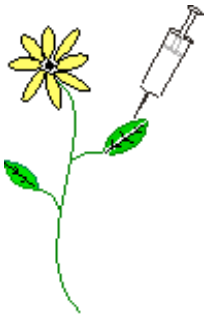
BIOL 260: GENETICS
FALL 2011 (updated 8 Sept 2011)



MWF 10:50-11:50
Olin Rice 250

Course Instructor: Mary K. Montgomery (aka M^2), Associate Professor
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Teaching Assistant: Ira Martopullo (email: imartopu@macalester.edu)

Required Texts and Materials:
• Benjamin Pierce, Genetics: A Conceptual Approach, 3rd edition (WHFreeman&Co.)
• Additional assigned reading material is listed below and posted on Moodle
• iClicker

Course Description
An introduction to the principles of genetics, including topics from classical Mendelian concepts to the contemporary molecular biology of the gene. Three lecture hours (4 credits) Prerequisites: Chemistry 111, or concurrent enrollment in Chemistry 111 or 113.

BROAD COURSE LEARNING GOALS: Upon successful completion of this course, students should be able to demonstrate the following competencies:
(1) an understanding of the central theories and methodologies that define the field of genetics and its various subdisciplines (specifically, classical and molecular genetics) and the ability to use the vocabulary that embodies this knowledge;
(2) an understanding that science is a continual process of investigation and interpretation and that scientific knowledge progresses via the support and rejection of competing hypotheses, collective decisions that are based on empirical evidence and logical interpretation using inductive and deductive reasoning;
(3) the ability to develop a scientifically informed position on some of the bioethical and social issues related to the practice and application of genetics research;
(4) and improved research skills and the ability to critically assess the content value of different types of information.

SCHEDULE

Date	Topic	Textbook Reading
Sept 7	Introduction to the course and the study of genetics	Ch 1: 1-13
9	Mitosis and Meiosis	Ch 2: 16-33
	SuperMouse (Fact or Fiction?)	
Sept 12	Mendelian genetics: monohybrid crosses	Ch 3: 43-56
	Mendel, Gregor (1865) Versuche über Pflanzen-Hybriden (Experiments in Plant Hybridization)	
14	Mendelian genetics: dihybrid and trihybrid crosses	Ch 3: 57-65
16	Sex determination and sex linkage	Ch 4: 73-92
Sept 19	Mendel modified: incomplete dominance, lethal alleles, multiple alleles, and more	Ch 5: 99-114
21	Modified ratios: gene interactions and maternal effects	Ch 5: 115-121
23	Epigenetics and phenotypic plasticity	Ch 5: 122-124
	http://learn.genetics.utah.edu/content/epigenetics/	
Sept 26	Quantitative traits	Ch 24: 645-654
28	Pedigrees and probabilities	Ch 6: 134-146
	PROBLEM SET 1 DUE	
30	Discussion: History of Eugenics	Ch 6: 146-151
	http://www.eugenicsarchive.org/eugenics/	
	Jonathan Beckwith's "Their own atomic history"	
Oct 3	Discussion: Genetic Testing	
	http://www.nlm.nih.gov/medlineplus/genetictesting.html	
	Steven Pinker's article, "My Genome, My Self"	
5	Catch Up and Review	
7	**EXAM 1**	
Oct 10	Linkage and genetic maps	Ch 7: 160-175
12	Linkage and genetic maps	Ch 7: 175-183
14	Structure of DNA	Ch 10: 267-79
	Watson, JD and FH Crick (1953) A structure for deoxyribonucleic acid. *Nature* 171, 737.	
	Wilkins', and Franklin & Gosling's 1953 Nature papers also discussed.	
Oct 17	DNA replication/synthesis	Ch 12: 315-35
19	RNA synthesis & processing	Ch 13: 345-63; 14: 368-85
	PROBLEM SET 2 DUE	
21	Protein synthesis	Ch 15: 395-413

Oct 24	Catch Up and Review	
26	**EXAM 2**	
28	**FALL BREAK**	
Oct 31	Control of gene expression at the level of DNA	Ch 16: 425-38
Nov 2	Control of gene expression at the level of DNA	Ch 17: 453-60
4	Control of gene expression at the level of RNA	Ch 17: 461-66
Nov 7	RNA interference (RNAi) and small RNAs	Pp. 386-90, 463-5, 536-7
9	Chromosomal mutations	Ch 9: 237-60
11	DNA mutations	Ch 18: 471-79
Nov 14	Molecular genetics: PCR and DNA cloning	Ch 19: 510-15
16	Molecular genetics: Slicing and splicing	Ch 19: 503-07
18	Molecular genetics: Blotting and probing	Ch 19: 508-9
Nov 21	Population genetics, DNA fingerprinting and the Innocence Project www.innocenceproject.org "FBI and states vastly expand DNA databases" NYTimes April 2009	Ch 19: 528-30; Ch 25: 679-683
23	Applications of recombinant DNA technology: Genetically modified organisms PROBLEM SET 3 DUE	Ch 19: 515-16
25	THANKSGIVING BREAK	
Nov 28	Applications of recombinant DNA technology: Gene therapy	Ch 19: 539-40
30	**EXAM 3**	
Dec 2	Structural and Functional Genomics	
Dec 5	Comparative Genomics	
7	EpiGenomics	
9	Poster Session I	
Dec 12	Poster Session II	
Dec 16	**FINAL EXAM (1:30-3:30)**	

Quizzes will become available on Moodle on a Friday at 4:30 p.m. and will end Sunday night at 11:55 p.m.

Quiz #	**Dates**
Quiz 1	Sept 9-11
Quiz 2	Sept 16-18
Quiz 3	Sept 23-25
Quiz 4	Oct 14-16
Quiz 5	Oct 21-23
Quiz 6	Nov 4-6
Quiz 7	Nov 11-13
Quiz 8	Nov 18-20

EXPECTATIONS AND EVALUATION

	% Final Grade
Exams (330 points total)	55%
Quizzes (72 points total)	12%
Problem Sets (72 points total)	12%
Short writing and discussion assignments (36 pts)	6%
Poster Project (60 pts)	10%
In class performance (30 pts)	5%

Final Grade Determination:

>92%	A- to A
84-92%	B to B+
76-83%	B-
70-75%	C+
65-69%	C
60-64%	C-
55-59%	D
<55%	NC

Below are descriptions of each assignment. Each assignment will be posted on Moodle well in advance of any due dates. Study guides outlining learning objectives will be made available at the start of a Unit.

Exams

Three exams (each worth 75-80 points) covering critical course content will be given during the course of the semester. A cumulative final exam worth 100 points will also be given. The exam format will be a mixture of multiple choice, matching, and short answer questions (ranging from single phrase to short paragraph answers). Exams will primarily test your ability to apply concepts, problem-solve, and to interpret/analyze data. Exam grades will be normalized against the highest grade (or in some cases highest 3 grades).

Quizzes
In addition, 8 quizzes will be posted on Moodle (see schedule posted above). These quizzes are individually "low stakes" in terms of affecting your grade (each consisting of 5-8 questions worth 1-2 points each, total 12 points each). They are designed to encourage you to do assigned readings before class and/or go over notes and study soon afterwards, and test your understanding of course material prior to high-stakes exams. Most students are able to better learn new/complex material by processing the same information multiple times using different formats (e.g. reading, hearing, visualizing). You will be allowed to drop the 2 lowest quiz scores from your final grade. **Quizzes cannot be made up if missed** (a missed quiz will score zero and automatically count as one of your "dropped" quiz scores); you are responsible for remembering to take the quizzes. Generally, quizzes will become available on Moodle on a Friday at 4:30 p.m. and will **end Sunday night at 11:55 p.m** (i.e., the quiz **closes** at this time so you need to start it **at the latest by 11:35** if you want a full 20 minutes); however, do not wait until the last few possible minutes to take the quiz as technical glitches are more likely to happen but may NOT be an excuse for missing a quiz. You have 20 minutes to complete once you start and can only submit your answers once. The questions are typically multiple choice or involve a numerical answer based on calculations you do to solve the stated problem.

Problem Sets
You will be given 3 problem sets to work on outside of scheduled class time. You will be able to work with other students in the course on the problems, but you will not be able to ask for help on these specific problems from others outside the course. The problem sets will consist of problems that demand more critical thinking and time to solve than could be reasonably expected from a quiz format. Each student must turn in an individual set of answers to be graded. Additional problems will be presented in class, and you will be given class time to discuss and work on. You will not be graded on your answers to these in-class assigned problems; but if you fail to actively engage with the problem and participate in group discussions, your final grade will be negatively impacted.

Short Writing and Oral Assignments
There will be several short writing assignments designed to help you to view writing as a process by which you can critically engage with a text, explore ideas, organize and share your thoughts. Examples are 1-2 paragraph summaries of assigned readings, reflection papers, concept maps, and analyses of technical writing/primary literature. Moreover, most of these short writing assignments will serve to improve the level of discussion in class. Each of these assignments will be posted and uploaded on Moodle. Some assigned papers are already listed in the syllabus schedule but additional readings may be posted during the course of the semester, particularly to take advantage of newly published scientific findings related to course material.

Poster Project
There will be one group project entailing the creation of a poster that explores the genetic, environmental, and epigenetic factors contributing to a common multifactorial human disorder or disease, such as obesity. Posters are a means by which to convey information in a highly concise and efficient manner. Students will work in groups of 4 (or 3) to research,

write, design, and present their findings in a 4' x 6' poster that will be presented at the end of the semester. All students in a group will be expected to contribute equally to the project, and every student within a group will have the opportunity to stand in front of the poster and provide a summary of the group's findings during a poster session. This project is an opportunity to synthesize much of what you will have learned during the course of the semester and apply it to a human health problem. Moreover, working effectively as a member of a team, as well as good communications skills, have increasingly become essential and valued skills in scientific and other disciplines. More detailed information on researching and building your poster will be made available on Moodle. Prizes (yes, really!) will be awarded to the top 3 posters as judged by me, the course teaching assistant, 1-2 other faculty members, and your peers. Grades will be assigned by me in consultation with the teaching assistant and may be distributed unequally within a group depending on within-group peer evaluation of relative contributions to the project.

In class performance

Your in class performance grade will be determined by your level of preparation for and participation in class discussions and activities, including (but not limited to) informal writing assignments and in-class problem-solving; these in-class assignments will not be graded, but you will lose credit if you do not complete them. Furthermore, unexcused absences from class will negatively affect this aspect of your grade. Attendance and participation will be monitored via iClicker activity.

Some Dry (but Important) Legalese

The only acceptable excuses for missing an exam are severe personal illness, a death in the family, or other emergency of similar nature. You will need to show me some form of documentation should such a situation arise and you return to class to make up an exam. If you cannot take an exam on the assigned day because of participation in a sporting event or other official Macalester activity, you must notify me ahead of time (i.e., BEFORE the day of the exam) so that we can schedule an appropriate time for you to take the exam. Assignments handed in late will suffer a 20% penalty or "late fee" for each 24 –hour period turned in after the due date/time. Plagiarism will be handled according to the Macalester policy on academic integrity in the student handbook, with which you need to be familiar (www.macalester.edu/~dstudent/handbook/academic_policies.html). Chronically showing up late for class, texting or internet surfing during lecture, and/or other types of disruptive behavior will not only negatively impact your grade for the course but can be distracting to other students who have paid a lot of money to attend class. Please respect me and your fellow classmates.

How to Succeed in this Course:

(1) Attend all class meetings. Pay attention, take notes, ask questions.
(2) Use the lecture outlines to organize your notes, but *not* as a substitute for taking your own notes.
(3) Read the assigned texts *before* coming to class.

(4) **Test** your understanding of some of the material using online problem sets and tutorials, such as those found at The Biology Project: http://www.biology.arizona.edu/default.html; Make flashcards for yourself to help with learning the enormous volume of new vocabulary.

(5) Turn in assignments on time. Similar to credit card company late fees, **assignments turned in after the due date will be penalized 20% for each day late**.

(6) Show up on time for exams to give yourself all the allotted time to work on the exam. Because many students have a class directly after this one, I will not be able to provide extra time to work on exams after the class period has ended. However, if you have a diagnosed learning disability or English is not your first language, please speak with me about making alternative arrangements for test-taking. If you need special accommodation for note-taking or test-taking, e.g. due to ESL or a learning disability, please feel free to discuss your situation with me. I will do my best to accommodate your needs and help you achieve your full potential in my course.

(7) Process the information you are learning in as many different ways as possible: by reading, writing, listening, speaking. Typically you will hear or read a concept or idea first in a passive setting (reading, listening). You then need to *actively* engage the material by doing problem sets, or writing a short paper, or explaining the material to someone else (e.g., your classmates). Understanding what you've just read or heard is *not* the same as knowing something well enough to explain it to others or being able to solve problems on your own. Only when you can do the latter will you be ready for the exams--and only then will you have really learned what this course has to offer.

(8) Spend on average 2-3 hours studying material outside class for each hour in class. Manage your time well. Set aside a block of time several times per week to do the readings and practice problems, and to go over your notes. For each lecture you might consider writing a summary of what you've learned and what questions remain unclear. Bring your questions to the next class meeting or email them to me or stop by my office during office hours.

(9) Form a study group. Get together with 2 or 3 of your classmates and meet on a regular basis (e.g., 1-2 hours per week). A useful way to run a study group session is for each member to have completed a problem set on his/her own and then get together with the group to go over the answers. If members are coming up with different answers for the same problem, often much learning can take place by discussing the problem and each person's approach to solving it.

(10) Come talk with me during my office hours. I will do my best to identify problem areas during class time; but, "the squeaky wheel gets greased" and you will get the best help when you ask for it. Don't wait until you are feeling overwhelmed or do poorly on an exam—come talk to me the minute you are feeling confused or uncomfortable in class. And come talk to me when things are going well! I'd love to hear for example when you've made a connection between what you are learning in the classroom and life outside it, or when you find a particular topic intellectually engaging. Those are the moments we professors live for.