

**Plant Tissue Culture/Plant Biotechnology Methods-
Hort/Biotech/Biol 459 (Spring 2002)**

**Part I. Plant Tissue Culture Component of the Course
Weeks 1-8 (to Spring Break)**

Instructor: Dr. Mark Guiltinan 220 Thomas Bldg. - 863-7286, mjg9@psu.edu
WEB PAGE: <http://www.courses.psu.edu/clue/>
<http://www.courses.psu.edu/courseweb/courses/index.cgi?course=hort459> mjg9

Lectures: Room 220 Thomas, Mon. and Wed. 4:40-5:30.

Labs: 250 Frear

Sect 1: R 01:25P - 03:20P

Sect 2: R 03:35P - 05:30P

Lab Instructor: Siela Maximova, snm104@psu.edu

Lab Coordinator: Beatrice Sirakaya, bxs205@psu.edu 5-8192-

TA:

Part II.. Instructor Ola Sodeinde oas1@psu.edu **Plant Biotechnology**

Office Hours: By appointment

Text: Experiments in Plant Tissue Culture, 3rd Edition by J. H. Dodds and L. W. Roberts. Cambridge University Press, 1995 ISBN 0-521-47313-6 (optional)
Plant from Test Tubes: An introduction to Micropropagation 3rd Ed. Lydiane Kyte and John Lley, Timber Press Inc. 1999. ISBN 0-88192-361-3 (optional)

Course Description:

Tissue culture is the aseptic culture of plant cells, tissues, organs and plants. This course seeks to familiarize students to the basic principles of tissue culture, and to expose them to its many applications. The theory, production and societal implications of transgenic plants will be discussed. The laboratory will be used to illustrate principles discussed in lectures. Students will give oral presentations (10 min) in groups of 2 on applied aspects of plant tissue culture. The lab will provide hands on experience in many of the methods discussed.

Course Objectives: Part I.

- To introduce the underlying principles of aseptic culture of plant cells, tissues and organs.
- To provide information about the equipment, procedures and terminology of aseptic culture.
- To review specialized cell culture techniques and their uses in plant science research and industry.
- To familiarize students with the technology of plant genetic engineering.
- To introduce tissue culture techniques and demonstrate the principles of tissue culture through student participation in the laboratory.

Lectures: Part I.

The initial lectures will be used to introduce the techniques and principles of aseptic culture. The following lecture topics will be used to introduce the principles of tissue culture, including how it is used to produce transgenic plants. Many of these principles will be demonstrated in the laboratory. The educational objective is to "learn by doing". Chapters in the text which provide background reading for the lectures are given in parentheses.

Topics to be Considered: Part I.

- Principles of aseptic culture (Chapters 2 and 3)
- Basic media components (Chapter 4)
- Organ culture (Chapter 9)
- Callus culture (Chapter 5)
- Cell suspension culture (Chapter 7)
- Organogenesis (Chapter 6)
- Somatic embryogenesis (Chapter 8)
- Micropropagation (Chapter 10)
- Anther culture for haploid plant production (Chapter 11)
- Protoplast isolation, culture and plant regeneration (Chapter 13 and 14)
- Applications of plant tissue culture (student presentations)

Laboratory: Part I.

The laboratory experiments will be designed to illustrate the basic principles of aseptic tissue and cell culture. The experiments will generally continue for several weeks. Frequently cultures started in an experiment earlier in the semester to demonstrate one principle will be used later in another experiment to demonstrate a different principle.

All students are expected to keep a detailed (loose leaf) laboratory notebook including the laboratory outline which is provided, a detailed record of the results, a discussion of the results, and general conclusions drawn from the experiment including suggestions for improving the laboratory where appropriate. Near the end of the semester, the notebooks will be collected and graded.

Grading: Part I.

- Performance in laboratory and laboratory notebook - 35%
- Examination I - 25% (Feb. 11; to cover the lectures)
- Examination II - 25% (Feb 27; to cover the student presentations)
- Oral Presentation – 15%

Oral Presentations:

Students will work in groups of 2. Sign up for a topic from the list below or from another topic of your choice (must be approved by instructor). Only one group per topic for each lab section (this will be done by week 2 in the lecture). TAs will provide a reference to start you in a literature search that can be done at the library. Learn about how tissue culture is used in either basic research or applied horticulture in commercial plant production, breeding ect. Prepare a 10 min. presentation, using handouts, overheads, slides, powerpoint presentations ect., outlining the application and giving real world examples. Share the time with your partner to present the materials to the class. You will be evaluated

on the content and clarity of the presentation. Provide a handout of notes to your fellow students, this will also be used in grading your presentation.

Clonal propagation systems

- 1) Micropropagation
- 2) Somatic embryogenesis
- 3) Disease indexing

Production of new cultivars

- 4) somatic hybridization
- 5) protoplast fusion
- 6) somaclonal variation

7) Medicinal compounds. Secondary metabolite production

8) Instant inbreds: haploid culture

9) Cryopreservation for germplasm conservation

10) Basic Research

- 10) Physiological processes
- 11) Hormone effects
- 12) Biotic stress (fungal, bacterial, viral pathogens)
- 13) Abiotic stress (salt, drought, cold, nutrient deficiency)

11) Transgenic Plants: Boon to the World, or Genetic Pollution?

Technology of Transgenic Plants

Applications of Transgenic Plants

Ethical, social, legal and environmental aspects of transgenic plants