Plant Biotechnology (PLNT S 4550/7550)
Syllabus for Spring 2016 (4 credit hours)

Instructors:
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Lectures: 30 Lectures excluding final week, two days per week, location TBD

Labs: 10 labs, date and location: Mumford 40 and Plant Transformation Core Facility
(16 weeks of spring semester excluding one-week spring break)

Prerequisite courses:
Readings in Biological Science (Bio_Sc 2960) or equivalent
General Genetics (Bio_Sc 2200) or equivalent
Introduction to Cell Biology (Bio_Sc 2300) or equivalent
Plant Structure and Function (PLNT 2125)

I. Introduction to Plant Biotechnology (4 classes, two labs)

- Introduction of the course (format, rules, policies, etc) and overview of Plant Biotechnology particularly Genetic Engineering (one class by David and Zhanyuan)
- DNA, RNA, transcription (promoters), protein synthesis (one class)
- Common techniques to quantify and analyze DNA, RNA, proteins (one class) (lab 1 / David MC: quantification of DNA and gel electrophoresis)
- PCR, cDNA, RT-PCR, qPCR (one class) (lab 2 / David MC: PCR)

II. Molecular Biology (4 classes, 2 labs)

- Plasmid biology (plasmid incompatibility groups; minimal components of a plasmid) (one class)
- Restriction enzyme cloning (one class)
- Cloning without restriction enzymes (USER) and Recombination-based cloning (Gateway cloning, In-Fusion) (one class) (lab 3 / David MC: Gateway cloning, and bacterial transformation)
- Bacterial, yeast, shuttle plasmids, binary vectors (one class) (lab 4: plasmid isolation, digestion, and restriction-based ligation)
III. Identification of targets for genetic manipulation (4 classes, 1 lab)

- Regulation of metabolic pathways; Introduction to the control of metabolism
- Identification of rate-limiting steps (lab 5 / David MC: dry lab, simulation software)
- Compartmentation/transport processes
- Tissue-specific expression in multicellular organisms

IV. Bioinformatics and resource centers (4 classes)

- Data mining (i.e. Arabidopsis Resource Center, Genevestigator, SoyKB).
- (one class)
- Cell-specific transcriptome profiling (one class)
- Tissue-specific promoters and inducible promoters (half class); How to write term papers and small grant proposals (half class).
- First exam (feedback from students and exam; one class)

V. Plant tissue culture systems (three weeks with 6 classes, 2.5 labs)

- Major tissue culture systems: an overview (one class to cover the ABC of Plant Tissue Culture and major tissue culture systems: Protoplast, Cell suspension, anther culture, micropropagation, organogenesis and somatic embryogenesis) (lab 6: Tissue Culture ABC- aseptic techniques, medium stock and preparation, etc).
- Organogenesis (two classes) (lab 7: de novo shoot organogenesis from Arabidopsis)
- Somatic Embryogenesis (two classes)
- Epigenomic control of plant regeneration (one class)

VI. Plant transformation (two weeks with 4 classes and 1.5 labs)

- DNA transfer mechanisms (biolistics and other direct DNA transfer) (one class)
- DNA transfer mechanisms (T-DNA transfer) (two classes) (Lab 8: maize somatic embryogenesis and T-DNA transfer)
- Germline transformation - A. thaliana floral dipping; organelle transformation - chloroplast transformation (one class) (Lab 9: Arabidopsis flower dipping and gene-gun use)
- Analysis of transgene integration (Southern and PCR) and expression (northern, qRT-PCR, and Western), as well as progeny segregation (one class)
VII. Transgene expression study and reporter systems (two weeks with 4 classes, 1 lab)

- Variations in transgene expression (one class Lab 10: GUS reporter gene expression analysis)
- small RNA-mediated gene silencing (one class)

VIII. Perspectives in plant biotechnology (two classes excluding exam)

- Emerging transgenic technologies
- Perspectives in genetic engineering (Application of plant genetic engineering, synthetic biology, IP issues, and genetic engineering future)
- **Second exam** (feedback from students and exam, one class)

Course format:
Combinations of lectures/paper discussions and a combination of *active learning* techniques where students are prompted to participate through activities and discussions.

Before each class, students will be asked to read specific literature and look through reading questions ahead of time. At the start of each class, the instructor will give a brief overview of what contents will be covered, key concepts and principles.

For the second part of the class (Sections V-VIII), the instructor will provide a general introduction to the class to help students understand the assigned reading material. During the following classes, students will be randomly chosen to provide summary, synthesis, or overview of the contents from the assigned readings. Students will rotate so all students will have the chance to participate. Frequency and quality of student’s participation will be important criteria to evaluate student performance. Student attendance and punctuality will be also considered for class score.

Instructor will lead the class and discussions to facilitate participation and questioning. In some classes, where the material and contents are too scattered, the instructor will provide a more extensive review at the start of the class.

There will be two exams, mid-term and final, each account for 50% of the total exam scores.

**Score system** (100 total points)

<table>
<thead>
<tr>
<th>Component</th>
<th>Points</th>
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<tbody>
<tr>
<td>Class</td>
<td>50</td>
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<tr>
<td>Lab</td>
<td>30</td>
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<tr>
<td>Participation</td>
<td>20</td>
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</tbody>
</table>
100 points total

Final total score:

- 96-100 = A+
- 90-95  = A
- 85-89  = B+
- 80-84  = B
- 75-79  = B-
- 70-74  = C
- 60-69  = C-
- less than 60 = failure.

Class location: TBD
Class schedule: 9:30-10:45am, Tue and Thu

Lab Location: Life Science Center and Sears Plant Growth Facility
Lab schedule: 3:00-6:00pm Thu

Students are required to apply for building pass using ID cards. Please send your full names and SSN to Diane Wyatt (wyattdr@missouri.edu) to ask for building to enter Sears Plant Growth Facility.

Academic Dishonesty

Academic integrity is fundamental to the activities and principles of a university. All members of the academic community must be confident that each person's work has been responsibly and honorably acquired, developed, and presented. Any effort to gain an advantage not given to all students is dishonest whether or not the effort is successful. The academic community regards breaches of the academic integrity rules as extremely serious matters. Sanctions for such a breach may include academic sanctions from the instructor, including failing the course for any violation, to disciplinary sanctions ranging from probation to expulsion. When in doubt about plagiarism, paraphrasing, quoting, collaboration, or any other form of cheating, consult the course instructor.

Students with Disabilities

If you anticipate barriers related to the format or requirements of this course, if you have emergency medical information to share with the instructors, or if you need to make arrangements in case the building must be evacuated, please let us know as soon as possible.

If disability related accommodations are necessary (for example, a note taker, extended time on exams, captioning), please register with the MU Disability Center, S5 Memorial Union, 573-882-4696, and then notify the instructors of your eligibility for reasonable accommodations.
Intellectual Pluralism

The University community welcomes intellectual diversity and respects student rights. Students who have questions or concerns regarding the atmosphere in this class (including respect for diverse opinions) may contact the departmental chair or divisional director; the director of the Office of Students Rights and Responsibilities; the MU Equity Office, or equity@missouri.edu.

All students will have the opportunity to submit an anonymous evaluation of the instructor(s) at the end of the course.