Cedar Crest College
Molecular Genetics II (BIO 336)
Syllabus for Spring 2009

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Course Information

Prerequisites: Principles of Biology I (BIO 121), Principles of Biology II (BIO 122), Genetics (BIO 231), Cell (BIO 222), and Molecular Genetics I (BIO 335)

Required Texts:

1) Weaver - *Molecular Biology* 3rd edition.
2) Lab Packet

Optional Texts:

3) Class Notes Packet

Description: This four-credit, lecture/lab course is part two of a two-part course in molecular genetics. This semester we will emphasize molecular mechanisms as they apply to eukaryotic organisms. Lectures will continue to emphasize basic techniques used in molecular biology research as we explore the processes of transcription and translation in eukaryotes. The impact that current research in the field of molecular genetics has on society health issues and world politics will also be examined, and you will have the opportunity to demonstrate what you have learned during the Health and Wellness Conference. 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 class 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, and allow you to explore the impact of molecular discoveries on society. 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 a to:

1) Understand basic concepts in molecular biology.
2) Apply basic molecular biology concepts to the study of human diseases.
3) 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.
4) Present current research, including background and experimental information.

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 explore the molecular basis of various human genetic disorders, discovering the genetic cause and therapies used for treatment. Students will be assessed through class presentations when they will be asked to select a genetic disorder and present current molecular research involving its discovery and/or treatment.
3) 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.
4) 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.
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 will 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. 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 working with one or two other students to give a fifty-minute class presentation describing the molecular basis of a human disorder. The group presentation should cover enough background information for your fellow classmates to understand the basis, mechanisms, and consequences of the disorder. You will also need to present original research detailing current findings related to the disorder that you have selected. Each member of the group will be expected to give her own individual presentation that should last approximately 10-15 minutes. You need to work together to coordinate your presentations so that you do not cover

the same information multiple times. I would suggest that the first presenter cover current research into the basis of the disorder and the following two presenters cover current research. Each presenter should describe a current research paper in their presentation, including 1) a background section that introduces your audience to the paper topic; 2) a results section that describes one experiment in detail from set-up to conclusions; and 3) a conclusions section that puts the experiment in a broader context. All three students are responsible for the coordination of the three presentations such that enough background information is given in each so that the audience fully understands that disorder. After all of the presentations have been completed, the three of you will take 5-10 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 papers you intend to cover at least *one week* in advance, your grade will suffer!!!

Course Participation: It is vital that you participate in all lab sessions, lab meetings, 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. A completed self-assessment of your participation should be handed in during the final exam. Participation will account for 5% of your final 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.), and analyze all results. 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 Report: After completing the RFLP project during week 3, you will be expected to write a scientific paper describing this as a novel technique for diagnosing hemochromatosis. The details for this paper are described in the lab manual. This report 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 15% of your final grade.

Lab Meetings: One lab meeting has been scheduled for this semester. During this lab meeting, you will be expected to give a 5-10 minute, informal presentation that details your project. You should clearly state the organism you selected and describe the gene (why you chose it, how it functions in the organism, and when it is maximally expressed) that you are attempting to clone, including any primer modifications that you have had to make. You will need to give a status report that includes any data you have obtained thus far. You will be expected to explain any

problems you have had, what you have done in an attempt to remedy the situation, and why you have chosen this course of action. You will also be expected to briefly explain your next step and put your research into a broader context. This presentation will contribute towards your course participation grade.

Grade Tally:

4 Class Exams	60%
Class Presentation	10%
Course Participation	5%
Lab Notebook	5%
Lab Report	5%
Lab Final	15%

Grading Scale:

92.0 – 100	A	78.0 – 79.9	C+
90.0 - 91.9	A-	72.0 – 77.9	C
88.0 – 89.9	B+	70.0 – 71.9	C-
82.0 – 87.9	B	60.0 – 69.9	D
80.0 – 81.9	B-	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.

Plagiarism: Students are expected to comply with the Cedar Crest policy on plagiarism. 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. 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. Realize, however, that I am a *morning* person, so if you choose to come to lab late in the evening/night, I will not be available to help you.

_____ **Name**

CLASS PARTICIPATION ASSESSMENT

Questions for Student Presenters

Question 1:

Answer 1:

Question 2:

Answer 2:

Question 3:

Answer 3:

Lecture Questions:

Question 1:

Answer 1:

Question 2:

Answer 2:

Question 3:

Answer 3:

Seminar/Poster Session Questions:

What seminar?
Question 1:

Answer 1:

What seminar?
Question 2:

Answer 2:

What seminar?
Question 3:

Answer 3:

Describe the quality of your preparation for one of the discussion sessions:

Describe the quality of your lab presentations (lab meetings and lab lecture):

My class participation grade should be ___% because…

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Week	Week of	Monday	Wednesday	Friday
1	January 19	Getting Started…watch out!	Chapter 10 Activities	Eukaryotic RNA Polymerases (10.1)
2	January 26	Eukaryotic Promoters, Enhancers, and Silencers (10.2, 10.3)	Eukaryotic Promoters, Enhancers, and Silencers (10.2, 10.3)	**Class Discussion #1**
3	February 2	Chapter 11 Activities	Class II Transcription Factors, Part I (11.1)	**Class Presentation #1**
4	February 9	Class II Transcription Factors, Part II (11.1)	Class I and III Transcription Factors (11.2, 11.3)	Activators and Protein-Binding Domains (12.4, 12.5)
5	February 16	**Exam I**	Activators, Insulators, Enhancers, Mediators, and Regulation of Transcription Factors (12.4, 12.5, 12.6)	**Class Presentation #2**
6	February 23	Chromatin Structure (13)	Chromatin Structure (continued) (13)	**Class Presentation #3**
7	March 2	Posttranscriptional Event Activities	Posttranscriptional Events: Splicing, Part I (14)	**Exam II**
8	March 9	**Spring Break**	**Spring Break**	**Spring Break**
9	March 16	Posttranscriptional Events: Splicing, Part II (14)	Posttranscriptional Events: Splicing, Part II (continued) (14)	Posttranscriptional Events: Capping and Polyadenylation (15)
10	March 23	Posttranscriptional Events: Capping and Polyadenylation (continued) (15)	Posttranscriptional Events: Timing of Polyadenylation (15)	Posttranscriptional Events: Timing of Polyadenylation (continued) (15)
11	March 30	Finishing up Post-transcriptional Events (16) rRNA and tRNA Processing (17)	Translation Initiation (17)	**Class Presentation #4**
12	April 6	Translation Initiation (17)	**Exam III**	**No Classes**
13	April 13	**No Classes**	Translation Elongation, Part I (18)	Translation Elongation, Part II (18)
14	April 20	**Class Discussion #2**	Translation Elongation, Part II (18)	Translation Termination, Part II (18)
15	April 27	Translation Termination, Part I (18)	Translation Termination, Part I (18)	Molecular Mechanisms of Disease
16	May 4	Molecular Mechanisms of Disease	**Tuesday is Friday Schedule** Last Day of Classes	

Tentative Lab Schedule
Spring 2009

Date		Lab Activity	Student Lectures
Jan 20	10-12 13-14	Procedural Discussion Primer Design <RNALater, when needed>	PCR Primer Design
Jan 27	3-4 8-9	RFLP PCR and Restriction Digest Case Study	RFLP Analysis Hemochromatosis (2)
Feb 3	5	RFLP gel and analysis	
Feb 10	13, 15 16 17-18	RNA Isolation UV Spec Analysis of RNA Gel Analysis of RNA	Types of RNA mRNA to cDNA (oligo dT)
Feb 17	19 16 20	First Strand cDNA Synthesis UV Spec Analysis of cDNA PCR	PCR Applications Troubleshooting PCR
Feb 24	22 21 23-24	PCR gel Troubleshooting PCR Ligation Reaction and Transformation	TOPO Cloning Kits (Invitrogen)
Mar 3	25 22	Colony PCR Gel analysis	
Mar 17	25 25-26 27	<O/N Cultures> Frozen Stocks & Mini-prep & UV Spec PCR & Restriction Mapping	
Mar 24	22 32	Gel Analysis Discussion of Next Step	IPTG and Gene Expression
Mar 31	25 28 29	<O/N Culture of Positive Clone> Induction of Gene Expression Collection of Time Points	Features of the pET101/D-TOPO plasmid (Invitrogen) and differences between TOP10 and BL21 cells
Apr 7	29	Protein Gel and Staining	**Lab Meeting**
Apr 14		Independent work	
Apr 21		Independent work	
Apr 28		Independent work Lab Clean-up	

Important Dates to Note

- Jan 20: Design the Cloning Project by choosing your organism and making your primers
- Jan 27: Start the RFLP Project
- Feb 3: End the RFLP Project
- March 17: RFLP Write-up Due
- Jan 20—Feb 10: Obtain your RNA and preserve it in RNALater
- Feb 10: Start the Cloning Project
- April 7: Everyone presents their own project
- April 14—April 28: Work independently on finishing your own project