AGRO/HORT/BOT 340: Plant Cell Culture and Genetic Engineering

Spring Semester 2015

Course Description: This course presents an overview of the techniques and underlying theory of plant tissue culture and genetic engineering, research and commercial applications, and issues/challenges in the area of plant biotechnology.

Course Objectives:

1. To introduce students to the principles, practices and application of plant cell and tissue culture, and genetic engineering in science, agriculture and industry.
2. To acquaint students with experimental design and analysis of plant biotechnology experiments.
3. To give students hands-on experience and training in representative plant cell culture and genetic engineering techniques.
4. To introduce students to biosafety and regulatory requirements for conducting research involving cell culture, microbes and recombinant DNA.
5. To expose students to issues and challenges encountered in the areas of in vitro culture and plant biotechnology.

Instructor: Dr. Heidi Kaeppler, 461 Moore Hall/Plant Science, Department of Agronomy, Phone: 262-0246 Email: hfkaeppl@wisc.edu

Lecture : Tuesday/Thursday 9:30-10:45am, room 136 Plant Sciences

Laboratory: Thursday 11:00am-1:45pm, room 136 Plant Sciences

Required Textbooks:

R.N. Trigiano and D.J. Gray. 2011. Plant Tissue Culture, Development and Biotechnology. CRC Press, Taylor & Francis Group, LLC. ISBN 978-1-4200-8326-2

Course-specific learning materials will also be posted on Learn@UW

Prerequisites: Botany 130 or Botany/Zoology/Biology 152 or Zoology 102,and Chemistry 104, 109, or 116

Credits: 4

Grading:

Undergraduate students

Three exams, each worth 25% of grade
Laboratory reports, total worth 25% of grade

Graduate students

Three exams, each worth 20% of grade
Laboratory reports, total worth 25% of grade
Review paper, worth 15 % of grade

Letter grades will be determined by the scale presented below. (Intermediate grades [AB and BC] are used at the end of the semester and only for borderline cases, at the discretion of the teaching staff.)

Percentage	Letter Grade
90.0-100	A
80.0-89.9	B
70.0-79.9	C
60.0-69.9	D

Course Outline: Plant Cell Culture and Genetic Engineering

Lecture		**Lab(s)**
Week 1	Introduction Lab safety and biotech regulations Lab notebook notation/preparation Sterile technique History of plant tissue culture/genetic engineering	Stock preparation/sterile technique
Weeks 2-3	Plant tissue culture media components Nutrients Phytohormones Carbohydrate sources Gelling agents, antibiotics Preparation and storage of culture media Contamination issues	Media preparation Contamination tests Aseptic Oat germination
Week 4	Plant anatomy/development review Explant sources Culture initiation Culture types	Explant isolation Culture initiation
Week 5-6	Vector design and construction Vector components Promoters/Enhancers Selectable/screenable markers Bacterial culture/plasmid isolation	Subculturing Bacterial culture growth Plasmid DNA isolation
Week 7-8	*Agrobacterium*-mediated transformation Review of Agrobacterium Monocot vs dicot protocols Binary vectors Agrobacterium culture/cocultivation Floral dip vs. other target tissues	Agro. culture growth Arabidopsis/Maize transf.
Week 9-10	Microprojectile bombardment-mediated transformation Intro. to direct DNA delivery DNA delivery parameters Microcarrier preparation Target tissue preparation	Target tissue preparation Microcarrier coating Biolistic DNA delivery
Week11-12	Selection and regeneration of transgenic plants Media manipulations Subculture and selection Screenable marker assays Regeneration and transplanting Molecular genetic and expression assays Greenhouse and field growth of transgenic plants	Selection of callus sectors GUS, GFP assays Transgenic seedling screens

Lecture		**Lab(s)**
Week 13-14	Plant biotechnology data collection and management	
	Databases	Transplanting of regenerants
	Experimental design and analysis	DNA isolation and assays
	Data summary and interpretation	
Week 15	Developments and issues in plant biotechnology	
	Genome editing	Southern blot interpretation
	Pharmaceuticals	PCR assays
	Impact on cropping systems	
	Novel applications	
	Risk assessment	