AGRO/HORT/BOTA 339: Introduction to the molecular techniques of plant biology and biotechnology

COURSE OBJECTIVE
To provide a practical experience in the major techniques used in plant genetic analysis at the molecular and bioinformatic levels.

TEXTBOOK
Analysis of genes and genomes. 2004. Richard J. Reece. Ed. Wiley. Required readings will be assigned from this textbook. Please bring your textbook to all lectures. A copy will also be on reserve at the library.

PREREQUISITES
Botany/Zoology 152 or equivalent
Chemistry 104 or equivalent

CREDITS: 4CR

INSTRUCTORS
Professor
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OFFICE HOURS
MF 1:30-2:30 and by appointment

SCHEDULE
LEC 11am-12:15 pm
TR 136 Plant Sciences

LAB1 1:20-4:20 pm
W 136 Plant Sciences

LAB2 1:20-4:20 pm
R 136 Plant Sciences

SUPPLIES NEEDED: TEXTBOOK ONLY
HOW YOUR GRADE WILL BE DETERMINED
Mid-term exam 1  8%
Mid-term exam 2  8%
Presentation 8%
Laboratory reports  48% (12 evaluations, 4% per report)
Lectures final exam  8%
Lab final exam  20%

LABORATORY EVALUATION
The laboratory evaluations will be based on the manipulations and the laboratory report. The report must be returned to the instructor at the beginning of the next lab course. If the report is not returned on time, no points will be counted for the corresponding lab course.

GROUP PRESENTATIONS
Each student will make a 10 minutes presentation of a technical article to the class. This presentation will be followed by a 5 minutes discussion with the class. The date and of the article are randomly assigned by the instructor.

POLICIES ON TESTING
Tests will be closed book unless otherwise stated prior to the exam. Tests will generally consist of short answer and essay questions and problems/calculations. Material covered in labs and in assigned readings is considered fair game for tests. Tests outside of regularly-scheduled class period will not be given.

FEEDBACK ON THE COURSE
Conversations about how to improve the course or any problems that you may have are welcome anytime.
<table>
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<tr>
<th>Week</th>
<th>Topics</th>
<th>Textbook</th>
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| 1 | LEC Sept 4: Plant biotechnology Principles and Techniques: what, why, how...  
LEC Sept 6: From DNA to proteins  
LAB Sept 5 or 6: Lab safety, notebook, measurements, pipette exercises and basic laboratory sterile techniques (No evaluation of the lab report) | NONE |
| 2 | LEC Sept 11: Genes and expression  
LEC Sept 13: Genes and genomes  
LAB Sept 12 or 13: Plant genomic DNA isolation and DNA quantification techniques | Chapter 1 |
| 3 | LEC Sept 18: Recombinant DNA technology  
LEC Sept 20: The basics of cloning  
LAB Sept 19 or 20: Basic bacterial culture techniques (growth, selection, pure culture isolation, cryostorage, inoculation of liquid media and plates). Plasmid DNA isolation | Chapter 2 |
| 4 | LEC Sept 25: DNA sequencing and databases  
LEC Sept 27: Bioinformatics (Midterm exam 1 covers up to here)  
LAB Sept 26 or 27: DNA restriction analysis, cloning of restriction fragment and transformation of E. coli agarose gel electrophoresis | Chapter 3 |
| 5 | LEC Oct 2: Polymerase Chain Reaction (PCR) and applications  
Oct 4: MIDTERM EXAM 1 ON LECTURES  
LAB Oct 3 or 4: Designing PCR primers and PCR based screening of colonies and amplification of gene | Chapter 4 |
| 6 | LEC Oct 9: Monitoring gene expression  
LEC Oct 11: Vectors and libraries  
LAB Oct 10 or 11: Plant RNA extraction, RNA gel and quantification. Reporter gene technology (Green Fluorescent Protein and lacZ) | Chapter 5 |
| 7 | LEC Oct 16: Forward genetics (1/2) (Muthusubramanian Venkateshwaran)  
LEC Oct 18: Forward genetics (2/2)  
LAB Oct 17 or 18: Semi-quantitative RT-PCR. Bioinformatic analysis of DNA sequences (sequence alignments, databases, BLAST). Analysis of T-DNA mutants. | Chapter 6 |
| 8 | LEC Oct 23: Reverse genetics (1/2)  
LEC Oct 25: Reverse genetics (2/2)  
LAB Oct 24 or 25: PCR based Site Directed Mutagenesis | Chapter 7 |
| 9 | LEC Oct 30: Information from a cloned gene  
LEC Nov 1: Protein expression, purification and analysis (1/2) (Midterm exam 2 covers up to here)  
LAB Oct 31 or Nov 1: Protein extraction, quantification and SDS-PAGE | Chapter 8 |
| 10 | LEC Nov 6: Protein expression, purification and analysis (2/2) (Muthusubramanian Venkateshwaran)  
Nov 8: MIDTERM EXAM 2 ON LECTURES  
LAB Nov 7 or 8: Western blot and Reverse genetics | NONE |
| 11 | LEC Nov 13: Post-translational modifications (Article for presentation assigned)  
LEC Nov 15: DNA fingerprinting  
LAB Nov 14 or 15: Genetic maps and RAPD as molecular marker | Chapter 9 |
| 12 | LEC Nov 20: Genome mapping  
NO LAB THANKSGIVING | Chapter 10 |
| 13 | LEC Nov 27: Using mutants to clone genes  
LEC Nov 29: Microarrays  
LAB Nov 28 or 29: Gene prediction programs. Integration of genetic and physical maps | Chapter 11 |
| 14 | LEC Dec 4: Group presentations  
LEC Dec 6: Group presentations  
LAB Dec 5 or 6: Bioinformatics, proteomics and genomics tools | NONE |
| 15 | LEC Dec 11: Group presentations  
LEC Dec 13: Group presentations  
LAB Dec 12 or 13: Molecular phylogenetic techniques (No evaluation of the lab report) | NONE |
| 16 | FINAL EXAM ON LECTURES  
LAB FINAL EXAM | NONE |