Program in

Plant Biology
Guidelines to the Program in Plant Biology

Guidelines to the Graduate Program in Plant Biology
(Revised 7/22/02)

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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 are generally satisfied in year one, allowing students in year two to design a curriculum that suits their specific interests. 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 the thesis research (usually by the end of the first year) 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.

Course Requirements
Core courses for the Plant Biology Program are:

1) Plant Developmental Genetics, Genomics and Model Systems; Bio 4022 (3 cr., Fall).
2) Nucleic Acids and Protein Biosynthesis; Bio 548 (3 cr., Fall)
3) Biochemistry of Plants; Bio 4021 (3 cr., Spring)
4) Ethics and Research Science; Bio 5011 (1 cr., Spring, taken in year 2)
5) Plant Biology Journal Club; Bio 572 (1 cr., 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 should enroll in journal club for the first time in the Spring of year 1 to help develop the knowledge base and critical evaluation skills that will help them prepare for and pass the qualifying exam. Students are strongly encouraged to complete the journal club requirement in year two.

Elective courses
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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. 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 that serves as valuable practice for the qualifying exam.
Fundamentals of Molecular Cell Biology (Fall); Bio 5068
Developmental Biology (Spring); Bio 5352
Molecular Microbiology & Pathogenesis (Spring); Bio 5392

NOTE: 15 credit units total are required, however 18 credit units are recommended for those interested in teaching careers in southeastern states of the United States (state teaching requirement/regulation).

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 plant biology seminars sponsored by the Biology Department or by the Division of Biology and Biomedical Sciences.

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 no longer than one semester (or four months if the rotation includes the summer months, May-August). Rotations should broaden the intellectual and technical experience of the student and contribute to ongoing research in sponsoring laboratories. Students can arrange to perform their third rotation with a laboratory at Monsanto, another 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.

Qualifying (Preliminary) Examinations
Students must undergo a qualifying examination before February 28 of their second year and are advised to schedule the examination in the semester in which they do not serve as a Teaching Assistant. Note that qualifying exams and all subsequent committee meetings should be scheduled during the regular academic year and not between mid-May and mid-August (the period between graduation and the beginning of classes). This is due to the fact that faculty have 9 month appointments at the University and have no academic duties for 3 months during the summer.

The format for the preliminary 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 (http://grants1.nih.gov/grants/funding/416/phs416.htm). Sections of the
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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 in the hands of 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 preliminary 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 has primary responsibility for preparing and coaching the student for the exam. 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 and committee composition, students should see the Program Coordinator to obtain the required form. After completing the form and obtaining the necessary signatures, the exam will be scheduled. The written proposal must then be provided to the members of the examining committee at least two weeks (ten working days) before the date of the oral presentation. The examining committee should consist of at least five faculty members suggested by the student but requiring approval of the chairman of the examining committee and the Director of the Plant Biology Program. At least two of the faculty should be members of the Plant Biology Steering Committee. The examining committee will either accept the exam as passing, recommend (in consultation with the steering committee) that the exam be retaken, or recommend to the Steering Committee that the student not become a doctoral candidate. A re-take of the exam must occur within three months 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).

**Thesis Proposal and thesis advisory committee**

Within one year of 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 5 additional faculty members, at least one of whom should have their primary affiliation with another program. The faculty should be chosen for their expertise and their willingness to help guide the student's thesis research. To obtain approval of the advisory committee composition, students should see the Program Coordinator to obtain the required form. 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 preliminary 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
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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.

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 mid-May and mid-August (the period between graduation and the beginning of classes). This is due to the fact that faculty have 9 month appointments at the University and have no academic duties for 3 months during the summer. Instead, most research-active faculty receive summer salary from their research grants and owe 100% of their time to those grants.

**Student Travel**

Students may travel with Division support after the thesis proposal has been approved by the Thesis Advisory Committee. Exceptions to these eligibility requirements are permitted only in unusual circumstances as determined by the Program Director. The Division provides up to $600 toward travel expenses for all students during their graduate training; this money may be used to help pay for field trip expenses or to help pay for attendance at a meeting. Money will only be provided for the latter if the student is presenting a talk or a poster at the meeting. To request travel support, the student submit a letter to the Program Director asking for use of the funds and stating the purpose of the trip.

**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 faculty with adjunct appointments, including members of the Donald Danforth
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Plant Science Center, are not full-time Washington University faculty. Thus students working with a mentor who holds an adjunct appointment will need at least seven committee members. 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.
Year 2: Choose thesis lab; complete course requirements; satisfy teaching requirement; pass Preliminary Examination.
Year 3: Assemble thesis advisory committee, present and gain approval of 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.
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 Affair 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 three months 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. The examining committee, in consultation with the steering committee, will decide whether a new proposal should be prepared or the original proposal used again and can give the second examining committee instructions concerning subject areas that should be emphasized in the questioning.

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.