BIOL436H - Plant Genetics, Development, and Biotechnology, Spring 2020
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 students 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 discuss with the instructor whether an exception is warranted. Students in the Honors Carolina program have priority to register for the Honors version of this course.

Goals. The course will focus on several themes that will illustrate methodological approaches and intellectual questions in plant biology. These themes may differ in different years. Each theme will be covered over several class periods (2-3 weeks).
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 new crop varieties.

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 one or more papers 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 (individually or in groups) will "teach" a portion of the class, by presenting a paper or topic describing a recent advance in plant biology or biotechnology. The first presentation (in February) will focus on the findings of a single paper from the recent primary literature. The second presentation (in April) will be a broader overview of a topic putting alternative approaches into context. Students will also be required to hand in a written discussion of the paper or topic they are presenting. We will choose papers and topics for presentations a couple of weeks beforehand. I will provide later a more detailed description of the assignment, and will meet individually with students to provide 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. If you have questions about topics not otherwise covered, bring those up too. We can talk about anything of interest. Student-suggested topics can also be the subject of student presentations.

Readings. Assigned readings will be posted on the course Sakai site: **https://sakai.unc.edu/portal/site/biol436h_spring_2020**. 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 and accompanying written discussions (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.

Preliminary 2020 Schedule based on 2019 class – likely to change somewhat this year

Th, January 9	Course introduction – how do you make a plant?

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

T, January 14	Regulating growth – growth hormones, photoreceptors
Th, January 16	Paper Discussion – shade avoidance
T, January 21	Primary cell wall structure and assembly; cellulose, hemicellulose, pectin
Th, January 23	Paper Discussion – pectin modification and new organ growth

Theme 2: Leaf growth and development

T, January 28	Physical forces in plant morphogenesis
Th, January 30	Paper Discussion – pavement cell interdigitation
T, February 4	Leaf development and polarity
Th, February 6	Paper Discussion – leaf polarity and outgrowth
T, February 11	Exam I

Student presentations – topics to be chosen

Th, February 13
T, February 18
Th, February 20
T, February 25
Th, February 27

Theme 3: Signaling in response to stress and day length

T, March 3	Stomata and water movements
Th, March 5	Paper Discussion – Root-to-shoot drought signaling to close stomata
March 9-13	Spring break
T, March 17	Stomatal development
Th, March 19	Paper Discussion – evolution of stomatal function
T, March 24	Induction of flowering
Th, March 26	Paper Discussion – Flowering in annuals and perennials
T, March 31	Exam II

Theme 4: Seed development and epigenetics

Th, April 2	Epigenetics, seed formation
T, April 7	Paper Discussion – Gene silencing in sperm cells
Th, April 9	Paper Discussion – Peptides that regulate sperm release and fertilization

Student presentations, Theme 5: New applications in plant biotechnology – topics to be chosen

T, April 14
Th, April 16
T, April 21
Th, April 23

Monday, April 27, 12:00 Final exam