

<p style="text-align: center;"><b>Biology 142Q – Advanced Topics in Genetics and Molecular Biology</b> <b>Course Syllabus</b> <b>Fall 2013</b></p>
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**Lecture:** 9A -MWF 9:30-10:35 AM; 12A- 12:00-1:05 PM Pierce 102

**Laboratory:** 9A - Wednesday 2:30-5:30 PM; 12A – Tuesday 1:40-4:40 PM, Pierce 123

**Faculty Information:** Dr. Nitya Jacob, Office: Room 104, Pierce Hall; Phone: 770-784-8346

*Office Hours:* Mondays, 1:30-2:30 PM or by appointment

*Email:* njacob@emory.edu

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**Required Purchases:**

Textbook. *Genetics – A Conceptual Approach*. Fourth Edition. By Benjamin A. Pierce. 2012. W. H. Freeman and Company.

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, 2013, 4th edition, W.H. Freeman and Co. Very useful for writing assignments.

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**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 throughout the course. An emphasis will be placed on recognizing **social, ethical, and environmental impacts** of current advances in genetic research. **Critical thinking** and **scientific communication skills**, including writing and oral presentation, will be developed throughout the semester.

**NOTE:** This syllabus, particularly the schedule, is subject to change. You will be notified of any changes in the classroom and/or via Blackboard (BB). It is your responsibility to note the changes.

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

### Lecture Schedule Fall 2013

Date	Topic	Assigned Reading
W Aug 28	Introduction: The big picture	Ch. 1
F Aug 30	DNA: The Secret of Life	Ch. 1; Ch. 10
M Sep 2	No class – Labor Day	
W Sep 4	The history of genetics and DNA <i>Exercise and Film response due on BB by 9AM</i>	Ch. 1; Ch. 10
F Sep 6	DNA structure and technology	Ch. 10; Ch. 19: p. 513-519; 523-526
M Sep 9	DNA structure and technology <i>D1S80 draft 1 due in class and on BB</i>	same as above
W Sep 11	Chromosomes and cell division	Ch. 2
F Sep 13	Transmission genetics - overview	Ch. 3; Ch. 5 (overall concepts)
M Sep 16	Sex determination and sex linkage <i>D1S80 figures &amp; tables due in class</i>	Ch. 4
W Sep 18	Human pedigree analysis <i>Draft Group proposal due day after lab on BB</i>	Ch. 6: p.135-143; p. 146-154
F Sep 20	Human pedigree analysis	Ch. 6: same as above
F Sep 20	<i>Required: Writing Workshop 2:30 – 3:30 pm and 3:30 – 4:30 pm</i> <i>D1S80 draft 2 due at workshop and on BB</i>	
M Sep 23	The complexity of genetics	Ch. 5: p. 99-120
<b>Tues Sep 24</b>	<b>EXAM I 8:00 - 9:30 a.m. (Chs. 1-4, 5, 6, 10 and 19)</b>	
W Sep 25	Linkage and recombination	Ch. 7: p. 161-186
F Sep 27	Linkage and mapping	Ch. 7: same as above
M Sep 30	Three-point crosses <i>Final group research proposal due in class and on BB</i>	Ch. 7: same as above
W Oct 2	Cytogenetics: chromosome structure	Ch. 11: p. 291-302
F Oct 4	Genetics of bacteria and viruses	Ch. 8: p. 203-213; p. 216-222; 227-230
M Oct 7	Genetics of bacteria and viruses <i>D1S80 complete paper due in class and on BB</i>	Ch. 8: same as above
W Oct 9	DNA Replication	Ch. 12: p. 321-342
F Oct 11	DNA Replication <i>Lab notebooks due in class</i>	Ch. 12: p.321-342

**Biology 142 – Lecture Schedule Fall 2013 Continued**

Date	Topic	Assigned Reading
M Oct 14	<b>FALL BREAK</b>	
W Oct 16	Current research article discussion	Journal article – <i>summary due</i>
F Oct 18	Gene expression: Transcription	Ch. 13
M Oct 21	Gene expression: RNA processing	Ch. 14
<b>Tues Oct 22</b>	<b>EXAM II – 8:00 – 9:30 a.m. (Chs. 7, 8, 11, 12)</b>	
W Oct 23	Gene expression: Translation	Ch. 15
F Oct 24	Revisit the complexity of genetics	Ch. 5: p. 99-120
M Oct 28	Principles of gene regulation	Ch. 16: p. 431-441
W Oct 30	Lac operon regulation	Ch. 16: same as above
F Nov 1	Lac operon mutations; Trp operon <i>Materials and Methods draft due in class</i>	Ch. 16: same as above
M Nov 4	Regulation in eukaryotes	Ch. 17
W Nov 6	Regulation in eukaryotes	Ch. 17 (Also read p. 297-298; 394-396; 385-388)
F Nov 8	Review and catch up <i>Results draft due in class</i>	
M Nov 11	Mutations I	Ch. 18
W Nov 13	Mutations II	Ch. 18; Ch. 11: 303-315
F Nov 15	Current article discussion	Journal article – <i>summary due</i>
M Nov 18	Mutations III	Ch. 18; Ch. 9 – some highlights
<b>Tues Nov 19</b>	<b>EXAM III - 8:00 – 9:30 a.m. (Chs. 13-17)</b>	
W Nov 20	Cell cycle regulation	Ch. 23
F Nov 22	Cancer and cell cycle regulation	Ch. 23
M Nov 25	DNA: Curing Cancer film	<i>Presentation draft due</i>
W, F Nov 27, 28	THANSGIVING BREAK	
M Dec 2	Cancer and cell cycle regulation <i>Film response due on BB by 9AM</i>	Ch. 23
W Dec 4	Applied topics in genetics	
F Dec 6	Applied topics in genetics	
M Dec 9	Genetics: biology, society, and ethics <i>Final Paper and Lab Notebooks due at 5 pm</i>	

**\*\*\* FINAL EXAMINATION\*\*\* 9A class - Tuesday, Dec 17, 9AM-12PM**

**12A class - Wednesday, Dec 18, 2-5 PM**

(Chs. 18, 11, 9, 23, applied topics, comprehensive questions)

**Biology 142 – Advanced Topics in Genetics and Molecular Biology**  
**Laboratory Schedule Fall 2013**  
*Dr. Nitya Jacob – Room 123*


<b>Date</b>	<b>Topic</b>	<b>Written Assignment</b>
Sep 3/4	D1S80 VNTR Investigation I Human DNA Extraction and PCR	Introduction + Materials & Methods ( <i>due in class and BB 9/9</i> )
Sep 10/11	D1S80 VNTR Investigation II Human Genotype Analysis	Figures and Tables ( <i>due in class 9/16</i> ) Results + Discussion ( <i>due at workshop 9/20</i> ) Complete paper in final form ( <i>due in class and BB 10/7</i> )
Sep 17/18	Microbes and Granite Outcrops Literature Search for Research Project	Research Proposal draft ( <i>due next day on BB at 9AM</i> ) Final proposal ( <i>due in class and BB 9/30</i> )
Sep 24/25	Sample Collection – Arabia Mountain	
Oct 1/2	Observation of Collections and Sample Selection	
Oct 8/9	Bacterial DNA Extraction and PCR	Lab notebooks ( <i>due in class 10/11</i> )
Oct 16/18	No lab – Fall break	
Oct 22/23	Purification of PCR products, MspI digest	
Oct 29/30	RFLP analysis of rDNA	Materials and Methods Draft ( <i>due in class and BB 11/1</i> )
Nov 5/6	Bioinformatics and Analysis Tools Practicing Sequence Analysis	Results Draft ( <i>due in class and BB 11/8</i> )
Nov 12/13	Sequence Analysis of Outcrop Microbes	
Nov 19/20	Preparation for Research Symposium	<i>Presentation draft due</i>
Nov 26/27	No lab – Thanksgiving Break	
Dec 3/4	Research Symposium	Lab notebooks and Final paper ( <i>due at 5pm – paper on BB and print</i> )

## GUIDE TO BIOLOGY 142

*Information in this syllabus is critical to your success and may be subject to change according to my discretion, so please record any changes made during the semester. Please check the Blackboard site regularly for announcements, changes, documents, and submissions.*

**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 other words, you will learn about genetics in this course not just by learning information simply “given” to you. You will learn about the subject by practicing methods that led to the discovery of that knowledge in the first place - by asking questions, designing experiments, reading and writing critically, working independently, making connections, and thinking beyond the confines of the discipline.

**TIPS FOR SUCCESS:** *Biology 142 is a rigorous and demanding course. Being successful in this course relies on your learning and study strategies both in and out of the classroom throughout the semester. To be the best in this class, READ the following tips carefully and regularly PRACTICE ALL of these suggestions.*

 What are the best strategies for **learning** and **retaining** information in this course?

- ☞ **Take detailed class notes!!** Your time in the classroom and laboratory is THE most important time you will spend in learning for this course. Taking detailed notes, organizing your notes by concepts or topics, drawing images, and identifying the examples are ways in which your notes will be most useful for later study. The class time often does not involve just a “lecture” by the instructor. You will learn best if you write details of what the instructor conveys, and if you also take notes during discussions, problem solving, or when other students raise points in the classroom. In the laboratory – write good notes about procedures and concepts to understand the process, which will later help you in communication.
- ☞ **Complete the assigned reading!** There is an assigned chapter or pages from a chapter for every topic covered in this course. You must make every attempt to read or at least take note of the key topics and images in the assigned chapter BEFORE you come to class. Also answer the “Concept Checks” questions. After class, you can read the chapter again in detail.
- ☞ **Review Biology 141 information!** You are now learning about advanced topics in the field and using your knowledge from Biology 141 (or prior course) is VERY critical for your learning in this course. For every topic that we cover in 142, you must make it a point to review your 141 notes or textbook to re-learn the foundational information. Truly mastering the information in 142 and to work independently requires building further upon the knowledge that you already have about the subject. I will expect you to make those connections in the classroom as part of your learning process.

☞ **Ask questions and make contributions!** Students who ask questions and also contribute their understanding in and out of the class everyday are the ones who are most successful in this course. To be able to contribute in class, you **MUST** be following the above three tips on a regular basis. I will give you opportunities to be a regular participant and you must use these for learning. If you find yourself asking and answering questions in class every day or every week – it is a good indication that you are on the right path to success in this course.

🌸 What are the best strategies for **studying** in this course?

☞ **Study on a daily and weekly basis!** The night **BEFORE** every class, review the class notes from the previous class period and at least study the key concepts. Review the connections to Biology 141 information. Every weekend, you should actually study the information from your class notes and link them with the explanations in the textbook. Study details and processes using visuals from the Powerpoints (posted on Blackboard) and the textbook. *It is not advisable to make a whole new set of notes from the textbook – instead spend your time wisely by reorganizing or adding to the class notes that you already have.* Many of the exam questions come out of the material discussed in the classroom.

☞ **Study all handouts and additional resources!** **BEFORE** every class, review any handouts given to you in the previous class period and be able to explain their significance. Use the same handouts to study every weekend while conducting the above tip. Many of the exam questions come out of these resources.

☞ **Practice all problems and complete all worksheets daily and weekly!** Problem solving and critical analysis is **ESSENTIAL** to learning in the field of genetics. Every day or every weekend at the least, you **MUST** complete all problems and worksheets given in class that week. Solve all textbook problems given in the “Assigned Problems From Textbook” handout (also available on Blackboard). Each test will have a set of application problems. Students who solve these problems and worksheets at the last minute do not perform at the highest level in this course.

☞ **Attend SI sessions!** This course has a Supplemental Instruction (SI) leader. **Cari Hunter** is the SI for this course. Every week, she will hold two SI sessions (timings communicated via Blackboard) to review key concepts and to engage you in problem-solving. Being in SI twice a week is very valuable for you and it helps you achieve some parts of the three tips listed above.

🌸 What do the **exams** cover in this course and what are the best strategies to prepare for these tests?

A large part of your success in learning and studying for this course will be measured by your performance on three term examinations and one final examination. **Format** - Each exam will have a combination of multiple choice, short answer and short essay questions, including application problems. **Coverage** - Exams will primarily focus on **ALL** material covered in the classroom and including information from relevant assigned textbook

readings and practice problems (*see above tips for learning and studying*). The final examination will cover the last topics in detail and will include comprehensive information. **Preparation** – to best prepare for tests, follow ALL strategies listed above!

🌸 What are the best strategies for being successful in the laboratory?

The laboratory is a very CRITICAL component of this course and your success in the laboratory significantly impacts your overall performance in this course. **Pre-laboratory preparation** - 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, complete the pre-laboratory assignment, and be fully prepared for each lab. You must also read ALL instructions for assignments carefully. **Format** - The laboratory portion of Biology 142 resembles a research lab setting, where students are expected to learn how to be independent (with some guidance) in thinking critically, troubleshooting problems and learning how to clearly document observations and analysis. A molecular study of microbes is a main component of this laboratory. Samples will be collected from rock outcrops and brought back to the laboratory for genetic analysis. Students will work in research teams, develop an independent project question, and will be expected to communicate results in the form of an oral presentation and a full-length scientific paper. **Evaluation** - Your performance in lab will be evaluated based on your written assignments (see syllabus schedule), lab notebook, group work, project paper, and group presentation.

### OTHER IMPORTANT ASPECTS OF THIS COURSE:

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

**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 from your prior knowledge.

**Exam Protocols:** Do not come to any exam with notecards in your pockets or on your person. All cell phones are to be turned off and either in your bag in the front of the room or on the instructor's bench. Do not write notes or study material, or anything that could be construed as these, on your body. Check for such notations and remove before the exam time. These are considered to be a breach of the Honor Code.

**Current Research Articles:** There are scheduled discussion days on current research articles for this course (*see schedule*). A scientific journal article will be distributed for reading prior to each discussion day. Each student is required to read the paper, write a one page summary (as directed) of the investigation conducted in the article, and contribute to an in-class discussion.

**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).

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

**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 clearly communicate with the instructor as much in advance as possible about medical or family emergencies.

**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 only permitted to gather evidence for your research project.

**Personal Computer or Tablet:** If you would like to take notes on your personal laptop or tablet in class you must first seek special permission from the instructor. Surfing the web, Facebook, Skype or other multitasking/networking/chat during class is completely unacceptable and will not be tolerated.

**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.

#### **Distribution of Evaluation Points:**

##### Lecture:

Lecture exams (3)	300 points
Quizzes	40 points
Class participation	10 points
Film responses	15 points
Article discussion	30 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	25 points
Full-length scientific paper	80 points

**Total            770 points**

**Final grade determination:** *Your final grade in the course is determined by the percentage of total points (out of 770) that you earn at the end of the course.*

(Plus and minus grades are given on the final grade)

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