures will provide scientific and technical content for the corresponding lab period.

Laboratory Periods: Lab periods are Tuesday (Section 1), Wednesday (Section 2), or Thursday (Section 3) from 12:40 to 5:30 p.m in BMB 113 or 117. Laboratory experiment videos will be posted online. Students are encouraged to view these videos before attending lab and performing the experiments. Some data obtained from experiments will be distributed via D2L modules.

Recitations: Recitations will be held on Friday from 12:40 to 1:30 p.m. EST in Room BMB 101. Recitations will cover experimental learning outcome debrief, data analysis, and general Q&A.

Quizzes: Six short quizzes will take place between 1:10 and 1:30 p.m. EST on Fridays as noted.

Office Hours

Office hours are a great way to interact directly with instructors to clarify questions and concerns you may have questions about the material in this course. This semester, we will host some in-person office hours and utilize Zoom virtual conferencing software. This software is compatible with most internet browsers, and if you are unfamiliar with Zoom, please visit <https://msu.zoom.us> for technical help.

We have some standing weekly times that are open for students to drop into. You can find the times, instructors, and zoom links to these sessions in the “Instructor Zoom office hours links” module of the D2L course page under the Content tab. If the times listed there do not work for you, please feel free to email any of the instructors to set up an individual appointment. Please allow 24 hours for a reply.

Grade in BMB 470

- Notebooks 40%
- Problem Sets (LON-CAPA) 10%
- Lab Report 20%
- Quizzes 25%
- Learning Modules (LON-CAPA) 5%

- Laboratory notebooks are due at 5:30 p.m. after the lab period for each section as noted.
- Problem Set answers are due on Mondays at 12:40 p.m. EST as noted in the schedule.
- Quizzes will be given every other Friday from 1:10-1:30 p.m. EST as noted in the schedule.
- Learning Module answers are due on Mondays at 12:40 p.m. EST of the corresponding week.

Students earning approximately 85% or more of the total points will receive a grade of 4.0. The dividing line between 2.5 and 2.0 grades will be approximately 70% of the total points. The range between 70% and 85% will be divided into approximately equal parts for assigning grades of 2.5, 3.0, and 3.5. The dividing line between 1.0 and 0.0 grades will be about 50%.

Late Penalties and Student Responsibilities

1. The **late penalty** for Notebooks and Lab Reports is 25% of the points for the assignment per day (including weekends).
2. **Biweekly quizzes** are taken through D2L, while Pre-lab Problem Sets and Learning Modules are accessed through LON-CAPA.
 - Quizzes will be given on the Friday of weeks 3, 5, 7, 9 11, and 13 from 1:10 to 1:30 p.m. EST. No late quizzes will be accepted, except by special arrangement.
 - The quizzes on D2L will be open for exactly 20 minutes and will test lecture and lab materials from the preceding two weeks.

3. **Learning Module answers** are due by 12:40 p.m. EST on the Monday indicated on the schedule. An exception is the first problem set, which is due Friday September 3rd.
4. **Problem Set answers** are due by 12:40 p.m. EST on Mondays.
 - No late Problem Sets or Learning Modules will be accepted.
5. **Absence from a Laboratory Session** must be documented in writing and, if possible, in advance. Medical excuses will be accepted up to 3 days after the missed class period. Other excuses must be authorized in advance by the instructor.
6. **Unexcused absences** will result in a penalty of 10 points with additional points lost for missing the TA initials for the pre-laboratory notebook write-up. No success of experiment points will be awarded for any missed lab period.
7. Students with **3 or more unexcused absences** from laboratory periods will be assigned a failing grade (0.0) in the course.
8. **Lab reports.** Failure to submit an acceptable laboratory report will result in a **failing grade in the course** (0.0). To receive a grade in the course (above 0.0), laboratory reports must be submitted, even if the report is so late it does not receive a score.
 - Do your own work. Graphs, figures, or text that are equivalent between laboratory partners or others in the class will not be evaluated for either individual (grade of 0.0). No points will be given for such submissions for laboratory notebooks, homework, or laboratory reports. Feel free to work together and collaborate with fellow students, but do not plagiarize or allow your work to be plagiarized. It is great to share ideas and discuss course topics but go off on your own when it comes time to analyze data, complete your notebook, or write your report. Do not submit the work of others as your own or allow others to directly reproduce your work. **A breach in the student's code of conduct for academic integrity will result in mandatory reporting to the university.**

Assignments:

1. **Laboratory Notebooks.** Proper maintenance of a laboratory notebook is essential for a professional career in science. Learning how to keep a laboratory notebook is, therefore, central to the BMB 470 learning experience. For each lab period, read the protocol for each experiment and prepare a detailed pre-lab write-up in your notebook before performing each lab. As soon as your experimental data are available, complete your laboratory write-up. Laboratory notebooks are submitted for grading every two weeks from the 4th lab period on. An example writeup will be available on D2L.
2. **Laboratory Report.** A key component of BMB 470 is the lab report. Lab reports are the most frequent kind of document written in science. They document your findings and communicate their significance. Instructions for preparing the laboratory report are in your textbook/coursepack (pgs. 14-16) and on D2L. Additional information will be provided as the due date approaches, including Q & A opportunities. The lab report is due Monday, November 22 at 12 p.m. (noon) EST. When preparing your lab report remember that a good lab report is not just a list of findings; it should demonstrate that you understand the concepts underlying these findings.
3. **Quizzes.** Knowledge and comprehension based on the previous two lectures and lab periods will be evaluated in bi-weekly quizzes. The first quizzes will be given on September 17. Quizzes will include math problems like those used in the preceding labs and questions pertaining to the experiments and lecture content.
4. **Problem Sets and Learning Modules.** Pre-lab Problem Sets and directed computer Learning Modules are available to test your level of preparation for the lab period and to supplement reading, lectures, and class notes. These modules are accessed through LON-CAPA.

5. **Class data**. When needed, class data will be available on Desire2Learn (D2L). If your research team fails to produce interpretable data for an experiment, use the data from another team to complete your laboratory write up. Give appropriate attribution to your colleagues who prepared the data. Also discuss your own data and explain why they are unsuitable.
6. **Success of Experiments**. Each experiment that results in data that can reasonably be evaluated (assays, plates, gels, etc.) will be graded for the level of “success”. The instructors will use their discretion in selecting which experiments will be subject to this evaluation. Points will not be awarded to students who are absent from class for any reason.

Week	Date	Instructor	Day	Lecture or Lab	Content	Reading	Assignments Due	Quizzes	Lon-Capa
0	Sept. 1	EMH	Wed	Lecture 1 - Dr. Martinez-Hackert	Course Introduction, Objectives, Organization, Expectations. Sterile Technique, Growing Bacteria	Preface, Ch 1-3	---	1:10-1:30 pm, online	online
	Sept. 3		Thurs	No lab	---		---		
	Sept. 4		Fri						
1	Sept. 6		Mon	No lecture - Labor Day	---				
	Sept. 7-9	EMH	Tue-Thurs	Lab 1	Exp 1A & 1B				
	Sept. 10	EMH	Fri	Recitation					
2	Sept. 13	KK	Mon	Lecture 2 - Dr. Kim	Introduction to Molecular Cloning and Cloning Vectors (Bacterial Plasmids and Bacteriophages)	Ch 4	Module: 2A & 2B		Problem Set #2
	Sept. 14-16	KK	Tue-Thurs	Lab 2					
	Sept. 17	KK	Fri	Recitation				QUIZ 1	
3	Sept. 20	KK	Mon	Lecture 3 - Dr. Kim	DNA Extraction, Purification & Detection Methods	Ch 5	Module: 3A/3B & 3C		Problem Set #3
	Sept. 21-23	KK	Tue-Thurs	Lab 3	Exp 3A, 3B, 3C, & 3D				
	Sept. 24	KK	Fri	Recitation					
4	Sept. 27	KK	Mon	Lecture 4 - Dr. Kim	Recombinant DNA Methods: Restriction Enzymes, DNA Ligase, Transformation and Selection	Ch 9	Module: 4B		Problem Set #4
	Sept. 28-30	KK	Tue-Thurs	Lab 4	Exp 4A & 4B			Notebooks due: 1A - 3C	
	Oct. 1	KK	Fri	Recitation				QUIZ 2	
5	Oct. 4	EMH	Mon	Lecture 5 - Dr. Martinez-Hackert	Gene-to-Protein: Transcription and Translation	Ch 7	Module: 5A & 5B		Problem Set #5
	Oct. 5-7	EMH	Tue-Thurs	Lab 5	Exp 5A & 5B				
	Oct. 8	EMH	Fri	Recitation					
6	Oct. 11	EMH	Mon	Lecture 6 - Dr. Martinez-Hackert	Gene Expression: Transcription Factors, Lac Repressor, T7 Promoter	Ch 5			Problem Set #6
	Oct. 12-14	EMH	Tue-Thurs	Lab 6	Exp 6A & 6B				
	Oct. 15	EMH	Fri	Recitation				QUIZ 3	
7	Oct. 18	AT	Mon	Lecture 7 - Dr. TerBush	How to Write a Lab Report				Problem Set #7
	Oct. 19-21	AT	Tue-Thurs	Lab 7	Exp 7A & 7B			Notebooks due: 3D - 6A	
	Oct. 22	AT	Fri	Recitation					
8	Oct. 25-26		Mon-Tue	No lecture - Break Days					
	Oct. 27-28	EMH	Wed-Thurs	Open Office Hours		Ch 6			
	Oct. 29			CANCEL					
9	Nov. 1	EMH	Mon	Lecture 8 - Dr. Martinez-Hackert	Protein Expression and Purification	Ch 6	Module: 9A & 9B		Problem Set #8
	Nov. 2-4	EMH	Tue-Thurs	Lab 8	Exp 8A & 8B			Notebooks due: 6B - 8B	
	Nov. 5	EMH	Fri	CANCEL				QUIZ 4	
10	Nov. 8	EMH	Mon	Lecture 9 - Dr. Martinez-Hackert	Topoisomerases: Mechanism & Function	Ch 10	Module: 10B		Problem Set #9
	Nov. 9-11	EMH	Tue-Thurs	Lab 9	Exp 9A & 9B				
	Nov. 12	EMH	Fri	Recitation					
11	Nov. 15	EMH	Mon	Lecture 10 - Dr. Martinez-Hackert	Polymerase Chain Reaction & Gel Electrophoresis		Module: 11B & 11C		Problem Set #10
	Nov. 16-18	EMH	Tue-Thurs	Lab 10	Exp 10A & 10B			Notebooks due: 9A - 10B	
	Nov. 19	EMH	Fri	Recitation				QUIZ 5	
12	Nov. 22		Mon	No lecture - Thanksgiving Break		Ch 10			Lab Report Due
	Nov. 23-26		Tue-Fri	No lab - Thanksgiving Break	---				
13	Nov. 29	EMH	Mon	Lecture 11 - Dr. Martinez-Hackert	Antibodies and Immunochemical Analysis	Ch 10			Problem Set #11
	Nov. 30-Dec.2	EMH	Tue-Thurs	Lab 11	Exp 11A, 11B, 11C				
	Dec. 3	EMH	Fri	Recitation					
14	Dec. 6	EMH	Mon	Lecture 12 - Dr. Martinez-Hackert	Construct Design and Gibson Cloning				Problem Set #12
	Dec. 7-9	EMH	Tue-Thurs	Lab 12	Exp 12				
	Dec. 10	EMH	Fri	recitation				QUIZ 6	
15	Dec. 13		Mon	---	---		Notebooks due: 11 - 13		