

<p style="text-align: center;"><b>Biology 142 – Advanced Topics in Genetics and Molecular Biology</b> <b>Course Syllabus</b> <b>Fall 2009</b></p>
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*Office Hours:*, Please email me for an appointment or check in class  
*Email:* Learnlink or [njacob@emory.edu](mailto:njacob@emory.edu)

**Lecture:** MWF 9:30-10:25AM or 11:45AM-12:35PM, Room 101, Pierce Hall

**Laboratory:** Tuesday 2:30-5:30PM or Wednesday 2:00-5:00 PM, Room 123, Pierce Hall

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**Required:**

Text: *Genetics – A Conceptual Approach*. Third Edition. By Benjamin A. Pierce.  
2008. W. H. Freeman and Company – for lecture and lab topics.

Lab Book: Laboratory research notebook. This notebook should be purchased from the Oxford College bookstore. No substitutes will be accepted.

Lab Binder: A 3-ring binder is required for weekly laboratory handouts.  
Laboratory handouts must be downloaded and printed from the Blackboard site each week.

**Highly Recommended:**

Solving Problems: *Solutions and Problem-Solving Manual to accompany Genetics – A Conceptual Approach*. Third Edition.

Writing in Biology: *A Student Handbook for Writing in Biology*, Karen Knisely,  
2009, 3<sup>rd</sup> edition, W.H. Freeman and Co. Very useful for writing assignments.

**Course Objectives:** Biology 142 examines how genetic and molecular mechanisms influence multiple aspects of biological life. Physical and chemical properties of genes, transmission mechanisms, and processes by which genes are manifested as physical characteristics in a whole organism will be covered in detail. The control of gene expression is an important concept covered in this course. The causes of mutations and resulting genetic disorders, such as cancer, will also be explored. You will be introduced to techniques in the laboratory such as DNA analysis, recombinant DNA technology, analysis of gene transmission, bioinformatics and mutation analysis, which are major technological advances in the field of genetics. The laboratory is designed as a research setting including a field study using molecular biology to examine biodiversity in the environment. Practical applications of genetics in the areas of two major human concerns - medicine and agriculture -will be discussed in the laboratory and the classroom. An emphasis will be placed on recognizing social, ethical and environmental impacts of current advances in genetic research. Critical thinking and scientific communication skills will be developed throughout the semester in laboratory and lecture.

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

**Biology 142 – Advanced Topics in Genetics and Molecular Biology**  
**Lecture Schedule Fall 2009**

Date	Topic	Assigned Reading
W, Aug 26	Why study genetics?	Ch. 1
F, Aug 28	DNA: The Secret of Life	Ch. 1; Ch. 10
M, Aug 31	The history of genetics and DNA	Ch. 1; Ch. 10
W, Sep 2	DNA structure and technology	Ch. 10; Ch. 19: p. 503-509; 513-516
F, Sep 4	DNA structure and technology	same as above
M, Sep 7	<b>** Labor Day **</b>	--
W, Sep 9	Chromosomes and cell division	Ch. 2
F, Sep 11	Transmission genetics - overview	Ch. 3; Ch. 5 (skim)
M, Sep 14	Sex determination and sex linkage	Ch. 4
W, Sep 16	Human pedigree analysis	Ch. 6: p.134-142
F, Sep 18	Human pedigree analysis	Ch. 6: p. 146-152
M, Sep 21	The complexity of genetics	Ch. 5: p. 99-119
W, Sep 23	The complexity of genetics	Ch. 5: p. 99-119
<b>Thurs, Sep 24</b>	<b>EXAM I 8:00 - 9:30 a.m. (Ch 1-5, parts of 6,10 and 19)</b>	
F, Sep 25	Linkage and recombination	Ch. 7: p. 160-185
M, Sep 28	Linkage and mapping	Ch. 7: p. 160-185
W, Sep 30	Current research article discussion	<i>Journal article – summary due</i>
F, Oct 2	Genetics of bacteria and viruses	Ch. 8: p. 200-210 p. 215-219; 228-230
M, Oct 5	Technology involving bacteria and viruses	
W, Oct 7	Cytogenetics: chromosome variations	Ch. 9
F, Oct 9	Cytogenetics: chromosome structure	Ch. 11: p. 285-309

## Biology 142 – Lecture Schedule Fall 2009 Continued

Date	Topic	Assigned Reading
M, Oct 12	<b>** Fall Break **</b>	
W, Oct 14	DNA Replication	Ch. 12: p. 315-335
F, Oct 16	DNA replication and technology	Ch. 12: p.315-335; Ch. 19: 525-529
M, Oct 19	Gene expression: Transcription	Ch. 13
<b>Tues, Oct 20</b>	<b>EXAM II – 8:00 – 9:30 a.m. (Chs., 7-9; 12; parts of 6 and 19)</b>	
W, Oct 20	Gene expression: RNA processing	Ch. 14: p. 368-385
F, Oct 23	Gene expression: Translation	Ch. 15
M, Oct 26	Principles of gene regulation	Ch. 16: p. 425-435
W, Oct 28	Lac operon regulation	Ch. 16: p. 436-445
F, Oct 30	Lac operon mutations; Trp operon	Ch. 16: p. 436-445
M, Nov 2	Regulation in eukaryotes	Ch. 17
W, Nov 4	Regulation in eukaryotes	Ch. 17
	(Also review p. 292; 386-388; 378-380)	
F, Nov 6	Review and catch up	
M, Nov 9	Mutations, effects, and repair	Ch. 18
<b>Tues, Nov 10</b>	<b>EXAM III - 8:00 – 9:30 a.m. (Ch. 13-17)</b>	
W, Nov 11	Mutations, effects, and repair	Ch. 18
F, Nov 13	Mutations; Scientific Inquiry; Biotechnology	Ch. 19: p. 530-540
M, Nov 16	Current article discussion	<i>Journal article – summary due</i>
W, Nov 18	Application: Stem Cells, a case study	
F, Nov 20	Application: Stem Cells, a case study	
M, Nov 23	Cell cycle regulation	Ch. 23
W, F 25-27	<b>** Thanksgiving Break **</b>	
M, Dec 1	The genetics of cancer	Ch. 23
W, Dec 3	The genetics of cancer	Ch. 23
F, Dec 5	DNA: Curing Cancer film	
M, Dec 8	Genetics: biological, social, and ethical questions	

**\*\*\* FINAL EXAMINATION\*\*\* 11A Section: Thursday, December 10, 2-5pm**  
**9A Section: Tuesday, December 15, 9am -12pm**  
**(Chs. 18, 19, 23; stem cells, comprehensive questions)**

**Biology 142 – Advanced Topics in Genetics and Molecular Biology**  
**Laboratory Schedule Fall 2009**

Date	Topic	Written Assignment
Sep 1, 2	Molecular Biology Techniques I Human DNA Extraction and PCR	<i>Introduction + Materials and Methods</i> <b>due in class Wed, Sept 9</b>
8, 9	Microbes and Granite Outcrops Literature Search for Research Project	<i>Research Proposal draft</i> <b>due at the end of lab</b> <i>Final proposal</i> <b>due in class, Mon, Sept 14</b>
15, 16	Molecular Biology Techniques II Human Genotype Analysis	<i>Complete Paper in Final Form</i> <b>due in class Fri, Sept 18</b>
22, 23	Field Trip to Rock Outcrops Sample Collection	
29, 30	Observation of Collections and Sample Selection	
Oct 6, 7	Bacterial DNA Extraction and PCR	<i>Lab notebooks</i> <b>due in class Fri, Oct 9</b>
12, 13	<b>**Fall Break**</b>	
20, 21	Purification of PCR products, Restriction enzyme digest	
27, 28	RFLP analysis of rDNA	<i>Draft of Introduction + Materials and Methods</i> <b>due in class Wed, Oct 28</b>
Nov. 3, 4	Bioinformatics and Analysis Tools Exercise in Sequence Analysis	
10, 11	Sequence Analysis of Outcrop Microbes	
17, 18	Preparation for Research Symposium	<b>Paper drafts due in class, Fri, Nov 20</b> <i>(incomplete ok)</i>
24, 25	No lab <i>Optional paper consultation time on 11/24</i>	Lab notebooks <b>due in class, Mon, Nov 23</b>
Dec. 1	Research Symposium - Presentations	<i>Final paper</i> <b>due Dec 5</b>
8	Wrapping up the semester	

## 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 and Blackboard site regularly for announcements and changes.

### Expectations/ Tips for Success:

- \* **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.
- \* **Be a regular participant.** It is important to be an active participant in course work and discussion. This includes completing “homework” problem assignments outside of class. There is a participation grade but more importantly, your active engagement is critical to your learning.
- \* **Read and use your textbook regularly.** Please read the chapter assignments BEFORE you come to class or lab. The textbook reading gives you a preview of the subject matter. Bring your textbook to class. After each class, review your lecture notes along with the textbook. Answer all of the “Concept Checks” questions associated with your reading assignment in the textbook to practice your knowledge. If a particular topic is in your reading but was not part of your lecture notes, you must still know the main points.
- \* **Practice all assigned problems and review worksheets.** Problem solving and critical analysis is very essential to learning in the field of genetics. You **MUST** review all problems and worksheets given in class on a regular basis to succeed in this class. In addition, solve all of the “Comprehensive Questions” listed in the textbook for the assigned reading. Solve all assigned “Application Questions” and a few “Challenge Questions” in the textbook. I will post the assigned problems periodically on Learnlink.
- \* **Avoid becoming overwhelmed.** This is an intense and rigorous course. You are expected to be competent in the knowledge, skills, and comprehension from Biology 141. To avoid becoming overwhelmed be well organized, attentive, keep up with the material, attend SI sessions, and practice problems several times. Work consistently in small doses!

**Supplemental Instruction.** Sara Radmard is the SI for this course. There will be two SI sessions per week. Check the class conference SI folder for timings.

**Evaluation:** Your performance in the course is evaluated through quizzes, examinations, writing assignments, and class participation. The distribution of evaluation points is on page 7.

**Quizzes** – There will be several unannounced quizzes during the course of the semester. The quizzes will test some important concepts you may have covered in your reading or should know from prior knowledge.

**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, related assigned textbook readings, and assigned problems. The final examination will cover the last portion of the material and will include comprehensive information.

**Discussion of Current Research Articles.** There are 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 your preparedness for class, participation in the discussion, and the written summary.

**Laboratory.** There is no published lab manual for this course. Handouts describing each lab exercise will be available a week in advance on the Blackboard site specifically designed for the course. The Blackboard site contains other resources for lecture and laboratory as well. Please keep these handouts in a 3-ring binder so that they are easily available for lab. You are expected to read each exercise thoroughly and be fully prepared for each lab. 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 written assignments, lab notebook, project paper, and presentation.

**Class Participation.** Biology 142 is an interactive course. There is a general participation requirement – a total of 25 points are assigned for participation. These points are assigned based on your engagement in the classroom (asking and answering questions in class), your contribution to problem solving in class, your level of preparation for class, and your performance on homework assignments.

**Application Topics and Film Discussions:** During the course we will focus on the practical aspect of genetics and molecular biology on several occasions. Your engagement and participation is required.

**Special Guest:** We have a special guest in our course this semester, Ms. Jennifer Johnston, HHMI Curriculum Fellow and graduate student in Pharmacology at Emory University who will help you learn some applied topics in genetics.

**Honor Code:** All examinations and work for credit in this course come under the regulations of the Honor Code. Please follow the Honor Code and include your signature on your work as your pledge.

**Absences:** The policy on absences is provided in a separate handout. Unexcused absences, tardiness, or a failure to follow the procedures outlined in that handout can result in a reduction in your grade. Any questions about absences should be asked immediately.

**Cell Phones:** The use of cell phones is strictly prohibited in the classroom and the laboratory. Please turn off your phone before you come to class and leave your phone at the front during exams. Photography with camera phones is also prohibited.

**Evaluation Points:**

**Lecture:**

Lecture exams (3)	300 points
Quizzes and other	50 points
General class participation	25 points
Film responses	10 points
Article discussion	20 points
Final exam	170 points

**Laboratory:**

Human genotyping paper (labs 1&2)	30 points
Proposal and literature summary	10 points
Lab notebooks	30 points
Paper drafts	20 points
Symposium presentation	20 points
Full length scientific paper	80 points

**Total                      765 points**

**Final grade determination**

*(Plus and minus grades are given)*

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