SYLLABUS HOS6932:
METHODS IN PLANT BIOTECHNOLOGY
(3 credits)

INSTRUCTOR

Dr. Kevin Begcy
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OFFICE HOURS:

By appointment. Every Tuesday from 8:00am – 11:00am. Please send me an e-mail.

MEETING DAYS AND LOCATION:

Monday: 2nd – 3rd Period (8:30am–10:25am)
Wednesday: 3rd period (9:35am – 10:25am)
Room: PSF 4

PREREQUISITES: PLS3004C, AGR3303, PLP3002C

COURSE DESCRIPTION

This graduate level course is designed as a comprehensive exploration to the field of Plant Biotechnology. Plant biotechnology has promptly developed into one of the most prolific, expanding and influential areas of the plant sciences. Applications of modern biotechnological tools have resulted in great advances for agriculture and society. Plant biotechnology is highly interdisciplinary and involves numerous plant sciences specialties, including cell biology, genetics, physiology, bioinformatics, biochemistry and tissue biology.

COURSE LEARNING OBJECTIVES

The overall objective of this course is to provide an environment for students to develop critical thinking on plant biotechnological tools for plant improvement. Principles and applications of plant biotechnology from the cellular to whole-plant levels will be covered. Upon completion of this course students will be able to:

- 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 against biotic and abiotic stressors.
- Hypothesize on strategies to increase plant yield and fruit/seed quality.

COURSE STRATEGY

- This course will focus on offering students the opportunity to learn biotechnological tools for plant improvement. 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 1-page critical essay 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.

TEXT AND MATERIALS

Textbook:

Suggested: Plant Biotechnology: The genetic manipulation of plants (Second Edition) by A. Slater, N Scott and M, Fowler.

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

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.

Missed exams/quizzes will count as a zero unless an arrangement to take a make-up is made **PRIOR** to the test date.

Total: 1000 points
Midterm 1: 150 points
Midterm 2: 150 points
Writing essays: 200 points
Final Exam: 300 points
Weekly Quizzes: 15 points each / 150 points total
Class participation (active interaction in class) and discussions: 50 points
The grading scale WILL NOT be adjusted or curved.

CRITICAL DATES

Midterm I Exam (February 10th)
Midterm II Exam (March 23rd)
Final Exam (April 27th)
Quizzes: they will be given each Wednesday and require no more than 15 minutes to complete

GRADE DISTRIBUTION

A	93-100%	A-	92-90%		
B+	86-89%	B	83-85%	B-	82-80%
C+	76-79%	C	73-75%	C-	72-70%
D+	66-69%	D	63-65%	D-	62-60%
E	59% or below				

PROGRAM AND TENTATIVE SCHEDULE

Date			Topics	Learning Modules
Jan	6	(M)	Introduction to the Class; History of Plant Biotechnology	Plant Genomes: The organization and expression of plant genes
Jan	8	(W)	Paper discussion I:	
Jan	13	(M)	DNA, Chromatin, Chromosome structure and Regulation of Gene Expression	
Jan	15	(W)	Paper discussion II:	
Jan	20	(M)	Plant tissue culture and growth regulators	
Jan	22	(W)	Paper discussion III:	
Jan	27	(M)	Holiday - No UF Classes	
Jan	29	(W)	Fundamental skills in DNA sequence analysis – Hands-on activity	Plant Tissue Culture and Techniques for Plant transformation
Feb	3	(M)	Agrobacterium Mediated gene transfer and biolistic	
Feb	5	(W)	Paper discussion IV:	
Feb	10	(M)	Midterm I	
Feb	13	(W)	In silico Vector construction – Hands-on activity	
Feb	17	(M)	Principles of cloning, vectors, restriction enzymes	Cloning and vectors for Plant Transformation
Feb	19	(W)	Paper discussion V:	
Feb	24	(M)	Gateway and GoldenGate strategies	
Feb	26	(W)	Paper discussion VI:	
Mar	2	(M)	No UF Classes	Spring Break
Mar	4	(W)	No UF Classes	
Mar	9	(M)	Overexpression and RNAi	
Mar	11	(W)	Paper discussion VII:	
Mar	16	(M)	CRISPR	

Mar	18	(W)	Paper discussion VIII:	Biotechnological strategies for plant improvement
Mar	23	(M)	Midterm II	
Mar	25	(W)	Paper discussion IX:	
Mar	30	(M)	TALEN and VIGS	
Apr	1	(W)	Paper discussion X:	
Apr	6	(M)	Strategies for engineering herbicide and disease resistance	Biotechnological manipulation of important traits
Apr	8	(W)	Paper discussion XI:	
Apr	13	(M)	Golden Rice	
Apr	15	(W)	Paper discussion XII:	
Apr	20	(M)	Molecular Farming	
Apr	22	(W)	Review Session	
Apr	27	(M)	Final Exam	

PAPER DISCUSSION

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 IIs 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. Zang X, Geng X, Wang F et al. (2017) Overexpression of wheat ferritin gene TaFER-5B enhances tolerance to heat stress and other abiotic stresses associated with the ROS scavenging. BMC Plant Biology. 17:14.

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. Brooks C; Nekrasov V; Lippman Z.B; Van Eck J (2014). Efficient gene editing in tomato in the first generation using the clustered regularly interspaced short palindromic repeats/CRISPR-associated9 system. Plant Physiol. 166: 1292-1297

X. Cermak, T. *et al.* (2011). Efficient design and assembly of custom TALEN and other TAL effector-based constructs for DNA targeting. *Nucleic Acids Res.* **39**, e82.

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; Kloti; 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.

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.

CLASS ATTENDANCE

Students are encouraged to attend every class session. Absences must be reported via email to Dr. Begcy. In case of illness please the next class submit an absence excuse letter signed by your medical doctor.

COURSE EVALUATION

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/.

SOFTWARE USE

All 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. There you will be able to access notes and lecture slides, view the course calendar, take quizzes, view exam scores, access study questions, read course announcements, and find information concerning assignments.

ACADEMIC HONESTY

Students should value honesty and personal integrity.

The University of Florida requires all members of its community to be honest in all endeavors. Cheating, plagiarism, and any other form of academic dishonesty will not be tolerated. Students in violation of this policy will earn a zero for the assignment, be subject to disciplinary action, and may receive a failing grade for the course.

When students enroll at UF they commit themselves to honesty and integrity. As a result of completing the registration form at the University of Florida, every student has signed the following statement:

"I understand the University of Florida expects its students to be honest in all their academic work. I agree to adhere to this commitment to academic honesty and understand that failure to comply with this commitment may result in disciplinary action up to and including expulsion from the university." Furthermore, on work submitted for credit by UF students, 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 to be assumed that all work will be completed independently unless the assignment is defined as a group project, in writing by the instructor. This policy will be vigorously upheld at all times in this course.

STUDENTS WITH DISABILITIES

Students with disabilities are encouraged to contact Dr. Begcy for a confidential discussion of individual needs for academic accommodation. I will make every attempt to provide flexible and individualized accommodation to students with documented disabilities that may affect their ability to fully participate in the course activities or meet course requirements. Students requesting classroom accommodation should also register with the Dean of Students Office. Phone number: 352-294-2273; email: DSOCares@dso.ufl.edu