

Bio 142, Advanced Topics in Genetics and Molecular Biology
Dr. Steven Nilsen
Spring 2007

Office hours: T/Th 2:00-3:30, or by appointment (Room 105, Pierce Hall)
Phone & email: 770-784-4678, steven.nilsen@emory.edu

Lecture: MWF 11:45-12:35, Room 102, Pierce Hall
Laboratory: W 2:00-5:00, Room 125, Pierce Hall

Required Materials:

Text: *Genetics – Analysis of Genes and Genomes*. Sixth Edition. By Daniel L. Hartl and Elizabeth W. Jones. 2005. Jones and Bartlett Publishers, Inc. – for lecture and lab.

Lab Book: Laboratory research notebook. This notebook should be purchased in the lab from the instructor. There is no published laboratory manual.

Lab Binder: Use a 3 ring binder for weekly laboratory handouts. Laboratory handouts must be downloaded from the conference site each week.

Highly Recommended:

Supplement: Student Solutions Manual and Supplement Problems to accompany *Genetics – Analysis of Genes and Genomes*. Sixth Edition.

Writing in Biology: A Student Handbook for Writing in Biology, Karen Knisely, 2005, 2nd edition, W.H. Freeman and Co. Very useful for writing assignments.

Course Objectives:

This course deals principally with the topic of molecular biology. Molecular biology encompasses a very broad set of skills and basic knowledge that advances the study of organisms in any biological sub-discipline. Specifically, we will concentrate on fundamental genetics and biochemistry, two fields of study that are nearly entirely focused on the molecular level. Bacteriology and developmental biology are also touched upon, as we study the molecular events that underscore basic organismal pattern formation and gene regulation late in the semester. Bacteria are studied more extensively in the laboratory. The laboratory for Biology 142 is a semester long study that begins with soil samples gathered in nature and ends with detailed molecular characterization of the bacteria in those soil samples. After the completion of this course you will be adequately prepared to learn many new biological topics at a much greater level of detail. You will begin to learn how to apply your knowledge to the analysis of primary literature. You will develop a familiarity with how real long-term, complex, biological experiments are conducted by executing a portion of one yourself. You will improve your ability to communicate science by doing so with the data you collect. Ultimately, we will discuss some contemporary ethical issues surrounding the application of molecular biology to various sections of commerce and society.

NOTE: This syllabus, particularly the schedule, may be subject to change. You will be notified of any changes in the classroom and the electronic conference. It is your responsibility to keep track of the changes.

Spring 2008 Lecture Schedule

Date	Topic	Assigned Reading
W, Jan 16	Introduction	
F, Jan 18	DNA: The Secret of Life	Ch. 1
M, Jan 21	*MLK Day* No Class	
W, Jan 23	The history of DNA	Ch. 1: p.1-25
F, Jan 25	DNA structure and technology	Ch. 2: p.42-69
M, Jan 28	Transmission genetics and pedigrees	Ch. 3: p.88-109
W, Jan 30	Human pedigree analysis	Ch.4: 155-156
F, Feb 1	Pedigrees and probability	Ch. 3: p.109-112
M, Feb 4	Incomplete dominance, epistasis, etc	Ch. 3: p.112-122
W, Feb 6	Chromosomes, karyotypes and cell division	Ch. 4: p.136-150 Ch. 8: 296-309
F, Feb 8	Chi Square analysis and linkage	Ch. 4: p.150-58, 162-67 Ch. 5: p.176-189
M, Feb 11	Linkage and three-point maps	Ch. 5: p.189-198
W, Feb 13	Linkage problems and applications	
Thurs, Feb 14	EXAM I - 8:00-9:30 AM, Chs 1-5, application	
F, Feb 15	DNA replication	Ch. 6: p.222-241
M, Feb 18	DNA replication and DNA sequencing	Ch. 6: p.241-245
W, Feb 20	Current research article discussion (<i>summary due in class</i>)	
F, Feb 22	Chromosome organization	Ch. 7: p.260-274; 277-287
M, Feb 25	Bacteria and viruses	Ch. 9: p.344-354 Selected figures
W, Feb 27	Review of transcription and translation	Ch. 10: p.398-403
F, Feb 29	Mechanism of transcription	Ch. 10: p.403-417
M, Mar 3	Mechanism of translation	Ch. 10: p. 417-433
W, Mar 5	Application: GMO Case Study	research article
F, Mar 7	Current research article discussion (<i>summary due in class</i>)	

<u>Date</u>	<u>Topic</u>	<u>Assigned Reading</u>
Mar 10-14	SPRING BREAK!	
M, Mar 17	Review and catch up	
Tues, Mar 18	EXAM II – 8:00-9:30 AM, Chs 6-9, 2, application	
W, Mar 19	Principles of gene regulation	Ch. 11: p.445-448
F, Mar 21	Bacterial transcriptional regulation	Ch. 11: p.448-460
M, Mar 24	Lac operon and Trp operon	Ch. 11: p.448-460
W, Mar 26	Eukaryotic gene regulation	Ch. 11: 464-477
F, Mar 28	Eukaryotic gene regulation	Ch. 11: p.477-485
M, Mar 31	Eukaryotic gene regulation	Ch. 11: p.477-485
W, Apr 2	Genetic control of development	Ch. 13: p.551-556
F, Apr 4	Genetic control of development	selected topics
M, Apr 7	Types of mutations, point mutations	Ch. 14: p. 592-640
Tues, Apr 8	EXAM III – 8:00-9:30 AM, Chs. 10-11, 14, application	
W, Apr 9	Point mutations, genetic diseases, repair	Ch. 14: p. 592-640
F, Apr 11	Large scale mutations	Ch. 14: p. 592-640
M, Apr 14	Cell cycle genes and proteins	Ch. 15: p.642-656
W, Apr 16	The genetics of cancer	Ch. 15: p.656-676
F, Apr 18	DNA: Curing Cancer film	
M, Apr 21	Review and catch up	
W, Apr 23	Application: Stem cells	
F, Apr 25	Current research article discussion (<i>summary due in class</i>)	
M, Apr 28	The importance of genetics in biology	
** FINAL EXAMINATION**	Comprehensive	
W, May 7	9:00-12:00 Pierce Hall, room 102 (normal classroom)	

Syllabus continues on next page

Biology 142 – Advanced Topics in Genetics and Molecular Biology
Laboratory Schedule – Spring 2008
Dr. Nitya Jacob and Dr. Steven Nilsen

<u>Date</u>	<u>Topic</u>	<u>Writing Assignment</u>
Jan 21, 22, 23	Molecular Biology Techniques I Human DNA Extraction and PCR	<i>Introduction and Materials and Methods due Jan 30</i>
NOTE: Jan 21 is a holiday, Mon lab students must join Tues or Wed lab for this week		
Jan 28, 29, 30	Molecular Biology Techniques II Human Genotype Analysis	<i>Full paper due Feb 6</i>
Feb 4, 5, 6	Microbes and Granite Outcrops Literature Search for Research Project	<i>Proposal due at end of lab Research Lit summary due 2/8</i>
Feb 11, 12, 13	Field Trip to Rock Outcrops for Sample collection	
NOTE: Feb 14, 15: Bacteria cultures must be examined and transferred to liquid cultures		
Feb 18, 19, 20	Bacterial DNA Extraction and PCR	
Feb 25, 26, 27	Purification of PCR products Restriction enzyme digest	
Mar 3, 4, 5	RFLP analysis of rDNA	<i>Notebooks due at end of lab</i>
Mar 10, 11, 13	SPRING BREAK	
Mar 17, 18, 19	Bioinformatics and Analysis Tools Exercise in Sequence Analysis	
Mar 24, 25, 27	Sequence Analysis of Outcrop Microbes	<i>Introduction; Materials and Methods sections draft due</i>
Mar 31, Apr 1, 2	Preparation for Research Symposium	<i>(optional) Results section draft due April 4</i>
Apr 7, 8, 9	Yeast Mutations	<i>(optional) Research paper drafts due April 11</i>
Apr 14, 15, 16	Research Symposium – Presentations	
Apr 21, 22, 23	GUS expression analysis and wrap up	<i>Final Research Paper due April 21 by 5pm Lab notebooks due April 28 by 5pm</i>

Important Dates For Biology 142 Spring 2008 (may be subject to change)
Optional assignments are listed in italics

January:

28/29/30 Introduction section (Lab 1) due in lab

February:

4/5/6 Lab paper (human genotyping) due in lab
Group proposal prepared in lab and due end of lab

8 Literature summary (lab) due in class

14 Exam I

20 Article summary due in class

March:

3/4/5 Lab notebooks due in lab

7 Article summary due in class

18 Exam II

24/25/26 Introduction; Materials and methods section draft due in lab

April:

4 *Results section of research paper due in class (optional)*

8 Exam III

11 *Full paper drafts due in class (optional)*

14/15/16 Research symposium in lab

21 Final research paper due by 5 pm

25 Research article summary due in class

28 Lab notebooks due by 5pm

May

7 Final Exam (9-12 AM)

GUIDE TO BIOLOGY 142

Please read this syllabus carefully and please be sure to clarify any doubts. This handout is your map to Biology 142! Please pay full attention to the information contained in this syllabus. Information in this syllabus is subject to change according to my discretion, so please pay attention to any changes made during the semester. Please check the class conference site regularly for announcements and changes.

Expectations/ Study tips:

- * **Class notes are most important!** Please work on taking good notes in class – this will be the most important information in the course. Some examples discussed in class may not be found in the text. Many of the exam questions come out of the material discussed in the classroom.
- * **Your textbook is a supplementary resource.** Please read these assignments BEFORE you come to class or lab. The textbook reading gives you an overview of the subject matter. We will not focus on all details presented in the text, so pay close attention to your class notes to determine the most important concepts and highlight them in your text reading. Learning every single detail from the textbook is not a good use of your time.
- * **Practice all assigned problems and worksheets.** I will assign specific problems from the textbook and provide worksheets that I have designed. Genetics is an applied field – you must learn how to use your knowledge of concepts and terminology for analysis. You must make it a point to keep up with the problem solving and practice solving them well in advance of an exam.
- * **Keep up regularly.** There will be a lot of information covered in this course. To be successful, you must keep up with the material from class to class. Attending your SI sessions and coming by during office hours throughout the semester (not just before exams) will help you tremendously. Being prepared everyday for class is crucial for your performance on exams.
- * **Be a regular participant.** It is important to be an active participant in course work and discussion.

Supplemental Instruction. Nina Yu will be the SI for this course. There will be two SI sessions per week. Check the class conference SI folder for timings.

Examinations: The lecture exams will be a combination of multiple choice, short answer and short essay questions, including application problems. Exams will focus on material covered in the classroom, and related assigned textbook readings. The final examination will cover the last portion of the material and it will include comprehensive information. Please feel free to ask me about any questions about the material on the exam.

Discussion of Research Articles: There are 3 scheduled discussion days on current research articles for this course (see syllabus). A scientific journal article will be distributed for reading prior to each discussion day. Every student is required to read and prepare to discuss the article before class. Each student is required to write a one page summary (as directed) of the investigation conducted in the article and the main conclusions. For each discussion day, students will be expected to discuss specific aspects of the paper in class. Discussions of these articles will be evaluated on the basis of preparedness for class, participation and the written summary. *Each paper summary with discussion participation is worth 10 points.*

Laboratory: There is no published lab manual for this course. Laboratory handouts describing each exercise are available on the electronic conference site for the course. You are expected to print and read each exercise thoroughly to be fully prepared for each lab. Please bring these handouts to lab in a 3-ring binder. The laboratory portion of Biology 142 resembles a research lab setting, where students are expected to think critically on their own, troubleshoot problems and learn to clearly document observations and analysis. A field study on local granite rock outcrops is a main component of this laboratory. Samples will be collected from these outcrops and brought back to the laboratory for genetic analysis. Students will work in research teams, develop an independent question about these organisms and their environment, and will be expected to communicate results in the form of an oral presentation and a full-length scientific paper. Your performance in lab will be evaluated based on your lab reports, lab notebook, project paper and presentation. There will be a few other short written assignments during the semester. *There are no lab practical exams.*

Class Participation: Biology 142 is an interactive course. There is a general participation requirement that will be assessed in the classroom. I expect you to think carefully about the material and ask questions that extend beyond what is presented in the classroom. You can also participate by contributing to the electronic conference or visiting office hours to discuss the course material. *Overall participation is worth 10 points.*

Application Topics and Film Discussions: During the course we will focus on the practical aspect of genetics and molecular biology on several occasions. There will be discussions on topics such as, genetically modified organisms (GMOs), sustainable agriculture and GMOs, stem cell research, social and ethical concerns. There will be films shown this semester and your participation in the film discussion is required. Such discussions can extend to the electronic conference.

Absences: Lecture is filled with activities and discussion, if you miss it you will lose that opportunity to learn what is expected of you. Hence, absences are not wise and will basically hurt your performance. Attendance in the lab is mandatory, see the attached departmental absence policy for details. If you need an excused absence, please contact me. In addition, tardiness is both noted and can also count against you.

Mobile Phones: Please turn off and stow away your mobile phones during lecture and lab. Mobile phones are *not permitted during examinations.*

Honor Code: The Honor Code of our institute applies to all work submitted for credit in this class, hard copy or digital format, and all such work shall be pledged to be your and yours alone.

“Primer length” competition: Throughout the course I will be taking notice of your individual performance on a level beyond basic participation. For instance, when you make an effort greater than expected or offer observations of uncommon or unusual value that I take note of you get a “nucleotide” added to your “primer”. On exams, there may be questions that if you correctly answer will gain nucleotides. In lab, if you run an exceptionally clean chemical reaction you will get a nucleotide. At the end of the semester, the students with the longest primer length will receive token award(s), but *in no way are nucleotides exchangeable for points.*

Evaluation: You will be evaluated in this course based on your performance in the classroom and the laboratory. The distribution of points is shown below.

Evaluation:

Lecture:

Lecture exams (3)	300 points
General class participation	10 points
Film responses	10 points
Article discussion	30 points
Final exam	170 points

Laboratory:

Human genotyping paper	30 points
Proposal and literature summary	15 points
Lab notebooks	40 points
Figures and tables	10 points
Symposium presentation	20 points
Full length scientific paper	80 points

Total	715 points
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Final grade determination

(Plus and minus grades are given)

90 - 100%	A
80 – 89%	B
70 – 79%	C
60 – 69%	D
<60%	F