

Biology 142Q - Advanced Topics in Genetics and Molecular Biology

Course Syllabus, Spring 2016

Lecture: 1A -MWF 1:15-2:20 PM; Oxford Science Building (OSB) 115

Laboratory: Tuesday, 9:45 AM - 12:45 PM, OSB 317

Faculty Information: Sarah Cash, Office: OSB 202; Phone: 770-784-4534

Office Hours: Tues 2:00-3:00 PM; F 11:00 AM – 12:30 PM or by appointment

Email: sarah.a.cash@emory.edu (best way to contact me!)



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.



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 Spring 2016

Date	Topic	Assigned Reading
W Jan 13	Introduction: The big picture	Ch. 1
F Jan 15	DNA: The Secret of Life	Ch. 1; Ch. 10
M Jan 18	No class—MLK <i>Film response due on BB by 5PM Tuesday Jan 19</i>	
W Jan 20	The history of genetics and DNA	Ch.1; Ch. 10
F Jan 22	DNA structure and technology <i>Take home Quiz 1 due in class</i>	Ch. 19: p. 535-541; 545-554
M Jan 25	DNA structure and technology	same as above
W Jan 27	Chromosomes and cell division	Ch. 2
F Jan 29	Transmission genetics - overview <i>D1S80 draft 1 (Introduction, Materials & Methods) due in class and on BB</i>	Ch. 3; Ch. 5 (overall concepts)
M Feb 1	Lab 3 Part 1 <i>Draft Group proposal due on BB by 5pm on Tuesday, Feb 2</i>	Complete pre-lab assignment
W Feb 3	Sex determination and sex linkage	Ch. 4
F Feb 5	Human pedigree analysis	Ch. 6: p. 139-147; 150-157
F Feb 5	Required: Writing Workshop 2:30 – 3:30 pm and 3:30 – 4:30 pm <i>D1S80 draft 2 due at workshop and on BB</i>	
M Feb 8	Human pedigree analysis	Ch. 6: p.139-147; 150-157
W Feb 10	Complexity of genetics and molecular basis <i>Revised group research proposal due on BB by 5PM</i>	Ch. 5: p. 103-117; 119-124
F Feb 12	Complexity of genetics and molecular basis <i>Lab notebooks due in class</i>	Ch. 5: p.103-117; 119-124
M Feb 15	Linkage and recombination	Ch. 7: p. 165-190
Tues Feb 16	EXAM I 8:00 - 9:30 a.m. (Chs. 1-4, 5, 6, 10 and 19)	
W Feb 17	Mapping and three-point crosses	Ch. 7: same as above
F Feb 19	Cytogenetics: chromosome structure	Ch. 11: p. 299-309
M Feb 22	Genetics of bacteria and viruses <i>D1S80 complete paper due in class and BB</i>	Ch. 9: p. 241-251; 254-260; 265-269
W Feb 24	Genetics of bacteria and viruses	Ch. 9: same as above
F Feb 26	DNA Replication <i>Lab notebooks due in class</i>	Ch. 12: p. 325-347
M Feb 29	DNA Replication <i>Take home Quiz 2 due in class</i>	Ch. 12: p.325-347
W Mar 2	DNA Replication review	
F Mar 4	<i>Primary research article discussion</i>	

Biology 142 – Lecture Schedule Spring 2016 Continued

<u>Date</u>	<u>Topic</u>	<u>Assigned Reading</u>
Mar 7-11	SPRING BREAK	
M Mar 14	Exam review/Transcription Introduction	Ch. 13
Tues Mar 15	EXAM II – 8:00 – 9:30 a.m. (Chs. 7, 9, 11, 12)	
W Mar 16	Gene expression: Transcription	Ch. 13
F Mar 18	Gene expression: Transcription	Ch. 13
M Mar 21	Gene expression: RNA processing	Ch. 14
W Mar 23	Gene expression: Translation	Ch. 15
F Mar 25	Principles of gene regulation <i>Materials and Methods draft due in class and on BB</i>	Ch. 16: p. 443-453
M Mar 28	Lac operon regulation	Ch. 16: same as above
W Mar 30	Lac operon mutations; Trp operon	Ch. 16: same as above
F Apr 1	<i>Primary research article discussion</i>	
M Apr 4	Regulation in eukaryotes <i>Lab notebooks due in class</i>	Ch. 17 p. 304-305; 402-404; 393-396
W Apr 6	Regulation in eukaryotes	Ch. 17
F Apr 8	Regulation and epigenetics in eukaryotes <i>Take home Quiz 3 due in class</i>	Ch. 21: 615-619; 627
M Apr 11	Mutations- overview and point mutations	Ch. 18
Tues Apr 12	EXAM III - 8:00 – 9:30 a.m. (Chs. 13-17)	
W Apr 13	Mutations – large insertions/deletions	Ch. 18
F Apr 15	DNA: Curing Cancer film <i>Results figures and tables due in class</i>	
M Apr 18	Cell cycle regulation	Ch. 23
W Apr 20	Cancer and cell cycle regulation	Ch. 23
F Apr 22	Cancer and cell cycle regulation <i>Film response due on BB by 5PM</i>	Ch. 23
M Apr 25	Back to the big picture <i>Lab notebooks due in class - 4/25</i> <i>Final research paper due on BB by midnight – 4/25</i> <i>Final research paper HARD COPY due by 12PM - 4/26</i>	

Wed , May 4 FINAL EXAMINATION 9AM-12PM (Chs 18, 11, and 23 + comprehensive)

Biology 142 – Advanced Topics in Genetics and Molecular Biology
Laboratory Schedule Spring 2016
Sarah Cash – Room 317 (Tuesday Labs)

Date	Topic	Written Assignment
Jan 19	D1S80 VNTR Investigation I Human DNA Extraction and PCR	Introduction + Materials & Methods (<i>due in class and BB 1/29</i>)
Jan 26	D1S80 VNTR Investigation II Human Genotype Analysis (<i>Complete D1S80 paper in final form due in class and BB – 2/22</i>)	Results + Discussion (<i>due at workshop 2/5</i>)
Feb 2	Microbes and Granite Outcrops Literature Search for Research Project <u>Note: Part 1 of this lab will be in class on Feb 1</u>	Research Proposal draft (<i>due next day on BB at 9AM</i>) Final proposal (<i>due in class and BB 2/10</i>)
Feb 9	Sample Collection – Arabia Mountain Lab notebooks <i>due in class – 2/12</i>	
Feb 16	Identification of unique colony types and PCR	
Feb 23	Colony abundance estimations and PCR Lab notebooks <i>due in class – 2/26</i>	
Mar 1	Purification of PCR products, MspI digest	
Mar 8	No lab – Spring break	
Mar 15	RFLP analysis of rDNA	Materials and Methods Draft (<i>due in class and BB 3/25</i>)
Mar 22	Bioinformatics and Analysis Tools Practicing Sequence Analysis	
Mar 29	Sequence Analysis of Outcrop Microbes Lab notebooks <i>due in class – 4/4</i>	
Apr 5	Preparation for Research Symposium	
Apr 12	Paper and Symposium	Results Draft - figures and tables (<i>due in class 4/15</i>)
Apr 19	Research Symposium Lab notebooks <i>due in class – 4/25</i> Final research paper due on BB by midnight – 4/25 Final research paper HARD COPY due by 12PM - 4/26	

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 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. **Amanda Kadesky** 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 all work for credit in this course come under the regulations of the Honor Code. Your signature on your work attests to your upholding the Honor Code. Please read the information on **plagiarism** on the Library web page and always ask if you have any questions about assignments. Note that writing assignments will be submitted to **SafeAssign on Blackboard**. 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.

Primary Research Articles: There are scheduled discussion days on current primary 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, complete a worksheet, 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:

<u>Lecture:</u>		<u>Laboratory:</u>	
Lecture exams (3)	300 points	Human genotyping paper (labs 1&2)	40 points
Quizzes	30 points	Group proposal and literature review	10 points
Class participation	10 points	Lab notebooks	40 points
Film responses	10 points	Paper drafts	20 points
Article discussion	20 points	Symposium presentation	25 points
Final exam	170 points	Full-length scientific paper	80 points
Total	755 points		

Final grade determination: *Your final grade in the course is determined by the percentage of total points (out of 755) 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%