BIOLOGY 215 GENETICS

Spring 2005

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Lecture and discussion meets MWF from 11:30-12:20 in Shankweiler 130.

Lab sections meet on Tuesday or Wednesday afternoons, as scheduled, from 1:30-4:20 PM in Shankweiler 230.

Genetics is the discipline that studies the nature of biological diversity and inheritance. In essence, Genetics concerns itself with two major questions: 1) What are the mechanisms for determining diversity within a species? 2) What are the mechanisms by which biological characteristics are inherited by offspring? Humans have practiced manipulative genetics since antiquity, millennia before it became a scientific discipline. For example, early humans selectively bred animals and plants for agricultural purposes, and many had inbreeding taboos. The scientific study of genetics began with the rediscovery of Gregor Mendel's famous pea experiments about 1900. The middle of the 20th century saw the birth of molecular genetics, as researchers connected the dots between biochemistry and Mendelian genetics. The end of the 20th century saw the birth of genomics—an information-oriented approach that combined the power of computers and information technology with genetic data.

This course will focus primarily on issues that are explicitly genetic—many applications of genetics are also covered in Molecular Biology, Cell Biology, Developmental Biology, Neuroscience, and Microbiology. We will emphasize **the experimental practice of genetics**—this is an astonishingly fast-moving area of science. Therefore, this course will be as much about how science gets done as what we've learned. We will perform laboratory experiments that reflect current procedures and the experimental approaches of genetics. We will also be reading selected primary scientific literature that focus on genetic issues; no class focusing on an active area of scientific research is complete without some treatment of the literature. My principle aim is to attempt both breadth of coverage, from population to molecular genetic approaches, and depth, with specific forays into more detailed examples of how genetics is used to learn more about biology.

SCHEDULE

DATE	DAY	TOPIC	READING
		TRANSMISSION GENETICS	
19-Jan	W	Variation, genetics, and environment	Ch. 1
21-Jan	F	Human Mendelian genetics	Ch. 2; pp 594-602
24-Jan	M	Gene interactions	Ch. 3
26-Jan	W	Gene interactions	Ch. 3
28-Jan	F	*Discussion*	
31-Jan	M	Chromosomes	Ch. 4; Ch. 12
2-Feb	W	Chromosomes	Ch. 4; Ch. 13
4-Feb	F	Aberrant chromosome segregation	Ch. 13
7-Feb	M	Aberrant chromosome segregation	Ch. 13
9-Feb	W	Mutation	Ch. 7, pp 256-268
11-Feb	F	*Discussion*	
14-Feb	M	Mutation	Ch. 7, pp 256-268
16-Feb	W	Mutation	Ch. 7, pp 256-268
18-Feb	F	Catch-up/review	
		POPULATION GENETICS	
21-Feb	M	Population genetics	Ch. 20
23-Feb	W	Population genetics	Ch. 20
25-Feb	F	*Discussion*	
28-Feb	M	Population genetics	Ch. 20
2-Mar	W	Quantitative genetics	Ch. 20, pp 398-404
4-Mar	F	Evolutionary genetics	Ch. 21
		SPRING BREAK	
14-Mar	M	Catch-up/review	
16-Mar	W	*Discussion*	
18-Mar	F	**MID-TERM EXAM**	
		MOLECULAR GENETICS	
21-Mar	M	Gene mapping	Ch. 5, pp 374-387
23-Mar	W	Gene mapping	Ch. 5, pp 374-387
30-Mar	W	Gene mapping	Ch. 5, pp 374-387
1-Apr	F	*Discussion*	
4-Apr	M	Microbial genetics	Ch. 14
6-Apr	W	Microbial genetics	Ch. 14
8-Apr	F	Gene cloning	Ch. 9
11-Apr	M	Gene cloning	pp 324-338, 387-398
13-Apr	W	Gene cloning	pp 324-338, 387-398
15-Apr	F	*Discussion*	
18-Apr	M	Genetic engineering	pp 394-396, Ref. E
20-Apr	W	Genetic engineering	
		GENOMICS	
22-Apr	F	Genomics	Ch. 10
25-Apr	M	Genomics	Ch. 10
27-Apr	W	Genomics	Ch. 10
29-Apr	F	*Discussion*	
2-May	M	Developmental genetics and model systems	Ch. 19, Appendices
4-May	W	Developmental genetics and model systems	Ch. 19, Appendices

EVALUATION

Your final grade will be determined based on your performance on exams, assignments, participation, attendance, and laboratory. The weighting of these different components will be as follows:

15%	Mid-term exam
20%	Final exam
25%	Take-home assignments
25%	Laboratory assignments and participation
10%	Discussion and lecture participation
5%	Homework

Grades will be assigned based on the familiar, if arbitrary, 90-100 A range, etc.

ASSIGNMENTS

For the lecture component of the course, there will be regular assignments of two types: weekly homework and longer take-home assignments. The former will be collected, assigned a simple score, and returned. These assignments will be drawn primarily from problems in the textbook. Over the course of the semester, you will be given four or five longer take-home assignments. These assignments will be typewritten and graded. The explicit nature of these assignments will be provided when each is assigned.

For the laboratory component of the course, there will be approximately six reports due over the course of the semester. Most will be of modest length.

DISCUSSIONS

Over the course of the semester there will by six meetings devoted entirely to discussions. Most or all of these sessions will focus on primary literature. You will be assigned to help lead the discussion of one session, along with three or four of your peers. Everyone must read the papers assigned and come to class prepared to discuss the paper. Have questions and observations in mind.

BIOLOGY DEPARTMENT SEMINARS

All students are strongly encouraged to attend the Biology Seminar Series regularly. Biology Department seminars are held at 4:30 PM in Shankweiler 109. Specific seminars, especially those that relate to genetics, will be announced in class.

TEXTBOOK

Hartwell, et al., 2004, *Genetics: From Genes to Genomes, 2nd Ed.*, Boston: McGraw-Hill.

This textbook is absolutely required for the course and available for sale in the bookstore.

OFFICE HOURS

My nominal office hours will be Tu/Th from 11AM -12:30PM and F 1-2PM. I'm likely to be in my office or nearby in one of the labs Tu-F between 9:30 AM and 4:30 PM. I'm also available Monday morning, but not afternoon. I also encourage you to email me with questions.

POLICIES

All assignments are due on the date indicated. Late assignments will result in a significant penalty. Each exam must be taken on the date and time scheduled. Exceptions to these policies will be allowed only in the case of serious illness or family emergency. All exceptions ***must be pre-approved*** by the instructor and documented by a physician or other official.

Cheating will not be tolerated in any form. Trying to obtain "answers" from students who took this course in years past is an ABC violation, and in any case will hurt you in the long run (this is really a course about questions). Keep in mind that all written work handed in for this course ***must*** be your own. In most cases, you may discuss assignments with your peers or me, but the written work submitted ***must*** be your work alone. In the case of the longer take-home assignments, all work ***must*** be your own, signing the ABC pledge will indicate your compliance in not discussing the assignment with anyone else.

Attendance is expected at every class. If you cannot attend a particular class, it is ***your*** responsibility to obtain notes from a classmate.

Students with documented disabilities should discuss appropriate accommodations with me as soon as possible.

PREREQUISITES AND ASSUMED KNOWLEDGE

The prerequisite for BIO 215 is the three semester Principles of Biology core sequence. For students who have not completed this sequence due to transfer, non-traditional or cross-registration status, this equates to complete mastery of the contents of *Biology*, by Campbell and Reece, or its equivalent. Specifically, students should be completely proficient in basic Mendelian genetics, the "central dogma" of molecular biology and the basics of recombinant DNA technology, which will NOT be covered in any detail in this course. Examples of terminology and concepts that will be assumed include, but are not limited to:

allele
gene
trait
characteristic
dominant
recessive
semidominant
codominant
Chi-square analysis
penetrance
expressivity
linkage
sex-linkage
meiosis
mitosis
recombination
recombinant DNA
vector, plasmid, etc.
transformation
amino acids
genetic code
Central Dogma
replication
transcription
reverse transcription
translation
splicing
lac operon
promoter