

The University Senate of Michigan Technological University

PROPOSAL 2-01

PHD PROGRAM IN FOREST MOLECULAR GENETICS AND BIOTECHNOLOGY

The Senate approves the program as described below.

1. RELATED PROGRAMS: Own/Other

The PhD in Forest Molecular Genetics and Biotechnology degree is a spin-off from the PhD in Forest Sciences degree at Michigan Technological University. As far as we know, no other university in the State of Michigan offers this degree.

2. RATIONALE

The PhD in forest molecular genetics and biotechnology is intended to be a research degree where the candidate demonstrates advanced ability in course work and innovative research work related to molecular biology of a forest species and/or application of that knowledge to the development of industrial products and processes. It is awarded in recognition of demonstrated mastery of subject matter in molecular genetics area and demonstrated competence in the conduct of individual research investigations that represent a significant contribution to the cumulative knowledge of this field.

Traditionally, the doctoral degree in forestry involves the study of forest species and their interactions at organismic levels; studies at molecular level were rare just a few years ago. With the advance of our knowledge of various biochemical pathways leading to production of raw materials for forest product industries, research has been focused on the molecular cloning of genes responsible for economically important traits. To do this, we have also established the transformation systems for various tree species. In short, academic and industrial interest has developed to understand the life of a forest species at the cellular and molecular levels. Moreover, molecular tools have also recently been applied to understanding of the population dynamics as well as evolution of forest species, which in turn may assist in marker-assisted selection and breeding. This has profound impact on forest management and forest product industries worldwide. Many forest product industries are, therefore, developing research programs involving molecular genetics and biotechnology and in future, more academic programs will be initiated in traditional forestry departments. However, there are no graduate programs in the State of Michigan that will meet this need and such programs nationwide are also rare. Our graduate students trained in forest molecular genetics and biotechnology will provide the major work force to fill this void. Researchers in the School of Forestry and Wood Products at Michigan Tech have performed outstanding research in this area that has been widely published in peer reviewed journals of high acclaim, attracted significant research funding from national and international agencies and have awarded so far seven PhD degrees with 10 graduate students currently enrolled in the forest molecular genetics and biotechnology specialization. Establishment of a PhD program in forest molecular genetics and biotechnology will provide appropriate description of their research area and provide better placement opportunities for students specializing in this field.

In addition to many faculty members from the School of Forestry and Wood Products, faculty members from Biology and Chemistry departments are also involved in this area of research and offer course work suitable for this degree. A thematic cluster in forest molecular biology and biotechnology has already been established and offered in the School of Forestry and Wood Products. Thus no new courses are currently required, but will be developed as the field of research develops. External grants as well as internal fellowships will support the graduate students.

The program of study and research for each student will be planned and supervised in accordance with existing University policies. The advisory committee must approve each candidate's course work and research topic as meeting the standards generally associated with the doctoral degree. A minimum of 36 course and/or research credit hours beyond the MS degree (or its equivalent) or a minimum of 81 course and/or research credit hours beyond the bachelor's degree is required.

3. ALIGNMENT OF THE PROPOSED PROGRAM WITH THE MTU'S ROLE STATEMENT AND THE STRATEGIC PLAN

Our proposal of a spin-off PhD degree program perfectly fits with the MTU's strategic plan, an action agenda for 2010. If MTU should be recognized as a major research university meeting the needs of a global and technologically rich society, then establishment of a degree program in forest molecular genetics and biotechnology is a natural extension of our PhD program in forest sciences. With the new technologies developed and growing demand for forest products worldwide, we will increasingly need more specialists in this discipline who will teach, perform research and lead projects. This degree program is being created for students and by the faculty members who believe that this is the right mode of action and have contributed substantially in the past to research in forest molecular genetics and biotechnology.

In the strategic plan, Biotechnology has been recognized as one of the high demand areas along with nanotechnology and information technology. Spin-off PhD program in forest molecular genetics and biotechnology is developed and proposed by faculty members in SFWP who have been building knowledge, infrastructures and attract funding in forest biotechnology research for past several years. In the goal 2 of our strategic planning strategies namely, expand our scholarship and research activities and concentrating in key areas, biotechnology has been recognized as a well-focused area that will lead to world class recognition for MTU.

4. INVOLVEMENT OF FACULTY AND STUDENTS IN THE DEVELOPMENT OF THE PROGRAM

The following faculty members were involved in the development and review of this program and they will be mainly participating in it in one or other capacity.

- Chandrashekar Joshi, Assistant Professor of plant molecular genetics
Forest biotechnology, molecular genetics and tree genomics
- Vincent Chiang, Professor of Wood Chemistry
Forest biotechnology and molecular biology
- David Karnosky, Professor of Forest Genetics
Forest genetics and biotechnology, pollution tolerance
- Chung-Jui Tsai, Assistant Professor of Forest biotechnology
Forest Biotechnology and genetic engineering
- Scott Harding, Research Assistant Professor
Biochemistry and molecular physiology
- Laigeng Li, Research Assistant Professor
Lignin molecular biology and biochemistry

In addition, all faculty members from our School as well as the entire MTU community are welcome to participate in our program if their research interests are similar to ours. Specifically, since molecular tools can also be used in ecological studies, the following faculty members from our School may use this program for their own graduate students if their research topic falls within the scope of this program or will be on graduate student committees of this spin-off PhD program as necessary

- Rolf Peterson, Professor of Wildlife Ecology
- Dave Reed, Professor of Forest Biometry
- Peg Gale, Professor of Production Ecology
- Jiquan Chen, Associate Professor of Landscape Ecology
- John Vucetich, Research Assistant Professor of Population Biology

Dr. C.P. Joshi will be the faculty member to communicate with the Senate committee. Currently, there are 10 PhD graduate students enrolled who may use this program and two of them are likely to graduate in Spring 2001.

5. ENDORSEMENT OF THE PROGRAM BY THE FACULTY MEMBERS OF THE SCHOOL OF FORESTRY AND WOOD PRODUCTS

In the faculty meeting of the School of Forestry and Wood Products (September 19, 2000), the attending faculty members discussed the proposal and unanimously approved its submission to the Senate committee.

6. CURRICULUM DESIGN

The PhD in forest molecular genetics and biotechnology student must do the following:

- Choose an advisory committee and chair
- File a Preliminary Program of Study form
- Complete the comprehensive exam
- File a Degree Schedule form
- Develop and defend a dissertation plan
- Defend an approved dissertation in an oral exam
- File the defended dissertation
- Fulfill the campus residency requirement
- Finish the degree within the prescribed time limit

Grades--All grades must be B (3.0 on a 4.0 scale) or better in the major subject area. The department chair can approve no more than 6 credits of C (2.0) in a cognate department. The student must maintain a cumulative grade point average of 3.0 or better.

Campus Residency Requirement--Doctoral students must spend at least four semesters on campus at MTU beyond attainment of a bachelor's degree or two semesters beyond attainment of a master's degree in a formal program of study and research under direct supervision of their major advisor. In special preapproved instances, this residency requirement may be waived.

Time Limit--Comprehensive examinations must be taken within five years and all requirements must be completed within eight years from the time of a student's first enrollment in the doctoral program by the Graduate School dean.

Foreign Language Requirement--Not a University-wide requirement for doctoral degrees. Individual departments or programs may require a foreign language. Each academic department or program is responsible for establishing standards and examination procedures where a foreign language is required. Doctoral students should consult with their advisory committee concerning departmental regulations.

In addition to the Graduate School requirements, which are described below, individual departments may have higher standards. Students are expected to know their department's requirements.

Advisory Committee

During the applicant's first semester of residence, an Advisory Committee will be chosen to assume responsibility for the direction of the student's educational program and to hold meetings as needed to fulfill this responsibility. The committee, consisting of at least three members of the graduate faculty with one member designated as chair, will be appointed by the chair of the major department or program with the approval of the dean of the Graduate School.

Preliminary Program of Study-Initially the Advisory Committee will meet with the student and prepare a program of course study and research work that will lead to the doctoral degree. This program must be filed in the Graduate School office during the second semester of residence on the Preliminary Program of Study form.

In preparing the program, the Advisory Committee recognizes that a well-prepared student should be able to complete the requirements for the doctoral degree within three to four years of full-time study and research after receiving the bachelor's degree. Subsequent changes in the program can be made by the advisory committee and will appear on the final Degree Schedule form. (The Graduate School office must be notified in writing of any significant changes affecting the time required for obtaining the degree.)

Proficiency Examinations--May be scheduled as necessary by the department or program to either plan a student's study program or determine the advisability of a student's continuing in the doctoral program.

Comprehensive Examination

A comprehensive examination will be given, no later than five years after enrollment, to determine the general knowledge appropriate to the student's program and the ability to use this knowledge. This examination will be a written examination, although it may be oral in part if recommended by the Advisory Committee. It is recommended that the comprehensive exam be given after about two years of doctoral study and following completion of all course work required by the Advisory Committee. The examination will be given after the applicant has completed any foreign language requirement and at least two semesters prior to scheduling the final, oral examination.

The examination will be prepared and administered by the major department or program with the cooperation of the Advisory Committee. Satisfactory performance on the comprehensive examination will be regarded as an indication that no additional formal course work is needed, although the student may take additional course work. Any member of the graduate faculty may attend the oral examination as an observer.

Final Degree Schedule- Upon satisfactory completion of the comprehensive examination, a final Degree Schedule form must be filed in the Graduate School office and approved prior to scheduling a final oral examination. This Degree Schedule should include all course work taken in pursuit of the doctoral degree and must be approved by the Advisory Committee as meeting the standards associated with the doctor of philosophy degree.

Dissertation

The research study undertaken as part of the doctoral degree program will be presented in the form of a dissertation that can be made a permanent acquisition of the library along with an expanded abstract, not exceeding 350 words. Any classified or proprietary material that cannot be made available to the public is not acceptable as a dissertation. Completing the dissertation includes approval of the dissertation

proposal, preparing the dissertation according to guidelines, and filing the completed (and successfully defended) dissertation.

The dissertation will be written and prepared under the supervision of the chair of the Advisory Committee according to discipline-specific writing requirements. Publication guidelines are found in the booklet, "Instructions Concerning the Preparation of Theses and Dissertations," available at the Circulation Desk in the J. R. Van Pelt Library. Additional guidelines are published by University Microfilms, Inc. (UMI). The Graduate School office sends the UMI booklet to students with their copy of the signed Degree Schedule form. A completed draft must be approved by the Advisory Committee two weeks prior to the final examination.

After the final dissertation has been satisfactorily defended, recommended or other appropriate editorial changes in the dissertation should be made with the approval of the Advisory Committee chair.

A minimum of three copies of the corrected version of the dissertation, one with the original signatures, must be submitted to the library's Binding and Preservation Department. Two will be bound for the library's use. The third, accompanied by the required form, attachments, and payment, will be forwarded to the Graduate School office for submission to UMI for microfilming and inclusion in Dissertation Abstracts International.

Oral Examination

At a public, final, oral examination, primarily concerning the research and doctoral dissertation, the candidate should justify the validity of the methods and conclusions contained in the dissertation and should be familiar with the import of the particular investigations reported in the dissertation relative to the larger body of existing knowledge. The examination will be given any time after a period of two academic semesters following the successful completion of the comprehensive examination and upon completion of the dissertation in a satisfactory form. The student's examination results must be reported to the Graduate School office.

The examination will be scheduled with the dean of the Graduate School, in consultation with the chair of the Advisory Committee, not earlier than two weeks following the approval of the completed draft of the dissertation by the Advisory Committee. Copies of the completed draft must be distributed to the new members at least two weeks prior to the scheduled examination date.

The Examining Committee will be appointed by the dean of the Graduate School in consultation with the Advisory Committee. The committee will consist of at least four members of the graduate faculty. At least one of these will be from a cognate department or program. Additional external examiners who are not graduate faculty may be appointed by a nomination memo to and approved by the dean.

Semester courses currently offered by School of Forestry and Wood Products faculty members that are suggested for PhD in Forest Molecular Genetics and Biotechnology.

Course Title	Credits	Term(s) Offered
FW4085 Wood Biotechnology	3	F
FW4087 Molecular Genetics of Trees	3	S
FW4089 Plant Bioinformatics	3	S
FW4110 Tree Seedling Prod & GH Man	1-4	S
FW4120 Tree Physiology and Genetics	3	S
FW4500 Bioinformatics & biomol model	3	S (Sp topics)

FW4500	Molecular genetic ecology	1	S (Sp topics)
FW4700	Diseases and Insects of Forest	3	F
FW5050	Curr Topics in Forest Biotech	3	S
FW5077	Adv Wood Chem & Biochem	3	
FW5810	Res Methods in Natural Res	4	S
FW6800	Doctoral Graduate Seminar	1	F S Su
FW6980	Graduate Teaching	2-4	F S
FW6999	For & Wood Prod Doc Res	1-15	F S Su

Semester courses currently offered by Biological Sciences faculty members that are suggested for PhD in Forest Molecular Genetics and Biotechnology

BL4010	Biochemistry I	3	F
BL4020	Biochemistry II	3	S
BL4030	Molecular Biology	3	F
BL4040	Environmental Biochemistry	3	S
BL4140	Plant Physiology	4	S
BL4820	Biochem Techniques I	3	F
BL4830	Biochem Techniques II	3	S
BL4840	Molecular Biology Techniques	3	F
BL5150	Advanced Plant Physiology	3	
BL5160	Plant Biochem & Molecular Bio	3	
BL5170	Plant Cell & Development	3	

Semester course currently offered by Chemistry faculty member that is suggested for PhD in Forest Molecular Genetics and Biotechnology

CH4710	Chemical Principles in Biology	3	S
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7. NEW COURSE DESCRIPTION

None

8. PLANNED IMPLEMENTATION DATE

Spring 2001

9. ACCREDITATION REQUIREMENTS

None

10. RESOURCES REQUIREMENTS

The proposed spin-off PhD program in forest molecular genetics and biotechnology does not have any unusual priorities with regard to the University resources. Currently six laboratories and a large

greenhouse space host the program in Forest molecular genetics and biotechnology in our school. With the new expansion, at least two more laboratories will be used for research in forest molecular genetics and biotechnology. All our labs contain state-of-the-art equipment. Our research personnel are highly trained to use the available research facilities. Library resources are adequate for our research and so are the courses offered on campus that fulfill the need of our graduate students. Our Plant Biotechnology Research Center additionally subscribes several journals that are required for our research but are not available in the library. There are no unusual resources requested in this proposal.

Adopted by Senate: October 18, 2000

Approved by President: November 29, 2000