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Biology & Biomedical Sciences

**ACADEMIC PROGRAM
GUIDELINES**

**Program in
Plant Biology**

Guidelines to the Program in Plant Biology

Guidelines to the Graduate Program in Plant Biology (Revised June 2009)

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Introduction to the Plant Biology Program

The Plant Biology Program trains Ph.D. students to have a strong background in modern biology, as well as research training specific to higher plants and photosynthetic microorganisms. Formal coursework requirements, teaching assistantship, and qualifying exam are usually satisfied in the first two years. Research training is accomplished by a combination of required research rotations in the first year followed by a significant thesis research project. Seminars and journal clubs help members of the program stay current with the latest scientific advances.

Advising

The Plant Biology Steering Committee advises each new student. The committee provides guidance concerning course work and lab rotations and is responsible for overseeing program requirements. Once the student has chosen a laboratory in which to do thesis research (usually by the end of the first year) and passed their Qualifying Examination, a thesis advisory committee is formed and assumes primary responsibility for monitoring the student's progress towards graduation. However, the Steering Committee monitors the written reports of the thesis advisory committees and makes sure that students schedule meetings with their advisory committees at appropriate intervals, not to exceed one year. See appendix B for information about the composition of the Steering Committee.

Course Requirements

Core courses for the Plant Biology Program are:

1. **From Seed to Senescence: the Genetics, Development, and Cell Biology of Plants;** Bio 4028 (3 credits, taken in Fall of year 1).
2. **Nucleic Acids and Protein Biosynthesis;** Bio 548 (3 credits, every Fall)
3. **How Plants Work: Physiology, Growth and Metabolism;** Bio 4023 (3 credits; taken in Spring of year 1)
4. **Ethics and Research Science;** Bio 5011 (1 credit, Spring, taken in year 2)
5. **Seminar in Plant Biology;** Bio 572 (1 credit, Spring). 2 semesters of journal club are required. One presentation must be made in each semester in which journal club is taken for credit. Students are required to enroll in journal club for the first time in the Spring of year one to help develop the knowledge base and critical evaluation skills that will help them prepare for and pass the qualifying exam. Students are required to complete the journal club requirement in year two.

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Elective courses

In addition to the core requirements, students must take at least 6 credits of advanced electives (400 level or higher) that facilitate specialization in their area of interest. Students are strongly recommended to complete their elective requirement by the end of year two. Relevant, popular courses include:

Advanced Genetics (Spring); Bio 5491 – This course is recommended strongly for all students. In addition to the material covered, students write a research proposal on a topic that can be developed further for the qualifying exam (see below).

Fundamentals of Molecular Cell Biology (Fall); Bio 5068

Developmental Biology (Spring); Bio 5352

Molecular Microbiology & Pathogenesis (Spring); Bio 5392

Important notes concerning course requirements:

1. ***Students must earn a grade of B- or better in core courses.*** Students earning grades lower than B- will need to take the course again so that they can master the material.
2. ***Students must earn a grade of C or better in advanced elective courses.***
3. Students who meet only the minimum course requirements take only 15 credits of lecture courses. It has come to the attention of the Division of Biology and Biomedical Sciences that some universities in the southeastern United States have a requirement that their professors must have taken at least 18 credits of lecture courses during their Ph.D. studies in order for them to be eligible to teach. Journal clubs and our ethics course do not count toward this requirement. The Plant Program has opted not to require 18 credits of lecture courses for the Ph.D. degree but students may wish to voluntarily take another course beyond the minimum requirements.

Other scholarly activities

All Plant Biology graduate students are expected to attend and participate in: Plant Lunch, held every Tuesday at noon; the annual Plant Biology Retreat held in the Fall; and relevant biology seminars sponsored by the Biology Department or by the Division of Biology and Biomedical Sciences. In addition, all Plant Biology graduate students should make an effort to attend the seminar series at the Donald Danforth Plant Science Center.

Laboratory Research Rotations

During the first 12 months after entering the program, each student arranges research rotations in three laboratories to help identify a laboratory in which to complete the Ph.D. thesis research. At least one rotation must be conducted on the Washington University campus with a mentor whose primary affiliation is with the Plant Biology Program. Each lab rotation should last ~ 2-3 months. Rotations longer than three months are discouraged. Rotations should broaden the intellectual and technical experience of the student and contribute to ongoing research in sponsoring laboratories. Students are encouraged to affiliate with a laboratory by the end (e.g. May) of their first academic year.

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Students can arrange to perform their third rotation at a St. Louis area biotechnology company, or with a laboratory whose principal investigator is not a member of the Division of Biology and Biomedical Sciences (e.g. many of the labs at Danforth Plant Science Center) if they can identify a thesis lab in their first two rotations. Ideally, such rotations should be arranged with the help and advice of the future thesis mentor. Please note that a student wishing to carry out a research rotation at a company must make arrangements to do so several months in advance with the program director and program coordinator. This is necessary to allow sufficient time for all approvals to be granted and any required paperwork to be completed. Even if a probable thesis lab is identified in the first two rotations, each student must complete three rotations to broaden their exposure to different techniques and experimental perspectives.

Qualifying (Preliminary) Examinations

Students must undergo a qualifying examination *during the prescribed period in January of their second year* (usually in the second week of January before the academic semester begins). The format for the qualifying exam is a research proposal, written in the format of the Research Plan section of an NIH postdoctoral fellowship (National Research Service Award) proposal (10 pages, single-spaced, 12 point font). The proposal should test one or more hypotheses related to a topic distinct from the student's probable thesis topic. Instructions for such proposals can be found on the internet at the following site: <http://grants1.nih.gov/grants/funding/416/phs416.htm>, and on the plant Program website (<http://www.biology.wustl.edu/plant/documents.php>). Sections of the proposal should include the Background and Significance of the topic, Specific Aims to be accomplished, the Research Methods to be employed, Potential Pitfalls that might be encountered (and alternative ways to achieve the aims), and a Timetable for completion of the aims. The proposal must be delivered to the examining committee members at least two weeks prior to the examination date. The student must then defend this proposal in an oral presentation before an examining committee. Detailed knowledge of all aspects of the proposed studies, methods and relevant literature is expected. In addition to asking questions concerning the subject matter of the written proposal, examining committee members may ask questions that probe the student's general knowledge derived from required coursework. The purpose of the Qualifying examination is to provide an introduction to grant writing for the student while allowing the faculty to assess the student's knowledge, critical thinking and ability to develop and test hypotheses, all of which are necessary skills for a successful research career.

The thesis mentor should not be a member of the qualifying exam committee but *primary responsibility for preparing and coaching the student for the exam lies with the thesis mentor*. This preparation should include rigorous discussions to determine whether the exam topic tests a clear hypothesis which is testable using the methods the student proposes. Mentors should also do their best to direct students to relevant literature, consider alternative approaches or hypotheses and to generally “know their stuff.” The chairperson of the examining committee does not share this obligation of preparing the student or of finding weaknesses in the proposal or the student’s knowledge in advance of the examination.

To begin the process of scheduling the exam and obtaining approval of the topic, students must see the Program Coordinator to obtain a Qualifying Exam Preparation form. A one-page summary of your proposed QE topic must be attached to the QE Preparation form. The summary should be a self-contained description of the proposed experiments, and include: 1) a brief introduction to the basic question or area of plant

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biology to be investigated, and 2) a summary of objectives and methods to be employed. The completed form, indicating your proposed Qualifying Exam topic and suggested committee composition, and your one-page summary should be submitted to the Program Director for approval no later than October 1 in the student's second academic year. ***The topic should not be related to the student's planned thesis topic or to a proposed or ongoing project in the thesis mentor's lab.*** If your topic is approved this form will be returned to you and the Division Office will contact you regarding an exam date. If your topic is not approved, the Steering Committee Coordinator will contact you. Students may choose to develop further the topic used in Advanced Genetics provided that the topic is related to plant biology. Note that Advanced Genetics proposals often describe a mutant screen, and as such may require significant adaptation to serve as an appropriate Qualifying Exam proposal, which should focus on testing hypotheses.

After completing the form and obtaining the necessary approval, the exam will be scheduled by the Program Coordinator in January of the student's second academic year. The written proposal must then be provided to the members of the examining committee at least two weeks before the date of the oral presentation. The examining committee will consist of four faculty members chosen by the Steering Committee, taking into account the student's suggested committee composition and faculty availability. At least one of the faculty members should be a member of the Plant Biology Steering Committee.

The examining committee can take one of four actions:

- 1) Accept the exam as passing
- 2) Grant a Conditional Pass and lay out the conditions for the student to successfully complete his/her requirements. If the conditions include submission of a revision of the original proposal, the committee will specify the problems or issues that need to be addressed in the revision. The committee will decide whether the student needs to defend the revised proposal in person or not. The student must successfully fulfill the requirements of the conditional pass within two weeks of the Qualifying Exam.
- 3) Recommend re-examination of a new proposal on a different topic. A re-take of the exam must occur within one month of the first exam. A student unable to pass the exam on the second attempt will have the option of completing a Master's degree within four months of the second examination. See Appendix A for additional information.
- 4) Recommend to the Steering Committee that the student not become a doctoral candidate.

Thesis Proposal and the Thesis Advisory Committee

After passing the qualifying examination students organize a thesis advisory committee in consultation with the thesis mentor. This committee should be composed of the thesis advisor and at least four additional full-time faculty members, at least one of whom should have their primary affiliation with another program. Note that the participation of PIs that are not DBBS members must be approved as a voting member of the committee by the Dean of the Graduate School. This approval must be done prior to the committee meeting. Also, note that the Thesis Examination Committee requires at least six full-time DBBS faculty members, so a thesis advisory committee with only five members must be augmented by the time of the thesis defense. The faculty of the advisory committee should be chosen for their expertise and their willingness to help guide the student's thesis research. The chair of the thesis advisory committee must be different than the thesis advisor, but need not be a member of the Plant Biology Program. Students **must** see the Program Coordinator to obtain approval of the

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advisory committee composition; the necessary Thesis Advisory Committee Approval form is available on the DBBS web site.

The student must then prepare a written thesis proposal and present this document, as well as an oral presentation of the proposal, to the advisory committee for their approval. Like the Qualifying exam, the thesis proposal should be written in the format of an NIH or NSF postdoctoral fellowship proposal but can be longer, ~15 pages. Sections of the proposal should include the Background and Significance of the topic, Specific Aims to be accomplished, the Research Methods to be employed, Potential Pitfalls that might be encountered (and alternative ways to achieve the aims), and a Timetable for completion of the aims. The written proposal must be provided to the committee at least two weeks in advance of the oral presentation. During the oral presentation, the student will discuss his/her research progress to date, describe the experiments to be done and the anticipated outcomes, and respond constructively to concerns or alternative ideas raised by committee members. The thesis proposal, and all subsequent meetings of the thesis advisory committee, will be chaired by a committee member other than the thesis advisor. This chairperson will be responsible for completing a written report of the thesis proposal examination and for completing reports at subsequent thesis committee meetings. These reports are sent to the Graduate Studies Office which, in turn, sends copies to thesis advisory committee members and the chair of the program Steering Committee. ***The thesis proposal must be prepared and defended by June 1 of the student's second academic year.*** Failure to meet this deadline will result in immediate suspension of stipend support.

After gaining approval of the thesis project, the student should provide written and/or oral progress reports to the thesis advisory committee and must convene a meeting of this committee ***at least once per year***. Note that committee meetings should be scheduled during the regular academic year and not between June 1 and September 1. This is due to the fact that many faculty have 9 month appointments at the University and have no academic duties for 3 months during the summer. Instead, most research-active faculty members receive summer salary from their research grants and owe 100% of their time to those grants. Note that a ***quorum of four committee members*** is required to hold a thesis update meeting.

Conflict of Interest

Research funding from sources that have intellectual property interests in the research, or in which the PI has personal financial interest, may create a real or perceived conflict of interest, given the dual roles of the principal investigator in obtaining funding for the lab and as a mentor for graduate students. Issues of paramount importance are (i) the ability to publish results in a timely fashion; (ii) the ability to communicate research results openly, especially to members of the thesis committee; and (iii) academic rights to publish and speak freely, especially as related to a graduate student's thesis and defense.

Statement of policy.

The following principles should apply to any situation involving a graduate student supported by funding that is associated with a confidentiality agreement:

The limitations and nature of the confidentiality agreement must be fully disclosed to and approved by the student, the thesis committee, and the DBBS Associate Dean for Graduate Affairs;

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The confidentiality agreement must not place an unreasonable burden or delay in publication or reporting at scientific meetings;

The confidentiality agreement must not delay the writing or defense of the thesis.

The complete policy can be view at:

<http://www.dbbs.wustl.edu/dbbs/website.nsf/WV/D47E84300A563248862575BE006C522C?OpenDocument>

Teaching Requirement

Students are required to assist in the teaching of one or two courses depending upon the workload of the course(s). Teaching usually is completed during the second year of graduate study, and TA assignments to a particular course are made with the student's background and interests in mind. TA assignments assist the Biology Department's teaching mission and provide a valuable opportunity for students to develop or improve their teaching skills. Student's wishing to gain additional teaching experience can usually arrange a second TA experience for which there may also be a modest increase in the student's stipend for that semester.

Doctoral Thesis

The thesis is expected to be of high quality, acceptable for publication in reputable, refereed journals. Typically, students have one or more first-authored papers published prior to the thesis defense. The preparation and defense of the thesis will follow guidelines set by the University Graduate School of Arts and Sciences (available in the Graduate Studies Office). The thesis examining committee must include 6 full-time tenure-track Washington University faculty members with at least two members whose affiliations are with programs other than the Plant Biology Program. Note that the committee participation of PIs that are not DBBS members must be approved as a voting member of the committee by the Dean of the Graduate School. Generally, the members of the thesis advisory committee also serve on the final Examining committee. Copies of the final written thesis must be in the hands of all members of the thesis committee at least 14 days prior to the scheduled defense. The format for the defense is a public seminar followed by a closed question and answer session with the Examining committee.

Timetable

Year 1: Begin required coursework, complete three research rotations and choose thesis lab.

Year 2: Complete course requirements; satisfy teaching requirement; pass Qualifying Examination; assemble thesis advisory committee and successfully defend Thesis Proposal.

Years 3-5 (longer, if necessary): Conduct thesis research. Publish work. Graduate!

Exceptions to the expected timetable will require the approval of the Plant Biology Steering Committee.

Publications

There is no specific requirement for publication to receive the Ph.D. However, high quality, peer-reviewed publications are an important determinant for a student's career. Similarly, the process of writing and submitting a manuscript and responding to reviewer critiques is an essential part of a student's training. Therefore, the publication record is one of several

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important and appropriate measures to be used by a thesis committee in evaluating a Ph.D. candidate. It is generally expected that students will have submitted and/or published one or more first author manuscripts in peer-reviewed journals at the time of the defense.

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Appendix A

Consequences of Failing the Qualifying Examination

The examining committee, in consultation with the Steering Committee, can recommend either that a student retake the examination or that the student not continue to candidacy for a Ph.D. in the Division of Biology and Biomedical Sciences. A decision to dismiss the student or take other action will be made by the Steering Committee. An Examining committee will limit its deliberation and decision to the narrow issue of whether or not the student passes the examination in question. If the student feels that the action of the Steering Committee has been incorrect due to a procedural flaw in the examination process, the student may submit a written petition to the Chair of the Programs and Student Affairs Committee.

The Examining committee, with approval of the Steering Committee, may recommend that a student retake the exam. The re-examination must take place within one month of the date of the failed examination. A new examining committee, which may include one or more members from the first committee, will be appointed.

If the student fails the retake exam, the Steering Committee may recommend obtaining a Master's Degree in Biological Sciences, with a thesis. Students must have successfully passed at least 24 credit units of research and coursework. According to the guidelines of the Graduate School, students are required to complete the following in order to obtain your Master's Degree:

- Fill out and submit the form "Notice of Title, Scope, and Procedure of Dissertation (Thesis)" to the Program Coordinator
- Prepare a modified thesis (substantially shorter than the typical Ph.D. thesis) and receive its approval from your mentor and the Program Director.
- Present the thesis to an examining committee, which typically will be the Plant Biology Steering Committee within a **four-month** period.
- Demonstrate competency in your field of study through a thesis defense. This will involve a public seminar in which you present your research findings and your conclusions followed by a meeting with the Steering Committee in which any questions concerning the contents of the thesis will be addressed.

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Appendix B

Guidelines for Faculty affiliated with the Plant Biology Program

1. Adjunct faculty affiliation with the Program

Principal investigators who obtain an adjunct appointment in one of the Departments of the Division of Biology and Biomedical Sciences (DBBS) are eligible to request an affiliation with the Plant Biology Program, thus making them eligible to train Plant Biology PhD students in their laboratory. As a condition of Plant Program affiliation, Adjunct Professors are expected to contribute to the Program's educational mission by contributing to teaching (core courses, journal club) and serving on qualifying examination and thesis advisory committees.

2. Steering Committee and Program Director

The Steering Committee is responsible for student recruitment, student advising, and establishing Program guidelines. The Steering Committee will be composed of 3-4 full-time Washington University professors (any rank) whose primary affiliations within DBBS are with the Plant Biology Program. The Program Director serves as the chair of the Steering Committee and must also be a full-time Washington University professor whose primary affiliation is with the Plant Biology Program. Only Program members who are full-time Washington University faculty are eligible to participate in the selection of Steering Committee members and selection of the Program Director.

The Ph.D. students select 1-2 representatives to the Steering Committee to provide feedback and suggestions from the students' perspective. One adjunct faculty member from a partner institution will also be invited to serve as a representative to the Steering Committee.