

BIO 308: MODERN GENETICS

FALL 2008: TR at 10:00 AM – 11:15 AM
Lab T 1:30 PM – 4:30 PM
(Optional) Recitation W 7:00 PM-8:00 PM

Room: Albertus Magnus 109

Lab: Albertus Magnus 212

Credit Hours: 4.00



PROVIDENCE
COLLEGE

INSTRUCTOR:

Name: Fr. Nicanor Pier Giorgio Austriaco, O.P., Ph.D.

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I am generally in my office (Sowa 229B) or in my laboratory (Hickey Hall 181) from 9:00 AM - 5:00 PM daily and am easily available with a prior appointment. To make an appointment, you may call me on my telephone or email me. I'll keep Thursday afternoons from 2:00 P.M. to 4 P.M. for drop-in appointments. Please feel free to talk to me about any issue relating either to the course or to your life as a student here at Providence College.

A PRAYER BEFORE STUDY

St. Thomas Aquinas, O.P.

O God, Creator of all things, true source of light and wisdom, graciously let a ray of your light penetrate the darkness of my understanding. Give me a keen intellect, a retentive memory, and the ability to grasp things correctly and fundamentally. Give me the talent of being exact in my explanations and the ability to express myself with thoroughness and charm. Point out the beginning, direct the progress, and perfect my work. We ask you this through Jesus Christ Our Lord. Amen.

COURSE DESCRIPTION:

This course presents the basic principles of classical and molecular genetics in an integrated fashion while emphasizing experimental design, analysis, and problem solving. The latest research and technological advances in biotechnology and human genetics will be covered, as well as the implications of this knowledge on the human condition. Laboratory work will consist of investigative exercises designed to introduce students to the basic techniques and experimental protocols of molecular biology and genetics.

REQUIRED TEXT:

- Leland H. Hartwell et al., *Genetics: From Genes to Genomes* (New York: McGraw Hill, 2008).

We will also be reading papers from the primary scientific literature. The papers are listed on the syllabus and have been posted to the class website on ANGEL.

ACADEMIC EXPECTATIONS:

There will be three take-home examinations for this course. Each examination will be an open-book examination. In other words, you are free to consult any textbooks, reviews, or scientific papers. If you do so, please reference your sources and note them in your response. ***However, you will be expected to do each examination by yourself without discussing it with anyone else except the instructor.*** Please submit the examinations to the instructor by the designated time. Late exams will be penalized one full letter grade (10 percentage points) unless prior arrangements were made with the instructor.

There will be regularly assigned problem sets for this course. You may discuss your answers with your classmates. However, I expect the responses to be written independently. Furthermore, if you do discuss your responses with your classmates, please note this on your problem set and list the names of your collaborators. Each week, I will randomly grade one or two problems from the assigned material. Problem sets will be due every Tuesday morning at the end of class. No late problem sets will be accepted unless prior arrangements were made with the instructor.

During the course of the semester, each student will be responsible for submitting two (2) Method & Logic Analyses for any two papers listed on this syllabus. A Methods & Logic Analysis Template is available on the class ANGEL website.

Regular attendance is expected. Please email the instructor in advance if you expect to miss a class. More than two unexcused absences during the semester may lead to a final grade reduction of a full letter grade (e.g., B+ to C+).

GRADING POLICY:

Grades will be calculated as follows:

Examinations (3x20%)	60%
Problem Sets	20%
Methods & Logic Analyses	10%
Lab Assignments	10%

Academic dishonesty, cheating, and plagiarism (“the stealing and passing off of the ideas or words of another as one’s own without crediting the source”) are not tolerated in the

professional world of scientific and medical research and will not be tolerated in this class. For the first offense, the student will receive a zero for the examination or the assignment. If a student aids another student during the exam, both parties will receive a zero. For the second offense, the student will receive an F for the course. Please consult the current Providence College Undergraduate Catalogue for its statement on “Academic Honesty.”

SCHEDULE OF READINGS AND ASSIGNED PROBLEMS

Week of September 2, 2008: Mendelian Genetics I

READING: Chapter Two

PROBLEMS: 2.4, 2.8, 2.14, 2.16, 2.18, 2.26, 2.30, 2.32, 2.36

PAPERS:

- Jones et al., "Single-Nucleotide-Polymorphism-Based Association Mapping of Dog Stereotypes," *Genetics* 179 (2008): 1033-1044.
- Kishi et al., "The identification of zebrafish mutants showing alterations in senescence-associated markers," *PLoS Genet* 4 (2008): e1000152.

Week of September 9, 2008: Mendelian Genetics II

READING: Chapter Three

PROBLEMS: 3.4, 3.10, 3.16, 3.18, 3.24, 3.30, 3.36, 3.38

PAPERS:

- Lorenz and Heitman, "Regulators of Pseudohyphal Differentiation in *Saccharomyces cerevisiae* Identified Through Multicopy Suppressor Analysis in Ammonium Permease Mutant Strains," *Genetics* 150 (1998): 1443-1457.
- Candille et al., "A-defensin mutation causes black coat color in domestic dogs," *Science* 318 (2007): 1418-1423.

Week of September 16, 2008: Chromosomal Structure and Inheritance

READING: Chapters Four and Thirteen

PROBLEMS: 4.12, 4.20, 4.28, 4.38, 13.8, 13.18, 13.26, 13.30

PAPERS:

- Lin et al., "A comprehensive synthetic genetic interaction network governing yeast histone acetylation and deacetylation," *Genes Dev* 22 (2008): 2062-2074.
- Wang et al., "Maternal phosphatase inhibitor-2 is required for proper chromosome segregation and mitotic synchrony during *Drosophila* embryogenesis," *Genetics*, Published on August 9, 2008.

Week of September 23, 2008 Linkage Analysis

READING: Chapter Five

PROBLEMS: 5.2, 5.8, 5.10, 5.12, 5.14, 5.22, 5.24, 5.40

PAPER:

- Karlsson et al., "Efficient mapping of mendelian traits in dogs through genome-wide association," *Nat Genet* 39 (2007): 1321-1328.

Week of September 30, 2008: Mutational Analysis

READING: Chapter Seven

PROBLEMS: 7.8, 7.18, 7.22, 7.24, 7.28, 7.30, 7.32, 7.38

PAPERS:

- Wrangé et al., "Accumulation of mutants in "aging" bacterial colonies is due to growth under selection, not stress-induced mutagenesis," *PNAS* Epublished on August 13, 2008.
- Sarin et al., "Genetic screens for *Caenorhabditis elegans* mutants defective in left/right asymmetric neuronal fate specification," *Genetics* 176 (2007): 2109-30.

Week of October 7, 2008: Gene Expression

READING: Chapter Eight

PROBLEMS: 8.6, 8.12, 8.16, 8.26, 8.32, 8.36, 8.38, 8.42

PAPERS:

- Ogawa et al., "Intersection of the RNA interference and X-inactivation pathways," *Science* 320 (2008): 1336-1341.
- Kim et al., "Pluripotent stem cells induced from adult neural stem cells by reprogramming with two factors," *Nature* 454 (2008): 646-650.

-- Week of EXAM I --

Week of October 14, 2008: Genomics I (NO CLASS October 14, 2008: Columbus Day Holiday)

READING: Chapter Nine

PROBLEMS: 9.4, 9.6, 9.12, 9.14, 9.18, 9.20, 9.26, 9.32

PAPER:

- O'Donovan et al., "Identification of loci associated with schizophrenia by genome-wide association and follow-up," *Nat Genet* Epublished on July 30, 2008.

Week of October 21, 2008: Genomics II

READING: Chapters Ten and Eleven

PROBLEMS: 10.19, 10.34, 10.35, 11.14, 11.16, 11.22, 11.24, 11.28, 11.30, 11.32

PAPERS:

- Lalueza-Fox et al., "A melanocortin 1 receptor allele suggests varying pigmentation among Neanderthals," *Science* 318 (2007): 1454-1455.
- Wheeler et al., "The complete genome of an individual by massively parallel DNA sequencing," *Nature* 452 (2008): 872-876.

Week of October 28, 2008: Gene Regulation I

READING: Chapter Seventeen

PROBLEMS: 17.8, 17.13, 17.16, 17.17, 7.22, 7.26, 7.27, 7.28, 7.30, 7.32

PAPERS:

- Ferrara et al., "Genetic networks of liver metabolism revealed by integration of metabolic and transcriptional profiling," *PLoS Genet* 4 (2008): e1000034.
- Matus et al., "Molecular evidence for deep evolutionary roots of bilaterality in animal development," *PNAS* 103 (2006): 11195-11200.

Week of November 4, 2008: Gene Regulation II (NO CLASS November 6, 2008: Rome Conference)

READING: Chapter Eighteen

PROBLEMS: 18.6, 18.10, 18.16, 18.18, 18.24, 18.30, 18.32

PAPERS:

- Marson et al., "Connecting microRNA Genes to the Core Transcriptional Regulatory Circuitry of Embryonic Stem Cells," *Cell* 134 (2008): 521-533.

-- Week of EXAM II --

Week of November 11, 2008: Cancer Genetics

READING: Chapter Nineteen

PROBLEMS: 19.4, 19.14, 19.20, 19.22, 19.27, 19.29

PAPERS:

- Valle et al., "Germline Allele-specific Expression of TGFBR1 Confers an Increased Risk of Colorectal Cancer," *Science* Epublished on August 14, 2008.
- Uren et al., "Large-scale mutagenesis in p19(ARF)- and p53-deficient mice identifies cancer genes and their collaborative networks," *Cell* 133 (2008): 727-741.

Week of November 18, 2008: Developmental Genetics

READING: Chapter Twenty

PROBLEMS: 20.3, 20.4, 20.6, 20.8, 20.12, 20.19, 20.20, 20.22, 20.23

PAPERS:

- Jeong et al., "The evolution of gene regulation underlies a morphological difference between two Drosophila sister species," *Cell* 132 (2008): 783-793.
- Pennisi, "Deciphering the Genetics of Evolution," *Science* 321 (2008): 760-763. [NEWS ARTICLE]

Week of November 25, 2008: Special Topics I (NO CLASS November 27, 2008: Thanksgiving Holiday)

Week of December 2, 2008: Special Topics II

Week of December 9, 2008: Final Exam Week

-- Week of EXAM III --

SCHEDULE OF LABORATORIES

Laboratory work will consist of investigative exercises designed to introduce students to the basic techniques and experimental protocols of molecular biology and genetics. These investigations will prepare students to read and comprehend a typical Materials & Methods section of a contemporary scientific paper in genetics and molecular biology.

September 9, 2008 Introduction to Bioinformatics

September 16, 2008 Genetic Analysis: Mutagenesis and Genetic Screening

September 23, 2008 Genetic Analysis: Mating and Complementation

September 30, 2008 Restriction Enzyme Mapping and Electrophoresis

October 7, 2008 Bacterial Transformation

October 21, 2008 Plasmid Isolation from Bacteria

October 28, 2008 Polymerase Chain Reaction (PCR)

November 4, 2008 Protein Isolation and PAGE I

November 11, 2008 Protein Isolation and PAGE II

November 18, 2008 Western Blotting I

November 25, 2008 Western Blotting II

December 2, 2008 Oral Presentations