BIOLOGY 215 GENETICS

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Lecture and discussion meets MWF from 11:30-12:20 in Trumbower 311.

Lab sections meet on Tuesday or Wednesday afternoons, as scheduled, from 1:30-4:20 PM in Shankweiler 243S.

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 read 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	ASSIGNMENTS
		TRANSMISSION GENETICS		
12-Jan	M	Variation, genetics, and environment	Ch. 1, p. 68-72	
14-Jan	W	From clinic to protein: A Case Study		
16-Jan	F	Human Mendelian genetics	Ch. 2	
19-Jan	M	*NO CLASS*		
21-Jan	W	Human Mendelian genetics	pp 660-664	Homework 1
23-Jan	F	Gene interactions	Ch. 3; pp 224-226	
26-Jan	M	Gene interactions	Ch. 3	Homework 2
28-Jan	W	Mutation	Ch. 7.1, 8.6, 20.2; pp 257-261	
20-Jan	F	Mutation	Ch. 7.1, 8.6, 20.2; pp 257-261	
2-Feb	M	Mutation	Ch. 7.1, 8.6, 20.2; pp 257-261	Homework 3
4-Feb	W	Chromosomes	Ch. 4, 14	
6-Feb	F	***EXAM I***		
9-Feb	M	*NO CLASS*		
11-Feb	W	*NO CLASS*		
13-Feb	F	Chromosomes	Ch. 4, 14	
16-Feb	M	Aberrant chromosome segregation	Ch. 4, 14	Homework 4
18-Feb	W	Aberrant chromosome segregation	Ch. 4, 14	
20-Feb	F	Gene mapping	Ch. 5, 11.1	
23-Feb	M	Gene mapping	Ch. 5, 11.1	Take Home #1
25-Feb	W	Gene mapping	Ch. 5, 11.1	
27-Feb	F	Gene mapping	Ch. 5, 11.1	Homework 5
		SPRING BREAK		
		POPULATION GENETICS		
9-Mar	M	Population genetics	Ch. 21	
11-Mar	W	Population genetics	Ch. 21	
13-Mar	F	Population genetics	Ch. 21	
16-Mar	M	Evolutionary genetics	Ch. 22	Homework 6
18-Mar	W	Quantitative genetics	Ch. 11.4	
20-Mar	F	Human ancestry	Ch. 11.5	
23-Mar	M	Make-up/Review		
25-Mar	W	***EXAM II***		
		MOLECULAR GENETICS		
27-Mar	F	Microbial genetics	Ch. 15	
30-Mar	M	Microbial genetics	Ch. 15	Homework 7
1-Apr	W	Gene cloning	Ch. 9, 11.3	
3-Apr	F	Gene cloning	Ch. 9, 11.3	
6-Apr	M	Genetic engineering	Ch. 9.1, 9.4, 20.2	
8-Apr	W	Genetic engineering	Ch. 9.1, 9.4, 20.2	
10-Apr	F	*NO CLASS*		
13-Apr	M	*NO CLASS*		
		GENOMICS		
15-Apr	W	Genomics	Ch. 10, 12	
17-Apr	F	Genomics	`	Take Home #2
20-Apr	M	Genomics	Ch. 10, 12	
		GENETIC INQUIRY		
22-Apr	W	Developmental genetics	Ch. 20	
24-Apr	F	Behavioral genetics		
27-Apr	M	Behavioral genetics		
29-Apr	W	Genetics of cancer	Ch. 19	

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:

24%	Mid-term exams (12 % each)
15%	Final exam
20%	Take-home assignments (10% each)
25%	Laboratory assignments and participation
6%	Laboratory literature project
10%	Homework and class participation

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 weekly homework assignments. These will be collected, assigned a simple score, and returned. These assignments will involve less than 10 relatively short problems that are designed to develop your problem-solving skills. You are free to work on them individually or in a study group. Over the course of the semester, you will be given two longer take-home assignments. These assignments will be typewritten and returned for a grade on the standard 100-point scale. They will involve three to four longer and more complicated problems. These assignments must be your work only. They may not be discussed or solved in collaboration with other members of a study group.

For the laboratory component of the course, there will be approximately two to three reports due over the course of the semester. Most will be of modest length. Some labs will have short questionnaires that will be completed at the end of the lab and handed in for evaluation.

BIOLOGY DEPARTMENT SEMINARS

All students are strongly encouraged to attend the Biology Seminar Series regularly. Watch the Biology Department's Seminar Webpage and the NSB Lobby screens for date, place, and time. Specific seminars, especially those that relate to genetics, will be announced in class.

TEXTBOOK

Hartwell, et al., 2008, *Genetics: From Genes to Genomes, 3rd 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 MW 9:30-10:30, Tu 11-11:30 and Th 11:30-12:30. 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, and Monday between 9:30 and 2 PM. I encourage you to email me with questions at any time.

POLICIES

All assignments are due on the date indicated. Homework will only be collected in class and will not be accepted late for any reason. If other assignments are handed in late, the grade for that assignment will be penalized on a per-day basis. Late assignments will *not be accepted* if they are more than 48 hours late. 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 (requiring emergency room treatment or hospitalization) 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