SYLLABUS SP2014
Bio 4025
Current Approaches in Plant and Microbial Research

Class details:

Monday 10-11 am
Wednesday and Friday 10-11:30 am
Location McDonnell 212

Course description:

Goals of the course.

1. Illustrate how modern approaches are used to answer questions in plant and microbial biology.
2. Give students experience in the design and application of these approaches.
3. Provide opportunities to improve oral presentation skills.
4. Lead students step-by-step through the creation of a research proposal.
5. Give students practice in peer review.

Expectations. Students in the course are expected to do the assigned background reading, attend to lectures, and participate in class discussions of the literature and in peer review.

General description. This course is designed to introduce graduate students and upper-division undergraduates to contemporary approaches and paradigms in plant and microbial biology. The course will include lectures, in-class discussions of primary literature and hands-on exploration of computational genomic and phylogenetic tools. Evaluations will include short papers, quizzes, and oral presentations. Over the semester, each student will work on conceptualizing and writing a short NIH-format research proposal. Particular emphasis will be given to the articulation of specific aims and the design of experiments to test these aims, using the approaches taught in class. Students will provide feedback to their classmates on their oral presentations and on their specific aims in a review panel.

Course design. The course will consist of:
1) A two-week introduction to basic topics in plant and microbial biology and research proposal design.
2) A set of 6 modules, each introduce a particular research approach with a one-hour lecture on Monday, and follow up with two 1.5-hour sessions on Wednesday and Friday that involve active learning such as leading a discussion of the literature or workshops on the use of contemporary software or online resources.

1. Classic genetics
2. Transcriptomics
3. Phylogenetics
4. Quantitative genetics
5. Phenotyping
6. Imaging

3) A week of in-depth lectures on current plant and microbial faculty research, designed to illustrate how multiple approaches can be used to answer research questions at the end.
4) The preparation of a high-quality research proposal at the end of the class. The students will participate in peer-reviewing each other's proposals during the last week of class.

Prerequisite. Fundamentals of Biology II: Genetics (Bio 2970) or permission of the instructor.

Evaluations:

Evaluation	Number	Points	Total points in semester
In class quizzes on discussion section	12	25	300
Workshop homework assignment	11	50	1100
Research proposal drafts and final product	1	500	500
Participation		100	100
Total			**2000**

Each week will incorporate a lecture, a discussion of the literature, and a workshop. Evaluations each week will include an in-class quiz on the reading assignments and a homework assignment. The research proposal project overall will be worth 500 points.

Instructors:

Elizabeth Haswell (course master)
Email ehaswell@wustl.edu
Phone 314-935-9223
Office McDonnell-205

Dan Chitwood
Email dchitwood@danforthcenter.org
Phone 314-587-1609
Office 1064 Donald Danforth Plant Science Center

Ram Dixit
Email ramdixit@wustl.edu
Phone 314-935-8823
Office McDonnell-216

Todd Mockler
Email tmockler@danforthcenter.org
Phone 314-587-1694
Office

Chris Topp
Email ctopp@danforthcenter.org
Phone 314-587-1401
Office 1062 Donald Danforth Plant Science Center

Jim Umen
Email jumen@danforthcenter.org
Phone 314-587-1689
Office 2033 Donald Danforth Plant Science Center

Topics Schedule (subject to change during the semester)

	Day	Date	Event	Leader	Topic
1	Mon	1-13	Lecture 1	Haswell	Course overview and introduction to plant development
	Wed	1-15	Lecture 2	Lucia Strader	Introduction to plant hormones
	Fri	1-17	Lecture 3	Todd Mockler	Introduction to plant biotic and abiotic stress
	Mon	1-20	MLK holiday		
	Wed	1-22	Discussion 1	Haswell	Quiz, present papers, discuss
	Fri	1-24	Workshop 1	Haswell	Choosing a research topic, devising specific aims, and writing a research proposal—Homework assignment
2	Mon	1-27	Lecture 4	Haswell	Forward genetics in Arabidopsis
	Wed	1-29	Discussion 2	Haswell	Quiz, present papers, discuss
	Fri	1-31	Workshop 2	Haswell	Designing a genetic screen—Homework assignment
	Mon	2-3	Lecture 5	Haswell	Reverse genetics in Arabidopsis
	Wed	2-5	Discussion 3	Haswell	Quiz, present papers, discuss
	Fri	2-7	Workshop 3	Haswell	Web-based tools for gene discovery—Homework assignment
3	Mon	2-10	Lecture 6	Mockler	Plant genome sequencing, assembly, analysis
	Wed	2-12	Discussion 4	Mockler	Plant genome sequencing, assembly, analysis
	Fri	2-14	Workshop 4	Mockler	Hands-on tutorial/computer lab - genome assembly
	Mon	2-17	Lecture 7	Mockler	Plant transcriptome analysis
	Wed	2-19	Discussion 5	Mockler	Plant transcriptome analysis
	Fri	2-21	Workshop 5	Mockler	Hands-on tutorial/computer lab -RNA-seq analysis
	Mon	2-24	Lecture 8	Mockler	Plant polymorphism discovery and analysis
	Wed	2-26	Discussion 6	Mockler	Plant polymorphism discovery and analysis
	Fri	2-28	Workshop 6	Mockler	Hands-on tutorial/computer lab - variant discovery
4	Mon	3-3	Lecture 9	Umen	Phylogenetics in the genomics era; homework assignment I
	Wed	3-5	Discussion 7	Umen	Quiz and workshop on tree building; homework assignment II
	Fri	3-7	Workshop 7	Umen	Student presentations and discussion
	Mon	3-10	Spring break		
	Wed	3-12	Spring break		
	Fri	3-14	Spring break		
5	Mon	3-17	Lecture 10	Chitwood	Quantitative genetic analysis; homework assignment and reading
	Wed	3-19	Discussion 8	Chitwood	Workshop: discussion of paper; designing and analyzing QTL experiments
	Fri	3-21	Workshop 8	Chitwood	Student presentations and discussion of mock QTL experiments
6	Mon	3-24	Lecture 11	Topp	Digital Phenotyping; reading assignment
	Wed	3-26	Discussion 9	Topp	Quiz and group discussion on reading assignment; homework assignment

	Fri	3-28	Workshop 9	Topp	Analyze digital images from homework assignment, presentation and discussion
7	Mon	3-31	Lecture 12	Dixit	Fundamentals of microscopy
	Wed	4-2	Workshop 10	Dixit	Introduction to ImageJ and homework
	Fri	4-4	Discussion 10	Dixit	Quiz and student paper presentations
	Mon	4-7	Lecture 13	Dixit	Plant cytoskeleton and cell walls
	Wed	4-9	Discussion 11	Dixit	Workshop on quantitative image analysis and homework
	Fri	4-11	Workshop 11	Dixit	Quiz and student paper presentations
	Mon	4-14	Lecture 14	Dixit	Membrane trafficking
	Wed	4-16	Discussion 12	Dixit	Quiz and student paper presentations
8	Fri	4-18	Lecture 15	Justin Fay	Reduced representation and genome sequencing to reveal the history of domesticated and wild yeast strains.
	Mon	4-21	Lecture 16	Bob Blankenship	Mass spectrometric analysis of intact photosynthetic complexes
	Wed	4-23	Lecture 17	Rebecca Bart	Genomics Approaches to Crop Improvement
9	Fri	4-25		All	Panel discussion of Research Proposal Summaries
	Mon	4-28		All	Panel discussion of Research Proposal Summaries
					Final Research Proposal Due