BOT 4734C (3 credits)

PLANT BIOTECHNOLOGY

FALL SEMESTER, 2016

Sanson Science Building 119 Wednesdays 9:00 – 10:20 am

Sanson Science Building 108 Fridays 9:00 – 11:50 am

Department of Biological Sciences, Charles E. Schmidt College of Science

Florida Atlantic University

Instructor: Dr. Xing-Hai Zhang (pronounced like "shing-hi jong"), Associate Professor of Plant Molecular Biology, SC 262, Phone: 561-297-1011, e-mail: xhzhang@fau.edu

Office Hours: Wednesdays, 10:30 am - 4 pm; Fridays, 12 pm - 4 pm, or by appointment

Teaching Assistant: xxxx, e-mail: xxxx@my.fau.edu; office: SC 259. Office hours: Wednesdays, 1 pm - 3 pm

Required Textbook: Lab manual online via Blackboard. You print it out and bring to the lab.

Suggested Textbook:

Plant Biotechnology: the genetic manipulation of plants, by A. Slater, N.W. Scott, M.R. Fowler, 2nd edition (2008). Oxford University Press.

Prerequisites: BSC 1010 or BSC 1010L (minimum grade: C-), or instructor's permission.

Course Description

This course combines lectures and labs. Each student has his/her own research project. This course provides materials and training to help students gain current knowledge of structure and function of plant genomes, genes, and gene products; to learn hands-on techniques of DNA-transfer-based plant biotechnology; and to prepare for a professional career in plant/agriculture biotechnology research.

Course Objectives

To gain knowledge of structure, function and analysis of genomes, genes and gene products.

To learn hands-on techniques of DNA-transfer based plant biotechnology.

To enrich research experience and improve problem-solving skills in preparation for graduate or professional schools.

Students are expected to study for a minimum of two hours for every hour of class time.

Course Content/Topics (Minor changes/rearrangements possible)

1. Introduction of nuclear genomes
2. Introduction of organelle genomes (mitochondrial and plastid)
3. Concepts of genes and gene organization

4. Concepts of gene cloning and expression
5. Gene transfer via biological interaction: *Agrobacterium*-mediated transfer
6. Gene transfer via physical process: particle bombardment (gene gun)
7. Construction of nuclear transformation vectors
8. Construction of chloroplast transformation vectors
9. Plant tissue culture techniques
10. Plant totipotency, cloning and regeneration
11. Extraction and analysis of DNA plasmids from bacteria
12. *Agrobacterium*-mediated transformation, selection and regeneration
13. Chloroplast transformation via particle bombardment, selection and regeneration
14. Identification of putative transgenic plants by selection marker gene
15. DNA analysis of putative transgenic plants: DNA isolation and PCR
16. Protein analysis of transgenic plants: protein extraction, SDS/PAGE, enzyme assay
17. Data processing and report writing
18. Development of research project, proposal and presentation

Course Procedure

This course is composed of two integrative parts — lectures and lab experiments. The lectures will introduce the basic principles and experiment concepts, and discuss the design, rationale and predicted outcome of an experiment. The major portion of this course is lab exercises. Real experiments are carried out in a real lab setting. Each student or a group of two students, depending on enrollment and lab space, will be assigned a specific research project. The experiments will require the knowledge and study from the lectures and hands-on training. Throughout the course, the project progress will be closely monitored, successes and difficulties discussed and solutions for next steps designed and tested. We will attempt to carry out most of the experiments within the allotted time. However, depending on the progress and need of specific projects, you should be prepared to take care of your experiments beyond the class schedule.

This course is intended for students who are really interested in science research and have a career plan for graduate schools or biotech jobs; it is more problem-solving and less memorization demanding. Your attitude (willingness to learn) and scientific curiosity are most important in succeeding in this course. Carefully planning and executing experiments, intelligently following protocols, self-motivation, innovation and being inquisitive are all qualities that this course attempts to promote.

Assessment

Assessment consists of (1) several written assignments (home work), (2) a final comprehensive project report in a format of a scientific journal publication, (3) a comprehensive research proposal, and (4) one 15-min oral presentation of your proposal. Successful or inventive completion (good results) of your experiments, i.e. generation of a true transgenic plant, will be

rewarded. Late assignments/reports result in the penalty of 20% of the scores per day. More details will be provided in advance.

Tentative schedule for Assessment

- Week 3 Assignment 1 (use of Genbank and data mining)
- Week 5 Assignment 2 (analysis of gene gun utility)
- Week 7 Assignment 3 (*Agrobacterium*-mediated DNA delivery to plant cells)
- Week 12 Lab report
- Week 14 Research proposal (final)
- Week 15 Oral presentation (final)

Grading

The final letter (A to F) grade will be based on:

- Assignments: 30%
- Project report: 30%
- Research proposal: 20%
- Oral presentation: 15%
- Attendance: 5%

Assignment of Grades

Cumulative Performance Percentage	Grade
>94%	A
>90% - 94%	A-
>87% - 90%	B+
>83% - 87%	B
>80% - 83%	B-
>75% - 80%	C+
>65% - 75%	C
>60% - 65%	C-
>57% - 60%	D+
>53% - 57%	D
>50% - 53%	D-
<50%	F

Honor Code of Academic Integrity

Students at Florida Atlantic University are expected to maintain the highest ethical standards. Academic dishonesty, including cheating and plagiarism, is considered a serious breach of these ethical standards, because it interferes with the university mission to provide a high quality education in which no student enjoys an unfair advantage over any other. Academic dishonesty is also destructive of the University community, which is grounded in a system of mutual trust

and places high value on personal integrity and individual responsibility. Harsh penalties are associated with academic dishonesty. For more information, see University Regulation 4.001 at http://www.fau.edu/ctl/4.001_Code_of_Academic_Integrity.pdf

For this class, use of internet for learning and researching is very helpful and is strongly encouraged. However, using others' work without proper acknowledgement is wrong and may fall into the category of academic misconducts. Assignments and reports must be individual efforts and based on your own research data. Plagiarism, even if due to innocent oversight, should be avoided at all cost.

Attendance Policy

Attendance is mandatory. Missing a total of two classes shall result in a request of withdraw (grade W) from this class or a grade of "F" if without a valid excuse, or a grade of "I" when applicable. Absence can be excused only under certain circumstances and with valid documentations, such as participation in jury duty, University-approved activities, medical emergency, and religious observance. There is no possibility of making up missed assignments and reports.

Classroom Etiquette and Lab Safety

You are encouraged to actively participate in discussion and ask challenging questions any time during the lectures. Coming late to class is disruptive. I personally feel annoyed by late comers. All electronic devices must be turned off during class. Laptop computers are allowed only if you do not bother others. No eating, drinking or any other disruptive behaviors are allowed during the lecture or the lab.

We will try to cultivate a relaxed and engaging environment in class to encourage discussion and debates. However, lab safety rules and procedures must be strictly followed since we will be dealing with biohazardous and transgenic materials. You are encouraged to take proper training classes in lab safety offered by FAU. To successfully carry out an experiment, you should follow instructions intelligently, pay attention to details, use instruments/reagents properly and ask when uncertain.

Florida Atlantic University policy on the use of electronic devices states: "In order to enhance and maintain a productive atmosphere for education, personal communication devices, such as cellular telephones and pagers, are to be disabled in class sessions."

Students with Disabilities

In compliance with the Americans with Disabilities Act (ADA), students who require reasonable accommodations due to a disability to properly execute coursework must register with the Office for Students with Disabilities (OSD) – in Boca Raton, SU 133 (561-297-3880); in Davie, LA 240 (954-236-1222); in Jupiter, SR 110 (561-799-8010); or at the Treasure Coast, CO 117 (772-873-3441) and follow all OSD procedures.