



# GENETICS & MOLECULAR BIOLOGY (BIOL3010)

## FALL 2012

### COURSE DESCRIPTION

What makes humans different from fruit flies? Why do you look like your mother? Why does your brain have neurons and not liver cells? The short answer to each of these questions is: It's the genes! And, that's what this course is about. Throughout the semester, we will consider what genes are, both physically and functionally. We will consider their chemical make-up, how they are passed on from generation to generation, how they are expressed and how that expression is regulated, how disruptions in the structure and expression of genes arise and how those disruptions lead to cellular defects and disease.

### WHY STUDY GENETICS?

Ultimately, genetics underlies not only how organisms develop, but also how they respond to and interact with each other and their environments. But, aside from that and any particular curiosity you have about our relationship to fruit flies in the grand scheme of life, why should you care about genetics? Genetics has an enormous impact on modern society. Our increasing understanding of the molecular genetic basis of heritable traits, including disease, prompts difficult health and reproduction-related questions for both individuals and lawmakers. Our growing knowledge of the function and control of our genome is enabling greater opportunities for developing effective gene therapies to treat/cure genetic diseases. Rapidly evolving technical advances are making it possible to gather unprecedented information about our individual genetic profiles (our genetic fates?). This course is designed to help you develop the analytical skills necessary to enhance not only your continuing studies in biology, but also your future contributions to the vigorous societal debates that focus on these genetics issues.

### COURSE OBJECTIVES

The overall goal of this course is that you learn how to think like a geneticist. Specifically, at the end of this course, you will:

- understand how genes and traits are related.
- be able to analyze inheritance patterns to deduce information about genes, alleles and gene functions.
- be able to use statistical analyses to assess how well observed inheritance patterns fit theoretical predictions.
- be able to connect the function of genes & genomes with their molecular anatomy.
- be able to understand the mechanisms by which an organism's genome is passed on to the next generation and assess where during that process structural abnormalities in the genome arise.
- be able to analyze and understand how different types of mutations affect genes and their corresponding RNA/protein products.
- be able to relate genes & gene function to core principles in other major disciplines of biology, such as cell biology, development, biochemistry, and evolution.

## IMPORTANT COURSE DETAILS

Lectures: 1:00-1:50 MWF Chem 402

Semester Tests: 7:00-9:00 PM Mondays (see calendar) Chem 402

Required Discussion Sessions: as scheduled

### INSTRUCTOR INFORMATION

**Claire Cronmiller**, Professor of Biology. Born in Syracuse, New York, but grew up in New York State, Washington State, Massachusetts and New Jersey. Started out as a German literature major in college, but eventually had to admit to a less than scholarly talent for literary criticism. Took Introductory Biology in college to fulfill a science requirement: The rest, as they say, is history. In the lab, grows fruit flies as an experimental model to study the genetic regulation of development, but at home cares for 18-year-old *Pulcino*, a Quaker parrot.

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Office Hours: T 10-11, W 2:15-3:15 [Gilmer 227] & by appointment [Gilmer 260]

### (TEACHING ASSISTANTS)

XX, XX, XX, XX

Email addresses, office locations & office hours posted on the course Collab site.

### TEXTBOOK & ONLINE LEARNING PROGRAM

*Genetic Analysis: An Integrated Approach* by Sanders and Bowman, 1<sup>st</sup> ed., Pearson. This book will be used throughout the semester to provide foundational knowledge, as well as application practice problems; the book is available in both hardcover and loose leaf editions. *Mastering Genetics* is an online learning program that will be used to give you help with problem solving and to provide you with feedback on the depth of your understanding of fundamental concepts; access codes are available either bundled with the text or separately.

### PREREQUISITES

BIOL 2010 and at least one semester college chemistry (e.g. CHEM1410/1420/1810/1820). The premise for this course is that you have completed these prerequisites and are familiar with their concepts and principles.

### IMPORTANT COLLEGE DATES:

Last Day to Add: September X

Last Day to Drop: September X

Last Day to Withdraw: October XX

Last Day to Request Final Exam Change: November XX

## TIPS FOR SUCCESS IN GENETICS

- *Complete the pre-class assignments.* Class time will be used to consider concepts and processes at levels that go beyond simply "define and describe." To participate fully in class time discussions and activities, you will need to come prepared. The reading for each class is listed in the course schedule. By 10:00AM on each class day, complete the short *Mastering Genetics* quiz that is based on the reading material; this will help *you* gauge your comprehension of the reading, and it will help *me* identify particularly difficult material that needs to be clarified during class.
- *Come to class.* Class presentations and activities will help you understand extensions, implications and applications of genetic concepts. We will also use iClickers to help you assess your own understanding of these concepts and your ability to apply them to problems and simulations.
- *Use the available resources.* In the Learning Aids folder on Collab (Resources), you will find suggestions for taking notes, reading your textbook, solving problems, integrating concepts throughout the semester, etc. You will also find *Cronmiller's Tips for Success in Genetics*, which includes strategies for developing your problem solving skills.
- *Practice, practice, practice!* Confucius said: I hear and I forget, I see and I remember, I do and I understand. If listening and reading are as far as you go with your course involvement, you will undoubtedly be dissatisfied with your encounter with genetics this semester. Unfortunately, we cannot offer you the hands-on "doing" experience that would most effectively lead you to genuine understanding of genetic principles. Instead, we use problem solving to simulate "doing." Typically, we are not born with an instinctive ability to dissect and explain genetic scenarios: That ability needs to be developed. Moreover, cultivating that ability is not a passive activity: It will require significant time and effort on your part. However, since solving practice problems, diligently and honestly (see *Cronmiller's Tips for Success in Genetics*), is the only *reliable* way to gauge your understanding of genetics concepts, that time and effort will be well worthwhile.
- *If you need it, get help early and often!* **Each week** we offer you 10 hours of walk-in, open office hours. No standing in line -- just come in and ask questions, get help on problems, or listen to questions asked by others.

## EVALUATION & GRADING

Your learning will be assessed by:

- 3 problem-based semester tests (XX points each)
- online quizzes related to the pre-class reading (XX points)
- weekly homework problems (XX points)
- discussion activities and attendance (XX points) [see Discussion Information & Policies on Collab]
- final exam (XX points)

You will also receive 20 points for taking 2 short online assessments of your general knowledge of genetics. These multiple choice assessments are closed book and require no advance preparation. Check the *Schedule* and *Tests & Quizzes* link on Collab for information regarding the timed, limited access to these assessments (one at the beginning of the semester and one at the end).

Although iClicker responses will not contribute to your course points, you should take this class participation seriously and answer all questions thoughtfully: iClicker scores will be considered for determining borderline final grades.

The final letter grades for the course will be assigned according to...[THIS SECTION TO BE COMPLETED LATER].

## TESTS

All tests are comprehensive. Genetics, like science generally, is cumulative. Be careful not to “pigeonhole” your learning: On every test you will encounter questions/problems that will require you to combine several concepts to synthesize plausible answers. In these cases, just memorizing isolated concepts and examples **will not work**. You will need to draw on and integrate concepts you saw in Chapter 4, even as you consider problems that you encounter in Chapter 7. [Concept maps can help you re-examine and relate material continuously throughout the entire course!] Moreover, what you understand by the end of the course matters most. Comprehensive tests not only give you multiple chances to show and get credit for your comprehension, but they also put the emphasis for assigning final grades on the knowledge and abilities that you’ve developed by the end of the class, rather than on the average of your accomplishments throughout the semester. *If, in spite of sincere and conscientious efforts for the 3 semester tests, you perform better on the comprehensive final exam than collectively on the semester tests, your final exam score (x3) will be used as your total tests + final exam score in the calculation of your final grade.*

All tests are **closed book** format, and only **nonprogrammable** calculators may be used during tests! (Tip: Get the calculator *now*, and use it for all problem solving, so that you’re comfortable with it during the test.) For suspected test grading *errors*, please email CC *after* the test scores & answer keys have been posted on Collab.

## MAKE-UP TESTS

Alternate test times for semester tests may be requested for varsity athletic or legitimate academic reasons; requests must be made and approved at least **5 days in advance**. Otherwise, students who miss any one of the 3 semester tests **and** have an excusable justification (e.g. death in the family or incapacitating illness with hospital/physician verification), may take a single, comprehensive make-up test (**Monday, November 26th, 7-9 PM**). Except in case of emergency, approval to take the make-up test must be requested before the test that will be missed.

## ELECTRONIC DEVICES & RECORDING POLICY

Cell phones and pagers that ring during class are disruptive; please turn them off and put them away before class begins. If there is an emergency situation that requires that you be reached, set your phone/pager to vibrate/mute; if it rings, leave the class to take the call. Laptops/digital notebooks may be used during class only if they are being used for a class activity, such as taking notes. "Multitasking is mostly wishful thinking." So, please do not IM, tweet/facebook, surf the web, play games or prepare/read/send email or text messages during class. Students who violate these rules will be asked to leave the classroom. [FYI: Studies show that laptop abuse during class lowers grades (research citation available upon request). So, it is in your best interest to stay focused during class.]

Recording of lectures/presentations is allowed for **personal use only**. Students may not post such recordings on *any* internet site.

## COPYRIGHTS

According to the Technology Harmonization and Education Act of 2002, I am required to provide this legal notice that online materials provided for your use in this course could be

copyright-protected. Fair Use laws permit me to provide this material for your personal use, but we are all prohibited from unlimited copying and distribution of it.

### HONOR STATEMENT

We trust that every student will comply fully with all provisions of the UVA honor system. We also assume that any student, who observes an incidence of cheating, will contact an Honor Advisor. Any student who is caught (by the instructor/TA) cheating or committing academic fraud will receive a "0" (zero) on the assignment/test, irrespective of any subsequent action taken by the Honor Committee. For all assignments, please pay attention to explicit instructions regarding what resources you may (or may *not*) use for their completion and whether you may (or may *not*) collaborate with classmates.

### CLASS/ASSIGNMENT SCHEDULE

Date	Topics	Readings and Activities	Assignments
<b>Theme 1: Genetics is all around us.</b>			
Aug. 29	TBA	Course Syllabus Graphic Syllabus	
<b>Theme 2: Historical &amp; molecular foundations of modern genetics</b>			
Aug. 31	TBA	Textbook Chapter 1	<i>Mastering Genetics</i> Quiz #1
<b>Theme 2: What is the new intriguing, provocative, or beautiful question students will explore?</b>			
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<div style="display: flex; align-items: center; justify-content: center;"> <div style="display: flex; flex-direction: column; align-items: center; margin-right: 10px;"> <span>•</span><span>•</span><span>•</span><span>•</span><span>•</span><span>•</span><span>•</span><span>•</span><span>•</span><span>•</span> </div> <div style="border: 1px solid black; padding: 10px; text-align: center;"> <p>[THIS SECTION TO BE COMPLETED LATER]</p> </div> </div>			
Dec. XX 9:00AM- 12:00 noon	<b>Time to tie it all together!</b>	<b>Final Exam</b>	