

Plant Biology (PB) Interdepartmental Graduate Program (IDGP) - Strategic Plan 2015

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Mission Statement: The PB IDGP is a key component of the land grant mission of UMass. PB seeks to train future plant scientists to use state-of-the-art technologies for solving basic and applied research questions that span all levels of plant biology, from the structure and mechanism of individual molecules to plant interactions at the ecosystem level. The program seeks to imbue in students a respect for and knowledge of the roles of fundamental and translational research, as well as to recognize the importance of and/or participate in teaching, extension and outreach.

History and Composition: The PB program was started in 1996 headed by Peter Hepler (1994-2002), followed by Danny Schnell (2002-2004), Elsbeth Walker (2004-2014), and currently Elizabeth Vierling (2015-). The program has continuously had over 30 faculty members drawn from Biology, Biochemistry & Molecular Biology, The Stockbridge School of Agriculture, and Chemical Engineering at UMass, along with faculty from Smith, Hampshire and Mt. Holyoke Colleges. In 2013, recruiting and training of Plant, Soil and Insect Science (PSIS) graduate students was folded into the PB program. Currently, PB has 37 faculty members, 22 PhD and 3 MS students. As of 2015, PB students are from 8 countries and 9 states in the US.

Preparation of this plan: The PB program leader and steering committee devised a survey with questions about curriculum and other student training opportunities, facilities, program activities, and new faculty hires. Thirty-two of 37 PB faculty members responded, and one spoke privately with the director. A survey with related questions was sent to PB graduate students, with 22 of 25 responding. Survey results were considered in completing this document.

Program Strengths:

PB has a number of important strengths that reflect a strong culture of plant biology on campus:

- Breadth of the program – both in departments and disciplines
- Cohesive cohort of students and a strong PB program culture
- Labs are collegial and afford opportunities for excellent student interactions
- PB has a strong culture of support for junior faculty members in the form of student funding
- A weekly PB program seminar with lunch with the speaker for the students
- A highly regarded, fall PB Symposium, nationally and internationally recognized
- Potential to link basic and applied plant biology

The PB program has access to excellent research facilities, some very recently available:

- Greenhouse space, including the new CNS greenhouse space
- New laboratory space in Paige and LSL
- Extensive equipment for cell biological and biochemical research – core facility upgrades associated with IALS (mass spectrometry, protein biophysical characterization, and high-end light microscopy including super-resolution and rapid 4-D microscopies)

- Agricultural Research Center, South Deerfield
- Agricultural Learning Center, Amherst

PB has some limited, small financial instruments for support of students:

- Gilgut Endowment – Funds at discretion of Gilgut Professor, usually supports one student
- Some Hatch funds - support of faculty with Hatch projects.
- Davis Botany fund – provides small sums for student professional development
- Crabtree Fellowship – for graduate students conducting research in sustainable farming
- Torrey Fellowship – supports an undergraduate during the summer in a PB faculty lab

Program Challenges and Vision for Change:

Challenges:

Remaining at the forefront of plant sciences: Advances in genomics, microscopy, mass spectrometry and other technologies have made it possible to investigate the diversity of plant model and non-model (crop and wild) species at a level previously unprecedented. We need to continue to ensure our faculty have access to these technologies and hire new faculty with expertise and vision in using these advances to address basic and applied questions in plant function, evolution and food security.

Recruiting excellent students: Major reasons students choose programs other than UMass PB are: 1) Specific research/faculty interests of competing institutions; 2) Personal reasons of place preference; 3) Higher stipends at other institutions; 4) Lack of a first year teaching requirement at other institutions.

Offering advanced curriculum and professional training: The program struggles to define and offer graduate coursework. A major limitation is the fact that PB faculty members are also engaged in undergraduate teaching and receive no “credit” for graduate teaching. The breadth of PB (also a strength) makes it difficult to offer advanced course work appropriate for all students.

Availability and management of controlled environment plant growth space: The number of growth chambers on campus is insufficient, which impacts the feasibility of many controlled experiments.

Integrating Stockbridge School and other CNS faculty and students in PB: The recent folding of the PSIS graduate program into the PB graduate program has met with some hiccups in creating a training format that provides the best outcome for students with interests spanning experimental field work through to basic cell and molecular biology.

Need for continued integration and enhancement of research facilities: Although new laboratory space and greenhouse facilities have recently become available, there is still a portion of the PB faculty who are in subpar laboratory space, dispersed across campus. This is a significant recruitment issue for attracting both excellent new faculty and students.

Vision for Change:

Ensuring PB is at the forefront of plant sciences: As also put forward in the overall plan for the future of all IDGPs, *the PB program needs to have input into faculty hiring priorities.* This is crucial to maintain program strength at the cutting edge of plant sciences research and will increase our ability to attract excellent students. The faculty survey indicated very strong support for new hires in 1) Breeding and genetics using genomics technologies; 2) Plant physiology and metabolic biochemistry; 3) Plant-microbe interactions. The students also supported these areas. However, these fields are not exclusive needs, as ecology and evolutionary biology, as well as sustainable agriculture and plant cell biology are also strongly desired. The PB program would like to see hires in the plant sciences be “bridging positions” in the sense that the new faculty member will have research interests and expertise in state-of-the-art methodologies that will promote interactions across the basic and applied divide, or through different levels of organization from molecular to ecosystem. PB seeks to participate in new faculty hiring in collaboration with departments and the Stockbridge school.

Enhancing student support:

The PB program needs a minimum of 5 to 6 PhD students per year, and could benefit from an increase in coming years. Our program is currently at a size that promotes a strong graduate student identity in PB. Our vision is to see the number of students increase over time with the enhancement of plant sciences on campus, but not to a program size that leads to a loss of cohesion among the students.

Graduate stipends need to increase. A survey of our aspirational institutions indicates a \$4000 or more gap in our stipend level. Increasing the stipend requires a solution to the rising curriculum fee (indexed to stipend). The cost of a graduate student is fast becoming (or is already!) prohibitive relative to the size of NSF and USDA grants that fund plant science research. The administration needs to carefully examine university policy on curriculum fees, as they tax grant funds.

The PB program needs to encourage students to submit applications for fellowship support. The PB Steering Committee is discussing how best to achieve this goal. Students should also be encouraged to take advantage of short term research opportunities in national facilities, as offered by the USDA and DOE, and for international exchange. Students can obtain guidance in fellowship preparation offered by the graduate school.

The PB program needs to consider applying for training grant support for PB students. Opportunities vary and, though limited do exist in both the USDA (on the applied side) and NSF. Recent enhancement of facilities (greenhouse, lab and equipment) should improve possibilities.

The university needs to provide more fellowship support for first year students. Competing institutions (eg. MSU, UC Riverside) have fellowships that support first year students in plant sciences. This eliminates the requirement for teaching in the first year, is an indication of the importance of the program, and is an excellent recruiting tool.

Revising PB curriculum and offering professional development:

PB core curriculum needs to be reconsidered. PB currently requires first and second semester core courses. Faculty surveys indicated widespread dissatisfaction with the first semester Core I course. The major critique is the shortness of the “modules” (one week per topic), and the focus on more molecular topics vs topics more specifically related to agriculture. There was general satisfaction with the Core II course (grant writing), although aspects were also critiqued. PB will review opportunities to make changes in these courses.

Need for more basic courses at the graduate level. There is a major need for training in statistics/experimental design, computing, plant physiology and plant biochemistry. Coordinating with other graduate programs to offer statistics and computer coursework appropriate to life sciences could help solve this need. Offering other advanced courses may require a new model, such as modular 4 week courses that students could select among relative to their needs, or otherwise developing “tracks” for different disciplines.

Departments need to recognize graduate teaching as part of faculty teaching load. It continues to be difficult to offer advanced coursework in plant biology (as well as other IDGPs) due to a policy that requires participation in IDGP teaching to be performed on top of what may already be a large undergraduate teaching load. This policy is not uniform across departments.

PB students will be encouraged to participate in graduate school professional development courses. The office of professional development in the graduate school is a major bonus for all graduate students. Many aspects of training students indicated they desire (basic writing, oral presentation, outreach), should be fulfilled by this office. PB is interested in working with this office to fill our student’s needs. The program should develop and use Individual Development Programs (IDPs) for students.

Support student-initiated efforts to offer each other mentoring and to informally present their data. A group of PB students have initiated a student gathering to discuss graduate student issues, coursework and research. PB faculty members applaud and wish to facilitate efforts of this type in any way possible.

Better integration of PB faculty and students across Stockbridge and CNS departments:

Encouraging joint seminars. PB and Stockbridge will consider joint seminar events to enhance interaction among faculty.

Exploring more joint grant opportunities. Many grant opportunities in plant science require work with a crop or an applied component. PB would benefit from exploring these options. Seed funding for cross-campus collaborations that generate preliminary data or establish proof of concept would greatly facilitate the success of joint grant proposals to external funding agencies.

Consider mechanisms to increase communication. Possibilities include, having PB program faculty meetings, develop a PB newsletter, a PB faculty/student retreat.

Develop, with the Center for Ag, a yearly “Ag tour”. PB faculty (and students) should be aware of activities of UMass extension and farms, as well as local farms and nurseries. Several university land grant schools take new faculty and other interested parties on a two or three day tour to meet growers, see processing facilities and farms. These tours are not only critical educationally, they also build camaraderie, as well as appreciation for the complexities of agriculture and our food supply, and facilitate connections with stake holders.

Increased growth chamber space and support for staffing core facilities:

Support for greenhouse, growth chamber and farm maintenance oversight. Plant growth facilities/fields are the KEY RESOURCE for plant sciences. Current support needs to be secure and in some cases augmented. More controlled environment growth space needs to be obtained.

Staffing for next generation sequencing, microscopy and other analytical facilities. These facilities are essential to all aspects of plant biology. Most are inadequately, or even not staffed. One solution would be to provide teaching/research assistantships for students to help staff these facilities. This could be a key training component for many students.