CEDAR CREST COLLEGE
MOLECULAR GENETICS II (BIO 336)
SYLLABUS FOR SPRING 2010

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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* 4th 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. 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, 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 Poster: You will be working with your lab partner(s) to create a research poster (42" X 36") that details the microarray project. This poster should include necessary background information on all relevant portions of the project, including chick development, microarrays, and the chemical that was used in your study and its effects on development (yes, this will require you to some library investigation to find papers and you will need to include references). You should then outline the methods used in this lab, referencing sources as appropriate. All results that you have compiled should be clearly displayed on your poster, and proper figure legends should be included. Finally, you should include a discussion section that draws conclusions from your research and grounds your findings in the current body of literature. Of course, your poster should also have a reference section that lists the sources that you cited on your poster. You will submit this poster electronically (PowerPoint format) and it will be printed for you so that you may then present it in the second lab meeting (see section below). You should use the posters

hanging throughout the Science Center as examples of how a research poster should look, and you are also encouraged to consult with your lab instructors and fellow labmates for revision suggestions. This poster 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 account for 10% of your final grade.

Lab Meetings: Two lab meetings have been scheduled for this semester. During the first 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. In the second lab meeting, you will be presenting your microarray poster to the rest of the class. These presentations will count towards your course participation grade.

Grade Tally:

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

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:

Did you participate in all classroom and online discussions? To what extent?

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

My class participation grade should be ___% because…

Tentative BIO 336 Lab Schedule Spring 2010

Date	Lab Activity	Student Lectures
Jan 19	Procedural Discussion Primer Design <RNALater, when needed>	
Jan 26	RNA Isolation UV Spec Analysis of RNA Gel Analysis of RNA	Types of RNA mRNA to cDNA (oligo dT)
Feb 2	First Strand cDNA Synthesis Gene Specific PCR	PCR Applications Troubleshooting PCR
Feb 9	PCR gel Microarray Simulations	TOPO Cloning Kits (Invitrogen) Microarrays
Feb 16	RNA Prep and RNA gel	Chick Development
Feb 23	cDNA Labeling	Cy3 versus Cy5
Mar 2	Prep Slides (M, T, W)	Examples of Microarrays from the Literature (2)
Mar 16	Microarray Analysis	**Lab Meeting (Update on Part I)**
Mar 23	Microarray Analysis	
Mar 30	RFLP PCR and Restriction Digest Case Study	RFLP Analysis Hemochromatosis
Apr 13	RFLP gel and analysis	
Apr 20	Independent work	
Apr 27	Independent work Lab Clean-up	**Lab Meeting (Update on Part II)**
May 4	Lab Final Lab Notebook Due	

Important Dates to Note

Part I: Gene Cloning

Jan 19: Start the Cloning Project by designing your primers

Jan 26: Primers due via email

Jan 19—Jan 26: Obtain your tissue sample and preserve it in RNALater

Feb 16—April 27: Work Independently on Cloning Project

March 16: Everyone gives an update on their own project

Part II: Microarrays

Feb 9: Complete pre-lab activities BEFORE lab (Page 30)

Feb 16: Start the cDNA Array Project

Mar 23—Apr 13: Work independently on the cDNA Array Project

Apr 20: cDNA Array Poster Due

Apr 27: Everyone presents their findings

Part III: HFE RFLP

Mar 30: Start the RFLP Project

Apr 13: End the RFLP Project

Apr 27: RFLP Write-up Due

Molecular Genetics II (BIO 336) Spring 2010

Week	Week of	Monday	Wednesday	Friday
1	January 18	**No Classes**	Chapter 10 Activities	Eukaryotic RNA Polymerases (10.1)
2	January 25	Eukaryotic Promoters, Enhancers, and Silencers (10.2, 10.3)	Eukaryotic Promoters, Enhancers, and Silencers (10.2, 10.3)	Chapter 11 Activities
3	February 1	Class II Transcription Factors, Part I (11.1)	Class II Transcription Factors, Part I (11.1)	Class II Transcription Factors, Part II (11.1)
4	February 8	Class I and III Transcription Factors (11.2, 11.3)	Activators and Protein-Binding Domains (12.4, 12.5)	**Exam I (Chapters 10 & 11)**
5	February 15	Regulation of Transcription Factors (12.4, 12.5, 12.6)	Chromatin Structure (13)	**Class Discussion #1**
6	February 22	Chromatin Structure (continued) (13)	Posttranscriptional Event Activities Overview (14)	**Class Presentations #1**
7	March 1	**Lab Day: Microarray Slides**	**Lab Day: Microarray Slides**	**Exam II (Chapters 12 & 13)**
8	March 8	**Spring Break**	**Spring Break**	**Spring Break**
9	March 15	Posttranscriptional Events: Splicing, Part I (14)	Posttranscriptional Events: Splicing, Part II (14)	**Class Discussion #2**
10	March 22	Posttranscriptional Events: Capping and Polyadenylation (15)	Posttranscriptional Events: Timing of Polyadenylation (15)	**Class Presentations #2**
11	March 29	Finishing up Post-txn Events (16) rRNA and tRNA Processing (17)	Translation Initiation (17)	**No Classes**
12	April 5	**Tuesday is Monday Schedule** Translation Initiation (17)	Translation Elongation, Part I (18)	**Class Presentations #3**
13	April 12	Translation Elongation, Part I (18)	Translation Elongation, Part II (18)	**Exam III (Chapters 14, 15, & 16)**
14	April 19	Translation Elongation, Part II (18)	Translation Termination, Part II (18)	**Class Presentations #4**
15	April 26	Translation Termination, Part I (18)	Translation Termination, Part I (18)	**Class Presentations #5**
16	May 3	Molecular Mechanisms of Disease	**Wednesday is Friday Schedule Exam 4 (Chapters 17 &18)**	