Course Summary: (3 credits) Students will learn key research strategies for abiotic and biotic stress agents of plants. Students will complete at least one focused hands-on project. (Pre-requisite: PLNT_S 4500/7500, PLNT_S 7315 or PLNT_S 7320, BIO/PLNT_S 8505, or equivalent).

Course Mechanics: During the beginning of the semester students will attend two (75 min) lectures per week which will highlight key aspects of research with diverse abiotic and biotic plant stress agents. During the remainder of the semester, students will complete two laboratory projects focused on individual plant stress agents, or one integrated project with two stress agents, as approved by participating faculty.

Course times: Lectures are on Tuesday and Thursday from 11:00-12:15pm in Mumford Hall 40. Students will work with participating faculty to arrange necessary meeting times and locations for project completion.

Participating Faculty: [http://plantsci.missouri.edu/faculty/](http://plantsci.missouri.edu/faculty/)
**Grades:** The course grade will be a composite reflecting exam performance, overall effort on projects, and lab reports.

Exam 100pts  
Projects 200pts (100pts, single stress agent projects; 200pts, integrated projects)  
Total 300pts

Grade scale: ≥ 90% A; 80-89% B; 70-79% C; < 70% F.

**Semester Schedule:**

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<th>Week</th>
<th>Dates</th>
<th>Instructor(s)</th>
<th>Topic</th>
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<td>Schoelz</td>
<td>Biotic Stress - Viruses</td>
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<td></td>
<td>Mitchum</td>
<td>Biotic Stress - Nematodes</td>
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<td>3</td>
<td></td>
<td>English &amp; Mihail</td>
<td>Biotic Stress – Oomycota &amp; Fungi</td>
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<td>Blevins</td>
<td>Abiotic Stress - Nutrients</td>
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<td>Oliver &amp; Sharp</td>
<td>Abiotic Stress – Heat, Drought</td>
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<td>6</td>
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<td>*Boyer &amp; Sharp</td>
<td>Abiotic Stress - Drought</td>
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<td>7</td>
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<td>Exam</td>
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<td>7-15</td>
<td>Self-selected projects</td>
<td>By Arrangement</td>
<td>By Arrangement</td>
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*guest lecture

**Course Website:** The course website can be accessed at <https://courses.missouri.edu>

click on blackboard

pawprint is your email user name (for example, schoelzj)

password is your email password

You can check the website for lecture outlines, course announcements and required readings.

**Individual Projects:** Each student must complete two independent projects each focusing on a single stress agent OR one integrated project which focuses simultaneously on two stress agents. The topic for the project(s) must be approved by participating faculty and should be identified as early in the semester as possible. An extension of the graduate research topic may be acceptable for the class project. Projects may be selected from suggested topics below. You may propose an alternative project of particular interest as well. **All project topics must be approved by the 6th week of the semester.** Students are expected to work on average a minimum of 6
hours/week on their projects during the second half of the course. A written lab report will be due at the end of the semester (please consult Lab Report Guidelines).

**Projects with fungi & Oomycota (English & Mihail):**
- **Eumycota**
  - Collect and identify 10 genera of anamorphic fungi from any habitat.
  - Collect and identify 10 different leaf parasitic fungi.
- **Oomycota**
  - Classify 5 isolates of *Phytophthora* using the working key of Waterhouse
  - Characterize the homothallic/heterothallic condition and mating type of 5 *Phytophthora* isolates
  - Assess the host specificity of zoospore chemotaxis for 3 *Phytophthora* species

**Projects with nematodes (Mitchum):**
- Collect soil samples from different sites (field, garden, ornamentals, turf, etc), extract for nematodes, and identify 5 different genera of plant-parasitic nematodes
- Evaluate a set of soybean cultivars for resistance or susceptibility to soybean cyst nematode and/or root-knot nematodes
- Challenge wild-type and mutant/transgenic plants with cyst nematodes and evaluate nematode success (integrated projects might include mutants in genes known to play a role in drought or heat tolerance, nutrient acquisition, etc or transgenic plants with enhanced stress tolerance)
- Assess the virulence phenotypes of soybean cyst nematode field populations
- Evaluate host-range specificity of cyst and/or root knot nematodes
- Impact of drought, nutrient, or heat stress on nematode parasitism
- Use a bean pod mottle virus vector to silence soybean defense genes. Challenge the silenced plants with nematodes and evaluate for resistance and susceptibility
- Test commercial nematode biocontrol agents in greenhouse trials

**Project with viruses (Schoelz):**
- Use a tobacco rattle virus vector to silence plant defense genes. Challenge the silenced plants with a second plant virus and evaluate for resistance and susceptibility.

**Projects with drought stress (Sharp and Oliver):** [Projects will emphasize techniques for imposition of accurate and quantifiable water deficits.]
- Responses of root and shoot growth and metabolism to water deficits in maize or Arabidopsis mutants (to be decided)
- Impact of specific metabolic inhibitors (to be decided) on maize or Arabidopsis root and shoot growth and metabolism under water deficits
Interaction of water deficits and heat stress on root growth in maize
Interaction of water deficits and soil penetration resistance in root growth in maize or rice

Projects with heat stress (Fritschi):
- Growth responses of a temperature sensitive soybean mutant
- Influence of high night temperature on soybean seedlings
- Seed germination responses to temperature
- Chlorophyll fluorescence as a tool to screen for heat tolerance
- Canopy spectral reflectance analyses
- Thermal imaging of plant canopies
- Heat and drought interactions

Projects with nutrient stress (Blevins):
- Nutrient deficiency stress
  - Iron deficiency and chlorophyll synthesis
  - Using pediatric IV equipment to deliver iron to iron-deficient soybean plants
  - Boron deficiency, root growth and vitamin C deficiency
  - Manganese deficiency in selected C4 plants
  - Hidden hunger in plants
- Stress caused by toxic elements
  - Aluminum stress and root zone pH
  - Overcoming aluminum stress with boron or organic acid production

Policy on Cell Phones:

As a courtesy to fellow students and the instructor, all cell phones must be switched off during lecture and lab periods. Exception: if you are a primary care giver for a minor or ill relative, you may have your cell phone on to receive emergency calls. In this case, if your phone rings, you must leave the room without disturbing others and conduct your personal business outside the classroom.

University of Missouri Policy on Academic Dishonesty:

Academic honesty 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 required, 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 academic dishonesty as an extremely serious matter, with serious consequences that range from probation to expulsion.
When in doubt about plagiarism, paraphrasing, quoting, or collaboration, consult the course instructor.

The University has specific academic dishonesty administrative procedures. Although policy states that cases of academic dishonesty must be reported to the Office of the Provost for possible action, the instructor may assign a failing grade for the assignment or a failing grade for the course, or may adjust the grade as deemed appropriate. The instructor also may require the student to repeat the assignment or to perform additional assignments.

**Assisting Students with Special Needs:**

If you need accommodations because of a disability, if you have emergency medical information, or if you need special arrangements in case the building must be evacuated, please inform an instructor immediately.

To request academic accommodations (for example, a notetaker or extended time on exams), students must also register with the Office of Disability Services, (http://disabilityservices.missouri.edu), S5 Memorial Union, 882-4696. It is the campus office responsible for reviewing documentation provided by students requesting academic accommodations, and for accommodations planning in cooperation with students and instructors, as needed and consistent with course requirements. For other MU resources for students with disabilities, click on "Disability Resources" on the MU homepage.