Philadelphia University
Faculty of Science
Department of Biotechnology
Fall semester, 2014/2015
Course Syllabus

Course code: 240322	**Course Title:** Plant Biotechnology
Course Level: 3rd year	**Course prerequisite (s):** Introduction to Biotechnology (240281)
Lecture Time: 9:45-11:15 (Monday & Wednesday) **Credit hours:** 3 hours **Lecture Hall**: 902	**Course co requisite (s):** Plant tissue culture practical (240323)

Academic Staff Specifics

Name	Rank	Office Number	Office Hours	Email Address
Dr. Lolita Qouta	Assistant Professor	816	10:0-11:0 Sun. Tue. & Thur.	lqouta@philadelphia.edu.jo

Course module description

This module is required for all the students at the department of "Biotechnology and Genetic Engineering". It is a 3 credit hour course in which 3 lectures each of 50 minutes will be given per a week. This module will present an overview of the different techniques used in plant transformation and production of genetically manipulated plants. Students are expected to develop a better understanding of what plant biotechnology is along with the commercial applications, and issues/challenges in the area of plant production to meet the uprising continuous global demand in food production. Students are encouraged to take both of this module and the practical module # 240323 – Plant Tissue Culture Lab in the same term.

Sometimes, the introduction for the practical work will be illustrated every pre going to the lab on Wednesday. However, the quiz concerning the lab work will be given during the practical session around 13:10 pm.

Course module objectives

This course was designed to introduce the students to:

- The basic principles of plant tissue culture and its applications that can be practiced later in the laboratory module "Plant Tissue Culture 240323".
- The basic principles of genetic variations; sources, conservation, analysis and utilizations in improving plants through breeding.
- The different methods used for plant transformation and the use of transgenic plants in crop improvement or other biotechnological applications.

Course/ module components
Text books and web sites

All the lectures will be given in a PowerPoint format, Please note that the lectures will be prepared from different sources, however, the titles of topics to be discussed in class are arranged in accordance with headings of chapters in Plant Biotechnology and Genetics: Principles, Techniques and Applications textbook by N.C. Stewart (2008). You will be directed to the assigned chapters and feel free to borrow my copy over the weekends. In some lectures, the students will be referred to hardcopies of published papers/articles that will be available at the bookshop in level 1000. The students are encouraged to write down their own notes, read the assignments and handouts on weekly basis so it would be easier to review during the exams week. There will be three short (~15 minutes) open book quizzes involving a recently published paper per exam, the students should read and comprehend the paper in advance.

- Title: Plant Biotechnology and genetics: Principles, Techniques and applications, 2008
  Author: C. N. Stewart.
  Publisher: John Wiley and Sons. USA and Canada.

- Title: Plants, Genes, and Crop Biotechnology, Second Edition, 2003
  Authors: Chrispeels, M.J. and Sadava,D.E.
  Publisher: Jones and Bartlett
  ISBN-13: 9780763715861
  ISBN-10: 0763715867
  University library call number 363.8 CHR

- Title: Introduction to Plant Biotechnology
  Author: Chawla, H. S.
  Publisher: Science Publishers, USA. 2002
  University library call number: 631.5233 CHA

- Title: The *Arabidopsis* book (TAB)

Authors: It is a compilation of over 100 chapters, each written by a different scientist and is reviewing in detail an important and interesting aspect of the plant *Arabidopsis thaliana*, with reference to what is known in other plants and in other kingdoms.
Publisher: The American Society of Plant Biology
ISSN: 1543-8120
Free online access: **http://www.aspb.org/publications/arabidopsis/**

Learning outcomes

Upon completion of this course, the students should be able to :

- Understand the basic techniques and principles of plant genetic engineering.
- Discuss the benefits and the risks of plant DNA technology.
- Appreciate the significance and the vital role played by the plant species in the human food, feed, industry and pharmaceutics.

- Use the acquired information as guidance in debating issues like global warming, world hunger, and agricultural and environmental sustainability.

Communication skills (personal and academic)

The students will be encouraged and trained to analyze data and interpret results through the discussions of some publications demonstrating successful examples of plant biotechnology.

Assessment instruments

Assessment Instruments	Mark
First hour exam	20
Second hour examination	20
Quizzes, home works and attendance	20
Final examination	40
Total	100

Course/module academic calendar

Date	Subject
October 20, 22, 27 & 29	**Introduction: History of plant biotechnology** *Reference: Vasil, I.K. 2008. A history of plant biotechnology: from cell theory of Schleiden and schwan to biotech crops. Plant Cell Reports. 27: 1423-1440*
November 3	**Green revolution curse or blessing** *Reference: Hazell, P.B.R. 2003.Green Rovultion, Curse or blessing?*
November 5, 10 & 12	**The molecular basis of genetic modification and production of transgenic plants:** • *The gene; DNA as a polynucleotide, DNA coding for a protein via the molecular trilogy: DNA, RNA and amino acids, DNA packaging into eukaryotic chromosome. Multipartite nature of genes.* • *Transcription; mRNA, transcription factors, coordinated regulation of gene expression, regulation of gene expression by DNA methylation. Processing to produce mature mRNA.* • *Translation and post translation modification*.
November 17, 19, 24, 26 & December 1 & 3	**Marker genes and promoters** • *Definition of marker genes* • *Reporter genes* • *Promoters* • *Selectable marker genes* • *Selection on antibiotics* • *Selection on herbicides* • *Selection using non toxic metabolic substrates* • *Non selectable marker genes of reporter genes* • *B Glucurnonidase* • *Luciferase* • *Green fluorescent proteins* • *Marker free strategy*
December 8, 10, 15, 17, 22 & 24	**Transgenic plant production** • *Basic components for successful gene transfer to plant cells;* • *General transformation process, DNA delivery, target tissue status, selection and regeneration.*

	• *Agrobacterium; history of our knowledge of Agrobacterium, T-DNA, Agroinfiltration, Arabidopsis and floral dip.* *Reference: Gelvin, S.B. 2003. Agrobacterium-Mediated Plant Transformation: the Biology behind the "Gene-Jockeying" Tool. Microbiology and molecular biology reviews. 67 (1): 16–37.* • *Particle bombardment; history of particle bombardment; fate of introduced DNA, power and problems of direct DNA introduction.* *Reference: Altpeter et al., 2005. Particle bombardment and the genetic enhancement of crops: myths and realities. Molecular Breeding. 15: 305–327.* • *Other methods; protoplasts, whole tissue electroporation, Silicon carbide whiskers, viral vectors, laser micropuncture and nanofiber arrays* • *Criteria to consider: whether my plant is transgenic; resistance genes, marker genes and transgene DNA.*
December 29, 31 & January 5, 7, 12 & 14	**Genes and traits of interests for transgenic plants;** • Traits for improved crop production; • Herbicide resistance: Roundup • Insect resistance: Bt crops • Pathogen resistance • Traits for improved products and food quality • Nutritional improvement: Golden rice, Plant vaccines. *Reference: Davoodi et al., 2010. Chloroplast-derived vaccine antigens confer dual immunity against cholera and malaria by oral or injectable delivery. Plant Biotechnology Journal, 8: 223–242.* • Modified plant oils • Pharmaceutical products: Molecular farming • Biofuels
December 19, 21, 26	**Why transgenic plants are so controversial** • Feeding to fear; case studies • Moarch butterfly flap • Business and control; terminator seed technology • Seed banks • Health concerns • Environmental concerns

	Reference: Velkov et al., Will transgenic plants adversely affect the environment? Journal of Bioscience. 30(4): 515–548. • Consumer choice
Important dates for your calendar	********19-27/11/ 2014 period of First Hour Exams ******** ******** Thursday 25/12/2015 Christmas Holiday ******** ******** 28-6/1/2015 period of Second Hour Exams ******** ******** Thursday 1/1/2015 New Year Holiday******** ******** Thursday 22/1/2015 Last day to withdraw ******** ******** 1-9/2/2015 Final Exams ********

Attendance policy

Students are expected to attend all lectures. Absence from lectures should not exceed 15% (6 lectures). Students, who exceed the 15% limit without a medical or emergency excuse acceptable to and approved by the Dean of the Faculty of Science will receive a mark of zero for t course.

Expected workload

The students are encouraged to attend all the lectures and keep good notes of every topic discussed in class. Reading the covered material in advance will definitely enrich the student's vocabulary and enable him/her to follow the items discussed in the lecture. Every student is expected to spend 4 hours per week to prepare and/or study the assigned material.

Module references

In addition to the texts listed above, the students are requested to read the following publications which will be sent as attachments to the students' email addresses.

- Velkov, V.V., Medvinsky, A.B., Sokolov, M.S. and Marchenko, A.I. 2005. ***Will transgenic plants adversely affect the environment?*** Journal of Bioscience. 30(4): 515–548.

- Chapple, C., Ladisch, M. & Meilan, R. 2007. ***Loosening lignin's grip on biofuel production.*** Nature Biotechnology. 25(7): 746- 748.

- Paine, J. A., Sphipton, C.A., Chaggar, s., Howells, R.M., Kennedy, M.J., Vernon, G., Wright, S.Y., Hinchliffe, E., Adams, J.L., Sliverstone, A.L. and Drake, R. 2005. ***Improving the nutritional value of rice through increased pro-vitamin A content.*** Nature biotechnology. 23(4): 482-487.

- Rubin, E.M. 2008. ***Genomics of cellulosic biofuels***. Nature. 454: 841- 84.

Students are encouraged to visit http://www.chlorofilms.org/

ChloroFilms is a nonprofit project sponsored by the Education Foundation of the American Society of Plant Biologists (ASPB), Botanical Society of America, ", Penn State Institutes for Energy and the Environment, and the Canadian Botanical Association. **objective is** to promote the creation of fresh, attention-getting and informative video content about plant life and to make the best of these videos easy to find from a single website. This is intended to serve the general public and educators at all levels.