FD '01

Course Syllabus for Biology 431-Genetics
Fall 2001
Chaminade University of Honolulu

Meeting time & place:	MWF 10:00-10:50 AM Henry Hall 17
Textbook:	*Genetics, From Genes to Genomes* by Hartwell et al.
Supplemental materials:	No more than 5 articles from review journals will be handed out during the course of the semester as required reading.
Instructor:	Dr. Joan Kuh
Office & Contact Info:	16 Henry Hall, **735-4807** (phone), jkuh@chaminade.edu (e-mail)
Office Hours:	MWF 11-12, T Th 9:30-10:30 or by appointment

Course Description:

This course is a survey of genetics at the molecular, organismal and population levels. At each of these levels, the principles that govern transmission of genes from generation to generation and the numerous exceptions to those principles will be studied. We will also look at how DNA gives rise to *genotype* which, in turn, gives rise to *phenotype* and to what extent this flow of genetic information is affected by environmental effects, mutations and *epigenetic* phenomena. Organization and characterization of genomes will be discussed as well as the molecular tools that have assisted in this area of genetics.

Course Objectives: The student is expected to demonstrate the following:

1. An understanding of the Mendelian laws of gene transmission for one, two and more traits and the ability to apply these laws to pedigree analysis, determination of unknown genotypes, prediction of cross outcomes, quantitative traits, probability and meiosis.
2. An understanding of the numerous exceptions to Mendelian laws of gene transmission including codominance, epistasis, epigenetics, linkage and be able to describe/predict how these specifically modify Mendelian ratios.
3. Ability to deulato the amount of variation of a phenotype due to genetics and that due to environment.
4. To know why and how DNA fulfills the requirements of hereditary material, how it is organized into genes/chromosomes/genomes and how it is transmitted from cell to cell, generation to generation.
5. To describe how the genetic information in DNA is ultimately transcribed and translated into a physical trait.
6. Explain how cells with the same DNA content can have different morphologies and functions (i.e. phenotypes).
7. Measure and/or calculate allele, genotype and phenotype frequencies in populations.
8. Describe how various types of mutations arise and affect gene function.
9. An understanding of molecular biological tools and techniques applied to genetic and genome analysis.
10. And inherent in the first eight objectives, mastery of genetic terminology.

Adopt-A-Human (Gene) Project

Students in pairs will be assigned a gene or human phenotype for which they are expected to research specified genetic information. This information will be shared with the rest of the class in the format of a short (~5 minutes) presentation by both students on a team and a detailed outline. The exercise is meant to reinforce genetic terminology and principles as well as provide pre-professional students with knowledge of and experience in discussing human monogenic traits. Assignment of genes and description of the required elements of the project will be handed out during the human pedigree analysis lecture.

Grades: My goal is to assign grades on a 90-80-70-60 percentile scale with 800 as the total number of points possible (see below). That is A (720 or more), B (640-719), C (560-639), D (480-559), F (<480 points). If a student falls within 10 points of a grade, class participation in discussions and attendance will be taken into account with respect to giving the student the higher grade.

Homework assignments	(10 @ 30 points each):	300 points
Three midterm exams	(3 @ 100 points each):	300 points
Adopt-A-Gene Project	(1 @ 50 points):	50 points
Final exam	(1 @ 150 points):	150 points

Tentative lecture outline:

Date (Day)	Topic	Reading
M-8/27	Introduction	Prologue, pp 1-6; Epilogue pp. 814-820
W-8/29	Mendelian Genetics I	Chapter 1, pp 10-20
F-8/31	Mendelian Genetics II (HW 1)	Chapter 1, pp 21-25
M-9/03	Labor Day	
W-9/05	Mendelian Genetics III	Chapter 1, pp 25-29
F-9/07	Human Pedigree Analysis (HW 2)	Chapter 1, pp. 25-29
M-9/10	Modified Mendelian Ratios I	Chapter 2, pp. 38-49
W-9/12	Modified Mendelian Ratios II	Chapter 2, pp. 49-60
F-9/14	Modified Mendelian Ratios III (HW 3)	Chapter 3, pp. 93-98
M-9/17	Quantitative Genetics I	Chapter 2, pp. 60-61; Chapter 10 372-373
W-9/19	Quantitative Genetics II (HW 4)	Chapter 23, pp 769-776
F-9/21	Review	
M-9/24	Midterm Exam I	
W-9/26	Population Genetics I	Chapter 23, pp 754-759
F-9/28	Modified Mendelian Ratios IV	Chapter 4, pp 104-125
M-10/01	Modified Mendelian Ratios V (HW 5)	same as 9/28
W-10/03	Recombination/genetics prokaryotes	Chapter 13, pp 470-487
F-10/05	Chromosomes I	**Chapter 3, pp 70-75; Chapter 11 pp 399-404**
M-10/08	Discoverer's Day	
W-10/10	DNA I	Chapter 5, pp 144-150
F-10/12	DNA II	**Chapter 5, pp 150-157; Chapter 8, pp 264-268**
M-10/15	DNA III	Chapter 5, pp. 157-164
W-10/17	Genetic Analysis Tools I (HW 6)	Chapter 8, pp. 277-279, 285-293
F-10/19	Chromosomes II	Chapter 11, pp 390-399, 404-413
M-10/22	Review	
W-10/24	Midterm Exam II	
F-10/26	Mutations I	Chapter 6
M-10/29	Mutations II	Chapter 6
W-10/31	Mutations III	Chapter 6
F-11/02	Mutations IV (HW 7)	Chapter 12
M-11/05	Cancer Genetics (Mutations V)	Chapter 17
W-11/07	Flow of Genetic Information I	Chapter 7
F-11/09	Flow of Genetic Information II (HW 8)	Chapter 7
M-11/12	Veteran's Day	
W-11/14	Flow of Genetic Information III	Chapter 15
F-11/16	Flow of Genetic Information IV	Chapter 16
M-11/19	Flow of Genetic Information V	Chapter 16, 17
W-11 /21	Flow of Genetic Information IV (HW 9)	pp. 408-410, 573-577, 405-406
F-11/23	Thanksgiving Recess	
M-11 /26	Review	
W-11/28	Midterm Exam III	
F-11/30	Genetic Analysis Tools II	Chapter 8
M-12/03	Genetic Analysis Tools III	Chapter 9
W-12/05	Genetic Analysis Tools IV (HW 10)	Chapter 10
F-12/07	Genomes and Genome Mapping	Chapter 24, pp 793-801, Epilogue
Th-12/13	FINAL 10:30-12:30	

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Course Syllabus for Biology 431 L-Genetics Lab
Fall 2001
Chaminade University of Honolulu

Meeting time & place: Th **2-4:50 PM Henry Hall 13**

Textbook: *Genetics Laboratory Investigations (12 `" edition) by Mertens and Hammersmith*

Supplemental materials: **Handouts for labs not in text**

Instructor: Dr. **Joan Kuh**

Office & Contact Info: **16 Henry Hall, 735-4807 (phone),** jkuh@chaminade.edu **(e-mail)**

Office Hours: MWF 11-12, T Th 9:30-10:30 or by appointment

Course Description:

This is the laboratory that accompanies, but is distinct from, the Genetics Biology lecture course BI 431 and is intended to reinforce through practical applications the concepts presented in the lecture. Actual genetic crosses completed with the pomace fly, *Drosophila melanogaster,* **and analysis of human pedigrees will demonstrate both Mendelian and non-Mendelian patterns of inheritance for a number of traits. Experience with** *karyotyping* **and molecular biological techniques such as PCR, DNA extraction and restriction enzyme analysis will also be gained. Profiles of gene expression will be studied indirectly by examining the expression of an important developmental gene in the background of several mutations in** *Drosophila* **embryos. Additionally, there will be laboratory exercises pertaining to population genetics and the genetics of behavior.**

Course Objectives: The student should be able to demonstrate the following

1. **The determination of the mode of inheritance (Mendelian and non-Mendelian) of a genetic trait(s) by tracking the trait(s) through at least two (fly) generations or, in the case of human genes, from pedigree analysis.**
2. **The isolation and characterization of chromosomes from both plant and animal sources.**
3. **The basic components of a human karyotype and the various methods of analyzing both normal and abnormal karyotypes.**
4. **To understand the various steps and components of "blue-white" cloning and the importance of this technique to the analysis of a gene or genomes.**
5. **Determination of a genotype via PCR and subsequent population genetics analysis (e.g., determination of allele and genotype frequencies based on the data). Also, the principle of PCR, the components and what each does in the reaction.**
6. **Ability to describe how DNA is isolated, quantitated and characterized via restriction enzyme mapping and gel electrophoresis.**
7. **Describe how striped embryos and fluorescent imaginal disks from** *Drosophila* **demonstrate the concept of differential gene expression.**
8. **Describe how/what genes play a role in courtship behavior in** *Drosophila.*

Grades: Your grade in this course will be derived from the following:

3 (formal) laboratory reports (3 100 points each)	300 points
3 assignments (2 @ 30 points and 1 @ 40 points)	100 points
2 semester exams (2 @ 100 points)	200 points

The three laboratory reports will be I) Drosophila Genetics and Gene Mapping; II) Cloning and Characterization of a DNA Fragment via Blue-White Cloning; and III) PCR-based Genotyping and Population Genetics. The contents of these reports as well as the three assignments will be described at the appropriate times during the semester.

Tentative Laboratory Schedule:

Date	Laboratory (Reading from text)
8/30	Introduction, Looking at Flies (Chapter 1)
9/06	Probability, Chi Square, Monohybrid Crosses (Chapters 3, 4)[Assignment I due 9/13]
9/13	Dihybrid Crosses, Sex Linkage (Chapters 2, 9)
9/20	Recombination and Linkage Analysis (Chapter 12)
9/27	Chromosomes and Karyotyping (Chapters 5, 8, 11) [Assignment II due 10/11]
10/04	Wrapping up Fly Cross Analyses/Pedigree Analysis (Chapter 26)
10/11	Semester Exam I [Laboratory Report I due today]
10/18	Blue-White Cloning (Chapter 18, handout) [Laboratory Report II due 11/15]
10/25	Genotyping with PCR and Population Genetics (Chapters 17&24) [Laboratory Report III due 11/08]
11/01	Plasmid and Genomic DNA extractions (Chapter 15)
11/08	DNA manipulation-restriction enzyme mapping, quantitation and electrophoresis (Chapter 16)
11/15	Striped embryos and developmental regulation of gene expression (handout)
11/22	Thanksgiving Recess
11/29	*Genes & Behavior* (handout) [Assignment III due 12/06]
12/06	Semester Exam 11