

Cedar Crest College
Molecular Genetics I (BIO 335)
Fall 2008

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Office Hours: Monday and Wednesday 10-12, and by appointment

Course Information

Prerequisites: Principles of Biology I (BIO 121), Principles of Biology II (BIO 122), Genetics (BIO 231), Cell (BIO 222)

Texts:

- 1) Weaver – *Molecular Biology* 4th edition
- 2) Lab Protocols Packet
- 3) Class Notes Packet (optional)

Description: This four-credit, lecture/lab course is part one of a two-part course in molecular genetics. This semester we will emphasize molecular mechanisms as they apply to prokaryotic organisms. Lectures will begin with a general review of genetics and cell biology, cover basic techniques used in molecular biology research, and then detail the processes of DNA replication and transcription in prokaryotes. As this is an upper-level course, I will expect you to not only learn details about molecular biology, but also have an understanding of how this knowledge came about. You will be expected to interpret experiments and apply gained information during lectures, on exams, and through your journal article presentation. The laboratory portion of this course should help by giving you first-hand experience with molecular biology techniques.

Goals: The goal of the course is to prepare you for either graduate studies in molecular biology or a technician position in a research lab. The lecture portion of this course will help you develop skills in experimental design and data analysis as well as expose you to current issues in biological research. This is necessary for you to maintain a complete understanding of current topics in molecular biology. The laboratory portion of the course will expose you to the basic techniques used in molecular biology.

Objectives: At the completion of this course, students will be able to:

- 1) Understand basic concepts in molecular biology.
- 2) Design basic experiments to answer questions in molecular biology, understand many molecular laboratory techniques used in biotechnology, and analyze data obtained from basic molecular experiments.
- 3) Present current research, including background and experimental information.
- 4) Discuss relevant issues in biotechnology.
- 5) Show proficiency with basic molecular laboratory techniques used in biotechnology, including restriction digests, molecular cloning, and Southern analysis.
- 6) Discuss contrasting opinions on the ethics of scientific discovery, and the impact of research on society

Outcomes and Assessment:

- 1) Students will have a general knowledge of the mechanisms of DNA replication and prokaryotic transcription. This knowledge will be assessed through lecture examinations in which students will be asked to recall details from information presented in lectures and labs.
- 2) Students will demonstrate critical thinking in the design and analysis of molecular experiments. This ability will be assessed through lecture examinations in which students will be asked to design experiments to answer questions presented to them. They will also be asked to interpret given data on exams as well as their own data in their lab notebooks.
- 3) Students will demonstrate the ability to understand new concepts in molecular biology and be capable of explaining these concepts to others. Students will be assessed through class presentations in which they will be asked to select a current research paper that they will read, understand, criticize, and present to classmates.
- 4) Students will be engaged in discussions about current issues in the field of molecular research. They will be asked to think about various aspects of relevant topics and respond to questions in small and large discussion groups. Students will be assessed through a one-page response paper.
- 5) Students will be capable of following basic molecular biology protocols and drawing conclusions from these experiments. In the lab portion of this course, students will be introduced to many basic techniques and they will be expected to use these techniques in their semester-long cloning project. Students will be assessed through lab exercises and their lab notebook.
- 6) Students will explore societal issues and concerns regarding research practices and discoveries. Students will be assessed through class presentations, one of which may be developed into a workshop presented at the Health and Wellness Conference.

Grading

Lecture Exams: There will be 4 exams, each approximately 50 minutes in length. Exams are mixed format (multiple choice, matching, fill-in-the-blank, define, short essay, etc.), with a bias towards essay questions. Although none of the exams will be comprehensive, a general understanding of material presented earlier in the semester will be necessary. If you know that you will be absent from class on an exam date, see me *prior* to that date and we will set up a time for you to make up the exam. Students who fail to show up for an exam must obtain permission from the Dean of Students office before a makeup test will be arranged. The dates for the first three exams are indicated on the course schedule. The fourth exam and lab exam will be given on the final exam date. Each exam is worth 15% of your total grade, for a total of 60% in the grade calculation.

Class Presentation: You will be giving a presentation to the class on a topic of your choosing, in which you clearly describe a molecular technique, present data produced through the use of that technique, summarize results, and make connections to the field of molecular genetics. You will be expected to become an expert on this topic by reading current reviews and research papers in that area. You will select one of these research papers and include at least one figure from this paper in your talk. You will spend approximately 10 minutes describing the topic through a PowerPoint display. Your presentation should contain three parts: 1) a background section that introduces your audience to the topic and describes the technique used; 2) a results section that describes the experiment in detail from set-up to conclusions; and 3) a conclusions section that puts the experiment in a broader context. Following your presentation, you will take approximately 5 minutes of questions from your classmates (or me, if no one *else* has anything to ask). This presentation will be worth 10% of your final grade. Note: If you do not give me a copy of the paper you intend to cover at least *one week* in advance, your grade will suffer!!! In addition, you must give your presentation on your chosen date. Students who fail to present on their selected date must obtain permission from the Dean of Students office before a makeup date will be arranged.

Participation: It is vital that you participate in all lab sessions and class discussions. Students who do not take an active role in their education will not succeed in this class. You are expected to come prepared to class, participate in classroom discussions, respond to questions, ask questions of student presenters, evaluate your fellow classmates' presentations, and complete all lab work in a timely manner. Participation will account for 5% of your final grade.

Class Discussions: During the course of the semester, we will have 2-3 discussion sections during which we will talk about current issues related to biological research. There will be reading assignments and activities that you will be expected to do prior to the discussion. You will be required to come to these sessions prepared to participate in classroom activities related to your readings and assignments. After the session, you will write a one-page response paper, as assigned in class. This paper should reflect the work you did prior to class, as well as anything you learned during the class. These response papers (one per session) will count towards your participation grade.

Lab Notebook: Lab notebooks are the official way of recording everything you do in a laboratory. Keeping a good lab notebook is a skill that is crucial to working in a scientific lab.

As an added bonus, writing out procedures and data analyses will help you think through what you are doing in lab, and will keep you from making mistakes. It will also keep you current with lab material, and prepare you for the lab final. You will be expected to keep an updated lab notebook, organized in such a way that you can find experimental procedures. You should be able to refer to your notebook at any time to determine *exactly* what you did at each step of your procedure. The notebook *must* consist of original writings; Xerox copies of the lab text are *not* acceptable notebook entries. Prior to lab, you must paraphrase the laboratory purpose and procedure from the lab text. During lab, you should record any modifications to protocols, as well as the results of each part of the procedure. Also make sure that you label all data (lanes on gels, bands on gels, etc.). Your lab notebook will be evaluated at some (unknown) point during the semester, so I recommend that you are diligent and detailed in keeping your records. No excuses will be accepted for unprepared lab notebooks. This evaluation will account for 5% of your final grade.

Lab Final: To test your comprehension of the purpose and procedures covered in the lab, you will be given a brief final exam. This exam will be given at the same time as exam #4 (scheduled final exam date) and will account for 10% of your final grade.

Lab Assignments: Throughout the semester there will be a few assignments given to you (including the poster described below). These assignments will be collected as indicated on the course schedule. Late assignments will not be accepted. All assignments will account for a total 10% of your final grade.

Poster Preparation: Posters are often used to communicate scientific information. Technological developments have enabled scientists to print professional posters. You will use PowerPoint to layout a 36 x 48" poster that current event/controversy/discovery that impacts the field of molecular biology. Your poster must describe, in basic terms, the biotechnology, its impact on society, and implications for world communities. The PowerPoint file for your poster should be emailed to the course instructor by the date indicated on the syllabus. Completion of this project will count towards your lab assignment grade.

Grade Tally:

4 Exams	60%
Class Presentation	10%
Class and Lab Participation	5%
Lab Assignments	10%
Lab Notebook	5%
Lab Final	10%

Grading Scale:

92.0 – 100	A	72.0 – 77.9	C
90.0 - 91.9	A-	70.0 – 71.9	C-
88.0 – 89.9	B+	68.0 – 69.9	D+
82.0 – 87.9	B	62.0 – 67.9	D
80.0 – 81.9	B-	60.0 – 61.9	D-
78.0 – 79.9	C+	less than 59.9	F

Academic Philosophies

Honor Code: Students are expected to comply with the Cedar Crest College Honor Code as stated in the Catalog.

Classroom Protocol: Students are expected to comply with the Cedar Crest College Classroom Protocol Code as stated in the Catalog. Cell phones will not be tolerated in the classroom or laboratory. Make sure that you turn off your phone's ringer prior to entering the class/lab.

Plagiarism: Students are expected to comply with the Cedar Crest policy on plagiarism. This includes "self-plagiarism" in which the student uses the same assignment for two different courses. I expect that all work handed in for a grade is original and entirely the work of the student submitting it. Cases of plagiarism, whether deliberate or accidental, will not be tolerated and will result in an "F" for the given assignment.

Learning Disabilities: Students with documented disabilities who may need academic accommodations should discuss these needs with me during the first two weeks of class. Students with disabilities who wish to request accommodations should contact the Advising Center.

Attendance: You are expected to attend and actively participate in all lectures and laboratory exercises. I expect you to arrive to class in a timely manner. It is your responsibility to inform me of planned absences and it is your responsibility to obtain any assignments, handouts, etc. Absences on days of exams, presentations, or the collection of assignments will have to be approved by the Dean of Students. If the Dean of Students does not approve the absence, you will receive a zero for that portion of your grade. Your obligation for this course includes attendance at the final exam on the day and time scheduled by the Registrar's Office. You should not make travel arrangements (nor should your family make them for you) until the final exam schedule is published. If you must make plans early, you should schedule your travel after the last final exam day. In regards to lab, be warned: most molecular biology experiments do not fit neatly into a three-hour time period. You will be expected to come into lab on other days and times to continue your work. Make arrangements with your lab partner to pick a time best suited to your schedules, and make sure that you completely understand procedures that you will be doing outside of the lab period, as I may not be available to help you at these times.

The Bottom Line

Your success in this class is up to *you*. I can help you to understand difficult material, but it is your responsibility to read the material before coming to class, to take notes, and to organize information so that you can retrieve it. If you need help improving your study skills, talk to me. I will not know that you are having trouble until test time, and by then, it might be too late!

Recommendations for success:

- 1) **Attend class**—if you are not here, that will affect how well you grasp the material.
- 2) **Prepare ahead of time**—read the assigned material BEFORE coming to class.
- 3) **Keep your notes in good order**—I recommend that you recopy all notes within 24 hrs of lecture while the material is still fresh in your mind. This will also enable you to ask for missing information in the next lecture. The single most common problem in upper division courses is students without proper study skills. Note taking and note recopying are important study skills.
- 4) **If you do not understand something, ask for clarification**—do not be afraid to ask questions. The only dumb questions are those that are not asked.
- 5) **Write out answers to study questions**—the act of writing out answers requires that you organize your material and thoroughly understand the vocabulary. I will be happy to read your answers and give you feedback, if you do this well ahead of time.

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Tentative Schedule (subject to change)

Week	Dates	Monday	Wednesday	Friday	Lab
1	8/25-8/29	Intro Remarks; Assessment	Genetics and Cell Review (Ch 1,2)	Genetics and Cell Review (Ch 1,2)	Intro to Molecular Techniques
2	9/1-9/5	Labor Day: no class	Genetics and Cell Review (Ch 1,2)	Genes to Genomes (Ch 2)	Making Solutions Calculations Due
3	9/8-9/12	Cloning (Ch 4)	Cloning (Ch 4)	Techniques and More Techniques (Ch 5)	Introduction to Part 1 <Student Lecture: <i>lux</i> operon> Genomic Prep of <i>Vibrio</i> Using ppt Due (via email)
4	9/15-9/19	DNA Damage and Repair (Ch 20)	DNA Repair (Ch 20)	Exam I (Chapters 1-5)	<Student Lecture: Blue/White Screen> PCR of Genomic DNA Making Competent Bacteria and Test Transformations Kodak Assignment Due
5	9/22-9/26	DNA Replication: Overview and Enzymes (Ch 20)	DNA Replication: Initiation and Elongation (Ch 21)	Discussion #1	<Student Lecture: RE and RE Mapping> Gel of PCR Plasmid Prep of pGEM Vector Restriction Digests (<i>Sall</i>)
6	9/29-10/3	DNA Replication: Termination (Ch 21)	Homologous Recombination (Ch 22)	Class Presentations #1	Gel of Restriction Digests Phosphatase of Vectors Ligation Transformation of Ligation
7	10/6-10/10	RNA Polymerase and Promoters (Ch 6)	Transcription Initiation (Ch 6)	Exam 2 (Ch 20-22)	Prep of positive clones PCR of positive clones RE Mapping of positive clones
8	10/13-10/17	Fall Break	Transcription Initiation (Ch 6)	Discussion #2	Fall Break <Catch-up time, if necessary>

9	10/20-10/24	Transcription Initiation (Ch 6)	Transcription Elongation (Ch 6)	Class Presentations #2	<Student Lecture: Southern> Southern, Part I RE Mapping Due
10	10/27-10/31	Transcription Elongation (Ch 6)	Transcription Termination (Ch 6)	Class Presentations #3	<Student Lecture: α -amylase> Southern, Part II
11	11/3-11/7	Transcription Termination (Ch 6)	The <i>lac</i> Operon (Ch 7)	Class Presentations #4	Wrap-up of Part I Introduction to Part II Genomic Prep of <i>Bacillus</i> PCR of Genomic DNA Posters Due (via email)
12	11/10-11/14	Other Operons (Ch 7)	Shifts in Prokaryotic Transcription (Ch 8)	Exam III (Ch 6)	Gel of PCR Plasmid Prep of pGEM Vector, if necessary Restriction Digests (<i>HindIII</i>) Lux Operon RE Due
13	11/17-11/21	Shifts in Prokaryotic Transcription (Ch 8)	Shifts in Prokaryotic Transcription (Ch 8)	Class Presentations #5	Gel of Restriction Digests Phosphatase of Vectors Ligation Transformation of Ligation
14	11/24-11/28	Discussion #3	Thanksgiving Break: no class	Thanksgiving Break: no class	Thanksgiving Break: no Labs
15	12/1-12/5	DNA/Protein Interactions (Ch 9)	DNA/Protein Interactions (Ch 9)	DNA/Protein Interactions (Ch 9)	Prep of positive clones PCR of positive clones RE Mapping of positive clones
16	12/8	Last Day of Class: Catch-up			