

MISSOURI DEPARTMENT OF HIGHER EDUCATION

FORM NP: NEW PROGRAM PROPOSAL FORM

Sponsoring Institution(s): Washington University  
Program Title: PhD in Plant and Microbial Sciences  
Degree/Certificate: degree  
Options: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
Delivery Site(s): Washington University, Danforth Campus  
CIP Classification: 26.0399  
Implementation Date: September 26, 2013  
Cooperative Partners: \_\_\_\_\_  
Expected Date of First Graduation: May 2015

AUTHORIZATION

Name/Title of Institutional Officer:

Holden Thorp, Provost

Signature H. Holden Thorp Date 10/30/13

Person to Contact for More Information:

Susan E. Hosack, University Registrar

Telephone: (314) 935-5567

MISSOURI DEPARTMENT OF HIGHER EDUCATION

Form SE: STUDENT ENROLLMENT PROJECTIONS

Year	1	2	3	4	5
Full Time	5-10	10-15	10-20	20-30	30-40
Part Time	0	0	0	0	0
Total	5-10	10-15	10-20	20-30	30-40

Form PS: PROGRAM STRUCTURE

A. Total credits required for graduation: 72

B. Residency requirements, if any: \_\_\_\_\_

C. General education: Total credits: \_\_\_\_\_ (SEE ATTACHED)

Courses (specific courses OR distribution area and credits):

\_\_\_\_\_ cr. \_\_\_\_\_ cr. \_\_\_\_\_ cr.

\_\_\_\_\_ cr. \_\_\_\_\_ cr. \_\_\_\_\_ cr.

D. Major requirements: Total credits: \_\_\_\_\_

\_\_\_\_\_ cr. \_\_\_\_\_ cr. \_\_\_\_\_ cr.

\_\_\_\_\_ cr. \_\_\_\_\_ cr. \_\_\_\_\_ cr.

E. Free elective credits: \_\_\_\_\_ (Sum of C, D, and E should equal A.)

F. Requirements for thesis, internship or other capstone experience: (SEE ATTACHED)

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

G. Any unique features such as interdepartmental cooperation:

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

## MISSOURI DEPARTMENT OF HIGHER EDUCATION

### Form PG: PROGRAM CHARACTERISTICS AND PERFORMANCE GOALS

Institution Name: Washington University  
Program Name: PhD in Plant and Microbial Sciences  
Date: September 26, 2013

(Although all of the following guidelines may not be applicable to the proposed program, please carefully consider the elements in each area and respond as completely as possible in the format below. Quantification of performance goals should be included wherever possible.)

#### Student Preparation (SEE ATTACHED)

- Any special admissions procedures or student qualifications required for this program which exceed regular university admissions, standards, e.g., ACT score, completion of core curriculum, portfolio, personal interview, etc. Please note if no special preparation will be required.
- Characteristics of a specific population to be served, if applicable.

#### Faculty Characteristics (SEE ATTACHED)

- Any special requirements (degree status, training, etc.) for assignment of teaching for this degree/certificate.
- Estimated percentage of credit hours that will be assigned to full time faculty. Please use the term "full time faculty" (and not FTE) in your descriptions here.
- Expectations for professional activities, special student contact, teaching/learning innovation.

#### Enrollment Projections (SEE ATTACHED)

- Student FTE majoring in program by the end of five years.
- Percent of full time and part time enrollment by the end of five years.

#### Student and Program Outcomes (SEE ATTACHED)

- Number of graduates per annum at three and five years after implementation.
- Special skills specific to the program.
- Proportion of students who will achieve licensing, certification, or registration.
- Performance on national and/or local assessments, e.g., percent of students scoring above the 50th percentile on normed tests; percent of students achieving minimal cut-scores on criterion-referenced tests. Include expected results on assessments of general education and on exit assessments in a particular discipline as well as the name of any nationally recognized assessments used.
- Placement rates in related fields, in other fields, unemployed.
- Transfer rates, continuous study.

#### Program Accreditation (SEE ATTACHED)

- Institutional plans for accreditation, if applicable, including accrediting agency and timeline. If there are no plans to seek specialized accreditation, please provide reasons.

#### Alumni and Employer Survey (SEE ATTACHED)

- Expected satisfaction rates for alumni, including timing and method of surveys
- Expected satisfaction rates for employers, including timing and method of surveys

# PROPOSAL FOR NEW DEGREE PROGRAM GRADUATE SCHOOL OF ARTS AND SCIENCES

## Plant and Microbial Biosciences Program June 26, 2013

### I. OVERVIEW

The Plant Biology Program, one of 12 graduate programs in the Division of Biology and Biomedical Sciences (DBBS), has an established record of educating graduate students for successful careers in both academia and industry. Our program faculty conducts exciting, competitive, and well-funded research programs encompassing a wide range of fundamental questions in plant and microbial biology, including: physiology, biochemistry, cell biology, environmental sensing, signal transduction, regulation of gene expression, metabolism, genomics, structural biology, plant growth and development, plant-microbe interactions, molecular evolution, and ecology, as well as applications of plant and microbial sciences for energy production, enhancing agriculture, and addressing environmental problems.

The increasing number of faculty affiliated with the Plant Biology Program who are interested in microbial systems (Program faculty currently working on microbial systems are indicated by an \*\* on the attached program faculty list) has resulted in a gradual expansion in the emphasis of our program. However, although many of our current faculty combine plant and microbial systems for a variety of research directions, we have had difficulty attracting students interested in microbial systems to apply to our program. We believe this is due in part to the lack of visibility of our microbial research programs. Thus, we propose to restructure the program and change its name to "***Plant and Microbial Biosciences***" and shift the emphasis of our curriculum to better reflect both the research interests of the faculty in the Program and the expanding role of microorganisms in biology. These changes and restructuring were unanimously approved by the Executive Council of DBBS.

### II. NEED FOR NEW DEGREE PROGRAM

Many faculty affiliated with DBBS study microbial organisms to explore a wide-range of fundamental biological questions. For example, members of the Molecular Microbiology and Microbial Pathogenesis program (MMMP) are internationally recognized leaders in molecular microbiology with an emphasis on understanding the fundamental biology of medically relevant microorganisms and the diseases they cause. Several faculty in the Plant Biology and other DBBS programs also study microbial systems, covering a diverse range of microbial systems and research interests.

Despite success in training graduate students, both the Plant Biology and MMMP programs could do a better job of recruiting students in broader areas of microbiology, including microbe-generated biofuels, plant-pathogen interactions, and the basic physiological processes that take place in non-pathogenic bacteria, archaea, and eukaryotic microbes. We are aware of a pool of prospective graduate students interested in these areas, as they apply to other well-known microbiology programs (e.g. University of Wisconsin-Madison, UC-Berkeley, etc). We do not see a significant

number of these students applying to DBBS programs and suspect this is because these prospective students are not aware of the existing strength and breadth of research focusing on non-pathogenesis-related microbiology at Washington University.

As a step towards solving this problem, we propose to change the name of the Plant Biology program to "***Plant and Microbial Biosciences***" (PMB) and expand the program to include educational opportunities for students interested in studying a broader range of microbial organisms. The new name better reflects the breadth of research interests of the faculty currently affiliated with the Plant Biology Program, increases the visibility of the strong scientific expertise in the biology of non-pathogenic microbial systems at WUSTL to the scientific community and to prospective students, and emphasizes the integrative nature of the program.

We anticipate both the name and curricular changes will draw an increased cadre of high-quality applicants to WUSTL. Moreover, the PMB program will provide an intellectual center for the increasing number of WUSTL faculty, not only at the Medical School and in Arts and Sciences, but also in the School of Engineering, studying microbes that are neither "plants" nor pathogens. By attracting a more diverse group of students and faculty, this change will enrich microbial research across all programs and campuses.

### **III. PROGRAM REQUIREMENTS AND IMPACTS ON OTHER DBBS PROGRAMS**

#### Requirements

A total of 72 units of graduate credit are required. Formal coursework requirements include: 3 core courses, 2 advanced electives, 1 semester of PMB seminar, an ethics course (16 units) and 1 semester of teaching assistantship for a total of 17 units. Students will be required to satisfactorily complete a qualifying examination within the 1<sup>st</sup> two years. Research training is initiated by a series of required research rotations in the first year. Students will choose a thesis lab at the end of the 1<sup>st</sup> year and present a thesis proposal by the end of the second year. The culmination of the degree will be the successful defense of a thesis, demonstrating a significant contribution of new knowledge, to a committee approved by the Graduate School.

#### Curriculum

The Plant and Microbial Biosciences Program trains Ph.D. students to have a strong background in modern biology, as well as research training specific to vascular plants, mosses, algae, photosynthetic prokaryotes, and other microbes as experimental organisms to address both fundamental and applied biological questions. Seminars and journal clubs help members of the program stay current with the latest scientific advances.

#### Core courses (10 credits)

1. One PMB-specific grad level course in Fall (2 credits, taken in Fall of year 1)
  - Bio 5xx: Proposed Name: Experimental Design and Analysis in Biological Research
  - 2 credits: Meet 2 hours per week

- Format: Critical reading course, focusing on experimental logic, design, interpretation and methods in biology.
  - Topics of research papers chosen to illustrate important areas/concepts/approaches etc taken from in Plant biology, Microbiology, Genomics, etc.
  - Instructors: Course master: Petra Levin, with participation by two additional program faculty to lead discussion
2. Nucleic Acids and Protein Biosynthesis (Bio548, 3 credits)
  3. Modern Approaches in Plant and Microbial Research; Bio 40xx (3 credits, taken in Spring of year 1). Revised version of Bio4028: From Seeds to Senescence (Haswell et al).
    - Project based course, emphasis on active learning, student participation
    - Introduction to series of different experimental approaches, hands-on workshops
    - Students choose a research question at start of course, develop specific aims and write a grant proposal (proposal can be further developed for QE)
  4. Bio572: Seminar in Plant and Microbial Biosciences (Journal Club; 1 credit)
    - Required for G2 students, in Fall semester
    - Proposed change to format:
      - Link to Microbe & Plant Lunch, with presenter staying to discuss a research paper with the students in the class after presentation.
      - Topics chosen to cover areas relevant to training students in plant, microbial, computational biology, etc. Course master will help with choice of papers to be discussed
  5. Ethics and Research Science; Bio 5011 (1 credit, Spring, taken in year 2)
  6. Teaching Assistantship (1 credit, during Second year)

Electives: Recommended courses (need at least 6 credits of advanced electives)

- How Plants Work (Fall odd years; Bio 4023; 3 cr)
- Advanced Genetics (Spring); Bio 5491; 3 credits.
- Fundamentals of Molecular Cell Biology (Fall); Bio 5068; 4 credits
- Molecular Microbiology & Pathogenesis (Spring); Bio 5392; 3 credits
- Protein Analysis, Proteomics and Protein Structure Laboratory (Spring); Bio 4522; 3 credits
- Developmental Biology (Spring); Bio 5352; 3 credits
- Bioenergy (Spring); Biol 4830; 2 credits
- Algae: Cell Biology and Molecular Evolution (Spring) Bio4331; 2 credits
- Computational Molecular Biology (Fall) Bio 5495; 3 credits
- Genomics (Spring) Bio 5488; 3 or 4 credits
- Statistics for Medical and Public Health Researchers; Math 507; 3 credits
- Electron Microscopy of Cellular Structures and Processes (Spring) Bio4330; 4 credits
- Special Topics in Microbiology (Fall) Bio5127; 2 cr

- Metabolic Engineering and Synthetic Biology (EECE 596A); Fall
- New courses we are considering adding to recommended advanced electives:
- Biotech Industry Innovators (Bio 5014), Spring

### Summary of curricular changes

The proposed name change will be accompanied by an expansion and shift in emphasis of the program, including a change in our offerings of core courses for first year students. These two core courses, "Modern Approaches in Plant and Microbial Research (Bio 40xx)" and "Experimental Design and Analysis in Biological Research" (Bio 5xx) will emphasize scientific concepts and experimental approaches, help students to strengthen their critical reading and thinking skills, develop hypotheses, and design experiments to test these hypotheses. Accordingly, the courses cover material relevant to all students in the proposed PMB program (or in DBBS for that matter), regardless of the research system they are primarily interested in. Additional information about these courses is provided in the attached document ("Overview of Programmatic Changes & Curriculum"). It should be emphasized that the proposed name change and development of integrated courses reflects the current situation in the Plant Biology program, in which labs using both plants and microbes as model organisms blend to address cutting-edge scientific questions. Training students to see how knowledge, approaches, and insights intersect across multiple fields is a critical skill for future researchers. For more details on proposed course work, please see accompanying document.

These changes will not alter the curriculum for current students, nor would it affect faculty membership in the program or on the steering committee. Following approval by the Executive Council and the Graduate Council, the new graduate program name "Plant and Microbial Biosciences Program" will go into effect for all incoming students. Students currently in the program will be given the choice whether or not to affiliate with the new program name.

### Impact on other DBBS programs

This proposed name change will result in two programs at WUSTL (PMB and MMMP) that will appeal to students interested in studying microbes. Although we believe there will be some degree of overlap between the PMB and MMMP programs, as there is between most programs in DBBS, we anticipate that this will only enrich and promote the study of microbiological-related topics at our University. Many MMMP and Plant Biology faculty already have close interactive contacts and this change should strengthen both programs and lead to even more interactions. To ensure that students are routed to the most appropriate program, we suggest that the admissions committees for the two programs consult during application review. A similar process already takes place with the Plant Biology and Evolution, Ecology, and Population Biology (EEPB) graduate programs, which often exchange applications to guide students to the program best suited to their interests.

The MMMP program endorses the proposed PMB Program. We have discussed our curricular and programmatic changes with the leadership and several faculty members of the MMMP program, and their input during this process has been very helpful.

#### **IV. SELECTION OF CANDIDATES AND ADMISSION CRITERIA**

##### Academic Requirements of Qualified Applicants

A bachelor's degree in the sciences will be required of all applicants. Generally, applicants will have a degree in one of the biological sciences, but applicants interested in Plant and Microbial Sciences with appropriate experience who have degrees in related fields (e.g. chemistry, computer science or engineering) will also be considered.

##### Review of Applications

Candidates must submit an application for the Graduate School located at <http://graduateschool.wustl.edu> and must meet the basic admission requirements of the Graduate School and the degree program. Applications will be reviewed by the Assoc. Dean for Graduate Studies (DBBS) and the Admissions Committee of the Plant and Microbial Biosciences Program before recommendation to the Dean of the Graduate School of Arts and Sciences for final approval. Important criteria considered for a successful application include: curriculum and undergraduate grades; research experience; letters of recommendation; scientific maturity; scores on the Graduate Record Examination. In addition, graduates of non-English-speaking institutions will be required to take the Test of English as a Foreign Language.

#### **V. PROGRAM ADMINISTRATION**

##### Steering Committee and Program Director

The Steering Committee is responsible for student recruitment, student advising, and establishing Program guidelines. The Steering Committee will be composed of 5-6 full-time Washington University professors (any rank) whose primary or secondary affiliations within DBBS are with the Plant and Microbial Biosciences Program. The committee should be made up of a representative combination of faculty members working primarily on microbial or plant systems. The Program will be led by two Co-Directors, who will also serve as the co-chairs of the Steering Committee. The Directors must also be a full-time Washington University professor whose primary affiliations are with the Plant and Microbial Biosciences Program. The term for Program Director is normally 3-5 years. Only Program members who are full-time Washington University faculty are eligible to participate in the selection of Steering Committee members and selection of the Program Directors.

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

##### Evaluation of Student Performance

Overall evaluation of student performance is the responsibility of the Steering Committee and Program Director. They will monitor successful progress towards the degree by ensuring: students satisfactorily complete appropriate coursework; satisfactorily complete the qualifying exam created by their designated faculty; timely

formation of a thesis advisory committee and completion of the thesis proposal; timely interim reports from the thesis advisory committee, addressing any deficiencies that arise during the course of thesis work; and timely defense of the thesis.

### Academic Calendar

Coursework will follow the Academic Calendar of the School of Arts and Sciences but students will have 12 month appointments, not subject to the academic calendar.

## VI. RESOURCES AND SUPPORT

The new program is a reorganization of existing faculty in the Plant and Molecular Microbiology and Molecular Pathogenesis Programs. Support for students will continue with initial funding coming from DBBS endowment or training grants as appropriate. Support for students after the initial period of support will come from mentors and/or the mentor's department.

No new resources are required, although plans are in progress to increase endowment and initiate a training grant to include students from this new Program.

## VII. FACULTY

### Training Faculty

(X) = Primary DBBS affiliation: P = Plant, B = Biochem, E = EEPB, G = Mol Genetics, C = Computational and Systems Biology \*\*Plant faculty that study microbial systems

- **Wayne Barnes (P)** (*Department of Biochemistry*) PCR development; plant genetic engineering for insect or virus resistance.
- **Ivan Baxter (P)** (*Donald Danforth Plant Science Center*) Using high-throughput elemental profiling and quantitative genetics to understand how plants adapt to the environment.
- **Robert Blankenship\*\* (P)** (*Departments of Biology and Chemistry*) Molecular mechanisms of energy storage in photosynthetic systems. Photosynthetic bacteria
- **Tom Brutnell (P)** (*Donald Danforth Plant Science Center*). Developing tools and resources for the analysis of cereal crop genomes for the analysis of light response and C4 photosynthesis in maize and some of the most promising biofuels feedstocks.
- **Rainer Bussman (P)** (*Missouri Botanical Garden*) Agricultural origins; ecology; Ethnobotany; medicinal plants; paleoethnobotany; plant biology
- **James Carrington (P)** (*Donald Danforth Plant Science Center*) RNA-mediated regulation and silencing of genomes, genes and viruses. Combining genetics, genomics, computation and other approaches to address fundamental mechanistic problems using model systems, such as *Arabidopsis thaliana* and *Brachypodium distachyon*.
- **Thomas Croat (P)** (*Missouri Botanical Garden*) Systematics and ecology of Araceae.
- **Ram Dixit (P)** (*Department of Biology*) Molecular mechanisms of cytoskeleton organization and function in plants; regulation of cell shape and division.
- **Susan Dutcher\*\* (MGG)** (*Department of Genetics*) The role of centrioles in cell cycle progression and flagellar biogenesis in *Chlamydomonas*.
- **Gayle Fritz (P)** (*Department of Anthropology*) Analysis of archaeological plant remains; evolution of agricultural societies.
- **Ursula Goodenough\*\* (P)** (*Department of Biology*) Molecular genetics and evolution of sex

- in *Chlamydomonas*. Recently initiated studies on lipid-body biogenesis in *Chlamydomonas*, to contribute to the international effort to produce algal biodiesel as a transportation fuel.
- **Elizabeth Haswell\*\* (P)** (*Department of Biology*) Mechanotransduction and mechanosensitive ion channels in plants; organelle morphology determination. Mechanosensitive ion channels in *Escherichia coli*.
  - **Leslie Hicks (P)** (*Donald Danforth Plant Science Center*). Establishing methods, methodologies, and concepts to set the foundation for practical, and meaningful applications of proteomics and metabolomics in addressing important biological questions. Current research area: Development and application of gel- and liquid-based targeted methods to identify proteins using thiolbased redox switches.
  - **Jan Jaworski (P)** (*Donald Danforth Plant Science Center*) Biosynthesis and metabolism of plant fatty acids and lipids. Engineering oil composition for industrial applications, Increasing oil yield for biofuel applications:
  - **Joseph M. Jez\*\* (P)** (*Department of Biology*) Structural biology and biochemistry of plant and microbial metabolism.
  - **Tiffany Knight (E)** (*Department of Biology*) Plant population ecology, conservation biology, and plant-animal interactions.
  - **Robert Kranz\*\* (P)** (*Department of Biology*) Gene regulation and biogenesis of extracellular components in bacteria.
  - **Barbara Kunkel\*\* (P)** (*Department of Biology*) Plant-pathogen interactions; molecular mechanisms of pathogenicity and host susceptibility in interactions between the bacterial pathogen *Pseudomonas syringae* and its hosts, Arabidopsis and tomato.
  - **Toni M. Kutchan (P)** (*Donald Danforth Plant Science Center*) - Plant natural product biosynthesis and metabolic engineering of medicinal plants.
  - **Scott Mangano\*\* (E)** (*Department of Biology*)
  - **Todd Mockler (P)** (*Donald Danforth Plant Science Center*) Functional and comparative genomic studies in plants. Three main areas of interest: 1) Plant diurnal and circadian gene expression regulation and promoter architecture; 2) Alternative splicing and its regulation in plants; and 3) Development of *Brachypodium distachyon* as a new model system for grass crop research.
  - **Dmitri Nusinow (P)** (*Donald Danforth Plant Science Center*). Circadian clock regulation of physiology and development in plants.
  - **Kenneth M. Olsen (E)** (*Department of Biology*) Plant molecular population genetics, phylogeography and evolutionary genomics.
  - **Himadri Pakrasi\*\* (P)** (*Department of Biology*) Genetics and biochemistry of protein complexes in energy-transducing membranes; transport of metal ions. Systems studied: *Synechocystis*, *Arabidopsis thaliana*, *Physcomitrella patens*.
  - **Sona Pandey (P)** (*Donald Danforth Plant Science Center*). Perception and response of plants to abiotic stress. ABA-perception mechanisms and heterotrimeric G-protein function in ABA signaling.
  - **Jan Salick (E)** (*Missouri Botanical Garden*)
  - **Barbara Schaal (E)** (*Department of Biology*) Evolutionary genetics of plants; molecular evolution.
  - **Tom Smith\*\* (P)** (*Donald Danforth Plant Science Center*) Biochemistry and structural biology to elucidate a number of biological problems including the structure of viruses and the mechanism of vector transmission, ABC transporters, carbohydrate recognition complexes, and enzymes. In addition, biochemical methods are being used to create transgenic crops resistant to fungal infection and using natural products for drug design scaffolds.
  - **Lucia Strader (P)** (*Department of Biology*) Auxin synthesis, transport and signaling; hormone crosstalk.
  - **James Umen\*\* (P)** (*Donald Danforth Plant Science Center*). Cell size homeostasis and the

retinoblastoma (RB) tumor suppressor pathway; Cell growth regulation in photosynthetic eukaryotes; Evolution of developmental complexity and sexual dimorphism in Volvocine algae.

- **Weixiong Zhang\*\* (C)** (*Department of Computer Science*) Computational biology, transcriptional regulation, hormone and stress regulated gene expression. Systems biology to study fungal-host interactions during infection of rice by *Magnaporthe oryzae*, the causal agent of rice blast disease.

#### **Resource Faculty (not accepting students for thesis training)**

- **Roger Beachy (P)** (*Department of Biology*) Mechanisms of viral pathogenesis; structure and function of plant virus proteins; genetic engineering of plant virus resistance
- **Memory Elvin Lewis (P)** (*Department of Biology*) Ethnomedically focused drug discovery from plants.
- **Tuan-Hua David Ho (P)** (*Department of Biology*) Hormone and stress regulated gene expression in plants; function of stress proteins.
- **David Kirk (P)** (*Department of Biology*) Genetic control of germ/soma cellular differentiation in *Volvox*.
- **Danny Kohl (P)** (*Department of Biology*) N cycle processes; energy metabolism of N<sub>2</sub> fixing symbionts; adaptation of plants to stress; metabolic pathways.
- **Walter Lewis (P)** (*Department of Biology*) Plants used medicinally by indigenous peoples.
- **Barbara Pickard (P)** (*Department of Biology*) Sensory integration in plants.
- **William Pickard (P)** (*Department of Electrical Engineering*) Threshold signal detection, translocation, plant electrophysiology, bioelectromagnetics.
- **Ralph Quatrano (P)** (*Department of Biology*) Mechanisms of establishing cell polarity; hormone regulated gene expression in *Arabidopsis thaliana* and *Physcomitrella patens*.
- **Peter Raven (P)** (*Director, Missouri Botanical Garden*) Systematics and evolution of Onagraceae and Myrtales, phytogeography, tropical floristics and conservation.
- **Daniel Schachtman (P)** (*Monsanto Company*)
- **Oliver Yu (P)** (*Conagen, Incorp.*) Function and regulation of flavonoid and isoflavonoid biosynthesis.

More information about the PMB faculty can also be viewed at:

[http://wubio.wustl.edu/plant\\_biology/faculty](http://wubio.wustl.edu/plant_biology/faculty)

#### **Adjunct faculty affiliation with the Program**

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

### **VIII. EVALUATION OF PROGRAM**

A committee of senior DBBS faculty will review the program approximately every 5 years. Criteria to be included are: strength of faculty; strength of applicant pool; quality

of curriculum; time to degree; publication record of graduates; outcomes of graduates; opportunities for interaction with other graduate programs; opportunities for increased funding.

## **IX. ADMINISTRATIVE**

The Program will be administered by the Division of Biology and Biomedical Sciences with oversight by the Graduate School of Arts and Sciences. Students will matriculate and enroll in the Graduate School of Arts and Sciences.

Tuition will be assessed according to the Mallinckrodt endowment agreement between the School of Arts and Sciences and the School of Medicine from 1973.

Students will be assured of the stipend set annually by DBBS as long as they are making satisfactory progress towards their degree. The source of the aid will come from endowment, mentor research funds, departmental funds, fellowships or training grants, as appropriate.

Student Affairs will be set by the Graduate Council and the Graduate Student Senate.