

HOS6932
METHODS IN PLANT BIOTECHNOLOGY
(3 credits)

I. INSTRUCTOR

Course: HOS6932
Instructor: Dr. Kevin Begcy
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Office Hours: Every Monday from 9:00am – 10:00am or
by appointment. Please send me an e-mail.

II. MEETING DAYS, TIMES AND LOCATION:

Monday: 7th and 8th Periods (1:55pm – 3:50pm).

Wednesday: 7th Period (1:55pm – 2:45pm).

Room: PSF4

III. PREREQUISITES:

IV. COURSE DESCRIPTION

Plant biotechnology is a highly interdisciplinary field with new advances and techniques emerging at a fascinating speed. This graduate level course is designed as a comprehensive exploration to established and new methodologies used in the field of Plant Biotechnology.

V. COURSE LEARNING OBJECTIVES

The overall objective of this course is to provide solid knowledge related to the utilization of biotechnological tools for plant improvement. Principles and applications of plant biotechnology from the cellular to whole-plant levels will be discussed.

Upon completion of this course students will be able to:

- Provide detailed point to point review of any manuscript of plant biotechnology and/or related areas.
- Describe regulation of gene expression and implications for plant transformation.
- Distinguish plant culture techniques and culture types.
- Evaluate several methods for stable and transient plant transformation.

- Design strategies for plant genetic manipulation aiming to develop resilient crops against biotic and abiotic stressors as well as with increased productivity.
- Hypothesize on strategies to increase important traits including yield and fruit/seed quality.

VI. COURSE STRATEGY

- This course will focus on offering students the opportunity to learn biotechnological methods used in plant biotechnology. A strong emphasis will be given to develop critical thinking ability to design experiments using biotechnological tools for plant improvement.
- Teaching lessons will include discussions of state-of-the-art literature on plant biotechnology, hands-on activities and problem sets.
- Students will write a weekly 1-page critical review where they would focus on the strengths and weaknesses of the paper discussed each week. Font: Arial 12pt; 1.5 spacing. This activity will be used to develop skills in critical reading and how to review scientific literature.

VII. TEXT AND MATERIALS

Textbook:

Plant Biotechnology: The Genetic Manipulation of Plants. Second Edition. By Adrian Slater, Nigel W. Scott, and Mark R. Fowler. Oxford and New York: Oxford University Press. 2008

- Class material and additional reading material will be posted on Canvas weekly.

VIII. PAPER DISCUSSIONS

I. Vasil IK (2008). A short history of plant biotechnology. *Phytochemistry Reviews*. 7:387-394

II. Tiang CL; He Y; Pawlowski WP (2012). Chromosome organization and dynamics during interphase, mitosis, and meiosis in plants. *Plant Physiol*. 158:26–34

III. Bao Z; Clancy MA; Carvalho RF; Elliott K; Folta KM (2017) Identification of novel growth regulators in plant populations expressing random peptides. *Plant Physiol*. 175: 619–627

IV. Kyndt, T. et al. (2015). The genome of cultivated sweet potato contains *Agrobacterium* T-DNAs with expressed genes: an example of a naturally transgenic food crop. *Proc. Natl Acad. Sci. USA* 112:201419685

V. Engler C; Gruetzner R; Kandzia R; Marillonnet S (2009). Golden gate shuffling: a one-pot DNA shuffling method based on type IIIs restriction enzymes, *PLoS One*. 4: e5553

VI. Curtis MD; Grossniklaus U (2003) A gateway cloning vector set for high-throughput functional analysis of genes in planta. *Plant Physiol*. **133**, 462– 469.

VII. Cermak, T. et al. (2017) A Multipurpose Toolkit to Enable Advanced Genome Engineering in Plants. *Plant Cell* **29**, 1196–1217

VIII. Miao C, Xiao L, Hua K, Zou C, Zhao Y, et al. (2018) Mutations in a subfamily of abscisic acid receptor genes promote rice growth and productivity. *PNAS* **115**: 6058–63

IX. Shimatani Z., Kashojiya S., Takayama M., Terada R., Arazoe T., Ishii H., et al. (2017). Targeted base editing in rice and tomato using a CRISPR-Cas9 cytidine deaminase fusion. *Nat. Biotechnol.* **35**, 441–443.

X. Han, J. et al. (2020). TALEN-based editing of *TFIIA5* changes rice response to *Xanthomonas oryzae* pv. *Oryzae*. *Scientific Reports*. **10**, 2036.

XI. Bruggeman AJ; Kuehler D; Weeks DP (2014). Evaluation of three herbicide resistance genes for use in genetic transformations and for potential crop protection in algae production. *Plant Biotechnol J.* **12**: 894-902

XII. Ye X; Al-Babili S; Klott; Zhang J; Lucca P; Beyer P; Potrykus I. (2000) Engineering the provitamin A (β -carotene) biosynthetic pathway into (carotenoid-free) rice endosperm. *Science* **287**,303–305.

XI. GRADING

Course grades will be based on 1000 points. There will be two partial midterms and a final exam. Quizzes will be given each Wednesday and require no more than 15 minutes to complete.

In the event of an illness or an emergency that does not allow for an arrangement prior to the test date, the student should make arrangement as soon as they can.

Total: 1000 points

Midterm 1: 150 points (February 10th)

Midterm 2: 150 points (March 23rd)

Writing essays: 200 points

Final Exam: 300 points (April 21st)

Weekly Quizzes: 15 points each / 150 points total

Class participation and discussions: 50 points

Excellent Participation (50 points)

Consistently, actively supports, engages, listens and responds to peers. Takes a leading role. Participates in a meaningful way in class discussions. Stays on task.

Good Participation (40 points)

Makes an effort to interact with peers every class but does not take a leading role. Some active participation in class discussions. Sometimes deviates from task.

Average Participation (30 points)

Some effort to interact with peers but does not take a leading role. Minimal participation in class discussions. Sometimes deviates from task.

Participation Below Average (20 points)

Limited interaction with peers and rarely participates in class discussions and/or does not stay on task.

Unacceptable Participation (5 points)

Virtually no interaction with peers and does not participate in class discussions

The grading scale WILL NOT be adjusted or curved.

XII. CRITICAL DATES

Midterm I Exam (February 15th)

Midterm II Exam (March 22nd)

Final Exam (April 27th)

Quizzes will be given each Wednesday and require no more than 15 minutes to complete

Review reports are due every Monday before the class.

XII. GRADE DISTRIBUTION

A	100.0 - 93.1%	A-	93.0 - 90.1%		
B+	90.0 - 86.1%	B	86.0 - 83.1%	B-	83.0 - 80.1%
C+	80.0 - 74.1%	C	74.0 - 72.1%	C-	72.0 - 70.1%
D+	70.0 - 64.1%	D	64.0 - 62.1%	D-	62.0 - 59.1%
E	59.0% or below				

XIII. PROGRAM AND TENTATIVE SCHEDULE

Date			Topics	Learning Modules
Jan	11	(M)	Introduction to the Class; History of Plant Biotechnology	Plant Genomes: The organization and expression of plant genes
Jan	13	(W)	Paper discussion I:	
Jan	18	(M)	No UF Classes	
Jan	20	(W)	Paper discussion II:	
Jan	25	(M)	DNA, Chromatin, Chromosome structure and Regulation of Gene Expression	
Jan	27	(W)	Paper discussion III:	Plant Tissue Culture and Techniques for Plant transformation
Feb	1	(M)	Plant tissue culture and growth regulators	

Feb	3	(W)	Fundamental skills in DNA sequence analysis - Hands on activity	
Feb	8	(M)	Agrobacterium Mediated gene transfer and biolistic	Cloning and vectors for Plant Transformation
Feb	10	(W)	Paper discussion IV:	
Feb	15	(M)	Midterm I	
Feb	17	(W)	Paper discussion V:	
Feb	22	(M)	Principles of cloning, vectors, restriction enzymes	
Feb	24	(W)	Paper discussion VI:	
Mar	1	(M)	Gateway cloning and GoldenGate strategies	
Mar	3	(W)	Paper discussion VII:	Biotechnological strategies for plant improvement
Mar	8	(M)	Overexpression and Gene stacking	
Mar	10	(W)	Paper discussion VIII:	
Mar	15	(M)	RNAi and CRISPR	
Mar	17	(W)	Paper discussion IX:	
Mar	22	(M)	Midterm II	
Mar	24	(W)	Paper discussion X:	
Mar	29	(M)	TALEN and VIGS	Biotechnological manipulation of important traits
Mar	31	(W)	Paper discussion XI:	
Apr	5	(M)	Strategies for engineering herbicide and disease resistance	
Apr	7	(W)	Paper discussion XII:	
Apr	12	(M)	Golden Rice	
Apr	14	(W)	Paper discussion XIII:	
Apr	19	(M)	Review Session	
Apr	21	(M)	Final Exam	

XIV. EXPECTATIONS

Students are expected to spend 2-3 hours on the course material for EVERY hour spent in the classroom. The reading assignment list will be posted during the first week of the class. It is subject to change as the course progresses. Students are expected to be courteous and respectful to their fellow students and not interfere with their learning. You are expected to be on time. Students are asked to stow their cell phones before entering the classroom.

XVI. ATTENDANCE AND MAKE-UP WORK

Requirements for class attendance and make-up exams, assignments and other work are consistent with university policies that can be found at:

<https://catalog.ufl.edu/UGRD/academic-regulations/attendance-policies/>.

XVII. ONLINE COURSE EVALUATION PROCESS

Student assessment of instruction is an important part of efforts to improve teaching and learning. At the end of the semester, students are expected to provide feedback on the quality of instruction in this course using a standard set of university and college criteria. Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available at: <https://gatorevals.aa.ufl.edu/students/>. Students will be notified when the evaluation period opens and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via <https://ufl.bluera.com/ufl/>. Summaries of course evaluation results are available to students at: <https://gatorevals.aa.ufl.edu/public-results/>.

XIX. ACADEMIC HONESTY

As a student at the University of Florida, you have committed yourself to uphold the Honor Code, which includes the following pledge: "We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honesty and integrity." You are expected to exhibit behavior consistent with this commitment to the UF academic community, and on all work submitted for credit at the University of Florida, the following pledge is either required or implied: "On my honor, I have neither given nor received unauthorized aid in doing this assignment." It is assumed that you will complete all work independently in each course unless the instructor provides explicit permission for you to collaborate on course tasks (e.g. assignments, papers, quizzes, exams). Furthermore, as part of your obligation to uphold the Honor Code, you should report any condition that facilitates academic misconduct to appropriate personnel. It is your individual responsibility to know and comply with all university policies and procedures regarding academic integrity and the Student Honor Code. Violations of the Honor Code at the University of Florida will not be tolerated. Violations will be reported to the Dean of Students Office for consideration of disciplinary action. For more information regarding the Student Honor Code, please see:

<http://www.dso.ufl.edu/sccr/process/student-conduct-honor-code>.

XX. SOFTWARE USE

All faculty, staff and students of the university are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against university policies and rules, disciplinary action will be taken as appropriate.

XXI. SERVICES FOR STUDENTS WITH DISABILITIES

The Disability Resource Center coordinates the needed accommodations of students with disabilities. This includes registering disabilities, recommending academic accommodations within the classroom, accessing special adaptive computer equipment, providing interpretation services and mediating faculty-student disability related issues. Students requesting classroom accommodation must first register with the Dean of Students Office. The Dean of Students Office will provide documentation to the student who must then provide this documentation to the Instructor when requesting accommodation:

0001 Reid Hall, 352-392-8565, <https://disability.ufl.edu/>

XXII. CAMPUS HELPING RESOURCES

Students experiencing crises or personal problems that interfere with their general wellbeing are encouraged to utilize the university's counseling resources. The Counseling & Wellness Center provides confidential counseling services at no cost for currently enrolled students. Resources are available on campus for students having personal problems or lacking clear career or academic goals, which interfere with their academic performance.

- University Counseling & Wellness Center, 3190 Radio Road, 352-392-1575,

www.counseling.ufl.edu

Counseling Services

Groups and Workshops

Outreach and Consultation

Self-Help Library

Wellness Coaching

- U Matter We Care, www.umatter.ufl.edu/

- Career Connections Center, First Floor JWRU, 392-1601, <https://career.ufl.edu/>.

Student Complaints:

- Residential Course: <https://sccr.dso.ufl.edu/policies/student-honor-code-studentconduct-code/>.

- Online Course: <http://www.distance.ufl.edu/student-complaint-process>