

**BIOLOGY 142 – ADVANCED TOPICS IN GENETICS AND MOLECULAR BIOLOGY**  
**COURSE SYLLABUS, DR. AMANDA PENDLETON**  
**SPRING 2011**

**Faculty Information:** Pierce 105, (770) 784 – 4506, arpendl@emory.edu

**Office hours:** M, 2 – 3:30, T, 2 – 3:30; or feel free to make an appointment with me for another time

**Course Meeting Times:**

Lecture – M, W, F	10:40 – 11:30	Pierce Hall Room 102
Lab – W	2:00 – 5:00	Pierce Hall Room 125

**OR**

Lecture – M, W, F	11:45 – 12:35	Pierce Hall Room 102
Lab – Th	2:30 – 5:30	Pierce Hall Room 125

**Required Texts:**

- (1) Text: *Genetics – A Conceptual Approach*. Third Edition. By Benjamin A. Pierce. 2008. W. H. Freeman and Company – for lecture and lab topics.
- (2) Lab Book: Laboratory research notebook. This notebook should be purchased from the Oxford College bookstore. No substitutes accepted.
- (3) Lab Manual: The custom laboratory manual for this course will be available for purchase in the laboratory.

**Highly Recommended:**

- (1) *Solving Problems: Solutions and Problem-Solving Manual to accompany Genetics – A Conceptual Approach*. Third Edition.
- (2) *A Student Handbook for Writing in Biology*, Karen Knisely, 2008, 3<sup>rd</sup> edition, W.H. Freeman and Co. This is a great resource for writing, and is also on reserve in the library.

**Course Objectives:** The purpose of this course is to give you, the student, a firm foundation in the underlying themes of genetics and molecular biology, so that you can answer the following **essential questions**:

- \* What patterns are seen when traits pass from generation to generation?
- \* What are the cellular and molecular mechanisms that underlie inheritance patterns?
- \* What are the molecular properties of genes, gene expression, and mutation that contribute to phenotype?
- \* What principles and techniques do biologists use to study genetics and communicate their findings?

In addition, 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. My hope is that upon grasping the fundamental themes of genetics and molecular biology in this course, and using them to ask questions and solve problems, you will be well prepared to delve deeper, into more specialized areas of biology.

**BIOLOGY 142; LECTURE SCHEDULE SPRING 2011**

Date	Topic	Assigned Reading
W Jan 12	Introduction: The big picture	Ch. 1
F Jan 14	DNA: The Secret of Life	Ch. 1; Ch. 10
M Jan 17	<i>Martin Luther King Day – no class</i>	
W Jan 19	The history of genetics and DNA	Ch. 1; Ch. 10
F Jan 21	DNA structure and technology	Ch. 10; Ch. 19: p. 503-509; 513-516
M Jan 24	DNA structure and technology	same as above
W Jan 26	Chromosomes and cell division	Ch. 2
F Jan 28	Transmission genetics - overview	Ch. 3; Ch. 5 (skim)
M Jan 31	Sex determination and sex linkage	Ch. 4
W Feb 2	Human pedigree analysis	Ch. 6: p.134-142
F Feb 4	Human pedigree analysis	Ch. 6: p. 146-152
M Feb 7	The complexity of genetics	Ch. 5: p. 99-119
W Feb 9	The complexity of genetics	Ch. 5: p. 99-119
F Feb 11	Linkage and recombination	Ch. 7: p. 160-185
F Feb 11	<i>Required: Writing Workshop 2 – 3 pm and 3 – 4 pm</i>	
M Feb 14	Linkage and mapping	Ch. 7: p. 160-185
<b>Tues Feb 15</b>	<b>EXAM I 8:00 - 9:30 a.m. (Chs. 1-6, 10 and 19)</b>	
W Feb 16	Three-point crosses	Ch. 7: p. 160-185
F Feb 18	Genetics of bacteria and viruses	Ch. 8: p. 200-210 p. 215-219; 228-230
M Feb 21	Genetics of bacteria and viruses	same as above
W Feb 23	Cytogenetics: chromosome variations	Ch. 11: p. 285-309
F Feb 25	Current research article discussion	<i>Journal article – summary due</i>
M Feb 28	DNA Replication	Ch. 12: p. 315-335
W Mar 2	DNA Replication and technology	Ch. 12: p.315-335; Ch. 19: 525-529
F Mar 4	Gene expression: Transcription	Ch. 13
M Mar 7 – F, Mar 11	<b>***Spring Break***</b>	
M Mar 14	Gene expression: RNA processing	Ch. 14: p. 368-385
<b>Tues Mar 15</b>	<b>EXAM II – 8:00 – 9:30 a.m. (Chs. 7-9; 11, 12, 19)</b>	
W Mar 16	Gene expression: Translation	Ch. 15
F Mar 18	Principles of gene regulation	Ch. 16: p. 425-435
M Mar 21	Lac operon regulation	Ch. 16: p. 436-445
W Mar 23	Lac operon mutations; Trp operon	Ch. 16: p. 436-445
F Mar 25	Regulation in eukaryotes	Ch. 17

**LECTURE SCHEDULE SPRING 2011, CON'T.**

Date	Topic	Assigned Reading
M Mar 28	Regulation in eukaryotes	Ch. 17 (Also review p. 292; 386-388; 378-380)
W Mar 30	Review and catch up	
F Apr 1	Mutations: overview, base substitutions	Ch. 18
M Apr 4	Mutations: insertions/deletions; large variations	Ch. 18
W Apr 6	Mutations: large variations; DNA repair	Ch. 18
F Apr 8	Current article discussion	<i>Journal article – summary due</i>
M Apr 11	Cell cycle regulation	Ch. 23
<b>Tues Apr 12</b>	<b>EXAM III - 8:00 – 9:30 a.m. (Chs. 13-17)</b>	
W Apr 13	Cancer and cell cycle regulation	Ch. 23
F Apr 15	DNA: Curing Cancer film	
M Apr 18	Cancer and cell cycle regulation	Ch. 23
M Apr 18	<b><i>Lyceum Lecture by Nathaniel Comfort, Genetics Historian from the Johns Hopkins University School of Medicine; 7 p.m. in Williams Hall</i></b>	
W Apr 20	Application: Stem Cells	
F Apr 22	Application: Stem Cells	
M Apr 25	Genetics: biology, society, and ethics	
<b>FINAL EXAMINATION:</b>		
	<b>Friday, April 29;</b>	<b>Section 11A, 2:00 pm – 5:00 pm</b>
	<b>Monday, May 2;</b>	<b>Section 10A, 9:00 am – 12:00 pm</b>
	<b>(Chs. 18, 19, 23; stem cells, comprehensive questions)</b>	

**BIOLOGY 142, LABORATORY SCHEDULE, SPRING 2010****DR. NITYA JACOB & DR. AMANDA PENDLETON**

<b>Date</b>	<b>Topic</b>	<b>Assignment</b>
Jan 18, 19, 20	D1S80 VNTR Investigation I Human DNA Extraction and PCR	<i>Introduction + Materials &amp; Methods: due in class Fri, Jan 28</i>
25, 26, 27	D1S80 VNTR Investigation II Human Genotype Analysis	<i>Complete paper in final form: due in class Fri, Feb 18</i>
Feb 1, 2, 3	Microbes and Granite Outcrops Literature Search for Research Project	<i>Research Proposal draft: due in lab</i> <i>Final proposal with literature review: due in class Mon, Feb 7</i>
8, 9, 10	Field Trip to Rock Outcrops Sample Collection	
15, 16, 17	Observation of Collections and Sample Selection	
22, 23, 24	Bacterial DNA Extraction and PCR	
Mar 1, 2, 3	Purification of PCR products, Restriction enzyme digest	<i>Lab notebooks: due in class Fri, Mar 4</i>
8, 9, 10	<b>**Spring Break**</b>	
15, 16, 17	RFLP analysis of rDNA	
22, 23, 24	Bioinformatics and Analysis Tools Exercise in Sequence Analysis	<i>Draft of Materials and Methods: due in class Mon, Mar 21</i>
29, 30, 31	Sequence Analysis of Outcrop Microbes	<i>Draft of Results: due in class Fri, Apr 1</i>
Apr 5, 6, 7	Preparation for Research Symposium	
Week of 11th	Research paper consultations	
19, 20, 21	Research Symposium	<i>Lab notebooks: due in class Fri, Apr 21</i> <i>Final paper: due Mon, Apr 25 at 5 pm</i>

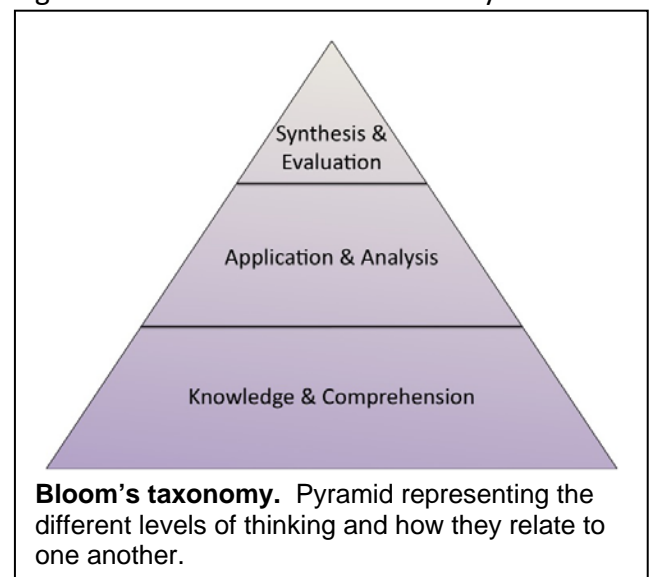
**The instructor reserves the right to make changes to this syllabus as necessary.**

## EXPECTATIONS, EVALUATION AND TIPS FOR SUCCESS IN BIOLOGY 142

Welcome to Biology 142! The information in this handout and accompanying materials should be read and followed by all students in Advanced Topics in Genetics and Molecular Biology. Please do not hesitate to ask for clarification. Biology 142 is designed for students who **plan to major in biology or neuroscience and behavioral biology, attend professional school in a health related field, or have a strong background in biology** and have chosen biology to fulfill their distribution requirements.

**Tips for Success:** Biology 142 is an *intensive course* that requires *time and commitment* and assumes competency in all Biology 141 material. To perform well in this course, you must manage your time appropriately and have a proper study plan, beginning from the *first day* of class. The best overall approach is to work consistently, in small doses. The following are some additional tips that will help you succeed:

- **Be prepared for class every day.** The readings should be done before class. The best overall reading approach is to read before class (or at least browse) assignments at first for an overview, jotting down questions or areas of confusion. Then, 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. Finally, read a second time after class (the same day as class is best), using a different color of highlighter and paying careful attention to topics discussed during class. This second reading is critical because it will help you to connect class discussions to the textbook assignments.
- **Take good notes.** During class, we will discuss the most significant concepts from your readings. At times, I will present examples that may not be given in your textbook. You are responsible for all of this information. Good note-taking will help you to remember which concepts were most important and why. Additionally, the act of note-taking is itself a learning exercise that helps you to stay actively engaged in the topic and better remember class discussions.
- **Ask questions.** Biology 142 is a collaborative course. Therefore, if you don't understand something discussed in class, ask questions in class, ask questions of your peers, form productive study groups, or arrange to meet with me. I welcome your questions, and if you're struggling, it's important to get help early. Additionally, by asking questions, you take charge of your own learning.
- **Build a foundation of knowledge, but aim high in your thinking** (adapted from [www.cas.lsu.edu](http://www.cas.lsu.edu)). While studying, keep in mind that you will need to do more than simply learn facts; you will need to think. We will use Bloom's taxonomy as a guide for our thinking this semester. Bloom's taxonomy describes different levels of thinking:
  - **Level 1 = Knowledge & Comprehension:** Memorizing and understanding information, restating in your own words, paraphrasing, or summarizing.
  - **Level 2 = Application & Analysis:** Identifying parts, patterns, and connections in new information and comparing, contrasting, or arranging these parts and patterns in a logical order or in categories. Using information to solve new problems; transferring abstract or theoretical ideas to a practical, new situation.



- **Level 3 = Synthesis & Evaluation:** Evaluating the relative effectiveness, value, or worth of a set of different solutions, ideas, or results. Predicting consequences. Taking a position on an issue and defending that position. Combining information to form a unique product; requires creativity and originality.

Notice how each level of the pyramid builds on the foundation that precedes it. We must learn the lower levels before we can effectively perform at higher levels. In general, students who earn lower grades have not gone past the 'Knowledge & Comprehension' level. Students who earn higher grades generally know the course material well enough to perform higher level thinking tasks.

- **Review, review, review and practice.** Any biology course these days will have a **lot** of information. So, mastering the course material at the 'Knowledge' and 'Comprehension' levels first is key. To do this, I suggest that you study the diagrams in your text and lecture handouts; practice writing out and linking concepts **by memory**; prepare your own tables and diagrams as a study aid; create lists of questions that help you remember the material, and then practice answering those questions **by memory**. You should do at least one or two of these activities (in addition to your reading) each day. To move up to the higher learning levels, complete all worksheets and problems given during class, complete all textbook problems given in the 'Assigned Problems from Textbook' handout (available on Blackboard), and attend SI sessions (where you will be given additional practice with higher-level thinking tasks).
- **Supplemental Instruction (SI)** is provided for all students in Biology 142. Your Biology 142 SI leader is Susanna Brantley. There will be two SI sessions per week. Check the course Blackboard site for more information.

**Evaluation Criteria:** Your performance in the course is evaluated through quizzes, examinations, writing assignments, and class participation.

- **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 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.** 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).
- **Extra Credit.** We have the special opportunity this semester to have on campus Dr. Nathaniel Comfort, a Genetics Historian from the Johns Hopkins University School of Medicine. Dr. Comfort will give a Lyceum Lecture on April 18 at 7 pm in Williams Hall. You will be awarded extra credit for attending this lecture and writing a response.
- **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.

#### Evaluation Points:

##### Lecture:

Lecture exams (3)	300 points
Quizzes	35 points
Class participation	15 points
Film responses	10 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**

**750 points**

#### Final grade determination:

*(Plus and minus grades are given)*

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

***Class Policies:***

1. **Attendance:** See the attached sheet for the attendance policy. Unexcused absences in lecture, lab, examinations or a failure to follow the procedures outlined in that handout will 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.
2. **Exams:** A student should place all book bags, purses, and other belongings at the front of the room while sitting for any type of exam or graded assignment. Cell phones should be turned off and should be placed in bags or on a bench at the front of the room. (Desktops should be clear except for the materials needed and authorized for testing). Students should feel free to ask for clarification about any question during the exams
3. **Late work:** My due dates are fixed, unless you provide documentation of a serious life event.
4. **Missed exams:** In general, missed exams may not be made up (see the attached sheet for the absence policy) except for serious reasons (such as death or illness) with proper documentation. However, if you already know you have a conflict, please inform me by Jan. 21, and I will determine if make-up arrangements will be possible.
5. **Electronic devices:** Please turn off all cell phones and other electronic devices prior to entering the classroom. Photography and using calculators on phones is also prohibited. 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**.
6. **Academic dishonesty:** Honesty and ethical behaviors are imperatives in any career. Therefore, academic dishonesty will not be tolerated. See [http://oxford.emory.edu/audiences/faculty\\_and\\_staff/resource\\_policies/faculty\\_handbook/honor\\_code.dot](http://oxford.emory.edu/audiences/faculty_and_staff/resource_policies/faculty_handbook/honor_code.dot) for descriptions of what constitutes academic dishonesty. Regulations of the Honor Code apply to all work in this course, including lecture and lab examinations and assignments. Please pledge all of your work with your signature to indicate that you have followed the rules of the Honor Code. Anyone caught violating this policy will be reported to the Honor Council, as detailed in the Honor Code. If you have any questions about what constitutes your own work, definitely ask!