BIOL 501 –Plant Biotechnology-Online
Western Kentucky University
Syllabus and Course Information Sheet
Spring 2020

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Class Schedule:
Lectures: Video Lectures posted Tuesday and Thursday on Blackboard Course Site
Virtual Labs: Videos posted Thursdays on Blackboard Course Site

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WELCOME TO BIOL 501

Congratulations to you all for joining the Western Kentucky University academic family and a warm welcome to our Plant Biotechnology community. Did you know that PLANTS benefit our lives not just as food sources, but as biofactories that provide us nutritionally superior foods, pesticides, biofuels and medicines to cure dreaded diseases such as cancer, Alzheimer's, AIDS and the like? You may also have heard about biotechnology and the media blitz on GMOs, Franken foods, and wondered what the hullabaloo was all about? This course will be the answer to all your questions and will lay a strong foundation of the basic concepts of plant molecular biology, plant tissue culture and biotechnology.

As in my earlier classes I will adopt the teaching methodology of "deep learning," a process where the student learns with understanding as opposed to rote or surface learning where he/she just collects innumerable unrelated facts. I excitedly look forward to introducing you to the WORLD OF PLANTS interspersed with episodic historical anecdotes, real world examples and modular schematic visuals towards a greater understanding of WHAT WE OWE TO PLANTS in terms of bettering our lives. The rest of the course information sheet will help you to understand the objectives we will achieve through this course, the methods used to measure and gauge your progress throughout the course, and the WKU academic policies and rules.

COURSE DESCRIPTION

Biology 501 (Plant Biotechnology-online) is a course that illustrates the current advances in plant biotechnology and their potential application in agriculture, health and environment. The course consists of online interactive lectures that involve written analysis of real world case studies of all concepts discussed as well as virtual online lab sessions specific to genetically engineering a model dicot plant tobacco and a model monocot plant rice as well as an experimental plant basil engineered for expressing anti-cancerous pharmaceuticals.

STUDENT LEARNING OUTCOMES

After successfully completing Biol 501, the student will have a theoretical and working knowledge of:

1. The role of plants in our daily lives
2. The basic concepts of plant tissue culture, plant molecular biology and plant biotechnology including plant genetic engineering for plant disease resistance, improved plant nutritional quality, pharmaceutical production, stress tolerance and herbicide tolerance
3. The basic lab techniques involved in plant molecular biology and biotechnology such as plant DNA/RNA isolation, plant tissue culture techniques including media preparation, callus culturing and plant regeneration, plant genetic engineering utilizing the *Agrobacterium*-mediated transformation including analysis of transgenic plants by PCR and southern blotting.
4. Specific case studies involving significant milestones in plant genetic engineering through written reading reactions aimed at a literature review publication.

5. Specific lab experiments with three specific plants (tobacco, rice and basil) that involve submitting a comprehensive lab report book and learn to design a manuscript with all facets of transgenic plant analysis.
6. The ethics and challenges of safe genetic engineering practices.

EXPANDED COURSE DESCRIPTION
Please refer to the lecture schedule at the end of this document

STUDY MATERIALS

Study materials in the form of power point slides and journal articles will be provided by me and will be posted on the blackboard course site.

CLASS POLICIES
Attendance: WKU believes that regular class attendance is a crucial component for student success. Every class lecture is a vital foundation for subsequent class meetings. Without full participation and regular class attendance, students will be at a severe disadvantage for achieving success at college. Class participation (including exams and assignments) is vital to understand the subject matter in a thorough manner. It is my responsibility as a faculty member, to determine how participation is achieved in all my classes. I will require students to regularly view the posted lectures on blackboard and the record of attendance as determined by participation in online discussion forums will be recorded from the first day of class and/or the first day the student's name appears on the roster through final examinations. When a student has a prolonged absence measuring to a week, as seen as inactivity on discussion forums, the student will receive an emailed warning from me that upon one more day of unexcused absence, the student will be dropped from all classes in which the unexcused absences are reported. Some of the forms of absence that can be considered officially excused are: (1) Sick and medical emergencies (2) Representing WKU/parent institution at an official institutional function. Other excuses will be considered, at my discretion, with documentation.

Dropping: If a student chooses to drop the course, it is that student's responsibility to ensure proper documentation with WKU. Failure to do so could result in a grade of F in the course. If you wish to withdraw from the course you should do so by the dates mandated by the University. Be sure you are aware of these dates because credit for the course will not be changed after the university's designated time. You also cannot drop the class or Withdraw after the designated time.

Disabilities: "Students with disabilities who require accommodations (academic adjustments and/or auxiliary aids or services) for this course must contact the Office for Student Disability Services at (270) 745-5004. Please DO NOT request accommodations directly from the professor or instructor without a letter of accommodation from the Office for Student Disability Services."

Dishonesty Statement: WKU does not tolerate cheating, plagiarism or other acts of dishonesty. Definitions of these acts and procedures for dealing with them are described in the WKU standards of professional conduct on the university website and in the student handbook.

Civility Statement: Members of the WKU community, which includes faculty, staff and students, are expected to act responsibly in the online classroom. WKU holds all members accountable for their actions and words. Therefore, all members should commit themselves to behave in a manner befitting a responsible College and Civilian community. Responsible College and Civil behavior applies to the language and behavior as exhibited by online postings. Please refrain from offensive online postings during discussions in the academic classroom and lab sessions.

COURSE REQUIREMENTS AND CRITERIA FOR GRADING

Lecture Exams: There will be three lecture exams during the semester. Exams will be of multiple choice or short answer questions based on case studies to examine your grasp on knowledge learned in class. Make-up exams are only offered to students with an excused absence. Excused absences include those officially recognized by WKU. To arrange for a make-up exam please e-mail me during the first class period following your absence. **An unexcused absence from an exam will result in a grade of zero.**

Literature review manuscript: Specific case studies covered in class will be the foundation for the students to submit a literature review manuscript modeled in the journal *Trends in Plant Sciences* format.

Lab Exams: There will be two lab exams that will test your understanding of the experiments you analyze during your virtual lab sessions.

Lab Report: A comprehensive lab report of the three plant species' experimented in the virtual lab sessions.

Assignments: Periodic assignments will cover recent topics and assigned readings from the lectures.

Research manuscript: A manuscript that encompasses all the facets of reporting a transgenic plant research study modelled on the format of the journal *Plant Biotechnology Reports*.

Final Project: The final project will be a presentation of a case study, an experimental plan or a literature review which you will design and execute as your choice while traversing the lecture and lab sessions. On the day of the final, you will do a classroom presentation of your work

Point Distribution:	Lecture Exams (3 exams x 100 points each)	300 points
	Literature review manuscript	100 points
	Final Project	100 points
	Research manuscript	100 points
	Assignments	100 points
	Lab report	100 points
	Lab Exams	200 points
		1000 points

LECTURE SCHEDULE

JANUARY 28 – INTRODUCTION-WHAT'S IN IT FOR ME?
– Biotechnology and Facing Starvation – The Legacy of Norman Borlaug
Case Study 1 – GREEN REVOLUTION vs GENE REVOLUTION
30 – The genes in Mendel's garden

FEBRUARY 4 – How do plants express their genes during development?
6 – What goes into making plants of our choice?
11 – How do we make plants in the field?
13 – How do plants develop in nature?
18 – What are the nuts and bolts in the inner workings in plants?
20 – What's in the recipe for making plants in lab?
25 – Exam 1
27 – How do we make plants in lab?

MARCH 3 – What are the molecular workings of plant genes?
5 – Plant systems biology
10 – SPRING BREAK
12 – SPRING BREAK
17– How do we genetically engineer plants?
19 – How do we design herbicide and insect resistant plants?
Case Study 2 – Basta resistant rice and roundup ready soybean
Case Study 3 – Insect resistant Bt cotton and corn
24 – How do we design disease free and high nutritional plants?
Case Study 4 – Fungal resistant cotton
Case Study 5 – Golden rice
26 – Plant gene switches
Case Study 6 – CaMV promoter vs Plant based promoters
31 – How do we select transgenic plants in lab?
Case Study 7 – Antibiotic based selection of transgenic plants
Case Study 8 – Marker free selection of transgenic plants

APRIL **2 – Exam 2**
7 – *Agrobacterium* – The natural genetic engineer
9 – Gene gun and other methods of plant genetic engineering
14 – How do we ensure the genes of choice in engineered plants?
Deadline to submit Literature Review Manuscript
16 – Regulating plant genetic engineering
21 – Engineered plants in our fields and food
Deadline to submit Research Manuscript
23 – Who owns the plant genes and engineered plants?
28 – **Exam 3**
30 – Frankenfoods?
Case Study 9 – Pustzai Affair and the Monarch butterfly studie

MAY 5 – Synthetic plants (Chapter 17)
7 – Plant gene maps and "Omics" (Chapter 17)
12 – **Final Project Presentation**

VIRTUAL LAB SCHEDULE

JANUARY 30 – INTRODUCTION

FEBRUARY 4 – Preparing for plant tissue culture – making the media for tobacco, rice and basil
11 – Preparing for *Agrobacterium*-mediated transformation – preparing the GFP vector
18 – Selecting transformed plants – Antibiotic selection in tobacco and basil vs mannose based selection in rice
25 – Regenerating transgenic tobacco, basil and rice

MARCH **3 – Lab Exam 1**
10 – SPRING BREAK
17 - Jelly fish protein in plants?
24 – Isolating DNA from transgenic plants
31 – Detecting transferred genes in plants - PCR

APRIL 7 – Detecting transferred genes in plants – Southern Blotting
14 – Hardening the transgenic plants
Deadline to submit Comprehensive Lab Report
21 – Testing the transgenic plant products – GFP in tobacco and rice, and eugenol in basil
28 – "Genethics" – the biosafety practices of plant genetic engineering

MAY **5 - Lab Exam 2**