

# Division of Plant Sciences

## Graduate Student Handbook

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Part I — Division of Plant Sciences Guidelines

I. GRADUATE PROGRAMS IN PLANT SCIENCES

The Division of Plant Sciences offers graduate programs leading to the Master of Science (M.S.) and Doctor of Philosophy (Ph.D.) degrees in Plant, Insect and Microbial Sciences. A student can select training from a wide range of courses and research programs to prepare for a career in research, teaching, industry and extension work.

The information outlined below summarizes the combined regulations and requirements of the Graduate School and the Division of Plant Sciences. Graduate students must recognize, from the start that the planned programs of study leading to an advanced degree are their own responsibility.

*General Requirements*

Certain requirements pertain equally to all graduate students whether on an M.S. or a Ph.D. program of study.

A. Selection of a Graduate Program Area and an Advisor

Students may complete their graduate degrees in the Division through any of the Graduate Program Areas:

Crop, Soil & Pest Management	Plant Biology & Genetics
Entomology	Plant Stress Biology
Horticulture	

Advisors for M.S. students must be members of the Graduate Faculty and advisors for Ph.D. students must be members of the Doctoral Faculty.

B. Academic Performance

The GPA in the Graduate School is based on the student's entire graduate record in courses numbered 7000 and above taken at MU. To remain in good standing, a student must maintain a cumulative GPA of 3.0 or better. This is based on a grading system where A=4.0, B=3.0, and C=2.0; there is no D grade for graduate students and no points are given for the failing grade of F.

At the end of any semester, a graduate student with a GPA below 3.0 is placed on probation. If, at the end of the following semester, the cumulative GPA is 3.0 or better, probation status is lifted. A student on probation who fails to raise the cumulative GPA to 3.0 may, on the recommendation of the division, be allowed a second and final probationary semester. A student is subject to dismissal upon failure to raise the cumulative GPA to 3.0 by the end of the second probationary semester or at any time that the semester GPA or the cumulative GPA falls below 2.0. To graduate, a student must have a GPA of 3.0 or better overall graduate courses.

In addition to dismissal for failure to meet the usual examination and grade requirements, the Division has the right to place on probation and, after at least 30 days of probation, to dismiss from the program any graduate student who is deemed not to be making sufficient academic progress and/or whose work is not of the quality required. The dismissal may occur at any time during the student's work toward a graduate degree

### C. Assessment of Satisfactory Progress

By May 31, each student will complete an annual progress report. The report will be developed using the on-line reporting system of the Graduate School at <http://web.missouri.edu/~umcgradweb/policies/progress/annual-review/progress-system/>. Once the student has recorded their progress, the advisor will respond with an evaluation of the student's progress during the past academic year. The advisor may elect to incorporate the annual evaluation process into a scheduled meeting of the student's advisory committee. Once the annual evaluation is complete, a printed copy signed by both the student and the advisor will be given to the Director of Graduate Studies.

### D. Petitions to Alter Graduate Course of Study

Petitions to alter the divisional graduate program requirements should be made by the Major Advisor to the Director of Graduate Studies, who will convene a meeting of the Graduate Education and Research Committee to discuss the matter and make a decision regarding an exception.

### E. Travel to Meetings

Graduate students are strongly encouraged to attend at least one regional or national professional meeting during their graduate program. Participation in such meetings can be an important forum for advanced students. Students should consult with their Major Advisor and other faculty regarding the availability of small grants to defray all or part of expenses associated with meeting travel. Students are also encouraged to contact the student organizations such as Graduate Professional Council and Graduate Student Association which make small travel grants.

<http://gradschool.missouri.edu/student-development/organizations/>

### F. Academic Integrity

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, students should consult with their Major Advisor.

## II. MASTER OF SCIENCE DEGREE

For success in a Master's program, knowledge - both general and detailed - must be combined with originality, reliability, and industry. A thesis is required of all Master's candidates in the division. A well-written thesis should foster scholarly interest and demonstrate knowledge of the tools and techniques necessary for research and the ability to integrate new and existing methods.

All requirements of the chosen Graduate Program Area must be met by the student in addition to the M.S. Degree requirements that follow.

### A. Master's Committee Approval and Design of the Program of Study

Once accepted by the Graduate School and the Division, the student and his/her Major Advisor should choose the Master's Committee. The Committee must consist of at least three members: the Advisor, a second faculty member from the Division, and one member from outside the Division. Once Committee members have agreed to serve, the **'Request for Thesis Committee'** form (M-2) at <http://gradschool.missouri.edu/policies/masters/requirements/m2.pdf> should be filled out and turned in to the Director of Graduate Studies or Christa Smith for copying and forwarding to the Graduate School. This form must be filed by the end of the student's second semester.

A planned course of study established early in the graduate program is essential. Thus, the student and Major Advisor next should design the plan of study and schedule the first meeting of the Committee. Prior to the meeting, the student, in consultation with the Major Advisor, should assemble a brief record of the post baccalaureate course work completed and fill out the **'Program of Study for the Master's Degree'** form (M-1)

at <http://gradschool.missouri.edu/policies/masters/requirements/m1.pdf>. After the student has incorporated any coursework modification(s) suggested by the Committee, the Major Advisor should sign the form (representing approval by the whole Committee) and the student should bring the form to the Director of Graduate Studies or Christa Smith for copying and forwarding to the Graduate School. The plan of study can be revised using the **'Plan of Study Course Substitution Form'**

at <http://gradschool.missouri.edu/policies/masters/requirements/subform.pdf>.

This is submitted by the Major Advisor to the Director of Graduate Studies and will be forwarded to Christa Smith and then to the Graduate Dean. Students should understand when planning their program that a course, once taken, may never be removed from their record.

A plan of research or research proposal written by the student (including a limited literature review) also is required for the first meeting of the Committee. This requirement is intended to assure that the candidate's research area and methods are acceptable to committee members before significant work is undertaken. This meeting must be held before substantial research data are collected, and no later than the end of the second semester.

## B. Course of Study

### 1. General Requirements

- a. A minimum of 30 credit hours must be completed from courses accepted for post-baccalaureate graduate. No more than 40% of the 30-hour credit requirement can be satisfied by research, readings and problems courses.
- b. At least 24 credit hours must be taken at MU. A maximum of 6 hours credit for post baccalaureate courses may be transferred from other accredited institutions on the recommendation of the student's advisor and with approval of the Graduate Dean. This allowance should be indicated at the time of application on the **'Program of Study'** Form.
- c. A minimum of 15 hours must be from courses numbered at the 8000 or 9000 level.
- d. Students who have completed a course numbered at the 4000 level, may not include the related 7000-level course in their Program of Study.
- e. During each Fall and Spring semesters, MS students must enroll for 9 credits to be considered full time students.

- f. During the Summer semester, graduate students are not required to enroll for class unless:
  - 1. They are international students whose visas require full-time enrollment. International students should check with the International Office for details.
  - 2. They have loans which would require repayment if they are not enrolled. Such students should check with the Financial Aid office.
  - 3. They have a fellowship or scholarship which requires such enrollment. Such students should check with their financial administrator for details.
- g. If graduate students do need to enroll in Summer semester for any reason, then full-time enrollment requires 4 credits for MS students.

## 2. Specific Course Requirements

- a. Students must enroll in Plant Sciences Seminar **for at least three semesters**. Students enroll in Plant Sciences 9087 for an A/F grade and make a presentation **during at least one semester**. For at least two semesters when the student does not make a presentation, he/she will enroll in Plant Sciences 7087 for an S/U grade.

The thesis defense seminar cannot be given in fulfillment of the PS 9087 requirement.

Three Graduate Program Areas (Crop Soil & Pest Management, Plant Biology & Genetics, Plant Stress Biology) require graduate student participation in an approved teaching opportunity or an approved Extension program. This requirement can be fulfilled by one additional seminar in a graded seminar series. One additional semester in PS 9087 fulfills this requirement.

MS students may transfer graduate-level seminar credit towards fulfillment of DPS seminar requirements and the 30 hour credit requirement. A maximum equivalent to one PS 7087 credit may be transferred. Attendance will be considered by the Director of Graduate Studies in consultation with the Graduate Education and Research Committee.

One credit hour of graded seminar may be used in partial fulfillment of the requirement of 15 credit hours completed at the 8000/9000 level.

- a. All students are required to take a research ethics class (e.g., PS 8010).
- b. There may be additional curricular requirements associated with the students' chosen Graduate Program Area. Consult the relevant sections of this handbook for details.

## 3. Enrollment Requirements

A student must be registered for credit at the time the thesis is submitted and the final examination conducted. Graduate School regulations stipulate that the program for the M.S. degree must be completed within a period of 8 years after the first semester of enrollment in the M.S. program, not including time spent in the armed forces.

## 4. Thesis Preparation and Submission

A thesis is required for the M.S. degree in Plant, Insect and Microbial Sciences. The thesis must demonstrate the student's capacity for research and independent thought. Organization of the thesis is subject to approval of the Master's Committee.

## 5. Thesis Defense and Final Examination

The Thesis Defense will consist of a research seminar and final examination, the latter to demonstrate the student's mastery of the academic focus of the chosen Graduate Program Area. It is the student's responsibility to check the Graduate School's graduation deadlines when

scheduling the exam.

The candidate must be enrolled to defend the thesis. The examination cannot be administered when MU is not officially in session.

The seminar will be presented by the student for division faculty, staff, students, committee members, and other interested persons. It must summarize the thesis research conducted by the student during the Master's program. The seminar will be followed by the final, oral examination administered by the Master's Committee. Although the general protocol followed during the oral examination shall be at the discretion of the Major Advisor, a typical oral examination lasts about 2 hours and is divided between defense of the thesis and non-thesis subject matter. The research seminar should be scheduled the same day (preferably) or during the week preceding the remainder of the final examination. The final examination is open to the general faculty; however, only members of the Master's Committee are eligible to sign the **'Report of the Master's Examining Committee'** form (M-3) at <http://gradschool.missouri.edu/downloads/index.htm>.

After the final examination, the student shall submit a **'Report of the Master's Examining Committee'** form (M-3) at <http://gradschool.missouri.edu/policies/masters/requirements/m3.pdf> to the Director of Graduate Studies or Christa Smith for approval and submission to the Graduate Dean, indicating whether the candidate passed or failed his/her examination.

If the Master's Committee decides that certain changes need to be made by the student in the thesis manuscript before approval can be given, the student will make the required changes within **six months**. Extensions beyond six months will require the approval of the Graduate Education and Research Committee. Signatures of all committee members on the cover page of the dissertation will signify their acceptance of the final document. It is the student's responsibility to ensure that all appropriate forms and the thesis arrive at the Graduate School prior to graduation deadlines.

Beginning with the Fall, 2006 semester, the Graduate School will only accept electronic theses and dissertations. Within the Division of Plant Sciences, each advisor retains the option to require students to supply hard copies of theses/dissertations. As you near your graduation date, check with your advisor to see if a hard copy of your theses/dissertation will be required.

### III. DOCTOR OF PHILOSOPHY DEGREE

The Doctor of Philosophy (Ph.D.) degree is the highest degree conferred by the University. It is a degree in philosophy and is not a technical degree. A candidate is expected to develop an awareness of the relationship between his/her expertise and society. Required course work is but one means of acquiring the broad based knowledge fundamental in establishing one's philosophy.

The dissertation should demonstrate a candidate's acumen for pursuing the scientific method; illustrating the difference between observations and hypothesis, between answering questions and testing hypotheses, and between opinion and truth.

All requirements of the chosen Graduate Program Area must be met by the student in addition to the Ph.D. degree requirements that follow.

#### A. Doctoral Committee Approval

Once accepted by the Graduate School and the Division, the student and his/her Major Advisor should plan for the Qualifying Exam (see below). A Doctoral Committee should be formed. The Committee must consist of at least four members including: the Major Advisor, two members from the Division of Plant Sciences, and one member from outside the division. Two members of the

Committee must be members of the Doctoral Faculty.

## B. Qualifying Examination

Once Committee members have agreed to serve, a date for the Qualifying Examination should be set and the Exam conducted. The Qualifying Exam must be scheduled for not later than the end of the second full semester of residence. The purpose of the Qualifying Exam is to ascertain the general background of the student and his/her prospects for success in the Ph.D. program. Typically, the Qualifying Exam is strictly an oral exam, although the structure (written and/or oral sections) is determined and administered by the Doctoral Committee. The student should consult with his/her advisor and other members of the Committee regarding format while scheduling the examination.

A student will be considered to have passed the Qualifying Exam if all members, or all but one, of the Advisory Committee vote affirmatively. A student failing the Qualifying Exam shall terminate his/her course of study in the division not later than the end of the semester in which the examination was failed.

A planned course of study established early in the graduate program is essential. Prior to the Qualifying Exam, the student, in consultation with the Major Advisor, should assemble a brief record of the post baccalaureate course work completed and the plan of study he/she plans during his/her tenure at MU (the **'Plan of Study for the Doctoral Degree Form'** (D-2)

at <http://gradschool.missouri.edu/policies/doctoral/requirements/d2.pdf> according to the Graduate School's sample format on the second page of the D-2 form. The proposed plan of study will be discussed at the same Committee meeting, immediately following the Qualifying Exam.

After the student has incorporated any coursework modification(s) suggested by the Committee, the Major Advisor should sign the **'Qualifying Examination Results and Doctoral Committee Approval Form'** (D-1)

at <http://gradschool.missouri.edu/policies/doctoral/requirements/d1.pdf> and the student should submit it to the Director of Graduate Studies or Christa Smith for copying and forwarding to the Graduate School. This form must be filed by the end of the student's second semester. If necessary, the plan of study can be revised using the **'Plan of Study Course Substitution Form'**

at <http://gradschool.missouri.edu/policies/masters/requirements/subform.pdf>. This is submitted by the Major Advisor to the Director of Graduate Studies or Christa Smith and will be forwarded to the Graduate Dean. Students should understand when planning their program that a course, once taken, may never be removed the record.

A plan of research or a research proposal written by the student (including a moderately detailed literature review) must also be received by the Committee. This requirement is intended to assure that the candidate's research area and methods are acceptable to committee members before significant work is undertaken. A Committee meeting to discuss the proposal must be held before substantial research data are collected, and no later than the end of the second semester. This discussion can be held immediately following the Qualifying Exam, or at a separate meeting.

## C. Residence Requirement

To satisfy the residency requirement, a student must complete at least two nine-hour semesters or three six-hour semesters in an 18-month period at MU. All courses taken to satisfy the residency requirement must be MU courses approved for graduate credit and approved by the student's Doctoral Program Committee.

## D. Course of Study

### 1. General Requirements

- a. A minimum of 72 credit hours must be completed from courses accepted for post-baccalaureate graduate credit. This can include credit hours from a Master's degree, if approved by the Doctoral Committee.
- b. A minimum of 15 hours must be completed from courses numbered at the 8000 or 9000 level (but exclusive of research, problems and independent study experiences).
- c. During each Fall and Spring semesters, PhD students who have not completed their comps must enroll for 9 credits to be considered full time students. PhD students who have passed their comps and are on 'continuous enrollment' must enroll for 2 credits for each Fall and Spring semester to be considered full-time students.
- d. During the Summer semester, graduate students are not required to enroll for class unless:
  1. They are international students whose visas require full-time enrollment. International students should check with the International Office for details.
  2. They have loans which would require repayment if they are not enrolled. Such students should check with the Financial Aid office.
  3. They have a fellowship or scholarship which requires such enrollment. Such students should check with their financial administrator for details.
- e. If graduate students do need to enroll in Summer semester for any reason, then full-time enrollment requires:
  1. 4 credits for PhD students who have not completed their comps.
  2. 1 credit for PhD students who have passed their comps.

### 2. Specific Course Requirements

a. Students must enroll in Plant Sciences Seminar **for at least five semesters**. Students enroll in Plant Sciences 9087 for an A/F grade and make a presentation during at least two semesters. **For at least three semesters** when the student does not make a presentation, he/she will enroll in Plant Science 7087 for a S/U grade. Doctoral students on 'continuous enrollment' **who have not fulfilled all seminar requirements** must contact the Graduate School to indicate that they will be enrolling for 1 credit of seminar and 1 credit of dissertation research (Plant Science 9090).

The dissertation defense seminar cannot be given in fulfillment of the PS 9087 requirement.

Three Graduate Program Areas (CS&PM, PB&G, PSB) require graduate student participation in an approved teaching opportunity or an approved Extension program. This requirement can be fulfilled by one additional seminar in a graded seminar series. One additional semester in PS 9087 fulfills this requirement.

PhD students may transfer graduate-level seminar credit towards fulfillment of DPS seminar requirements and the 72 hour credit requirement. A maximum equivalent to one PS 9087 and two PS 7087 credits may be transferred.

Exemptions to seminar enrollment and attendance will be considered by the Director of Graduate Studies in consultation with the Graduate Education and Research Committee.

Two credit hours of graded seminar may be used in partial fulfillment of the requirement of 15 credit hours completed at the 8000/9000 level.

b. All students are required to take a research ethics class (e.g., PS 8010) unless the course was completed in the Master's degree.

c. There may be additional curricular requirements associated with the students' chosen Graduate Program Area. Consult relevant sections of this handbook for details.

d. Students who have completed a course numbered at the 4000 level, may not include the related 7000-level course in their Program of Study.

### 3. Comprehensive Examination

#### a. Purpose

The Comprehensive Examination is a major milestone in the Ph.D. candidate's progress towards completion of the degree requirements. The candidate is expected to clearly demonstrate his/her knowledge and understanding of the principles and concepts of the chosen Graduate Program Area, related biological sciences, and the scientific method.

The Comprehensive Exam may not be scheduled until the candidate has essentially completed the required plan of study. The Comprehensive Exam must be completed at least seven months before the final examination (defense). The Comprehensive Exam Committee is typically the same as the Doctoral Committee.

#### b. Administration

The Comprehensive Exam requires both written and oral performance by the candidate. The student arranges the written Comprehensive Exam with each member of the Committee and is responsible for interacting with such members to determine particulars of the exam. The oral section of the examination is conducted upon completion of the written section and is open to the general faculty; however, only members of the examination committee are eligible to sign Form D-3. The entire exam must be completed within one month.

The protocol followed during the oral examination shall be at the discretion of the Major Advisor. At the completion of the oral examination, a '**Doctoral Comprehensive Examination Results Form**' form (D-3) at <http://gradschool.missouri.edu/policies/doctoral/requirements/d3.pdf> must be submitted to the Director of Graduate Studies or Christa Smith and then to the Graduate Dean. It should indicate whether the candidate has passed or failed and carry the signatures of all members of the Doctoral Committee. Committee members should cast one vote, based on the candidate's performance on both the written and oral sections of the examination. A candidate will be considered to have passed the Comprehensive Exam if all, or all but one, of the Committee vote affirmatively. In case of failure, the Committee may recommend remedial measures. After a lapse of at least 12 weeks, the candidate may be given a second examination. **Failure on the second examination terminates the student's candidacy.**

### 4. Continuous Enrollment Requirement

Following successful completion of the Comprehensive Exam, students who have completed all coursework requirements may elect to go to part-time status. However, continuous enrollment, requiring enrollment in each Fall and Spring term is mandatory for all doctoral candidates who have passed their Comprehensive Exam. Continuous enrollment is retained by registering in Plant Sciences 9090, Research, for 2 credit hours each Fall and Spring under the Major Advisors section.

After the Graduate School receives the D-3 form from the Division, the student has achieved Candidacy, and his/her name is put on a list of "continuous enrollment students." This list is updated periodically throughout each term and sent to the Registration Office. Doctoral students are automatically registered for their required hours of 9090 Research. The Cashiers Office then sends out a bill to the address on file for each student. **It is very important for graduate students to update any change of address.** If students do not pay their bill, interest will be added. If a bill is not paid by the final deadline, the student's registration will be canceled. The student will then be required to go through regular registration during the dates established each term, instead of pre-registration. If continuous enrollment students register after the last day of regular registration, a late fee will be charged.

All continuous enrollment doctoral students are charged in-state fees for the required hours of 9090 Research. If they choose to take additional hours or courses, they will be charged out-of-state fees, if applicable. Students who pass their Comprehensive Exam late in a term may not be placed on the continuous enrollment list in time to be automatically registered for the next term.

**Please check with The Cashiers office regarding information about FEE PAYMENT DEADLINES for continuous enrollment doctoral students.**

Should students not be enrolled for one full calendar year, they are considered by the Graduate School as having dropped from the program, although their file will technically still be open in the division. Re-entry to active status will require petition to the division by letter to the Director of Graduate Studies, who will refer the issue to the Graduate Education and Research Committee. Following approval, the request must then be forwarded for approval by the Graduate School Dean. The Graduate School also requires payment of full tuition and fees for missed enrollment, for up to seven semesters (see the Graduate Catalog for details).

#### 5. Reasonable Rate of Progress

A reasonable rate of progress toward the degree is required. A Ph.D. student must successfully complete the comprehensive exam within 5 years of their first semester of enrollment as a Ph.D. student. In addition, the remaining program for the doctoral degree must be completed within 5 more years after passing the Comprehensive Exam.

Before the expiration of the applicable period, any candidate requiring additional time must submit a request for an extension. The student must petition the Graduate School by submitting a request to the Director of Graduate Studies who, in turn, submits a written recommendation to the Graduate School that has been endorsed by the division faculty. The extension, if granted, may entail a revision of the candidate's program to update coursework and research, and will indicate a specific date by which the degree must be completed.

#### 6. Dissertation Preparation and Submission

A dissertation is required of every Ph.D. Candidate in the Division of Plant Sciences. This is to be a substantial scholarly manuscript of original research conducted by the student. The dissertation should reflect the depth of understanding, independent thought, and original work worthy of a Ph.D.

Beginning with the Fall, 2006 semester, the Graduate School will only accept electronic theses and dissertations. Within the Division of Plant Sciences, each advisor retains the option to

require students to supply hard copies of theses/dissertations. As you near your graduation date, check with your advisor to see if a hard copy of your theses/dissertation will be required.

## 7. Dissertation Defense

The Dissertation Defense consists of a research seminar and final examination. It is the student's responsibility to check the Graduate School's graduation deadlines when scheduling the exam.

The seminar will be presented by the student for division faculty, staff, students, committee members, and other interested persons. The student may choose to present the seminar as part of the Division Seminar Series. It must summarize the dissertation research conducted by the student during the Doctoral program. The seminar will be followed by the final, oral examination administered by the Doctoral Committee. Although the general protocol followed during the oral examination shall be at the discretion of the Major Advisor, a typical oral examination lasts about 2 hours and is divided between discussion of the dissertation and related, dissertation subject matter. The research seminar should be scheduled the same day (preferably) or during the week preceding the remainder of the final examination. The final examination is open to the general faculty; however, only members of the Doctoral Committee are eligible to sign the D-4 form (see below).

The candidate must be enrolled to defend the dissertation. The examination cannot be administered when MU is not officially in session.

After the final examination, the student shall submit a '**Report of the Dissertation Defense Form**' (D-4)

at <http://gradschool.missouri.edu/policies/doctoral/requirements/d4.pdf> to the Director of Graduate Studies for approval and submission to the Graduate Dean or Christa Smith, indicating whether the candidate passed or failed his examination.

If the Doctoral Committee finds that certain changes need to be made by the student in the dissertation manuscript before approval can be granted, the student will make the required changes within **six months**. Extensions beyond six months require approval of the Graduate Education and Research Committee. Signatures of all committee members on the cover page of the dissertation will signify their acceptance of the final document. Immediately following completion of the final exam, the student should bring the signed D-4 form to the Director of Graduate Studies. It is the student's responsibility to ensure that all appropriate forms and the dissertation arrive at the Graduate School prior to graduation deadlines.

## IV. GENERAL GUIDELINES AND INFORMATION

### A. Graduate Student Responsibilities

#### 1. New Student Orientation

Students beginning graduate studies will receive an appropriate orientation to the Division of Plant Sciences. It will be the responsibility of the Director of Graduate Studies to provide such an introduction for all new students. Orientation programs normally include, but are not limited to, those subjects covered in this Guide.

## 2. Duties

Students pursuing graduate degrees in the Division of Plant Sciences should understand that certain duties in addition to thesis research and any teaching requirements may be assigned by their major advisor. These are considered to be an integral part of graduate training and to contribute to the comprehensiveness of the student's program. Such duties are not so extensive that they add materially to the duration of the degree program.

## 3. Authorship of Manuscripts and Talks

Results of research accomplished using University facilities or funds become the property of the supporting institution. The Division of Plant Sciences has no set policy on priority of authorship for publication; this decision is the responsibility of each project leader or major advisor. Students should consult with their advisor to determine his/her policy regarding authorship of manuscripts resulting from graduate research. Students must obtain permission from the respective project leader prior to making any presentations of unpublished research results. Approval of the project leader also is required prior to any discussion of research with news reporters.

## 4. Vacation Policy

Graduate students supported by Agricultural Experiment Station or other official stipends are not automatically entitled to vacation time. Reasonable vacation can generally be determined after consultation with the Major Advisor.

## B. Divisional Operations

### 1. Office Supplies and Equipment

Divisional office supplies and equipment, including photocopy machines, are not available for general student use. Graduate students may access such material and equipment only after securing permission from their Major Advisor. Computers are available through the individual research projects. Of special concern is misuse of the photocopy facility. Students must be aware that current copyright regulations forbid multiple copying of most printed matter, and that in all cases permission from their major advisor must be obtained prior to copying any material. Material for a personal file may be copied for nominal fees at Ellis Library, Printing Services, and at Quick Copy facilities.

### 2. Incidental Departmental Expenses

Expenses associated with preparation of materials required for seminars, theses and dissertations will be borne by the individual student or by the project under which the student is working. The Major Advisor is responsible for determining those expenses which are appropriate for project funding.

### 3. Divisional Telephone Policy

Students generally have access to telephones in the laboratory or office to which they are assigned. It is important that such telephone numbers be provided to relatives so that students can be reached in case of emergencies. Students are permitted to use telephones in their assigned office or laboratory to make local calls, provided such calls do not tie up the telephone line for excessive periods of time. No personal long-distance calls will be charged to Divisional

telephones. In the event that a personal long-distance call is necessary during working hours, students can bill the call to their personal calling card or credit card. *Divisional telephone use is monitored closely and misuse will not be tolerated.*

WATS (Wide Area Telephone Service) lines. -- Long distance WATS capability in all divisional telephones facilitates economical communication for official business. Individual project leaders are provided with special access codes for this service, and their permission and assistance should be sought when it is necessary to make official long-distance calls. In addition, many project leaders have official telephone calling card numbers. Such numbers may be provided to students whose research projects call for extensive travel within the state.

#### 4. Division Vehicle Policy

Individual research projects frequently make use of vehicles through University Leasing for official transportation requirements. According to the University Policy and Procedural Manual, only employees, official visitors on University business, and University students can be passengers in official vehicles. This means that a member of an employee's family cannot be a passenger. One cannot take a friend along as this violates University policy. The liability insurance which the University carries is void whenever there is a violation of the "use policy", and should a person be operating an official vehicle in violation, any cost of repairs or injury to a person is the sole responsibility of the driver. Use of any University vehicle by anyone requires approval of Project Leader and the Division of Plant Sciences. All potential drivers must possess a valid Missouri driver's license.

#### 5. Keys

Forms and instructions needed to obtain official keys to University facilities are distributed to new graduate students along with the requisite personnel forms. Generally, keys issued will be (1) exterior doors of the research building, (2) particular office or laboratory to which assignment is made, and (3) other facilities as determined appropriate by the Major Advisor. Subsequent key issue will be made only after review by the major advisor. All keys should be returned upon termination of residency.

#### 6. Reporting of Accidents

It is important that students immediately report accidents of all types to their Major Advisor. This is primarily for the students' protection, and to assist with determination of liability.

#### 7. Hazardous Materials Disposal

Hazardous material is defined as any unwanted chemical which will pose a present or potential threat to health of humans or any other living organism. All students must be aware of appropriate procedures for disposal of such material, because severe penalties are imposed for violations. In particular, no hazardous material should be discharged into the sanitary sewer system. Divisional and project guidelines for approved disposal of such material can be obtained from individual major advisors. Examples of hazardous materials include, but are not limited to, solvents, reagents of all types, photographic chemicals, radioactive and biologically-active or pathogenic materials.

Of particular concern to the Division of Plant Sciences is safe and appropriate disposal of pesticide, unused pesticide mixtures, containers, and excess toxic material of all types. Guidelines for disposition of pesticide can be obtained from Major Advisors, and no students should handle these materials without appropriate instruction and supervision. In no cases will pesticidal materials be brought research buildings, except for small quantities designated for laboratory study and confirmed by the Major Advisor.

All students working with chemicals are required to attend the mandatory College safety training. Also, those working with pesticides should be familiar with CAFNR Memo No. 41 entitled "Pesticide Handling Guidelines for the University of Missouri Agricultural Experiment Station Research Operations"

#### 8. Borrowing of Equipment

Under no circumstances will equipment be removed from any Division of Plant Sciences laboratory or other research facility without permission from the appropriate project leader. In general, Division policy is to make necessary equipment available to all *bona fide* users; however, accountability for supplies and equipment is through individual projects.

#### 9. Student Travel Accident Insurance

The University of Missouri-Columbia provides the aforementioned coverage. The insurance is available for all students desiring coverage on authorized trips off campus as required by their regular curriculum and for students on trips off campus which are organized or sponsored by a University recognized and approved student organization.

#### 10. Use of Division Facilities During Non-Duty Hours

Access to division facilities is severely limited during other than normal working hours. Students needing permission to perform essential research activities during such time periods should consult with their Major Advisor. All students should be aware that late-night or weekend work with hazardous materials is potentially dangerous because emergency notification and treatment capabilities are limited.

#### 11. Use of Computer Related Facilities

The division's computer facilities ensure computer accessibility for all faculty, staff, and students. Each research and extension project has personal computers. These provide capabilities for word processing, data analysis, and access to the university and campus main-frame computers. The division has a computer graphics work station for the production of high quality graphics and slides. Faculty, staff, and students have the capability to produce computer graphics for manuscripts, extension and research presentations, and classroom use. Graduate students in the Division of Plant Sciences are encouraged to use this equipment.

License agreements for all computer software used in the Division must be honored. Scheduling time on computer equipment usually can be accommodated by checking with resident programming staff. Additional facilities are available at several campus locations. Information and Access Technology Services (IATS) offers non-credit short courses at no charge to faculty, staff, and graduate students each semester on a variety of mainframe, internet, and personal computer topics. Contact IATS or consult their newsletter, or web site (<http://www.missouri.edu/iats/>) for details.

#### C. Other Useful Information

##### 1. Student Health Insurance

This is the link to health insurance for Domestic and International students at <http://gradschool.missouri.edu/financial/medical-insurance/>

## I. Crop, Soil and Pest Management

### **Coordinator: Dr. Kevin Bradley**

The Crop, Soil and Pest Management Graduate Program Area prepares students for careers in research, teaching, extension, production agriculture and related industries. Current research programs emphasize Soil and Nutrient Management, Forage Management, Cereal and Oil Seed Crop Production, Alternative Crops, Cropping Systems, Weed Management, Integrated Pest Management, and Precision Agriculture. Many degree programs are cross-disciplinary to give students a comprehensive view of the field.

#### A. Specific Curricular Requirements

The Crop, Soil and Pest Management program area emphasizes a customized approach towards the course of study. Each student will work with their advisor and graduate committee to develop a course of study best suited to the student's educational and career goals.

#### B. Teaching

Graduate students in the Crop, Soil and Pest Management Graduate Program Area will be required to participate in an approved teaching opportunity, an approved extension program, or give one additional seminar in a graded seminar series during their M.S. and Ph.D. programs. A student must obtain his/her Major Advisor's consent to participate in a teaching capacity in courses other than those taught by his/her Major Advisor. It is recommended that all graduate students involved in teaching participate in the teaching orientation program offered by the Program for Excellence in Teaching. Each student is responsible for obtaining the approval of the Director of Graduate Studies for the activity which will be used to fulfill this requirement before the proposed activity begins.

#### C. Participating Faculty

**Stephen H. Anderson**, Adjunct Professor, soil physics

**Wayne C. Bailey**, Associate Professor, forage and field entomology

**Kevin Bradley**, Associate Professor, weed science

**Felix B. Fritschi**, Assistant Professor, Crop Physiology

**Bruce E. Hibbard**, Adjunct Associate Professor, insect resistance management

**Richard M. Houseman**, Associate Professor, insect ecology and behavior in human environments

**Robert L. Kallenbach**, Professor, forage management

**John A. Lory**, Extension Associate Professor, environmental nutrient management

**Manjula Nathan**, Extension Assistant Professor, Director Soil Testing and Plant Diagnostic Services Laboratory

**Kelly A. Nelson**, Research Associate Professor, crop production systems

**Craig Roberts**, Professor, forage quality

**Peter C. Scharf**, Professor, nutrient management

**Grover Shannon**, Endowed Professor, soybean breeding

**Reid J. Smeda**, Associate Professor, weed science

**Qisheng Song**, Associate Professor, molecular insect physiology

**W. Gene Stevens**, Extension Professor, crop production and soil fertility

**Kelly V. Tindall**, Research Assistant Professor, field crop entomology

**Michele R. Warmund**, Professor, fruit and nut crop physiology

**William J. Wiebold**, Professor, soybean and corn management

**J. Allen Wrather**, Professor, soybean disease control

**Xi Xiong**, Assistant Professor, turfgrass science

## II. Entomology

**Coordinator: Dr. Richard Houseman**

Within the Entomology Graduate Program Area, a student can select training from a wide range of courses and research programs to prepare for a career in any of the many areas of professional entomology, including research, teaching, industry and extension work.

Current research programs emphasize the following areas: ecology, pest management, insect behavior, biochemistry, morphology, molecular biology, physiology and systematics, as well as aquatic, forest, horticultural, and urban entomology, chemical ecology, biological and chemical control, host-plant interactions, and integrated pest management.

### A. Specific Curricular Requirements

In partial fulfillment of Division requirements, Masters students will complete the following four-entomology course (minimum) requirement:

- PLNTS 7710 Systematic Entomology
- PLNTS 7820 Principles of Insect Physiology
- PLNTS 9810 Insect Ecology
- One elective formal entomology course

In partial fulfillment of Division requirements, Doctoral students will complete the following five-entomology course (minimum) requirement:

- PLNTS 7710 Systematic Entomology
- PLNTS 7820 Principles of Insect Physiology
- PLNTS 9810 Insect Ecology
- Two elective formal entomology course

### B. Participating Faculty

**Wayne C. Bailey**, Associate Professor, forage and field entomology  
**Bruce A. Barrett**, Professor, insect behavior and tree fruit entomology  
**Brenda T. Beerntsen**, Adjunct Associate Professor, entomology, medicinal-veterinary vectors  
**Thomas A. Coudron**, Adjunct Associate Professor, insect biochemistry and biological control  
**Georgia Davis**, Associate Professor, Maize Functional Genomics  
**Deborah Finke**, Assistant Professor, Entomology/Plant-Insect interactions  
**Robert D. Hall**, Professor, medicinal, veterinary and forensic entomology  
**Bruce E. Hibbard**, Adjunct Associate Professor, insect resistance management  
**Richard M. Houseman**, Associate Professor, insect ecology and behavior in human environments  
**Marc J. Linit**, Professor and Associate Dean for Research and Extension Programs, College of Agriculture, Food and Natural Resources, ecology of forest insects  
**Arthur H. McIntosh**, Adjunct Professor, biological control, insect pathology  
**Holly J. Popham**, Adjunct Assistant Professor, insect virology and immunity  
**Jack Schultz**, Professor, Director of the Bond Life Sciences Center, Chemical Ecology  
**Kent S. Shelby**, Adjunct Assistant Professor, insect physiology and immunobiology  
**Robert W. Sites**, Professor, insect systematics, ecology of aquatic insects  
**Qisheng Song**, Associate Professor, insect physiology and molecular biology  
**Kelly V. Tindall**, Research Assistant Professor, field crop entomology

### C. Awards, Honors and Financial Assistance

At the beginning of each Spring semester, an announcement will be sent to all entomology students

and faculty regarding the application procedures and submission deadlines for the various entomology student awards. The awardees will be announced at the annual entomology spring awards banquet.

1. Philip C. and Ruth E. Stone Scholarship in Entomology. This annual award recognizes an outstanding entomology Master's graduate student based on scholarship and professional activities. Nominations and selection of the winner are made by the entomology faculty, and the recipient receives a check for \$500.

2. Leonard and Elosia Haseman Memorial Scholarship Award in Entomology. This annual award recognizes an outstanding entomology doctoral student based on scholarship and professional activities. Nominations and selection of the winner are made by the entomology faculty, and the recipient receives a check for \$1,000.

2. The Lloyd E. Adams and E.P. Meiner's Doctoral Scholarship in Entomology. This award is available annually on a competitive basis to an entomology doctoral graduate student. The goals of the award are to improve the quality of the program's doctoral students and their dissertations, and to enhance their professional credentials. The award covers up to \$1,500 of the expenses associated with a scholarly experience that would not normally be included in the recipient's program, such as participation in a workshop, short course, or visit to a laboratory or field station to learn a new research technique. Submitted student proposals are evaluated by an entomology faculty review committee.

4. Thomas R. Yonke Biodiversity Fellowship. This award is for Master's or doctoral students and covers up to \$500 of the expenses associated with a scholarly experience in insect biodiversity that would not normally be included in the awardee's program, such as participation in a workshop, short course, visit to a laboratory or field station or any activity or project that will enhance the recipient's understanding of insect biodiversity. Submitted proposals by the students are evaluated by an entomology faculty review committee.

5. The Fred Clute Memorial Scholarship in Entomology. This award is available annually on a competitive basis for an entomology Master's or doctoral student who has demonstrated excellence in an area of pest management in their research and outreach activities, both in agricultural and urban settings. Submitted student proposals are evaluated by an entomology faculty review committee, and the recipient receives a check for \$500.

6. The Gilbreath McLorn Fund in Entomology. This fund was designated to promote teaching and research in entomology. By agreement of the faculty, a part of the fund is used to support entomology graduate student participation in regional and national entomological meetings, and also to support speakers for the entomological seminars.

### III. Horticulture

#### Coordinator: Dr. Michele Warmund

The Horticulture program strives to improve the quality of life for Missouri citizens through teaching, research and Extension activities in environmental and food-crop horticulture. The program provides a meaningful educational opportunity for the student with career interests in any of the many fields of the diverse discipline of horticulture. It provides technical advances through its research programs and disseminates those advancements to the academic community, horticultural industry and general public through its teaching, extension and public service programs.

The Horticulture program has as one of its chief missions the obligation to find solutions to production problems of horticultural crops, especially as they relate to Missouri. These are crops with high enough economic value to warrant large inputs of labor, capital, technology and professionalism. Furthermore, research, whether applied to solving immediate problems or basic to solving problems of the future, is necessary to the teaching of horticultural science. Teaching remains another chief mission of the program and is intricately interwoven into our research effort.

#### A. Specific Curricular Requirements

In partial fulfillment of Division requirements, Masters students will take 15 hours of the required 30 hours in courses numbered 8000 or above. At least 6 of the 15 hours must be from formal courses, excluding Problems and other independent study courses. All programs of study must include at least 6 hours of research (Plant Science 8090) and, while additional hours of research may be taken, only 6 hours may be counted toward the 30-hour degree requirement.

All Doctoral students will have successfully completed the requirements for a Master's degree before beginning a Doctoral program. The student will work with their advisor and graduate committee to develop a customized course of study in partial fulfillment of Division requirements. No more than 30 hours of research (24 hours from the Ph.D. and 6 hours from the M.S. degrees) may be counted toward the 72 hour minimum requirement. No more than 6 hours may be transferred from other institutions.

#### B. Participating Faculty

**Wayne C. Bailey**, Associate Professor, forage and field entomology

**Mary Ann Gowdy**, Resident Instruction Assistant Professor, floriculture

**J. Andrew Kendig**, Extension Associate Professor, weed science (IS HE GONE?)

**Christopher J. Starbuck**, Associate Professor, woody ornamentals

**David H. Trinklein**, Associate Professor, greenhouse management, floriculture extension

**Michele R. Warmund**, Professor, fruit and nut crop physiology

## IV. Plant Biology and Genetics

### Coordinator: Dr. Kristin Bilyeu

Understanding the fundamental concepts of plant biology and genetics is essential to providing solutions to the wide array of problems in food, fiber and energy production that are facing the growing world population. In the Plant Biology and Genetics graduate program area, students receive training in a wide range of courses and research programs in plant physiology, biochemistry, molecular biology, genetics, plant-microbe interactions, breeding and biotechnology. We encourage interdisciplinary training that provides a comprehensive preparation for careers in research and education in plant biology, genetics and related areas.

#### A. Specific Curricular Requirements

To meet the Division requirements, each student will work with their advisor and graduate committee to develop a customized course of study best suited to the student's educational and career goals.

#### B. Teaching

Graduate students in the Plant Biology and Genetics Graduate Program Area will be required to participate in an approved teaching opportunity, an approved extension program, or give one additional seminar in a graded seminar series during their M.S. and Ph.D. programs. A student must obtain his/her Major Advisor's consent to participate in a teaching capacity in courses other than those taught by his/her Major Advisor. It is recommended that all graduate students involved in teaching participate in the teaching orientation program offered by the Program for Excellence in Teaching. Each student is responsible for obtaining the approval of the Director of Graduate Studies for the activity which will be used to fulfill this requirement before the proposed activity begins.

#### C. Participating Faculty

**Kristin D. Bilyeu**, Adjunct Assistant Professor, soybean seed molecular genetics  
**Dale G. Blevins**, Professor, plant physiology  
**Georgia L. Davis**, Associate Professor, corn genetics  
**Walter Gassmann**, Associate Professor, molecular plant pathogen interactions  
**J. Perry Gustafson**, Adjunct Professor, cereal genetics  
**Bruce Hibbard**, Adjunct Associate Professor, insect resistance management  
**Robert L. Kallenbach**, Associate Professor, forage management  
**Hari B. Krishnan**, Adjunct Professor, soybean molecular biology  
**Anne L. McKendry**, Associate Professor, wheat breeding  
**Michael D. McMullen**, Adjunct Associate Professor, corn genetics  
**Melissa G. Mitchum**, Assistant Professor, molecular plant nematode interactions  
**Henry Nguyen**, Endowed Professor, genetics and biotechnology  
**Mel Oliver**, Adjunct Professor, Plant Genetics  
**Mary A. Schaeffer**, Adjunct Associate Professor, bioinformatics  
**Daniel P. Schachtman**, Adjunct Associate Professor, molecular Plant Physiology  
**James E. Schoelz**, Professor, molecular plant virus interactions  
**Jack Schultz**, Director, Bond Life Sciences Center  
**J. Grover Shannon**, Endowed Professor, soybean breeding  
**Robert E. Sharp**, Professor, plant physiology  
**David A. Sleper**, Professor, soybean breeding (RETIRED?)  
**Gary Stacey**, Endowed Professor, functional genomics of soybean microbe interactions  
**Christopher Taylor**, Adjunct Assistant Professor, molecular plant nematode interactions  
**William J. Wiebold**, Professor, soybean and corn management  
**Zhanyuan Zhang**, Research Assistant Professor, plant transformation and gene regulation

## V. Plant Stress Biology

### Coordinator: Dr. Melissa Mitchum

Many of us take for granted the fact that we have a safe, abundant food supply. In many parts of the world, however, plant diseases can be devastating not only to plants themselves, but to the humans who rely on them. Through the study of plant microbiology and pathology, we help find solutions to these important problems. Our research programs focus on fundamental issues of plant-microbe interactions including both parasitic and mutualistic interactions. We seek to educate graduate students for careers in molecular plant-microbe interactions, plant pathology, and related areas.

#### A. Specific Curricular Requirements

In partial fulfillment of Division requirements, all graduate students will complete two entry level courses (to be completed in the first year). Choose from:

- [Plnt S 7315](#) Crop Physiology (3 credits) (REMOVE HYPERLINK)
- [Plnt S 7320](#) Plant Physiology (3 credits)
- [Plnt S 7500](#) Biology and Pathogenesis of Plant-Associated Microbes (4 credits)
- [Plnt S 8505](#) Introduction to Plant Stress Biology (2 credits)

All students are also required to take [Plnt S 8530](#) Research with Plant Stress Agents (3 credits)

#### B. Teaching

Graduate students in the Plant Stress Biology Graduate Program Area will be required to participate in an approved teaching opportunity, an approved extension program, or give one additional seminar in a graded seminar series during their M.S. and Ph.D. programs. A student must obtain his/her Major Advisor's consent to participate in a teaching capacity in courses other than those taught by his/her Major Advisor. It is recommended that all graduate students involved in teaching participate in the teaching orientation program offered by the Program for Excellence in Teaching. Each student is responsible for obtaining the approval of the Director of Graduate Studies for the activity which will be used to fulfill this requirement before the proposed activity begins.

#### C. Participating Faculty

**Johann N. Bruhn**, Research Associate Professor, forest mycology and mushroom cultivation

**Arun K. Chatterjee**, Professor, molecular genetics of plant bacteria

**James T. English**, Professor, molecular ecology of plant microbe interactions

**Claude Fauquet**, Adjunct Professor, plant virology; tropical plant biotechnology

**Deborah Finke**, Assistant Professor, entomology/plant-insect interactions

**Felix B. Fritschi**, Assistant Professor, crop physiology

**Walter Gassmann**, Assistant Professor, molecular plant pathogen interactions

**Bruce E. Hibbard**, Adjunct Associate Professor, insect resistance management

**Laszlo Kovacs**, Adjunct Associate Professor, *Vitis* genomics and gene discovery

**Hari B. Krishnan**, Adjunct Professor, soybean molecular biology

**Anne L. McKendry**, Associate Professor, wheat breeding

**Jeanne D. Mihail**, Professor, Fungal ecology and mushroom cultivation

**Melissa G. Mitchum**, Assistant Professor, molecular plant nematode interactions

**Henry T. Nguyen**, Endowed Professor, genetics and biotechnology

**Mel Oliver**, Adjunct Professor, Plant Genetics

**Wenping Qiu**, Adjunct Assistant Professor, *Vitis* genomics and gene discovery

**James E. Schoelz**, Professor, molecular plant virus interactions

**Jack Schultz**, Director, Bond Life Sciences Center

**Robert E. Sharp**, Professor, plant physiology

**Qisheng Song**, Associate Professor, insect physiology and molecular biology  
**Gary Stacey**, Endowed Professor, functional genomics of soybean microbe interactions  
**Laura Sweets**, Research Associate Professor, agricultural extension plant pathology  
**Christopher Taylor**, Adjunct Assistant Professor, molecular plant nematode interactions  
**Kelly V. Tindall**, Research Assistant Professor, field crop entomology  
**William Wiebold**, Professor, soybean and corn management  
**J. Allen Wrather**, Professor, soybean disease control  
**Xi Xiong**, Assistant Professor, turfgrass science