Plant Biology

Assessment Plan for the PhD Program

Program Learning Outcomes

The Ph.D. program in Plant Biology is guided by seven Learning Outcomes that define the set of skills and knowledge that Ph.D. students should possess at the time of degree conferral. A variety of direct and indirect assessment tools will be used to provide evidence of student learning.

Learning Outcome 1: Knowledge Acquisition

Each PhD student in Plant Biology will attain a comprehensive knowledge and master theoretical principles and methodological approaches in one major area and two minor areas of specialization in Plant Biology. A student should be able to apply knowledge and skills in these areas to address complex research problems in plant biology and related areas.

Approach: The major and minor areas of specialization in Plant Biology will be established within the first year of study after discussions with the student, research advisor and Guidance Committee. Students will acquire the factual knowledge, theoretical principles, and methodological approaches in three areas of specialization through their course program, independent studies and research projects.


Learning Outcome 2: Critical Thinking Skills

Students will be able to (1) critically read, understand, and evaluate scholarly literature; (2) integrate, synthesize and conceptualize ideas and theories; (3) identify and evaluate novel and relevant research questions; (4) develop appropriate and effective research strategies; and (5) communicate clearly and effectively both orally and in writing.

Approaches: Students will learn to critically evaluate science through a variety of course activities including writing proposals, reviews, and discussions. Students will learn to critically evaluate data, integrate and synthesize ideas, develop research questions, conduct research, and communicate results under the supervision of a faculty dissertation advisor. Students will be encouraged and supervised to apply for competitive
scholarships. BPSC 200A-B will provide guidance for best practices in oral and written communication and opportunities to develop these skills. Students will present a BPSC 250 seminar, critically evaluate student BPSC 250 seminar presentations, and present a public dissertation defense.

**Assessment Methods:** Assignments and examinations in courses that incorporate historical and contemporary literature. Assessment of BPSC 250 seminar and Dissertation Defense Seminar quality, performance in BPSC 240, and BPSC 200A- 200B. Success rates on the written and oral Qualifying exams. Outcomes and reviews of research project and fellowship submissions. Dissertation defense. Completion of critical evaluation forms at BPSC250 seminars.

**Learning Outcome 3: Research Skills**

Students will be able to (1) conduct research in a responsible and ethical manner; (2) evaluate, analyze, and interpret results; (3) develop and test hypotheses; (4) develop and sustain evidence-based arguments; (5) convey findings clearly and effectively; (6) identify broader implications of findings; and (7) disseminate research results through peer-reviewed publications and documents.

**Approach:** Students will be trained to be competitive and responsible scientists enabling a transition from mentor-led to independent research through the iterative process of hypothesis testing, data collection, and evaluation. Skills in data evaluation and interpretation of evidence will be developed through courses, student seminar presentations, and faculty feedback on research data. Students will publish research results in peer-reviewed journals. Training in research ethics will be addressed in the BPSC core courses (BPSC 200A and 200B), online courses with practical examples of issues in research ethics, formal training in responsible conduct of research by the Office of Research, and informal training in individual laboratories.


**Learning Outcome 4: Research Milestones**

Students will conduct independent research and be able to produce sound research results within reasonable timeframes.

**Approach:** Presentations in laboratory meetings and discussions with research advisors to focus students on productive and creative research paths with measurable research outcomes. The BPSC250 seminar
A presentation will provide an opportunity for students to relay research progress. Progress will be formally monitored by annual meetings of Guidance and Dissertation Committees.

**Assessment Methods:** Annual progress reports. Date of BPSC 250 seminar presentation. Dissertation defense. Published manuscripts. Advancement to candidacy within 1 year of normative time; degree conferral within 1 year of normative time.

**Learning Outcome 5: Effective Teaching**

Students will become effective teachers and communicators.

**Approach:** All students must complete the training provided by the Teaching Assistant Development Program (TADP). All students will serve as a Teaching Assistant for one quarter prior to graduation; during this time students are enrolled in a teaching practicum. When possible, students will assist teaching courses close to their discipline or broad-based classes that are foundational to the field of plant biology. Students will have opportunities to mentor other students in directed research activities. Presentations in laboratory meeting, courses and seminar programs will develop oral communication skills. BPSC 200A-200B will provide guidance for best practices in oral and written communication and opportunities to develop these skills, which are critical for teaching excellence.

**Assessment Methods:** Completion of TADP training, the teaching practicum, and BPSC 200A-B. Quality of student teaching evaluations. Success in BPSC 250 and BPSC 240. Attendance at BPSC 250 seminars. Participation in undergraduate mentoring. Dissertation defense.

**Learning Outcome 6: Professional Skills**

Students will learn leadership skills and become capable professionals.

**Approach:** Students will be trained to become professionals in plant biology through faculty mentorship, coursework, and in professional development skills (BPSC 200A-B). We will emphasize ethical behavior in all aspects of the graduate experience. Students will be encouraged to apply for external funding. Students will attend regional, national or international meetings in their discipline. Leadership and productive interactions amongst students across all of the disciplines of plant biology will be promoted by the professional development courses BPSC 200A-B. Students and faculty will be encouraged to submit applications or nominations, respectively, for student awards. Students will be given opportunities for formal and informal interactions with visiting scientists.

**Assessment Methods:** Assignments in professional development course. Conference participation and presentations. Fellowship and grant proposal applications and awards. Publications. Job placement. Community service. Documentation of service on department committees and graduate student
organizations. Professional service and awards. Documentation of responsible conduct of research training. Documentation of interactions with visiting scientists.

Learning Outcome 7: Professional and Academic Satisfaction

The Plant Biology program will produce graduates who are satisfied with research and learning during their PhD program.

**Approach:** The Plant Biology Student Handbook will be updated annually after consultation with graduate students. Classes will be adapted to accommodate student’s changing academic and professional needs; students’ recommendations will be assessed and implemented where appropriate. Opportunities for students to interact with visiting scientists and promote networking will be provided. New graduate-level courses and seminars will be offered according to students’ interests and disseminated in a timely manner. An annual student satisfaction survey and an independently administered focus group will be used to provide students the opportunity to identify the strengths and weaknesses in the program.

**Assessment Method:** Annual survey on the content and delivery of the materials in the Plant Biology Student Handbook. Assessment of academic classes and implementation of changes where appropriate. Assess opportunities for student interactions with visiting scientists. Recommendations from the student satisfaction survey, exit survey, and focus group will be reported, responses delivered to students promptly, and changes implemented where appropriate.
Program Learning Outcomes

The Plan I Master of Science (M.S.) Program in Plant Biology is guided by seven Learning Outcomes that define the set of skills and knowledge that M.S. students should possess at the time of degree conferral. A variety of direct and indirect assessment tools will be used to provide evidence of student learning.

Learning Outcome 1: Knowledge Acquisition

Each Plan I M.S. student in Plant Biology will attain extensive knowledge of the facts, theoretical principles and methodological approaches in an area of specialization. A student should be able to apply knowledge and skills in these areas to address significant problems in plant biology and related areas.

**Approach:** The area of specialization in Plant Biology will be determined within the first year of study after discussions with the student, research advisor and Guidance Committee. Students will acquire the factual knowledge, theoretical principles, and methodological approaches in the area of specialization through their course program, independent studies and research experiences.


Learning Outcome 2: Critical Thinking Skills

Students will be able to (1) critically read, understand, and evaluate scholarly literature; (2) integrate, synthesize and conceptualize ideas and theories; (3) identify and evaluate novel and relevant research questions; (4) develop appropriate and effective research strategies; and (5) communicate clearly and effectively both orally and in writing.

**Approaches:** Students will learn to critically evaluate science through a variety of course activities including writing proposals and reviews, and participating in discussions. Students will learn to critically evaluate data, integrate and synthesize ideas, develop research questions, conduct research, and communicate results under the supervision of a faculty advisor. A BPSC 250 seminar will be delivered and a M.S. thesis seminar will be encouraged. Students will critically evaluate the presentations in the BPSC 250 seminar series.

**Assessment Methods:** Assignments and examinations in courses that incorporate historical and contemporary literature. Assessment of BPSC 250 seminar quality and performance in BPSC 240. Annual assessment of research progress. Outcomes and reviews of thesis. Quality of M.S. thesis
Learning Outcome 3: Research Skills

Students will be able to (1) conduct research in a responsible and ethical manner; (2) evaluate, analyze, and interpret results; (3) develop and test hypotheses; (4) develop and sustain evidence-based arguments; (5) convey findings clearly and effectively; (6) identify broader implications of findings; and (7) disseminate research results through peer-reviewed publications and documents.

**Approach:** Students will be trained to be competitive and responsible scientists with the ability to test hypotheses and collect and evaluate data. Skills in data evaluation and interpretation of evidence will be developed through courses, student seminar presentations and faculty feedback on research data. Students will publish research results in peer-reviewed publications. Training in research ethics will be addressed in online courses with practical examples of issues in research ethics, formal training in responsible conduct of research by the Office of Research, and informal training in individual laboratories.

**Assessment Methods:** Annual progress reports and presentations to Guidance Committee. Seminar presentations. M.S. thesis. Publication of research results. Participation in responsible conduct of research training.

Learning Outcome 4: Research Milestones

Students will conduct independent research and be able to produce sound research results within reasonable time frames.

**Approach:** Presentations in laboratory meetings and discussions with research advisors will focus students on productive and creative research paths with measurable research outcomes. The BPSC250 seminar presentation will provide an opportunity for students to relay research progress. Progress will be monitored by annual meetings of Guidance and M.S. Thesis Committees.

**Assessment Methods:** Annual progress reports; Date of BPSC 250 seminar presentation. Published manuscripts. Degree conferral within 1 year of normative time.

Learning Outcome 5: Effective Teaching

Students will be given the opportunity to acquire skills to become effective teachers and communicators.

**Approach:** Presentations in laboratory meetings, the BPSC 250 seminar and courses will develop oral communication skills. Students may have opportunities to mentor other students in directed research activities. In
addition, although not required, M.S. students may serve as a Teaching Assistant for one quarter prior to graduation. If serving as a TA, the student must complete the training provided by the Teaching Assistant Development Program (TADP) and enroll in a teaching practicum during the quarter of their TAship. When possible, students will assist teaching courses close to their discipline or broad-based classes that are foundational to the field of plant biology.

**Assessment Methods:** Completion of TADP training and the teaching practicum course. Quality of student teaching evaluations. Performance in BPSC250 and BPSC 240 seminars. M.S. thesis defense. Assessment of undergraduate mentoring opportunities.

**Learning Outcome 6: Professional Skills**

Students will learn leadership skills and become capable professionals.

**Approach:** Students will be trained to become professionals in plant biology through faculty mentorship and coursework. Students will be encouraged to apply for external funding. Students will attend regional, national or international meetings in their discipline. Leadership and productive interactions amongst students across all of the disciplines of plant biology will be promoted. Students and faculty will be encouraged to submit applications or nominations, respectively, for student awards. Students will be given opportunities for formal and informal interactions with visiting scientists.

**Assessment Methods:** Conference presentations. Fellowship and grant proposal applications and awards. Publications. Job placement. Community service. Documentation of service on departmental committees and in graduate student organizations. Academic, professional or service and awards. Participation in responsible conduct of research training.

**Learning Outcome 7: Professional and Academic Satisfaction**

The Plant Biology program will produce graduates who are satisfied with research and learning during their M.S. program.

**Approach:** The Plant Biology Student Handbook will be updated annually after consultation with graduate students. Classes will be adapted to accommodate student’s changing academic and professional needs; students’ recommendations will be assessed and implemented where appropriate. Opportunities for students to interact with visiting scientists and promote networking will be provided. Timely dissemination of new graduate-level course offerings and seminar schedules will occur. An annual student satisfaction survey and an independently administered focus group will be used to provide students the opportunity to identify the strengths and weaknesses in the program.
**Assessment Method:** Annual survey on the content and delivery of the materials in the Plant Biology Student Handbook. Assessment of academic classes and implementation of changes where appropriate. Assess opportunities for interactions with visiting scientists in annual progress reports. Recommendations from the student satisfaction survey, exit interview, and focus group will be reported, responses delivered promptly and changes implemented where appropriate.
Program Learning Outcomes

The Plan II Master of Science (M.S.) Program in Plant Biology is conferred after the completion of a program of courses, study and research in one major area and one or two minor areas of emphasis, and a Comprehensive Exam. The Plan II M.S. students choose to write a directed research project report or critical literature review. The Plan II M.S. program is guided by seven Learning Outcomes that define the set of skills and knowledge that M.S. students should possess at the time of degree conferral. A variety of direct and indirect assessment tools will be used to provide evidence of student learning.

Learning Outcome 1: Knowledge Acquisition

Each Plan II M.S. student in Plant Biology will attain extensive knowledge of the facts, theoretical principles and methodological approaches in one major area and one or two minor areas of specialization in Plant Biology. A student should be able to apply knowledge and skills in these areas to address significant problems in plant biology and related areas.

**Approach:** The major and minor area(s) of specialization in Plant Biology will be determined within the first year after discussions with the student, research mentor and Guidance Committee. Students will acquire the factual knowledge, theoretical principles, and methodological approaches in the area(s) of specialization through their course program, independent studies and research experiences.

**Assessment Methods:** Assignments and examinations in courses that incorporate historical and contemporary literature. Attendance at BPSC250 seminars. Annual progress report. Oral and written comprehensive exams. Research report or critical literature review evaluation by the Comprehensive Exam Committee.

Learning Outcome 2: Critical Thinking Skills

Students will be able to (1) critically read, understand, and evaluate scholarly literature; (2) integrate, synthesize and conceptualize ideas and theories; (3) identify and evaluate novel and relevant research questions; (4) develop appropriate and effective research strategies; and (5) communicate clearly and effectively both orally and in writing.

**Approaches:** Students will learn to critically evaluate science through a variety of course activities including writing proposals and reviews, and participating in discussions. Students will learn to critically evaluate data, integrate and synthesize ideas, develop research questions, conduct research, and communicate results under the supervision of a faculty
advisor. Students will critically evaluate the presentations in the BPSC 250 seminar series.

**Assessment Methods:** Assignments and examinations in courses that incorporate historical and contemporary literature. Performance in BPSC 240. Annual assessment of research or critical literature review progress. Oral and written comprehensive exam performance. Quality of research report or critical literature review assessment by Comprehensive Exam Committee. Completion of critical evaluation forms at BPSC250 seminars.

**Learning Outcome 3: Research Skills**

Students will be able to (1) conduct research in a responsible and ethical manner; (2) evaluate, analyze, and interpret results; (3) develop and test hypotheses; (4) develop and sustain evidence-based arguments; (5) convey findings clearly and effectively; and (6) identify broader implications of findings.

**Approach:** Students will be trained to be competitive and responsible scientists with the ability to test hypotheses, and collect and evaluate data. Skills in data evaluation and interpretation of evidence will be developed through courses, student seminar presentations and faculty feedback on research data or the critical literature review. Training in research ethics will be addressed in the online courses with practical examples of issues in research ethics, formal training in responsible conduct of research by the Office of Research, and informal training in individual laboratories.

**Assessment Methods:** Annual progress reports and presentations to Guidance Committee. Written and oral comprehensive exams. Research report or critical literature review. Participation in responsible conduct of research training.

**Learning Outcome 4: Research Milestones**

Students will conduct research and be able to produce sound research results within reasonable time frames.

**Approach:** Presentations in laboratory meetings and discussions with research advisors will focus students on productive research paths with measurable research outcomes. Progress will be formally monitored by annual meetings of the Guidance Committee.

**Assessment Methods:** Annual progress reports. M.S. research report or critical literature review. Degree conferral within 1 year of normative time.

**Learning Outcome 5: Effective Teaching**

Students will be given the opportunity to acquire skills to become effective teachers and communicators.

**Approach:** Presentations in laboratory meetings, the BPSC 250 seminar and courses will develop oral communication skills. Students may have
opportunities to mentor other students in directed research activities. In addition, although not required, M.S. students may serve as a Teaching Assistant for one quarter prior to graduation. If serving as a TA, the student must complete the training provided by the Teaching Assistant Development Program (TADP) and enroll in a teaching practicum during the quarter of their TAship. When possible, students will assist teaching courses close to their discipline or broad-based classes that are foundational to the field of plant biology.

**Assessment Methods:** Completion of TADP training and the teaching practicum course. Quality of student teaching evaluations. Performance in BPSC 240. Attendance at BPSC 250 seminars.

**Learning Outcome 6: Professional Skills**

Students will learn leadership skills and become capable professionals.

**Approach:** Students will be trained to become professionals in plant biology through faculty mentorship and coursework. We will emphasize ethical behavior in all aspects of the graduate experience. Students will attend regional, national or international meetings in their discipline. Leadership and productive interactions amongst students across all of the disciplines of plant biology will be promoted. Students and faculty will be encouraged to submit applications or nominations, respectively, for student awards. Students will be given opportunities for formal and informal interactions with visiting scientists.

**Assessment Methods:** Conference presentations. Job placement. Community service. Documentation of service on departmental committees and in graduate student organizations. Professional service and awards. Participation in responsible conduct of research training.

**Learning Outcome 7: Professional and Academic Satisfaction**

The Plant Biology program will produce graduates who are satisfied with research and learning during their M.S. program.

**Approach:** The Plant Biology Student Handbook will be updated annually after consultation with graduate students. Classes will be adapted to accommodate student’s changing academic and professional needs; students’ recommendations will be assessed and implemented where appropriate. Opportunities for students to interact with visiting scientists and promote networking will be provided. Timely dissemination of new graduate-level course offerings and seminar schedules will occur. An annual student satisfaction survey and an independently administered focus group will be used to provide students the opportunity to identify the strengths and weaknesses in the program.

**Assessment Method:** Annual survey on the content and delivery of the materials in the Plant Biology Student Handbook. Assessment of academic
classes and implementation of changes where appropriate. Assess opportunities for student interactions with visiting scientists. Recommendations from the student satisfaction survey, exit interviews and focus group will be reported, responses delivered to students promptly, and changes implemented where appropriate.