

<p style="text-align: center;"><b>Biology 142Q – Advanced Topics in Genetics and Molecular Biology</b> <b>Course Syllabus</b> <b>Spring 2012</b></p>
--

**Faculty Information:** Dr. Nitya Jacob, *Office:* Room 104, Pierce Hall; *Phone:* 770-784-8346  
*Office Hours:* Tuesday: 1:30-2:30 pm; Friday: 9:30-10:30 AM or by appointment  
*Email:* Learnlink or [njacob@emory.edu](mailto:njacob@emory.edu)

**Lecture:** MWF 10:40-11:30AM, Room 102, Pierce Hall

**Laboratory:** Wednesday, 2-5 PM, Room 125, Pierce Hall

---

**Required:**

Text: *Genetics – A Conceptual Approach*. Fourth Edition. By Benjamin A. Pierce. 2012. W. H. Freeman and Company – for lecture and some lab topics.

Laboratory Research Notebook. This notebook must be purchased from the Oxford College bookstore. No substitutes will be accepted.

Laboratory Manual. The custom laboratory manual for this course will be available for purchase in the laboratory.

**Highly Recommended:**

Solving Problems: *Solutions and Problem-Solving Manual to accompany Genetics – A Conceptual Approach*. Fourth 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 extraction, PCR, analysis of gene transmission, bioinformatics, and DNA sequence analysis, which are major technological advances in the field of genetics. The laboratory is designed as a research setting including a semester-long project 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 on Blackboard. It is your responsibility to keep track of the changes.*

## **Biology 142 – Advanced Topics in Genetics and Molecular Biology**

### **Lecture Schedule Spring 2012**

<u>Date</u>	<u>Topic</u>	<u>Assigned Reading</u>
W Jan 18	Introduction: The big picture	Ch. 1
F Jan 20	DNA: The Secret of Life	Ch. 1; Ch. 10
M Jan 23	The history of genetics and DNA	Ch. 1; Ch. 10
W Jan 25	DNA structure and technology	Ch. 10; Ch. 19: p. 513-519; 523-526
F Jan 27	DNA structure and technology	same as above
M Jan 30	Chromosomes and cell division	Ch. 2
W Feb 1	Transmission genetics - overview	Ch. 3; Ch. 5 (skim)
F Feb 3	Sex determination and sex linkage	Ch. 4
M Feb 6	Human pedigree analysis	Ch. 6: p.135-143
W Feb 8	Human pedigree analysis	Ch. 6: p. 146-154
F Feb 10	The complexity of genetics	Ch. 5: p. 99-120
M Feb 13	The complexity of genetics	Ch. 5: p. 99-120
W Feb 15	Linkage and recombination	Ch. 7: p. 161-186
F Feb 17	Linkage and mapping	Ch. 7: p. 161-186
F Feb 17	<i>Required: Writing Workshop 2 – 3 pm and 3 – 4 pm</i>	
M Feb 20	Three-point crosses	Ch. 7: p. 161-186
<b>Tues Feb 21</b>	<b>EXAM I 8:00 - 9:30 a.m. (Chs. 1-6, 10 and 19)</b>	
W Feb 22	Genetics of bacteria and viruses	Ch. 8: p. 203-213 p. 216-222; 227-230
F Feb 24	Genetics of bacteria and viruses	same as above
M Feb 27	Cytogenetics: chromosome structure	Ch. 11: p. 291-302
W Feb 29	DNA Replication	Ch. 12: p. 321-342
F Mar 2	Current research article discussion	<i>Journal article – summary due</i>
M Mar 5	DNA Replication and technology	Ch. 12: p.321-342; Ch. 19: 534-539
W Mar 7	Gene expression: Transcription	Ch. 13
F Mar 9	Gene expression: RNA processing	Ch. 14
M Mar 12 – F, Mar 16	<b>***Spring Break***</b>	

## Biology 142 – Lecture Schedule Spring 2012 Continued

Date	Topic	Assigned Reading
M Mar 19	Gene expression: Translation	Ch. 15
<b>Tues Mar 20</b>	<b>EXAM II – 8:00 – 9:30 a.m. (Chs. 7-9; 11, 12, 19)</b>	
W Mar 21	Principles of gene regulation	Ch. 16: p. 431-441
F Mar 23	Lac operon regulation	Ch. 16: p. 441-451
M Mar 26	Lac operon mutations; Trp operon	Ch. 16: p. 441-451
W Mar 28	Regulation in eukaryotes	Ch. 17
<b>Th Mar 29</b>	<b><i>Oxford Studies/Lyceum lecture: Dr. Mark Frankel; 7 p.m. – Williams Hall</i></b>	
F Mar 30	Regulation in eukaryotes	Ch. 17 (Also review p. 298; 394-396; 385-388)
M Apr 2	Review & catch up	
W Apr 4	Mutations: overview, base substitutions	Ch. 18
F Apr 6	Mutations: insertions/deletions; large variations	Ch. 18; Ch. 11: 303-315
M Apr 9	Mutations: large variations; DNA repair	Ch. 18; Ch. 9
W Apr 11	Review & catch up	
F Apr 13	Current article discussion	<i>Journal article – summary due</i>
M Apr 16	Cell cycle regulation	Ch. 23
<b>Tues Apr 17</b>	<b>EXAM III - 8:00 – 9:30 a.m. (Chs. 13-17)</b>	
W Apr 18	Cancer and cell cycle regulation	Ch. 23
F Apr 20	Cancer and cell cycle regulation	Ch. 23
M Apr 23	Application: Stem Cells	
W Apr 25	Application: Stem Cells	
F Apr 27	DNA: Curing Cancer film	
M Apr 30	Genetics: biology, society, and ethics	

**\*\*\* FINAL EXAMINATION\*\*\* Tuesday, May 8, 9-12pm**  
**(Chs. 18, 19, 23; stem cells, comprehensive questions)**

**Biology 142 – Advanced Topics in Genetics and Molecular Biology**  
**Laboratory Schedule Spring 2012**  
**Dr. Nitya Jacob and Dr. Amanda Pendleton**

<u>Date</u>	<u>Topic</u>	<u>Written Assignment</u>
Jan 25, 26	D1S80 VNTR Investigation I Human DNA Extraction and PCR	<i>Introduction + Materials &amp; Methods:</i> <b>due in class F, Feb 3</b>
Feb 1, 2	D1S80 VNTR Investigation II Human Genotype Analysis	<i>Complete paper in final form:</i> <b>due in class M, Feb 27</b>
8, 9	Microbes and Granite Outcrops Literature Search for Research Project	<i>Research Proposal draft:</i> <b>due in lab</b> <i>Final proposal with literature review:</i> <b>due in class M, Feb 13</b>
15, 16	Field Trip to Rock Outcrops Sample Collection	
22, 23	Observation of Collections and Sample Selection	
29, Mar 1	Bacterial DNA Extraction and PCR	
Mar 7, 8	Purification of PCR products, Restriction enzyme digest	<i>Lab notebooks:</i> <b>due in class F, Mar 9</b>
14, 15	<b>**Spring Break**</b>	
21, 22	RFLP analysis of rDNA	
28, 29	Bioinformatics and Analysis Tools Exercise in Sequence Analysis	<i>Draft of Materials and Methods:</i> <b>due in class M, Mar 26</b>
Apr 4, 5	Sequence Analysis of Outcrop Microbes	<i>Draft of Results:</i> <b>due in class F, Apr 6</b>
11, 12	Preparation for Research Symposium	
18, 19	Research paper consultations	
25, 26	Research Symposium	<i>Lab notebooks:</i> <b>due in class F, Apr 27</b> <i>Final paper:</i> <b>due M, Apr 30 at 5 pm</b>

## 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 all information contained in this syllabus. Information in this syllabus is subject to change according to my discretion, so please record any changes made during the semester. Please check the Blackboard site regularly for announcements and changes.*

**Ways of Inquiry (INQ):** Biology 142 is designated as a “Ways of Inquiry” or INQ course. In INQ courses, students “understand and question the way knowledge is sought by actively learning and practicing the discipline’s approaches to inquiry” (INQ Vision Statement). In Biology 142, you will have many opportunities to engage in biological inquiry by asking questions, designing experiments, reading and writing critically, and working independently to seek knowledge.

### 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. There is a participation grade but more importantly, your active engagement is critical to your learning.
- \* **Come well prepared to class everyday.** To build on your learning, to participate, and to be best prepared for examinations, it is critical that you must be well prepared for class every day. REVIEW your class notes from the previous lecture EVERY DAY. Read or at least browse the chapter assignments, including figures, associated with the next day’s class prior to the day of class. Answer all of the “Concept Checks” questions associated with your reading assignment in the textbook to practice your knowledge. Bring your textbook to class and annotate the figures. After each class, review your lecture notes along with the textbook. 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 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 textbook problems given in the “Assigned Problems From Textbook” handout. A copy of this list is also available on Blackboard the assigned reading.
- \* **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, be attentive, keep up with the material, attend SI sessions, and practice problems several times. Work consistently in small doses and follow the tips above!

**Supplemental Instruction.** Anna Bausum is the SI for this course. There will be two SI sessions per week. Anna will communicate information about SI timings via Blackboard.

**Quizzes** – There will be several quizzes either in-class or take-home during the course of the semester. The quizzes will test some important concepts you may have covered in your preparation for class 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.** A custom laboratory manual is available for the course. Weekly laboratory exercises and instructions for assignments are included in this manual. The Blackboard site contains additional resources for the laboratory. You are expected to read each exercise thoroughly and be fully prepared for each lab. You must also read ALL instructions for assignments carefully. 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. Points are assigned for participation. These points are assigned based on your overall engagement in the classroom throughout the semester (asking and answering questions in class, problem solving abilities, level of preparation, displaying your interest by contributing news articles in genetics).

**Special Lecture.** We have the special opportunity this semester to have on campus Dr. Mark Frankel from the American Association for the Advancement of Science who will give an Oxford Studies/ Lyceum Lecture about the legal ramifications of recent

advancements in neuroscience on March 29 at 7pm in Williams Hall. There is an extra credit option for attending this lecture.

**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.

**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. It is your responsibility to communicate with the instructor as much in advance as possible about medical or family emergencies or send a message through another student.

**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.

**Personal Computer:** If you would like to take notes on your personal laptop in class you must seek special permission from the instructor. Use of laptops for surfing the web, Facebook, Skype or other networking/chat during class is **completely unacceptable**.

**College-Wide Assessment:** Student work submitted as part of this course may be reviewed by Oxford College and Emory College faculty and staff for the purposes of improving instruction and enhancing Emory education.

### Evaluation Points:

#### Lecture:

Lecture exams (3)	300 points
Quizzes	40 points
Class participation	10 points
Film responses	15 points
Article discussion	20 points
Final exam	170 points

#### Laboratory:

Human genotyping paper (labs 1&2)	30 points
Group proposal and literature review	10 points
Lab notebooks	40 points
Paper drafts	20 points
Symposium presentation	20 points
Full-length scientific paper	80 points

**Total 755 points**

### Final grade determination

*(Plus and minus grades are given)*

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