Biology 671: **Plant Responses to the Environment**
Tu-Th 2:00 – 3:15 Room CLS 104
Instructor:
Dr. Johannes Stratmann, Office 407 CLS

Course Description: Plants have evolved numerous mechanisms to cope with a plethora of harmful environmental conditions. Understanding these adaptations is crucial for the improvement of agricultural and environmentally important traits. We will examine induced plant responses to environmental stress at the physiological, molecular and genetic levels. The biotic forms of stress covered include viral, bacterial and fungal pathogens, and herbivores. The abiotic forms of stress include UV-B, ozone, drought, salt, cold, freezing and heat stress. In addition, plant responses to deficits in mineral nutrients as well as responses to toxic metal exposure will be studied. The interaction between various signaling pathways involved in plant responses to stress will be addressed. Finally, recent advances in agricultural biotechnology are discussed including, the manipulation of plant metabolism to enhance the nutritional quality of plants and the manipulation of plant defense responses to enhance the resistance of plants to various pathogens and pests.

Learning outcomes for undergraduate students:
At the end of the course, students should
- have gained a basic understanding of how plants cope with abiotic and biotic stresses in their environments
- have gained a basic understanding of the genetic, molecular, biochemical and physiological mechanisms that underlie responses to the environment
- understand how plants are integrated into ecosystems
- understand how plants evolved as a consequence of changes in their environment
- have gained a basic understanding of scientific techniques employed for studying responses to the environment
- have a background understanding of biotechnology aimed at improving crop plants for better adaptations to harmful environments
- be able to understand primary research papers
- appreciate the complexity of living systems

Learning outcomes for graduate students:
All of the above pertaining to undergraduate students.
In addition, graduate students will improve their science literacy and should
- have gained the ability to critically evaluate primary research papers
- have gained basic scientific presentation skills
- have improved their scientific writing skills

Prerequisites: BIOL 302 (Cell and Molecular Biology); BIOL 303 (Fundamental Genetics) is recommended but not required.

Office Hours:
Dr. Stratmann: 777-5730: email; johstrat@biol.sc.edu 3:30 – 4:30 Tu/Th or by appointment.

Text: 1) Biochemistry and Molecular Biology of Plants (Buchanan, Gruissem and Jones, eds.) available at the bookstores. 2) Selected readings from the primary literature (required). 3) Lecture Notes.

#	Date	Reading	Topic
1	Aug 20	notes	Intro/*Arabidopsis thaliana*
2	Aug 25	notes	Molecular Methods
3	Aug 27	ch 22: 1158-1170	Water-deficit/salt stress 1
4	Sep 1	ch 22: 1158-1170	Water-deficit/salt stress 2
5	Sep 3	ch 16: 786-823	Macronutrients: nitrogen nutrition
6	Sep 8	ch 23.4	Micronutrient deficiencies (example Fe)
7	Sep 10	ch 23.5/16.14	Plant responses to mineral toxicity - Phytoremediation
8	Sep 15	ch 22.8-22.9	Oxidative stress/Heat stress
9	Sep 17	**EXAM #1 (8 lectures)**	
10	Sep 22	ch 22.8/6.3/22.8	Ozone and Ultraviolet-B radiation
11	Sep 24	notes	Plant responses to elevated CO_2 – global warming
12	Sep 29	ch 21.1/24	Diseases, damage and constitutive defense
	Oct 1	*Last day to drop without a WF*	
13	Oct 1	ch 18/21	Defenses against pathogens 1
14	Oct 6	ch 18/21	Defenses against pathogens 2
	Oct 8	*Fall Break*	
15	Oct 13	ch 18/21	Defenses against pathogens 3
16	Oct 15	ch 18/21	Defenses against pathogens 4
17	Oct 20	Film (Societal aspects of biotechnology/genetic engineering)	
18	Oct 22	Guest lecture Sarah Hind – Research in Plant Science	
19	Oct 27	ch 18/21	Defenses against pathogens 5
20	Oct 29	**EXAM # 2 (8 lecture +2)**	
21	Nov 3	ch 21.5.11	Virus-induced gene silencing
22	Nov 5	ch 18.1-4/21.5-6	Direct defenses - herbivores I
23	Nov 10	ch 18.1-4/21.5-6	Direct defenses - herbivores II
24	Nov 12	notes	Indirect defenses - herbivores I
25	Nov 17	notes	Indirect defenses - herbivores II
26	Nov 19	notes	Evolutionary battle
27	Nov 24	ch 21	Biotechnology Applications
	Nov 26	*Thanksgiving Day*	
28	Dec 1	**EXAM # 3 (7 lectures)**	
29	Dec 3	Review	
	Dec 5	Reading Day	
	Dec 9	**FINAL EXAM (CUMULATIVE) 2 pm** (Wednesday)	

Exams: There will be four examinations including a cumulative final exam. The final exam will be optional and you will be able to use it either to replace your lowest grade or to take the place of an exam that you may have missed during the semester.

There are **no make-up exams**; if you miss an exam, you will receive a zero.

There will be **no rescheduling of exams** due to conflicts with other courses.

Exams will be in the form of essays, short answers and multiple choice designed to test understanding of the concepts. The exams will primarily emphasize material covered in the lectures. Semester exams will generally cover material presented during the immediately preceding class period. The final exam will be cumulative.

In addition, graduate students will be required to give a presentation (20-30 min.) covering a paper or papers chosen from the primary literature that cover topics related to the course. Papers will be chosen by the instructors. Students scheduled to give presentations in class are strongly encouraged to read the paper in advance and discuss it with the instructor. Students giving presentations are also required to submit a summary/analysis of the paper. This should be 1-2 pages and include background, a summary of the results and conclusions and future directions. The paper should also address problems and/or shortfalls of the paper and how these may be overcome in future studies. All students are required to read the papers to be presented prior to class. Short exam questions may be based upon material covered in the papers. In addition, students that participate in the discussion of papers will earn extra credit.

Undergraduate Student Grades: Your final grade will be calculated in the following way:
Each exam is worth 1/3 of your grade.
Extra credit for class participation/discussion possible.

Graduate Student Grades: Your final grade will be calculated in the following way:
Each exam is worth 25% of your grade.
Presentation/Summary Paper: 25%

Grading scale:

A 90-100%	C 70-75%
B+ 85-89%	D+ 65-69%
B 80-84%	D 60-64%
C+ 75-79%	F below 60%

Attendance: You are expected to attend class and complete the reading assignments prior to the lecture. Attendance will be taken on a random basis. Four absences will be considered the basis for lowering your final grade by ONE FULL GRADE regardless of how well you are doing in the course.