BIOL436 - Plant Genetics, Development, and Biotechnology
Recent advances in plant molecular biology, genetics, development, and biotechnology, and their potential relevance to agriculture. The course will include lectures, reading and discussions of papers from the primary literature, and student presentations.
Prerequisites: Biology 271 or Biology 202 or permission of the instructor.

Course meetings: T/Th, 11:00-12:15, GSB 1377 – 2.5 contact hours per week
Instructor: Jason W. Reed, 305 Coker Hall, jreed@email.unc.edu
Office Hours: by appointment

Intended audience. This course is intended for undergraduates interested in the genetics and development of plants and how these areas can contribute to biotechnology and agriculture. Students should have some previous knowledge of either plant biology or genetics and molecular biology. Students not having taken either of the alternative prerequisites (Biology 271, Introduction to Plant Biology or Biology 202, Genetics and Molecular Biology) should contact the instructor to discuss whether an exception is warranted.

Course design. The course will include lectures, class discussions, and student presentations. Lectures will serve to introduce each topic and provide context. We will spend a good portion of most classes discussing a paper from the scientific literature. Typically we will break into groups to discuss aspects of the paper, and then review collectively what we have understood. This style of teaching will predominate for the first month, and will also recur later in the course. Students should hone their paper-reading and analytical thinking skills through these activities.

Twice during the course, students will "teach" a portion of the class, by presenting a paper describing a particular advance or a recent advance in plant biotechnology. Later, I will provide literature papers to choose among, as well as further guidance.

Always write down any questions or ideas you have about the reading, and email them to me before class and/or bring them with you so we can discuss them during the class.

Goals. The course will focus on several themes that will illustrate methodological approaches and intellectual questions in plant biology. Each theme will be covered over several class periods (2-3 weeks). We will intersperse lectures and more focused class discussions centered on papers from the primary scientific literature reporting research findings. Students will i) learn about current methodologies and questions of scientific interest in plant molecular biology; ii) practice reading and evaluating papers from the scientific literature; iii) consider how discoveries in these areas may be useful to develop crop varieties.

Readings. Assigned readings will be posted on the course Sakai site: https://sakai.unc.edu/portal/site/biol436_plant_dev_spring19. A detailed schedule will be handed out separately. Articles from the scientific literature will be assigned to introduce and provide an overview of a particular topic (review articles), or to provide a detailed example (papers from the primary literature). Some articles are open-access and others are not - as the university has subscriptions to all of the relevant journals, you are entitled to download them for your personal use. We will analyze these papers carefully in class, in order to understand the logic of the experiments, the methodologies used, and the conclusions reached. It is important to read these in advance, and to think about any questions or comments you have about them, in

order to be prepared to participate in (and benefit from) the discussions. These exercises will help you to learn to read and understand primary literature papers.

In addition, the following two books have been put on reserve in the undergraduate library. These will be useful references when you want to look up some aspect of plant physiology or biochemistry.

Taiz, L. and Zeiger, E. Plant Physiology, 5th edition
Sunderland, MA : Sinauer Associates, c2010
[The library does not yet have the more recent 6th edition.]

Biochemistry & molecular biology of plants 2nd edition
edited by Bob B. Buchanan, Wilhelm Gruissem, and Russell L. Jones.
Published: Chichester, West Sussex ;Hoboken, NJ : John Wiley & Sons, Ltd, 2015.

Requirements. Course grades will be determined by two in-class exams and a final exam (25% each), by preparation for and participation in class discussions (5%) and by student presentations (20%). It is likely that the final grades will be curved. As in all classes, the honor code is in effect.

Classroom etiquette. Laptops and other electronic devices may be used only for viewing the scientific content we are currently discussing. Use of such devices to engage in social media conversations or other extraneous activity is not permitted. Please eat your lunch after, but not during class.

Changes. The instructor reserves the right to make changes to the syllabus, including the schedule of topics, project due dates and test dates (excluding the officially scheduled final exam), as needed to accommodate unforeseen circumstances. Any changes will be announced as early as possible so that students can adjust their schedules.

Tentative Schedule – likely to change somewhat

Th, January 10	Course introduction – how do you make a plant?

Theme 1: Regulating cell walls, cytoskeleton, and mechanical forces to control growth

T, January 15	Regulating growth – growth hormones, photoreceptors
Th, January 17	Paper Discussion – shade avoidance
T, January 22	Primary cell wall structure and assembly; cellulose, hemicellulose, pectin
Th, January 24	Paper Discussion – pectin modification and new organ growth

Theme 2: New organ emergence

T, January 29	Physical forces in plant morphogenesis
Th, January 31	Paper Discussion – pavement cell interdigitation
T, February 5	Leaf development and polarity
Th, February 7	Paper Discussion – leaf polarity and outgrowth
T, February 12	Exam I
Th, February 14	Student group presentations –
T, February 19	Student group presentations –
Th, February 21	Student group presentations –
T, February 26	Student group presentations –

Theme 3: Stomata and water relations

Th, February 28	Stomatal development and function
T, March 5	Paper discussion – regulation of stomatal formation
Th, March 7	Paper Discussion - Evolution of stomatal function
March 11-15	Spring break
T, March 19	xylem and phloem differentiation
Th, March 21	Long distance signaling
T, March 26	paper discussion – drought response
Th, March 28	paper discussion – wounding response

Theme 4: Seed development and epigenetics

T, April 2	Exam II
Th, April 4	Induction of flowering; seed formation
T, April 9	paper discussion - Endosperm, gene imprinting
Th, April 11	paper discussion – engineering parthenogenesis in rice

Theme 5: Fun Biotechnology

T, April 16	Student presentations
Th, April 18	Student presentations
T, April 23	Student presentations
Th, April 25	Student presentations

Monday, April 29, 12:00 Final exam