

Date: March 12, 2009

From: Jay Hobgood

To: CAA

Subject: Proposal for a New Ph.D. Graduate Program in Translational Plant Sciences

Subcommittee B met on February 11, 2009 to consider the proposal for a new Ph.D. Program in Translational Plant Sciences. The proposed new Ph.D. program is a result of a Targeted Investment in Excellence (TIE) award to the Interdisciplinary Plant Molecular Biology/Biotechnology (PMBB) Program. The PMBB program is not a degree granting program and the proposed program is an attempt to address the needs of students who are engaged in translating developments in plant sciences in applications.

The members of Subcommittee B felt that the proposal was well constructed and that the section providing evidence for the need of the new program was particularly well written. The members of the subcommittee had a few questions that they wanted answered before approving the proposal. These questions were:

1. Are there any Ph.D. programs at other institutions in the U.S. that are similar to the program being proposed?
2. Is the importance of the internships in the Ph.D. program a unique feature?
3. What are the requirements for admission to the program (e.g. Do students need a certain degree from one of a group of majors?)?
4. How are students admitted to the program (i.e. What procedures lead to their admission?)?
5. It appears that the Director of the PMBB program will also direct this program. Is that correct? How is the Director chosen?
6. What happens if the expected external funding is not secured (i.e. Is there a backup plan?)?
7. What is the size of the targeted base of applicants to the program?
8. What is the minimum number of Ph.D. students needed to make the program viable?

As chair of the subcommittee, I sent an e-mail to Dr. F. Robert Tabita on February 16, 2009 asking for a response to those questions. That e-mail and Dr. Tabita's response are appended to the end of this document. Dr. Tabita's responses to the questions were circulated to the members of Subcommittee B by e-mail and the members voted by e-mail to approve the proposal. Thus, the proposal is now being moved to CAA for its consideration.

Dear Dr. Tabita:

Subcommittee B of the Council of Academic Affairs (CAA) discussed the proposal for a New Ph.D. program in Translation Plant Sciences on Wednesday, February 11, 2009. The discussion was positive and the members of the subcommittee felt that certain parts of the proposal (e.g. the section demonstrating the need for the new program) were particularly well written. The members of the subcommittee did have a few questions that developed from the discussion of the proposal. The questions represent points of clarification for the edification of the subcommittee and do not represent objections to the proposal. The subcommittee felt that the questions could be answered via e-mail and did not require a face-to-face meeting.

The questions are:

1. Are there any Ph.D. programs at other institutions in the U.S. that are similar to the program being proposed?
2. Is the importance of the internships in the Ph.D. program a unique feature?
3. What are the requirements for admission to the program (e.g. Do students need a certain degree from one of a group of majors?)?
4. How are students admitted to the program (i.e. What procedures lead to their admission?)?
5. It appears that the Director of the PMBB program will also direct this program. Is that correct? How is the Director chosen?
6. What happens if the expected external funding is not secured (i.e. Is there a backup plan?)?
7. What is the size of the targeted base of applicants to the program?
8. What is the minimum number of Ph.D. students needed to make the program viable?

I would appreciate it if you could take a few minutes and answer these questions for the subcommittee, and then email the answers back to me. I will forward the answers to other members of the subcommittee. Your responses will also help me when I present the proposal to the full CAA.

Please feel free to contact me if you have any questions. Thanks in advance for your help.

Respectfully,

Jay S. Hobgood
Associate Professor
Chair, CAA Subcommittee B

Original-recipient: rfc822;hobgood.1@osu.edu
X-Mailer: QUALCOMM Windows Eudora Version 7.0.1.0
Date: Mon, 16 Feb 2009 16:04:18 -0500
To: Jay Hobgood <hobgood.1@osu.edu>
From: "F. Robert Tabita" <tabita.1@osu.edu>
Subject: Re: Translation Plant Sciences proposal
X-Spam-Score: 0.90 () [Tag at 4.50]
HTML_10_20,HTML_MESSAGE,MIME_HTML_ONLY
X-CanItPRO-Stream: 11_tagonly_no_subject
X-Canit-Stats-ID: Bayes signature not available
X-Scanned-By: CanIt (www . roaringpenguin . com) on 128.146.216.134

Dear Prof. Hobgood:

Thank you for your E-mail message and for giving me the opportunity to respond to some of the questions that arose from the Subcommittee's deliberations. In fact I am just now deep in the process of preparing an NSF-PIRE (PIRE = Partnership for International Research and Education) grant proposal to obtain support for our effort to initiate the international exchange/internship of Ph. D. students with Brazilian universities (especially the Univ. of Sao Paulo). This is due on Feb. 26. We were one of the three of about 15 chosen by OSU to go forward with this proposal as NSF limits each university to a maximum of 3 submissions. I believe I can answer most of your questions pretty rapidly, one or two I might have to think about a bit longer and/or get some help from colleagues.

Best wishes,

Bob Tabita

My answers to your questions **are in red below:**

At 02:38 PM 2/16/2009, you wrote:

Dear Dr. Tabita:

Subcommittee B of the Council of Academic Affairs (CAA) discussed the proposal for a New Ph.D. program in Translation Plant Sciences on Wednesday, February 11, 2009. The discussion was positive and the members of the subcommittee felt that certain parts of the proposal (e.g. the section demonstrating the need for the new program) were particularly well written. The members of the subcommittee did have a few questions that developed from the discussion of the proposal. The questions represent points of clarification for the edification of the subcommittee and do not represent objections to the proposal. The subcommittee felt that the questions could be answered via e-mail and did

not require a face-to-face meeting.

The questions are:

1. Are there any Ph.D. programs at other institutions in the U.S. that are similar to the program being proposed?

Not to my or anyone else's knowledge.

2. Is the importance of the internships in the Ph.D. program a unique feature?

We believe this to be the case (in our field especially), although it is difficult to believe that someone else has not considered this. In particular since we have talked about these ideas with colleagues from other Universities.

3. What are the requirements for admission to the program (e.g. Do students need a certain degree from one of a group of majors?)?

We feel that students trained in any modern area of biological sciences, especially molecular aspects, would be fully able to matriculate into this program.

4. How are students admitted to the program (i.e. What procedures lead to their admission?)?

We have a Graduate Studies Committee, like any department, that rigorously considers the qualifications of students to this special Program. Moreover, no student who would not be admitted to one of our partner established departments would not be admitted to this Program.

5. It appears that the Director of the PMBB program will also direct this program. Is that correct? How is the Director chosen?

We have a Chair of the Graduate Studies Committee (Prof. David Mackey), along with the aforementioned PMBB Grad. Studies Committee, that will oversee admissions and student progress in the new Program. As far as how the PMBB Director is chosen; much like any Dept. Chair, this is a matter of the PMBB members responding to the Deans of

two Colleges as to who should be appointed as Director. The PMBB Director answers and reports to the Deans of both FAES and CBMPS. There is also a PMBB Council, made of four rotating and PMBB member-elected representatives that interacts with the Director and helps the Director keep track of the various Committees and helps to administer the PMBB TIE.

6. What happens if the expected external funding is not secured (i.e. Is there a backup plan?)?

We are one of the few units that has continued to receive Regents Innovation funding (to the tune of 400K per year) to support our graduate program efforts related to our TIE, which is essentially to fund our efforts to recruit graduate students of the type we would recruit for the new graduate program. We initially thought this funding had dried up, however we continue to receive this and so far as I can tell these are recurring funds. By the same token, while we are ecstatic that we have been able to maintain this funding, we realize that these dollars could dry up at a moments notice. THUS, our aggressive efforts to secure external funding as noted above re the PIRE Program.

7. What is the size of the targeted base of applicants to the program?

Initially, we would like to take between two to four students/yr., depending on whether they are multiple or single year offers. We've done both. This usually translates, based on past experience, to about twice the number of offers for the available slots. Our initial experiences indicate that we have had about 8 to 10 applications the first year (last year) and somewhat more this past year, although I would have to check with Dave Mackey to verify the accuracy of these numbers. Obviously, as this Program gets off the ground, especially as a well defined dedicated new Graduate Program, we hope to have more applications and increase the number of students we accept.

8. What is the minimum number of Ph.D. students needed to make the program viable?

Inasmuch as we feel this will be pretty unique, we hope to have about 10 students from OSU, with an equal number from Brazil and Rutgers for the tripartite Ph. D. program. Perhaps slightly less for those students who desire only to do an industrial internship. To be honest, I would like to discuss this with my colleagues to get their impression on this point.

I would appreciate it if you could take a few minutes and answer these questions for the subcommittee, and then email the answers back to me. I will forward the answers to other members of the subcommittee. Your responses will also help me when I present the proposal to the full CAA.

Please feel free to contact me if you have any questions. Thanks in advance for your help.

Respectfully,

Jay S. Hobgood
Associate Professor
Chair, CAA Subcommittee B

Dr.F.Robert Tabita, Ohio Eminent Scholar and Professor
Director, Plant Biotechnology & Plant Molecular Biology/Biotechnology Program
Director, Plant-Microbe Genomics Facility

Address: Department of Microbiology
The Ohio State University
484 West 12th Avenue Columbus, Ohio 43210-1292 U.S.A.
E-mail:Tabita.1@osu.edu
Fax:614-292-6337
Phone:614-292-4297
<http://www.osumicrobiology.org/faculty/ftabita.htm>

Dena Myers

From: Elliot Slotnick
Sent: Monday, June 02, 2008 1:46 PM
To: Randy Smith
Cc: Dena Myers
Subject: FW: PDP
Attachments: PDPPMBBreviseBT3.pdf

Dear Randy,

Attached is a proposal for the delivery of a new doctoral degree program in Translational Plant Sciences. The program has been vetted and approved through the Graduate School's present curriculum review processes and is ready for processing by the Council on Academic Affairs (CAA). Please let me know when we can proceed with the distribution of a Program Development Plan (PDP) of this proposal through RACGS processes.

It is my understanding that Lakshmi has completed her tour of duty in your office. Is there somebody else to whom I can send our proposals in your office so that they can be appropriately and efficiently tracked without having to burden you?

Best,
elliott

Program Development Plan

For:

A New Ph.D Graduate Program in Translational Plant Sciences

The Ohio State University Plant Molecular
Biology/Biotechnology Program
Columbus, Ohio 43210-1292
Wooster, Ohio 44691

Contact person:

Dr. F. Robert Tabita
Eminent Scholar and Professor
Director, PMBB Program
Department of Microbiology
The Ohio State University
484 West 12th Avenue
Columbus, OH 43210-1292
Phone: 614-292-4297
Fax: 614-292-6337
E-mail: Tabita.1@osu.edu

1. Designation of the new degree program, rationale for that designation and a brief description of its purpose. Basic plant sciences at The Ohio State University, particularly molecular-based studies, are very strong and are highly ranked amongst land-grant universities. The majority of faculty conducting plant-related research reside in various departments of the College of Biological Sciences (CBS) and College of Food, Agricultural, and Environmental Sciences (CFAES). Other colleges, i.e., Pharmacy, Medicine, and Engineering, also contribute to the overall excellence in plant-related research on campus. Several years ago, the interdisciplinary Plant Molecular Biology/Biotechnology (PMBB) Program was created to provide leadership in accelerating the trend towards interdisciplinary plant molecular biology research. Although it is a critically important interdisciplinary research program, the PMBB Program is not a degree granting program. Instead, students currently earn their graduate degrees in their home departments, however students can obtain a Graduate Specialization in Plant Molecular Biology/Biotechnology if they so desire that appears as an important credential on their transcripts. This has proven to be a desired option as a number of our students have opted for this PMBB Specialization. Recently the PMBB Program was recognized and selected for one of the Targeted Investment in Excellence (TIE) awards given by OSU for programs that show unusual promise for national leadership. This TIE award (in Translational Plant Sciences) provides substantial resources for the hiring of new faculty and service personnel and the purchase of large pieces of equipment to enable basic research to be more effectively “translated” to applied endeavors. Most importantly, the TIE also provides resources to develop a degree granting graduate program in Translational Plant Sciences that will basically integrate molecular laboratory research with hands-on experience in emerging areas related to the globalization of plant science, the ecological and economical aspects of agriculture and plant biotechnology, and the interplay between academia, government, industry and the public. It is fitting that the PMBB Program be the focal point for such a novel graduate program since the PMBB Program, as described above, has effectively marshaled plant-related research on campus for a number of years and has served as an important asset to the more traditional plant departments on campus. By its very nature the PMBB Program is interdisciplinary, with faculty from seven (and soon more) different departments making up a highly integrative group of researchers. Students have been attracted to this interdisciplinary effort and the opportunities it provides for career advancement. However, beyond the PMBB Graduate Specialization degree, we currently lack a dedicated Ph.D. program that meets the needs of such students. Given the importance of plant molecular biology research in global issues of bioenergy and biofuels, bioproducts and natural products, and agricultural applications, we seek to offer a novel Ph.D. program that allows trainees to bridge disciplines, countries, and the academia-government-industry-public barrier, while at the same time providing the basic training to translate basic research to applied projects. Students recruited to this new program will thus be afforded a cutting edge learning and research experience that will provide them an integrated program designed to meet individual needs and interests. This integrated program will also open a vast number of doors for our students to develop professionally once they have completed the PMBB Translational Plant Sciences Program. The flexibility and novelty of our program is demonstrated later in the proposal when we discuss the proposed curriculum. In addition to the flexibility that the Translational Plant Sciences doctoral program could provide our students, it should be stressed that there are no similar programs currently available in the state of Ohio. We thus feel that OSU and the state of Ohio possess an unusual opportunity to attract a graduate student clientele that desires more than a traditional Ph.D. program; e.g., graduates from our program will have ample opportunity and ready access to professional employment in academia, industry and governmental settings, while also gaining the ability to obtain international experience.

2. Description of the proposed curriculum. The five year-long program will combine laboratory research with a strong curriculum in plant molecular biology, genomics and bioinformatics, supplemented with a series of courses and workshops on intellectual property, regulatory measures, bio-safety, socio-economic issues pertinent to genetically modified organisms, newly emerging topics in plant sciences (e.g., biofuels/renewable energy), programming and database development, and responsible conduct of research. A six-month internship in one of the seven tracks listed below will be a highlight and a novel aspect of this program. These internships may be served at:

- a. A biotechnology company (e.g., BASF, 454 Corporation, Monsanto)
- b. International research institutions (e.g., CIP, CIMMYT, Consultative Group on International Agricultural Research institutes in Mexico, the International Rice Research Institute (IRRI) in the Philippines, the International Crops Research Institute for the Semi-arid Tropics (ICRISAT) in India, the University of São Paulo)
- c. Agricultural extension centers (e.g., centers affiliated with land-grant institutions such as Piketon)
- d. Government laboratory facilities such as the DOE and USDA national laboratories
- e. Intellectual property or science policy organization (e.g., OSU Technology Transfer Office, Rockefeller or McKnight Foundation)
- f. Faculty/TA Development Office and Department of Education-based measures to enhance the teaching skills of those inclined to use their advanced training to teach at high schools and four-year colleges¹
- g. Science writing and journalism; science policy

This multi-dimensional training, together with careful mentoring, will nurture a new breed of professionals in plant sciences who have the background to devise practical solutions with a perspective that includes public education, business, the environment, and society.

Moreover, this new training program will neither substitute nor replace any existing program but will complement traditional graduate programs and the existing PMBB specialization. It offers an excellent training opportunity for those students who are interested in pursuing careers at the interfaces between basic molecular biological work and application, societal and environmental issues. It also encourages interested faculty members to explore new avenues to combine research and training that may have long-term benefits to society and rewards for their research programs. Therefore, the Translational Plant Sciences graduate program will substantially enhance, rather than compete with, existing programs. Faculty will be encouraged to think outside the box and identify one of the aforementioned areas that are tangentially affiliated with ongoing research projects. The success and impact of the program will be evaluated periodically, for instance every two years, to identify areas for continuous improvement, and we will especially insure, along with the departments, that the new program provides the novel, multi-dimensional training that sets it apart from traditional programs.

An abridged typical five year plan for a student in the program is given in the table below. It includes required core courses and electives as well as the workshops and internships mentioned above. Required core courses (10 credits) include: Mol Gen 701 Molecular Genetics (3 cr), Biochem 702 Regulation of Gene Expression (3 cr), PCMB 622 Plant Molecular Biology (4 cr) Two of the following courses (6-8 credits) are also required: PCMB 623 Plant

¹ CBS is becoming more involved in the Graduate Interdisciplinary Specialization in College and University Teaching

Genetics and Genomics (4 cr), PCMB 625 Plant Metabolic Engineering (3 cr), Plant Path 703 Agricultural Genomics, Principles and Applications (3 cr), any course in biochemistry at the 600 level or above. In addition, there are over 20 additional courses in Plant Cell & Molecular Biology, Horticulture and Crop Sciences, Plant Pathology, Microbiology, Biochemistry,

Quarter	Year 1	Year 2	Year 3	Year 4	Year 5
Summer	Orientation session incl. training in lab safety & conduct of responsible research; Lab rotations I and II (12 wks)	Electives; Workshops on specialized topics (e.g., GMOs); Doctoral Research	Course on Scientific Writing; Complete Ph.D. candidacy examination by the last day of the quarter	Doctoral research; Extension activities	Doctoral research; Development of communication skills – involvement in case study-based training
Autumn	Core courses; Lab rotation III; Choose a thesis advisor	Electives; Doctoral research	Doctoral research	Doctoral research	Doctoral research
Winter	Core courses; Doctoral research	Biotechnology industry internship	Doctoral research	Doctoral research	Doctoral research
Spring	Core courses; Doctoral research	International research institute internship	Doctoral research	Doctoral research	Doctoral research, dissertation defense and graduation

Molecular Genetics and other departments that are recommended depending on the student's Specialization.

A more detailed typical five year plan for a student in the TPS program is given in the table of Appendix 1. This illustrative example (Appendix 1) is for a student with specific research interests in plant-microbe interactions and, as above, it includes required core courses and electives as well as the workshops and internships. Required core courses (10 credits) include: Mol Gen 701, DNA Transactions (3 cr); Biochem 702, Regulation of Gene Expression (3 cr); and PCMB 622, Plant Molecular Biology (4 cr). Two of the following courses (6-8 credits) are also required: PCMB 623 Plant Genetics and Genomics (4 cr), PCMB 625 Plant Metabolic Engineering (3 cr), Plant Path 703 Agricultural Genomics, Principles and Applications (3 cr), or any course in biochemistry at the 600 level or above. Also required is participation in a TPS seminar series, TPS 995 (1 cr), which will involve both outside speakers and student seminars. Students would be expected to present one seminar each year in this series, one the first year on their proposed research and the others on research progress. In addition, there are over 20 additional courses that are germane from the other departments listed above.

Details on the internship aspect of the program. As indicated above and in the Table of the sample Ph.D. program (Appendix 1), a specific seminar course, TPS 995, will be instituted in which the students will yearly discuss the progress of their research. As the internship program will be a fundamental part of the research experience, upon completion of the internship, the students will be required to report on their internship research experiences during this seminar. In addition, the dissertation of each student in this program will contain a chapter based on the research internship. This chapter will be evaluated by the Ph.D. dissertation committee as a fundamental part of the dissertation document. Moreover, it is worth pointing out that the

research internships will not merely be junkets to exotic and interesting places. Justification for the scientific progress of the dissertation problem will need to be provided to the Ph.D. Committee; for example, as part of collaborative interactions with faculty at partner institutions where joint Ph.D. programs are currently being developed, such as the University of Sao Paulo (USP). A key issue is that the Ph.D. problem and research will be expected to be enhanced at the internship institution over and above what might be accomplished only at OSU. Along these lines, we should point out that in April 2007 representatives from the PMBB Program joined colleagues from Rutgers and USP at a conference on biotechnology and biofuels which also featured discussions on a joint tripartite TPS-related graduate program. President Holbrook and Deans Moser and Herbers from OSU attended along with equivalent officials from Rutgers and USP. Several industrial representatives from the US and Brazil also attended. This meeting, and several recent visits of USP and OSU faculty and officials to both Columbus and Sao Paulo have been made to cement this relationship, which is absolutely relevant to the proposed new TPS Ph.D. Program. Indeed, the Dean and another official from USP recently met with representatives of the PMBB group, along with Deans Osmer, Slotnick, Herbers, and Moser in Columbus. When all is said and done, we hope to have a facile mechanism whereby faculty from OSU and USP, as well as Rutgers, can jointly participate as full members of student Ph. D. committees at each institution, with the end result that students will be able to be awarded joint degrees from the participating institutions. MOU's relative to this program have been signed by the Presidents of each of the participating institutions. This will undoubtedly serve as a model for further international joint Ph.D. programs.

Different career paths that students might pursue after their degrees are completed.

Students will have the ability to enter academia, industry, or government positions and will provide a unique perspective that will be attractive to employers. The following points are particularly relevant for positions in these areas:

academia: many of our current faculty have appointments in other countries, notably in China and India, and some in Brazil as a result of the burgeoning joint graduate program being developed between OSU and the University of Sao Paulo. The Translational Plant Sciences (TPS) graduate program would facilitate the development of such international joint appointments for a broad range of countries, particularly third world countries.

industry: in addition to typical research positions, the TPS program would prepare students for non-traditional jobs, such as international programs, intellectual property issues, regulatory affairs, etc. Usually these require extensive in-house training of employees.

government: students trained through the TPS program might fit really well into positions such as national grant program managers, international affairs, regulatory affairs, in addition to USDA research.

Admission to Candidacy Procedures. In Appendix 2 we describe the detailed procedures for the Ph.D. Admissions to Candidacy (ACE) examination for all students in this program. This proposed plan is based on the best and most effective procedures PMBB faculty have experienced from their individual departmental candidacy examinations.

3. Administrative arrangements for the proposed program: department and school or college involved. The Translational Plant Sciences graduate program will be administered in concert with the PMBB Program. The PMBB Program is already overseen by the Deans of two colleges (CBS and CFAES) and PMBB administers the Graduate Specialization in PMBB via connections and collaborations with three departments, Plant Cellular and Molecular Biology, Horticulture and Crop Sciences, and Plant Pathology as well as the Molecular, Cellular, and

Developmental Biology (MCDP) Program. However, as described above, the new Translational Plant Sciences program will present many novel options, in particular the internship program, and will attract a diverse and dedicated student clientele different from our usual applicants. The interdisciplinary nature of the PMBB Program has attracted additional faculty applicants and we will soon add faculty from the Colleges of Engineering, Pharmacy, and Medicine. Thus, students will have the opportunity to work with a truly diverse cadre of investigators and study basic molecular events related to plant metabolism in an applied context. Students will thus relate these studies to research on such varied topics as natural products, biofuels and bioenergy, plus agricultural and health-related aspects, while gaining valuable hands-on experience through the unique internship program.

Further details of the administrative structure of the program: The PMBB program is administered by a Director and an Administrative Associate. In addition, a PMBB Council was recently formed to help increase the participation of PMBB members in the direction taken by PMBB. The PMBB Council consists of four PMBB faculty, along with the Director who is an ex-officio member. Each member of Council serves two years before rotating off. Membership is staggered so that two new Council members are elected to replace two out-going members each year. This assures continuity of leadership on Council. The Council was established to assist and form a communication bridge between the Director and the PMBB members. In particular, the Council helps to organize and monitor the activities of the various committees that are responsible for PMBB-related functions. Thus, The Council provides an interface between the Director and the PMBB group and increases the flow of ideas as well as ensuring that responsibilities within the group are carried out.

A major Committee within the PMBB Program is the Graduate Studies Committee (GSC), which also has an associated Fellowship subcommittee. Like departmental GSC's, the PMBB GSC will be responsible for direct supervision of the new TPS Graduate Program. There is a GSC Chair and up to 3 additional members that sit on the GSC and/or Fellowship subcommittee. Like all PMBB committee chairs, the GSC Chair is solicited from among the PMBB group by the PMBB Council and serves for up to 3 years. A Chair-elect will be chosen from among the existing GSC members during the last year of the current Chair's appointment. GSC members are derived from the PMBB member pool and serve staggered 3 year terms to insure representative participation.

4. Evidence of the need for the new program. As previously described, the Translational Plant Sciences program will provide significant benefit to the student, the various departments, the university and the state. Ohio's economy is particularly dependent on the agricultural sector and basic research innovations that affect plant productivity and plant health. However, the number of students, particularly domestic, selecting graduate programs in the plant sciences is declining due to two main reasons: first, increasing competition from other professional careers (e.g., medicine), and second, because of the perception that only a limited number of career options are available to those who obtain a conventional graduate education in plant biology. The decline in number of graduate students is felt least acutely by top-tier institutions because they better compete for students. The new program in Translational Plant Sciences is designed to include thematic variations not in vogue at peer institutions thus providing a distinctive edge for OSU to attract the most talented and motivated students. By providing a completely novel framework for approaching research in the plant sciences, the new initiative will provide an opportunity to access a pool of students who would have otherwise been less inclined to consider the existing programs at OSU. By allowing trainees to formulate different career paths, those undecided about a research career might be enticed into exploring the unique opportunities offered by this program. Such initiatives will be essential for causing a net increase in the number of undergraduates considering a research career. Also, in the highly competitive

environment to obtain research funding and human resources, institutions with the vision to invest in career development programs for their trainees will be able to sustain very productive research programs.

5. Prospective enrollment. We have an initial five-year plan that is based on the TIE award. The TIE plan also folds in our efforts to create a dedicated new Translational Plant Sciences Graduate Program. That plan is further supported by funds awarded over a two-year period from the Board of Regents (BoR) from their Innovative Incentive Program, earmarked for supporting graduate education associated with PMBB and the recently awarded TIE. These BoR funds will be used primarily for graduate fellowships and will help initiate recruitment efforts of students from Ohio colleges as well as from institutions throughout the USA. As noted above, we will also foster student training and/or exchanges with several potential international partners. In particular, talks have progressed nicely with the University of Sao Paulo, where we have a number of existing collaborative projects and a history of cooperation in undergraduate exchange programs. Thus, students who find that their research might be enhanced by spending some time doing collaborative research at an international laboratory will be able to do so. Two types of fellowships will be implemented. The first type consists of four-year long "Excellence in Plant Molecular Biology/Biotechnology (PMBB) Graduate Fellowships". We expect to have at any given year four such fellows in the program. The second type of fellowships will be first-year graduate fellowships, and we expect to be able to support 4 such fellows each year. These fellowships will allow us to build a strong graduate program, which over the first four-years is expected to have enrollments as follows:

Year 1: 1-3 Excellence in PMBB Graduate Fellows + 4 first year = 5-7

Year 2: 2-4 Excellence in PMBB Graduate Fellows + 4 first year = 10-12

Year 3: 3-4 Excellence in PMBB Graduate Fellows + 4 first year = 15-16

Year 4: 4 Excellence in PMBB Graduate Fellows + 4 first year = 20

Students awarded one-year fellowships will subsequently be supported by funds provided by their preceptors and, depending on overall funding as the program goes forward, we may opt for this one-year fellowship/preceptor support model for all students. **Thus far, we have already succeeded in recruiting two students to our program who would not normally have chosen OSU.** In addition, we will seek funds from industry and national laboratories to help fund the intern program as these entities should find the industrial internship program attractive for the recruitment of well prepared new employees. Finally, as the new graduate program becomes established, we will be in a strong position to compete for a training grant, such as an NSF IGERT training grant, to further support this program. The NSF IGERT program is especially interested in novel graduate programs and prior discussions with IGERT officials has reinforced our confidence that we can compete for such funds. Thus, we fully expect that the new graduate program will become independently supported in the future.

Administration: Applications for these Fellowships will be derived from a dedicated recruitment and advertisement effort and/or applications may be submitted by any PMBB member to the PMBB Graduate Committee (or a special PMBB Fellowship Committee created for evaluating such applications) by January 31 of each year. This Committee will identify candidates and offers will be made shortly thereafter. Applicant quality will be the top priority.

6. Special efforts to enroll and retain underrepresented groups in the given discipline. The Ohio State University has a comprehensive Diversity Action Plan designed to increase representation of women and minorities in all of our programs. In fact, payoffs are already evident with a steadily rising minority student population. The Translational Plant Sciences graduate program will serve as a critical part of Department, Program and College efforts to implement the Plan. Ms. Cyndi Freeman-Fail, Director, Graduate Student Recruitment and

Diversity Initiatives at the Graduate School, has kindly offered to assist us in the development of relationships with HBCUs, HSIs and Tribal colleges as well as with student recruitment for research experiences and graduate study. She has presented us with a number of ideas and we are enthused to put these to practice. One of the measures of success of the program will be its ability to recruit and retain women and underrepresented minorities. PMBB faculty, staff and participating departments and graduate programs will work together to recruit a diverse population of trainees. Among the available strategies we have identified are: attempting to recruit our own talented undergraduates; attempting to recruit undergraduate students from other institutions that come to Ohio State summer internship programs, REU programs, etc. Indeed, the PMBB Program recently established a Summer Undergraduate Research Experience (SURE) program in plant sciences; a program that will bring to OSU about eight to ten superior participants each summer for a period of about 10 weeks to work in PMBB member laboratories. The SURE program is funded by our TIE/BoR funds for Translational Plant Sciences and will provide an opportunity for students to explore what OSU has to offer for graduate education and interact with current PMBB faculty members and graduate students. As such, it will be a distinct recruitment tool for acquainting top students with the proposed Translational Plant Sciences graduate program. As part of our recruitment efforts, we will also build on established linkages with regional institutions with large minority enrollments, including Central State University, Wilberforce University, and Cleveland State University. We will also tap into diversity networks and minority registries and build on existing contacts at minority institutions where we have successfully recruited students in the past, including Kentucky State University, Howard University, California State University at San Marcos, and Leman College in New York City (part of CUNY). Furthermore, we will coordinate our efforts with diversity efforts at Ohio State in individual colleges, coordinate our work with the OSU Graduate School as discussed above, and work closely with the NSF IGERT National Recruitment Program. It should be noted that several programs already exist at OSU to help enhance minority participation. For instance, the Ohio Young Scholars Program was created in 1988 to increase the number of African-American, Hispanic and Native American students. We believe that our Translational Plant Sciences trainees can do their share in this regard. As part of our commitment to the long-term goal of enhanced minority involvement, we will encourage all of our minority interns to serve in leadership roles at the Office of Minority Affairs wherein they will meet younger students to motivate, encourage and illustrate by example how higher education can become meaningful in their lives.

7. Availability and adequacy of the faculty and facilities available for the new degree program. The PMBB Program faculty is currently comprised of 30 scientists from seven different Departments from both the Columbus and Wooster campuses (see Appendix 3 for a listing of the PMBB faculty). The PMBB Program provides a focus to plant-related research efforts, enabling participating scientists to more effectively take advantage of potential interdisciplinary and collaborative research efforts. In addition, the PMBB Program fosters interactions between basic and applied scientists to facilitate the transfer of laboratory technology to the field, and ultimately new products. Our faculty lead well supported research programs with state of the art facilities. All PMBB faculty have experience in training graduate students and there is a distinct history of placing our Ph.D. graduates in highly visible academic, industrial, and government positions.

With respect to prospective funding sources for the students, the current TIE award in Translational Plant Sciences, and the 2 years of Regents Innovation funds received for this program, have allowed us to begin the recruitment of students to this new program (currently admitted via our existing PMBB Graduate Specialization Program) (see parts 5 and 6 above). As part of our efforts to recruit students into this new Ph.D. Program, who would not normally choose OSU, we have initiated the Summer Undergraduate Research Experience program

(SURE). The goal is to attract outstanding undergraduate students who subsequently choose OSU for graduate school. Thus far, we have been successful in recruiting a number of outstanding undergraduates to this program and we look forward to some of these students deciding to stay at OSU for their Ph.D. studies in Translational Plant Sciences.

There are additional institutional and extramural sources of funding that will come into play to provide stipends for our students. These include one recruitment fellowship provided by the PMBB Program and other potential funding that is in negotiation with the Third Frontier-funded Ohio Bio-Products Innovation Center (OBIC). (OBIC is a partner in our TIE). Other funding sources for students where the PMBB group is a major player include the state-funded Ohio Plant Biotechnology Consortium, administered by OARDC and the OSU Institute for Energy and the Environment (IEE), which provides for some support in the form of starter grants. A major source of funding will come from extramural funds provided by PMBB members; this includes over \$ 9 million in OSURF funds expended during the last fiscal year by PMBB faculty. Typically, faculty advisors will pay the GRA stipends and fees of advisees from these extramural grants. Finally, we fully expect that by the time that the current TIE award expires that we will have secured a major training grant for students enrolled in this program. Please note that we have been advised by NSF that our proposed program definitely meets their requirement for innovative graduate study and they are particularly interested in our international internship component.

8. Need for additional facilities and staff and the plans to meet this need. The OSU Targeted Investment in Excellence in Translational Plant Sciences is a once-in-a-lifetime opportunity that will provide start-up funds to add faculty and to accelerate the rise of OSU into one of the top plant molecular biology and plant science groups in the nation. The TIE award will greatly strengthen applied and basic research in three specific areas: (a) bioenergy and carbon sequestration, (b) sustainable bioresources and bioproducts, and (c) plant-microbial interactions. Each focus is an area targeted for future investment by national funding agencies (NSF, DOE, USDA). Our goal is to hire exceptional faculty members who will build strongly-funded research programs in the above areas and bring international prominence. New hires will target strategic fields in each of the three areas to complement existing strengths and lead to team building. Their cutting edge basic research will in turn support, directly or indirectly, the needs and priorities of applied research, a synergy representing the “translational” impetus of this proposal. The funds awarded from Targeted Investment are based on the addition of at least five new hires in the departments of PCMB, Plant Pathology, H&CS, and Microbiology, with additional opportunities for expansion through ever expanding interactions with other programs such as Food & Nutritional Sciences, Pharmacy, and Chemical & Biomolecular Engineering. In addition, funds are available to hire new support staff and purchase needed large equipment items. Clearly, the new proposed graduate program in Translational Plant Sciences fits hand and glove with the recent TIE award in the same subject area.

9. Projected additional costs associated with the program and evidence of institutional commitment to meet these costs. There are no additional costs associated with the proposed new graduate program as the preceding pages have documented the institutional support for this program in the form of the TIE award and the Innovative Incentive BoR funds for graduate education. All funding sources are in place to establish this novel graduate program.

Appendix 1. A typical detailed Ph.D. program for a student specializing in plant-microbial interactions

Quarter	Year 1	Year 2	Year 3	Year 4	Year 5
Summer	Orientation session incl. training in lab safety & conduct of responsible research; Lab rotations I and II (12 wks)	Workshop: HCS 694 (4), Group Studies on DNA Microarrays; Biochem 706 (5), Advanced Biological Chemistry Lab; Doctoral Research	Newly developed TPS course on scientific writing; Complete Ph.D. candidacy examination by the last day of the quarter	Plnt Pth 685 (2); Field Plant Pathology (Extension Experience); Doctoral research	Doctoral research; Plnt Pth 830, Special Studies (Development of communication skills – involvement in case study-based training)
Autumn	Plnt Pth 600 (3), Introduction to Bacterial and Viral Plant Pathogens; PCMB 623 (4), Plant Genetics and Genomics; TPS 995 (1), Seminar ; Lab rotation III; Choose a thesis advisor	Mol Gen 701 (3), DNA Transactions; Biochem 761 (3), Advanced Biochem: Proteins; Special Topics; TPS 995 (1), Seminar; Doctoral research	TPS 995 (1), Seminar; Doctoral research	TPS 995 (1), Seminar; Doctoral research	TPS 995 (1), Seminar; Doctoral research
Winter	Plnt Pth 660 (5), Mycology; PCMB 622 (4), Plant Molecular Biology; TPS 995 (1), Seminar; Doctoral research	Plnt Pth 842 (3), Plant Responses to Infection; Biochem 702 (3), Regulation of Gene Expression; TPS 995 (1), Seminar; Doctoral research	Biotechnology industry internship, Monsanto Company	TPS 995 (1), Seminar; Doctoral research	TPS 995 (1), Seminar; Doctoral research
Spring	Plnt Pth 602 (3), Plant Microbe Interactions; TPS 995 (1), Seminar; Doctoral research	Plnt Pth 703 (3), Agricultural Genomics; PCMB 722 (3), Plant Transgenic Systems; TPS 995 (1), Seminar; Doctoral research	International research institute internship, International Rice Research Institute (IRRI), Philippines	TPS 995 (1), Seminar; Doctoral research	TPS 995 (1), Seminar; Doctoral research, dissertation defense and graduation

Appendix 2. Procedures for the Translational Plant Sciences Admissions to Candidacy Examination (ACE)

Timing. A student should take the ACE by no later than the end of their third year in the program. By this time the student should have (1) completed the course requirements with a GPA of at least 3.0, and (2) defined and become well ensconced in the dissertation research. Exceptions will be considered by the GSC in individual cases, within the guidelines of the Graduate School Handbook.

A student planning on taking the ACE should meet with their Advisory Committee at least several months before the exam to work out the final aspects of fulfilling the course requirements and to update the committee on the progress in research (The Advisory Committee will consist of 4 PMBB faculty members, including the student's advisor and will be chosen in consultation with the advisor). Written documentation of readiness to take the ACE should be submitted to the GSC by the student's advisor.

This documentation should include:

- (a) an updated CV of the student,
- (b) a list of graduate courses taken and grades, and
- (c) a brief description of the student's current and intended research.

If possible, all documents should be submitted as PDF's to facilitate timely distribution among the GSC members for evaluation. GSC approval is required for the ACE to proceed.

i. Written Portion

1. The objective of the ACE is to test the student's ability 1) to identify an important area of research, b) to formulate meaningful and testable hypotheses, c) to select strategic and feasible methodology, d) to explain the context (literature and relevant data) of the questions, and e) to write a coherent and convincing grant proposal.
2. The student proposes to its Advisory Committee one to three possible topics in an area different from the student's doctoral research to form the subject for the grant proposal.
3. The Advisory Committee will evaluate and approve the topic of the proposal. This can be done easily by e-mail communication, or by a meeting between and student and the Advisory Committee if so desired.
4. The grant proposal should represent the student's own creativity and intellectual work. A proposal previously written by the student and evaluated by peer review cannot be used for the ACE. An example is a proposal submitted to fulfill course requirements. Nor is a proposal acceptable if it overlaps extensively with existing grant proposals, for example those from the student's advisor.
5. After the Advisory Committee has approved the topic of the proposal, the student submits a one-page summary of the proposal to the Advisory Committee. The topic must be approved unanimously by the student's Advisory Committee. A committee member indicates approval by signing the summary or by e-mail communications. If the topic is rejected, the above steps are repeated.
6. Upon approval, the student has 4 weeks to complete the grant proposal. During the process, the student may consult fellow graduate students and postdoctoral researchers on ideas and on the proposal itself. Faculty input should be minimal. Any major participation of the research advisor in the proposal preparation must be documented. However, both the student and the advisor should be fully aware that any significant inputs from the advisor on the proposal may jeopardize the quality of the ACE. The student should be prepared to fully defend and justify the proposal orally.

7. The format should follow that required by the agency to which the proposal will be “submitted”. In any case, it should be no longer than 10 pages, single-spaced with one inch margins and a 12 point font. Included in the 10 pages are figures and tables, but not references (SEE DESCRIPTION BELOW).

8. The student submits copies of the completed proposal and evaluation form to the Advisory Committee. Each committee member provides a written evaluation and a numerical rating. The advisor collects the completed Evaluation Forms and comments and distributes copies to the candidate and to all members of the Candidacy Exam Committee.

9. If the proposal is judged acceptable as is or with minor revision, an Oral Examination is scheduled and conducted in no sooner than two weeks. If one or more member(s) of the Committee indicates that the proposal requires major revisions, the student shall submit a revised proposal to the Committee within two weeks.

10. If the revision is acceptable, an Oral Exam is scheduled. If the revised proposal is still judged as seriously flawed, the Committee can either recommend that: The student be given the option of canceling the exam with an overall grade of Unsatisfactory. If this option is chosen, the Chair of the Candidacy Exam Committee returns the exam results form to the Graduate School along with a letter signed by the student to waive his/her right to take the Oral part of the ACE. Or the candidacy exam may be rescheduled at the discretion of the Committee.

The proposal format should follow that required by the agency (NSF, USDA, NIH, DOE) to which the proposal will be “submitted”. In any case, it should be no longer than 10 pages long, single-spaced with one inch margins and a 12 point font. Included in the 10 pages are figures and tables, but not references. Sufficient information needs to be included to facilitate an effective review by committee members without requiring them to refer to the literature.

Abstract The abstract should be one paragraph, not to exceed 250 words. It should be a summary statement of the background, research goals, methodology, and expected outcomes and impact.

Aims & Hypotheses The specific aims of the proposal and the hypotheses to be tested should be clearly defined and justified.

Background The introductory portion of the proposal should discuss the current status, knowledge gaps, and/or pressing issues in field of the proposed research. This discussion serves the purpose of formulating testable hypotheses. It needs to be presented such the reviewers are convinced of the importance, necessity and feasibility of the proposal research. The writing needs to maintain a balance between providing sufficient information and brevity.

Experimental design The experiments should be well planned to convince reviewers that they will succeed. This section should not be simply a listing of the techniques to be used or a detailed description of methods. Rather, it should be a general experimental design with brief and informative description of key aspects of the methods with thoughtful justifications. It is important to discuss why a particular method is used, what pros and cons are associated with method, and what alternative approaches will be used. It is also essential to discuss how data generated from an experiment will be analyzed and interpreted.

References All cited references should be listed at the end of the project description, following the formats for full citation (i.e., with all authors’ names, complete article title, inclusive pages numbers and year of publication listed) established by major journals.

When the proposal is written, the student should make copies “Research Proposal Evaluation Form”. The student should fill in the top half of the form and distribute it to each

member of the Advisory Committee. The student should ensure that his/her advisor is aware of the date of return of the evaluations and that the advisor notifies the members of the committee to return the evaluations in a timely fashion.

At the time of final stages of proposal preparation, the candidate should obtain the form for Scheduling the Candidacy Examination from the Graduate School office (250 University Hall). The candidate should arrange a time and place for the oral examination and file the form with the Graduate School at least two weeks prior to the scheduled date of the oral portion of the Examination.

Review of the Admission to Candidacy Exam: The grant proposal will be evaluated by each member of the Advisory Committee. Each member will give an overall score and provide a written review. The proposal is evaluated with respect to the quality of the research questions being asked, the methodology, logic, and writing. These comments help the student prepare for the oral defense of the proposal, which constitutes the second required portion of the ACE.

- The Oral Exam be scheduled and the student be evaluated on the basis of both the written and oral portions of the ACE.

ii. Oral Portion

1. The Committee that conducts the Oral Portion of the ACE consists of at least four faculty members.
2. The Oral portion of the ACE will be held no sooner than two weeks after the Advisory Committee approves the written part of the proposal. It is strongly encouraged that this portion of the ACE be conducted immediately after the two-week grace period. This portion should last for no more than 2 hours. During this two-hour period, the Committee should focus on questioning the student about the content of the proposal and about any subjects directly or indirectly related to it. These could include techniques, current literature, and basic and broad biological background. The Exam could also test student's awareness of current and new progresses in plant biology/general biology and biology-related social issues.
3. The Oral and the Written Portions are considered one exam. It is possible that either the Written or Oral portion is judged Unsatisfactory, but is counterbalanced by a sufficiently good performance on the other portion to obtain an overall Satisfactory grade. Committee approval must be unanimous.
4. If the student fails the exam, the Committee must decide (a) whether the student is or is not permitted to take a second ACE, and (b) whether all or part of the exam should be repeated (see relevant sections in the Graduate School Handbook.)
5. At the end of the ACE, the result will be given to the student and be recorded on the Graduate School form. A copy of this form must be delivered to the GSC Chair and the original returned to the Graduate School.

Appendix 3. PMBB faculty and their affiliation

[(Note; members from nonplant departments all have appointments in at least one of the three plant-related departments of Plant Pathology, Horticulture and Crop Sciences, and Plant Cellular and Molecular Biology (PCMB)]

In Columbus

armstrong.275@osu.edu	Greg Armstrong	PCMB
bisaro.1@osu.edu	Dave Bisaro	Molecular Genetics
bonello.2@osu.edu	Enrico Bonello	Plant Pathology
coplin.3@osu.edu	Dave Coplin	Plant Pathology
ding.35@osu.edu	Biao Ding	PCMB
gopalan.5@osu.edu	Venkat Gopalan	Biochemistry
graham.1@osu.edu	Terry Graham	Plant Pathology
graham.19@osu.edu	Madge Graham	Plant Pathology
grotewold.1@osu.edu	Erich Grotewold	PCMB
hamel.16@osu.edu	Patrice Hamel	PCMB
jang.40@osu.edu	Jyan-Chyun Jang	Hort. & Crop Sciences
lamb.129@osu.edu	Rebecca Lamb	PCMB
mackey.86@osu.edu	David Mackey	Hort. & Crop Sciences
meier.56@osu.edu	Iris Meier	PCMB
metzger.72@osu.edu	Jim Metzger	Hort. & Crop Sciences
mittchell.815@osu.edu	Tom Mitchell	Plant Pathology
sayre.2@osu.edu	Dick Sayre	PCMB
scholl.1@osu.edu	Randy Scholl	PCMB
somers.24@osu.edu	David Somers	PCMB
tabita.1@osu.edu	Bob Tabita	Microbiology
verma.1@osu.edu	Desh-Pal Verma	Molecular Genetics
wang.620@osu.edu	Guo-Liang Wang	Plant Pathology

in Wooster

finer.1@osu.edu	John Finer	Hort. & Crop Sciences
francis.77@osu.edu	David Francis	Hort. & Crop Sciences
jones.1968@osu.edu	Michelle Jones	Hort. & Crop Sciences
mcspadding-garden.1@osu.edu	McSpadden Gardener Brian	Plant Pathology
meulia.1@osu.edu	Tea Meulia	OARDC
pratt.3@osu.edu	Rich Pratt	Hort. & Crop Sciences
redinbaugh.2@osu.edu	Peg Redinbaugh	OARDC, Plant Pathology
stockinger.4@osu.edu	Eric Stockinger	Hort. & Crop Sciences
vanderknaap.1@osu.edu	Esther van der Knaap	OARDC, Hort. & Crop Sciences