

TO: Randy Smith, Vice Provost for Academic Programs
FROM: Jennifer Schlueter, Faculty Fellow for Curriculum, Graduate School
DATE: 6 May 2017
RE: Proposal to make curricular changes in the Masters of Science in Plant Pathology and Doctorate in Plant Pathology

The Department of Plant Pathology proposes to restructure the MS curriculum to streamline coursework to better fulfill the program's educational mission. The program proposes the creation or merging of courses and moving other courses from required to electives to meet the curricular requirement of 30 credit hours for the MS in Plant Pathology degree.

The students in the Plant Pathology Ph.D. program will be required to complete a minimum of 80 credit hours. In addition to the courses required for the Master's program, Ph.D. students will be required to take a course on Molecular Bases of Plant Host-Microbe Interactions plus 2-3 additional graduate level Plant Pathology courses and elective credit hours to bring the total credits to degree to 80, 50 of which must be completed beyond the master's degree. Flexibility has been built in the curriculum to allow students to select electives based on their academic background and research area.

The proposal was received by the Graduate School on 15 Feb 2017. It was reviewed by the combined GS/CAA Curriculum subcommittee, chaired by the Faculty Fellow, on 20 March 2017, and revisions were requested on 27 March 2017. Revisions on the proposal were returned to the committee on 12 April 2017 and were reviewed by the subcommittee on 17 April 2017. The revisions were deemed sufficient and the Faculty Fellow forwarded the proposal on to the Graduate Council for their review on 20 April 2017. Because the Graduate Council had already held its final meeting of the academic year, the proposal was circulated for electronic review on 24 April 2017. The positive results of this electronic review were returned to the Faculty Fellow on 5 May 2017.



January 6, 2017

Office of Academic Affairs
203 Bricker Hall
190 North Oval Mall
Columbus, OH 43210

Dear OAA,

The members of the Department of Plant Pathology wish to address curricular issues in the graduate programs by implementing changes to the Masters in Plant Pathology program and the Doctorate in Plant Pathology starting Autumn Semester 2018. These changes are summarized in a letter written by Dr. Francesca Hand, Chair of the Plant Pathology Academic Affairs Committee.

The faculty in the Department of Plant Pathology met on August 17, 2015 in a retreat to discuss graduate program goals. On December 11, 2015 the group met again to determine the graduate program curricula. The faculty since has reviewed the curricula, learning outcomes, rationale, assessment plan, and transition policy for each graduate program. A vote was conducted by the faculty on October 13, 2016. The vote for the proposal was unanimous. Subsequently, we forwarded the proposal to the College of Food, Agricultural, and Environmental Science Academic Affairs Committee for review.

We ask that the program changes be approved. In the case they are not, please provide detailed descriptions of improvements needed.

Sincerely,

Laurence Madden
Acting Chair and Distinguished Professor in Plant Protection
Department of Plant Pathology

January 6, 2017

Office of Academic Affairs
203 Bricker Hall
190 North Oval Mall
Columbus, OH 43210

Dear OAA,

The Department of Plant Pathology currently offers seven academic programs: undergraduate Minor in Plant Pathology, undergraduate Major in Plant Health Management, undergraduate Major in Plant Pathology, Master of Science (MS) in Plant Pathology (plans A and B), professional Master in Plant Health Management, and Doctorate of Plant Pathology (Ph.D.). This letter is to report our plan to restructure our MS and Ph.D. curricula to better serve our graduate students.

During the conversion to semesters, the faculty in the Department of Plant Pathology established Learning Goals (LGs) and Learning Outcomes (LOs) and designed a comprehensive curriculum to accomplish them. After using that curriculum and collecting data for 4 years, it is clear that while we are achieving our expected outcomes, it is coming at the price of inefficiencies in classroom time and leaving little time for hands-on learning. As such, the department faculty and graduate students convened focus groups and re-envisioning sessions, as well as two half-day retreats that included graduate student representatives from both campuses, to consider our LGs, LOs, and curriculum. The result is a new curriculum that we feel fulfills our educational mission and streamlines the curriculum. Detailed changes are described below, but in general we propose the creation or merging of courses and moving other courses from required to electives. Our goal is to have the full implementation of the new curriculum by Autumn Semester 2018, although some course changes/new courses will be offered as soon as possible.

The proposed curriculum for the MS in Plant Pathology will consist of 30 credit hours. The students will be required to complete the following graduate level courses: pathogen courses (Plant Virology, Phytobacteriology, and Plant Nematology), Plant Disease Management course, Plant Disease Diagnosis summer course, a statistics course approved by the student's advisory committee, and two new Advanced Plant Pathology Laboratory classes where students will learn core lab techniques. Students will also choose at least one of the following fungal courses: Science of Fungi: Mycology Lecture and Lab, or a new Plant Pathogenic Fungi course to be developed. The students will also be required to take the Department's seminar course each semester and register for research credits. The students will then choose elective credits to complete the 30 credit hour requirement to earn the degree. New graduate students with no prior plant pathology experience will be asked to take/review an online version of the General Plant Pathology course prior to their first semester as a graduate student.

The curriculum for the Plant Pathology Ph.D. program will consist of a minimum of 80 credit hours. In addition to the courses listed above for the Master's program, PhD students will also be required to take a course on Molecular Bases of Plant Host-Microbe Interactions. They will also be required to take 2-3 additional graduate level Plant Pathology courses



of their choice (listed as Plant Pathology Electives, 6 credits). Other elective credit hours will be included to bring the total credits to degree to 80, 50 of which must be completed beyond the master's degree. The program does build in flexibility in the curriculum at the discretion of the student's advisory committee based on the student's academic background and research area. As such, our students will be strongly advised by faculty to guide them to develop a plan that fits their career goals. Please find attached our transition plan for each program, as well as curricular tables detailing the new program plans.

Sincerely,

Francesca Hand
Assistant Professor
Chair, Department of Plant Pathology Academic Affairs Committee

Summary of changes (also included in a comparison table attached):

Course Changes

- PLNTPTH 5010 - Phytobacteriology (2 cr) - course change request - from 7 weeks to 14 weeks
This course has been expanded to a full semester class to allow for a more effective learning experience. Topics covered during the semester will be integrated with hands-on activities through the new laboratory course PLNTPTH 6002 outlined below.
- PLNTPTH 5020 - Introductory Plant Virology (2 cr) - course change request - from 7 weeks to 14 weeks
This course has been expanded to a full semester class to allow for a more effective learning experience. Topics covered during the semester will be integrated with hands-on activities through the new laboratory course PLNTPTH 6002 outlined below.
- PLNTPTH 5030 - Plant Nematology (2 cr) - course change request - from 7 weeks to 14 weeks
This course has been expanded to a full semester class to allow for a more effective learning experience. Topics covered during the semester will be integrated with hands-on activities through the new laboratory course PLNTPTH 6002 outlined below.
- PLNTPTH 5050 - Plant Pathogenic Fungi (3 cr) - new course proposal
This new course is designed to provide a more in-depth look at fungal plant pathogens to better prepare graduate students planning on constructing careers in plant pathology. This course will cover the different groups of fungal pathogens with examples, their biology, and their impact in society both historically and currently. Topics covered during the semester will be integrated with hands-on activities through the new laboratory course PLNTPTH 6002 outlined below.
- PLNTPTH 6002.01 - Advanced Plant Pathology Laboratory: Viruses and Bacteria (1 cr) - new course proposal
This new graduate-level course will be a core requirement adding hands-on learning activities in support of the pathogen-specific courses PLNTPTH 5010 and 5020. Offered during autumn semester. This course is intended to



prepare students to be able to implement techniques used by bacteriologists and virologists in both lab and field settings.

- PLNTPTH 6002.02 - Advanced Plant Pathology Laboratory: Plant Pathogenic Fungi and Nematodes (1 cr) - new course proposal. *This new graduate-level course will be a core requirement adding hands-on learning activities in support of the pathogen-specific courses PLNTPTH 5030 and 5050. Offered during spring semester. This course is intended to prepare students to be able to implement techniques used by nematologists and mycologists in both lab and field settings.*

Program Changes MS:

- Eliminate PLNTPTH 6001 - General Plant Pathology as a core requirement
We propose that this course is eliminated as a core requirement. The course will still be offered and can be taken as elective credit. New graduate students with no prior plant pathology experience will be asked to take/review an online version of this course prior to their first semester as a graduate student.
- Add PLNTPTH 5050 - Plant Pathogenic Fungi as an option for the core curriculum (mycology area)
The class will be offered as an alternative or in addition to PLNTPTH 5040 and 5041 (Science of Fungi: Mycology Lecture and Lab). Specifically, it will provide a more in-depth look at fungal plant pathogens to better prepare graduate students planning on constructing careers in plant pathology.
- Add new core requirement, PLNTPTH 6002.01 - Advanced Plant Pathology Laboratory: Viruses and Bacteria.
This new graduate-level course will be a core requirement adding hands-on learning activities in support of the pathogen-specific courses PLNTPTH 5010 and 5020. Offered during autumn semester.
- Add new core requirement, PLNTPTH 6002.02 - Advanced Plant Pathology Laboratory: Plant Pathogenic Fungi and Nematodes. *This new graduate-level course will be a core requirement adding hands-on learning activities in support of the pathogen-specific courses PLNTPTH 5030 and 5050. Offered during spring semester.*
- Allow for more elective courses to be chosen by student and advisory committee
Given the reduction of core credit hours in the new curriculum, the student and Student Advisory Committee (SAC) will have increased flexibility in the choice of elective courses and will be able to design a plan of study that best fits the graduate student's academic background, research area, and career goals.

Program Changes PhD:

- Eliminate PLNTPTH 6001 - General Plant Pathology as a core requirement
We propose that this course is eliminated as a core requirement. The course will still be offered and can be taken as elective credit. New graduate students with no prior plant pathology experience will be asked to take/review an online version of this course prior to their first semester as a graduate student.
- Eliminate PLNTPTH 7002 - Plant Disease Epidemiology as a core requirement (course will still be offered)
We propose that this course is eliminated as a core requirement. This is a niche-specific course that was not a core requirement prior to semester implementation. The course will still be offered and can be taken as elective credit.
- Eliminate PLNTPTH 7003 - Agricultural Genomics as a core requirement (course will still be offered)
We propose that this course is eliminated as a core requirement. This is a niche-specific course that was not a core requirement prior to semester implementation. The course will still be offered and can be taken as elective credit.



- Eliminate PLNTPTH 8300 - Current Topics in Plant Pathology as a core requirement (course will still be offered)
We propose that this course is eliminated as a core requirement. This is a niche-specific course that was not a core requirement prior to semester implementation. The course will still be offered and can be taken as elective credit.
- Add PLNTPTH 5050 - Plant Pathogenic Fungi as an option for the core curriculum (mycology area)
The class will be offered as an alternative or in addition to PLNTPTH 5040 and 5041 (Science of Fungi: Mycology Lecture and Lab). Specifically, it will provide a more in-depth look at fungal plant pathogens to better prepare graduate students planning on constructing careers in plant pathology.
- Add new core requirement, PLNTPTH 6002.01 - Advanced Plant Pathology Laboratory: Viruses and Bacteria.
This new graduate-level course will be a core requirement adding hands-on learning activities in support of the pathogen-specific courses PLNTPTH 5010 and 5020. Offered during autumn semester.
- Add new core requirement, PLNTPTH 6002.02 - Advanced Plant Pathology Laboratory: Plant Pathogenic Fungi and Nematodes.
This new graduate-level course will be a core requirement adding hands-on learning activities in support of the pathogen-specific courses PLNTPTH 5030 and 5050. Offered during spring semester.
- Allow for more elective courses to be chosen by student and advisory committee
Given the reduction of core credit hours in the new curriculum, the student and Student Advisory Committee (SAC) will have increased flexibility in the choice of elective courses and will be able to design a plan of study that best fits the graduate student's academic background, research area, and career goals.

Doctorate in Plant Pathology

New curricular changes compared to current curriculum (highlighted areas show changes)

Current curriculum				Proposed new curriculum			
Course number	Course title	Credit hours	Length of course; notes	Course number	Course title	Credit hours	Length of course; notes
PLNTPTH 6001	Advanced Plant Pathology	3	14 weeks; eliminating as requirement	PLNTPTH 6002.01	Advanced Plant Pathology Laboratory – Viruses and Bacteria	1	New course; 14 weeks
				PLNTPTH 6002.02	Advanced Plant Pathology Laboratory – Plant Pathogenic Fungi and Nematodes	1	New course; 14 weeks
PLNTPTH 5010	Phytobacteriology	2	7 weeks	PLNTPTH 5010	Phytobacteriology	2	14 weeks
PLNTPTH 5020	Introductory Plant Virology	2	7 weeks	PLNTPTH 5020	Introductory Plant Virology	2	14 weeks
PLNTPTH 5030	Plant Nematology	2	7 weeks	PLNTPTH 5030	Plant Nematology	2	14 weeks
PLNTPTH 5040 and 5041	Science of Fungi: Mycology Lecture and Lab	4	14 weeks	PLNTPTH 5040 and 5041 OR PLNTPTH 5050	Science of Fungi: Mycology Lecture and Lab OR Plant Pathogenic Fungi	4 3	14 weeks 5050 - New course
PLNTPTH 5603	Plant Disease Management	3	14 weeks	PLNTPTH 5603	Plant Disease Management	3	14 weeks
PLNTPTH 5685	Plant Disease Diagnosis	2	2 weeks, summer term	PLNTPTH 5685	Plant Disease Diagnosis	2	2 weeks, summer term
PLNTPTH 8400	Molecular Bases of Plant Host-Microbe Interactions	3	14 weeks	PLNTPTH 8400	Molecular Bases of Plant Host-Microbe Interactions	3	14 weeks
Statistics	Choose advanced statistics course from list	3	14 weeks	Statistics	Choose advanced statistics course from list	3	14 weeks
Electives	Choose courses, seminar, or research credits to fill elective hours focused on area of study	Minimum ~45	Varies	Plant Pathology Electives	Choose graduate level plant pathology courses, to fill this elective requirement (2-3 courses)	6 credits	Varies (can include PLNTPTH 7002, 7003, 8300, 8901/8902 that were eliminated from core requirements)
PLNTPTH 8899	Plant Pathology Seminar	1, each semester	14 weeks	Other Electives	Choose courses, seminar, or research credits to fill elective hours focused on area of study	Varies (suggested minimum ~51)	Varies
PLNTPTH 8999	Plant Pathology Research	varies	Full term, all semesters	PLNTPTH 8899	Plant Pathology Seminar	1, each semester	14 weeks; taken each semester

PLNTPH 7002	Plant Disease Epidemiology	3	14 weeks; eliminating as requirement	PLNTPH 8999	Plant Pathology Research	varies	Full term, all semesters
PLNTPH 7003	Agricultural Genomics: Principles and Applications	3	14 weeks; eliminating as requirement				
PLNTPH 8300	Current Topics in Plant Pathology	2	7-14 weeks; eliminating as requirement				
PLNTPH 8901 or 8902	Mentored Teaching/Extension in Plant Pathology	1-3	14 weeks; eliminating as requirement				

PROPOSED Ph. D. in Plant Pathology

Core Curriculum

Course number	Course title	Credit hours	Semester completed	Notes
PLNTPH 6002.01	Advanced Plant Pathology Laboratory – Viruses and Bacteria	1	Autumn1	Topics will coordinate with 5010 and 5020.
PLNTPH 6002.02	Advanced Plant Pathology Laboratory – Plant Pathogenic Fungi and Nematodes	1	Spring 1	Topics will coordinate with 5030 and 5050.
PLNTPH 5010	Phytobacteriology	2	Autumn 1	14 weeks
PLNTPH 5020	Introductory Plant Virology	2	Autumn 1	14 weeks
PLNTPH 5030	Plant Nematology	2	Spring 1	14 weeks
PLNTPH 5040 and 5041 OR/AND PLNTPH 5050	Science of Fungi: Mycology Lecture and Lab OR/AND Plant Pathogenic Fungi	4 3	Autumn 1 Spring 1	5050 - 14 weeks (new course 2017)
PLNTPH 5603	Plant Disease Management	3	Autumn 2	
PLNTPH 5685	Plant Disease Diagnosis	2	Summer 1	
PLNTPH 8400	Molecular Bases of Plant Host-Microbe Interactions	3	Spring 2	
Statistics	Choose advanced statistics course from list	3	Autumn 2 (or Spring)	As agreed upon by SAC
Students will register for a total of 6 credits (2-3 classes) in graduate-level Plant Pathology courses				
Plant Pathology Electives	(Example: PLNTPH 7002: Plant Disease Epidemiology, 3 credits)	6	Varies	As agreed upon by SAC
Credits students may register for each semester. Total number of credits may vary.				
PLNTPH 8899	Plant Pathology Seminar	1, each semester	All AU & SP semesters	Enroll each semester (AU, SP)
PLNTPH 8999	Plant Pathology Research	varies	All semesters	Hours determined by SAC
Other Electives	Choose courses, seminar, or research credits to fill elective hours focused on area of study	~51-53	Varies	As agreed upon by SAC

The Ph. D. credit requirement is 80 graduate credit hours (semester) with a minimum cumulative GPA of 3.0. At least 50 of those credits hours must be completed beyond the master's degree (Graduate School Handbook).

New graduate students with no previous plant pathology experience will be asked to take/review an online version of General Plant Pathology prior to their first semester.

Transition Policy- Ph. D. in Plant Pathology

A student entering the Ph.D. in Plant Pathology program in **Academic Year 2017-2018** may follow the suggested semester course plan below.

In general, the program's courses will remain the same with a few additions and deletions in required courses. Two new courses will be created: Plant Pathogenic Fungi and Advanced Plant Pathology Laboratory. The length of the course will be changing for our pathogen classes from 7 weeks to 14 weeks: Plant Nematology, Plant Virology, and Phytobacteriology. The semester of offering may also change for a few classes. As stated in the Graduate Program Handbook, the SAC may allow for substitutions of courses with others that are more appropriate for the student's graduate program.

Course Map of Core Curriculum for Students Entering Academic Year 2017-2018

Year	Semester	Courses	Credits
1	Autumn 2017	5040**, 5041**, 5603, 8400, 8899	12
1	Spring 2018	5010, 5020, 5030, 8899	7
1	Summer 2018	5685	2
2	Autumn 2018	Statistics, 8899	4
2	Spring 2019	8899	1

*Depending on what the SAC determines, students may register for 8999 research credits each semester.

** Assuming student enrolls in only Mycology and not Plant Pathogenic Fungi since this is listed as an AND/OR option in the curriculum.

Note: international students from countries where English is not the first language may be required to take English writing courses.

A student entering the Ph.D. in Plant Pathology program in **Academic Year 2018-2019** may follow the suggested semester course plan below.

Course Map of Core Curriculum for Students Entering Academic Year 2018-2019

Year	Semester	Courses	Credits
1	Autumn 2018	6002.01, 5010, 5020, 8899	6
1	Spring 2019	6002.02, 5030, 5050**, 8899	7
1	Summer 2019	5685	2
2	Autumn 2019	5603, Statistics, 8400, 8899	10
2	Spring 2020	8899	1

OR

Year	Semester	Courses	Credits
1	Autumn 2018	6002.01, 5010, 5020, 5603, 8899	9
1	Spring 2019	6002.02, 5030, 5050**, Statistics, 8899	10
1	Summer 2019	5685	2
2	Autumn 2019	8400, 8899	4
2	Spring 2020	8899	1

*Depending on what the SAC determines, students may register for 8999 research credits each semester.

** Assuming student enrolls in only Plant Pathogenic Fungi and not Mycology since this is listed as an AND/OR option in the curriculum.

Course Descriptions

Course number	Course title	Credit hours	Course Description	Weeks
PLNTPH 5010	Phylobacteriology	2	Taxonomy, molecular biology, physiology, and ecology of plant-associated bacteria that interact with plants, especially those that cause disease and affect plant health.	14
PLNTPH 5020	Introductory Plant Virology	2	Plant virus structures, genome organizations and replication strategies. Symptoms and diagnosis of virus diseases of plants.	14
PLNTPH 5030	Plant Nematology	2	Introduction to plant-parasitic nematodes, with emphasis on identification, epidemiology and host interactions.	14
PLNTPH 5040 and 5041	Science of Fungi: Mycology Lecture and Laboratory	4 (3 + 1)	Fungi are some of the most important organisms on the planet. This course covers the diversity, biology, and genetics of fungi.	14
PLNTPH 5050	Plant Pathogenic Fungi	3	This course is designed to provide a more in-depth look at the filamentous plant pathogens to better prepare graduate students planning on constructing careers in plant pathology. This course will cover the different groups of fungal pathogens with examples, their biology, and their impact in society both historically and currently.	14
PLNTPH 5603	Plant Disease Management	3	Theory and practice of plant disease management; emphasis on integration of cultural, biological, chemical methods and plant disease resistance.	14
PLNTPH 5685	Plant Disease Diagnosis	2	Study of field and laboratory procedures for diagnosis of plant diseases.	2
PLNTPH 6002.01	Advanced Plant Pathology Laboratory - Viruses and Bacteria	1	This course is intended to prepare students to be able to implement techniques used by virologists and bacteriologists in both lab and field settings.	14
PLNTPH 6002.02	Advanced Plant Pathology Laboratory – Plant Pathogenic Fungi and Nematodes	1	This course is intended to prepare students to be able to implement techniques used by nematologists and mycologists in both lab and field settings.	14
PLNTPH 8400	Molecular Bases of Plant Host-Microbe Interactions	3	Introduction to plant host-pathogen interactions, with emphasis on molecular bases of pathogen virulence and host resistance.	14

PLNTPH 8899	Plant Pathology Seminar	1	Covers various ongoing research topics presented by graduate students and invited speakers.	14
PLNTPH 8999	Plant Pathology Research	varies	Research for thesis of dissertation purposes only.	14

Possible Statistics Courses

PLNTPH 5550	Quantitative Methods for Agricultural Scientists	3	A practical introduction to the variety of quantitative methods used for data analysis by agricultural, environmental, and life sciences researchers.	14
HCS 5887	Introduction to Experimental Design	3	Introduction to experimental design, including selection and layout of plots, data analysis software, and data interpretation.	14
HCS 8887	Experimental Design	4	Intended to develop student's ability to use appropriate and robust statistical techniques of experimental design in research, with an emphasis on approaches for biological and agricultural sciences.	14
STAT 5301	Intermediate Data Analysis 1	4	The first course in a two-semester non-calculus sequence in data analysis covering descriptive statistics, design of experiments, probability, statistical inference, one-sample t, goodness of fit, two sample problem, and one-way ANOVA.	14
STAT 5302	Intermediate Data Analysis 2	3	The second course in a two-semester sequence in data analysis covering simple linear regression (inference, model diagnostics), multiple regression models, variable selection, model selection, two-way ANOVA, mixed effects model.	14
MOLGEN 5650	Analysis and Interpretation of Biological Data	3	Methods of analyzing biological data including: sampling, descriptive statistics, distributions, analysis of variance, inference, regression, and correlation. Emphasizes practical applications of statistics in the biological sciences.	14
ANISCI 7000	Applied Biometrics	3	Study methods used in the quantification of biological processes and the integration of research results and knowledge into quantitative methods.	14

Ph.D. in Plant Pathology - Advising Sheet

New graduate students with no previous plant pathology experience will be asked to take/review an online version of General Plant Pathology prior to their first semester.

<u>Course number</u>	<u>Course Title</u>	<u>Credits</u>	<u>Term</u>
CORE			
PLNTPTH 5010	Phytobacteriology	2	AU Year 1
PLNTPTH 5020	Introductory Plant Virology	2	AU Year 1
PLNTPTH 6002.01	Advanced Plant Pathology Laboratory - Viruses and Bacteria	1	AU Year 1
PLNTPTH 5040 & PLNTPTH 5041	Science of Fungi: Mycology Lecture (3 cr) & Science of Fungi: Mycology Lab (1 cr)	4	AU Year 1
OR			
PLNTPTH 5050	Plant Pathogenic Fungi.....	3	SP Year 1
PLNTPTH 5030	Plant Nematology	2	SP Year 1
PLNTPTH 6002.02	Advanced Plant Pathology - Plant Pathogenic Fungi and Nematodes	1	SP Year 1
PLNTPTH 5685	Plant Disease Diagnosis	2	SU Year 1 or 2
PLNTPTH 5603	Plant Disease Management	3	AU Year 2
Variable	Statistics class, as determined in consultation with *SAC	3	AU or SP Year 2
PLNTPTH 8400	Molecular Bases of Plant Host-Microbe Interactions	3	SP Year 2
ELECTIVES	Determined in consultation with SAC	Varies	
ENGLISH courses (may be required for international students depending on ESL composition placement)			
EDUTL 5901	Advanced English as a Second Language (if required)	3	Year 1
EDUTL 5902	Advanced Writing in English as a Second Language (if required).....	3	Year 1
SEMINAR			
Students will enroll in PLNTPTH 8899 Seminar (1 credit) each Autumn & Spring semester		Varies	AU, SP
RESEARCH CREDITS			
Students will enroll in PLNTPTH 8999 Research each term (variable credits), including Summer, to fulfill full-time enrollment requirements for associateships/fellowships		Varies	AU, SU, SP
**TOTAL CREDITS			

* **Student Advisory Committee (SAC).** The SAC consists of the major advisor and at least two graduate faculty. Including the major advisor. At least two of the SAC members must be regular faculty in the Department of Plant Pathology. The SAC can approve electives, schedule changes or course substitutions. Course substitutions should be clearly documented, with a brief justification, on Form I and submitted to the GSC chair.

****TOTAL CREDITS:** The Ph.D. credit requirement is 90 graduate credit hours (semester), including research (8999) and seminar (8899) credits, with a minimum cumulative GPA of 3.0. At least 50 of those graduate credits must be completed beyond the master's degree (Graduate School Handbook). Full-time students on graduate appointments typically exceed 90 total credits.

Department of Plant Pathology

PLNTPTH 5050: Plant Pathogenic Fungi

3 credits

Prerequisite: PLNTPTH 3001 or 6001, or permission of instructor

Course description: This course is designed to provide a more in-depth look at the filamentous plant pathogens, fungi, to better prepare graduate students planning on constructing careers in plant pathology. This course will cover the different groups of fungal pathogens with examples, their biology, and their impact in society both historically and currently.

Course Goals

Learning goal 1: Understand the characteristics that set fungi apart from other life forms.

Learning outcome 1.1: Describe the features common to the major phyla in the fungal kingdom.

Learning outcome 1.2: Describe the features common to Oomycetes.

Learning goal 2: Learn about the different fungal pathogens, how they infect, their impact, and their control.

Learning outcome 2.1: Identify the most commonly found fungal pathogens in the environment.

Learning outcome 2.2: Outline the lifecycles of representative species of important fungal pathogens.

Learning goal 3: Understand the basic tenants of fungal biology, physiology, and genetics.

Learning outcome 3.1: Explain different mechanisms involved in filamentous microorganism survival, nutrient acquisition, maintenance of genetic diversity, and adaption to host immunity.

Content Topic List

Ascomycetes	<i>Botrytis cinerea</i>	Basidiomycetes	<i>Rhizopus spp.</i> (Mucormycetes)
<i>Fusarium graminearum</i>	<i>Sclerotinia sclerotiorum</i>	<i>Armillaria spp.</i>	Oomycetes
<i>Fusarium oxysporum</i>	<i>Blumeria</i> (Erysiphe) spp.	<i>Rhizoctonia spp.</i>	<i>Phytophthora spp.</i>
<i>Verticillium dahliae</i>	<i>Aspergillus spp.</i>	<i>Heterobasidion annosum</i>	<i>Pythium ultimum</i>
<i>Magnaporthe oryzae</i>	<i>Penicillium spp.</i>	<i>Monilophthora perniciososa</i>	<i>Bremia,</i> <i>Pseudoperonospora</i>
Gaeumannomyces		<i>Ustilago nuda</i>	
<i>Colletotricum</i>		<i>Ustilago maydis</i>	
<i>Ophiostoma ulmi</i>		<i>Puccinia graminis f. sp. Tritici</i>	
<i>Cryphonectria parasitica</i>		<i>Hemileia vastatrix</i>	
<i>Septoria</i>		Early diverging fungi	
<i>Mycosphaerella</i>		<i>Synchytrium</i>	
<i>Alternaria alternata</i>			
<i>Cochliobolus heterostrophus</i>			

Department of Plant Pathology

PLNTPTH 6002.01: Advanced Plant Pathology Lab - Viruses and Bacteria

1 credit

Course description: This course is intended to prepare students to be able to implement techniques used by virologists and bacteriologists in both lab and field settings.

Prerequisite or concur: PLNTPTH 5010 and 5020

Course Goals:

Plant Viruses

Learning goal 1: Inoculate viruses to plants using mechanical and insect transmission methods.

Learning outcome 1.1: Understand and describe transmission modes of plant viruses

Learning outcome 1.2: Inoculate viruses in the laboratory

Learning outcome 1.3: Describe and identify a range of known virus symptoms

Learning goal 2: Identify virus symptoms and diagnose viruses

Learning outcome 2.1: Use serological methods to diagnose virus infections

Learning outcome 2.2: Use amplification-based methods to diagnose virus infections and compare sequences

Learning outcome 2.3: Understand the principles underlying deep-sequencing based virus identification and discovery

Learning goal 3: Learn how to purify virus particles and visualize virus infections

Learning outcome 3.1: Purify virus particles using ultracentrifugation

Learning outcome 3.2: Understand how virus infections can be visualized using microscopy

Plant-Associated Bacteria

Learning goal 1: Isolate and culture bacteria

Learning outcome 1.1: Students will understand and demonstrate the importance of sterile technique.

Learning outcome 1.2: Students will demonstrate how to isolate, culture and store plant-associated bacteria.

Learning goal 2: Using selective media for culturing plant-associated bacteria.

Learning outcome 2.1: Students will describe and demonstrate how selective media can be used to isolate plant-associated bacteria.

Learning goal 3: Methods for identifying bacteria

Learning outcome 3.1: Students will be able to describe and demonstrate the use of various DNA techniques used to identify plant-associated bacteria.

Content Topic List

- **Virology:** Virus transmission modes, symptoms, and laboratory transmission of potyviruses with host range differentials; ELISA and RT-PCR for virus detection; Virion purification using ultracentrifugation; Leaf dip, ISEM and fluorescent microscopy
- **Virology:** Principles of deep sequencing virus discovery; Deep sequencing techniques for virus identification and discovery
- **Bacteriology:** Working with Phytobacteriology Sterile technique; Maintenance/storage of bacterial cultures; Selective media and biochemistry; Identification of phytobacteria: PCR; Identification of phytobacteria: ARDRA;
- **Bacteriology:** Identification of phytobacteria: BLAST and phylogenetics

Department of Plant Pathology

PLNTPH 6002.02: Advanced Plant Pathology Lab - Plant Pathogenic Fungi and Nematodes

1 credit

Course description: This graduate course is intended to prepare students to be able to implement techniques used by nematologists and mycologists in both lab and field settings.

Prerequisite or concur: 5030 and 5050

Course goals or learning objectives/outcomes

Fungal Pathology:

Learning goal 1: Describe and identify the structures of common plant pathogenic fungi.

Learning outcome 1.1: Students will be able to recognize and discuss common fungal pathogens they may encounter during their careers.

Learning goal 2: Execute and analyze results of different techniques used by mycologists.

Learning outcome 2.1: Students will be able to produce, isolate, and use fungal cultures originating from both media and plant tissue.

Learning outcome 2.2: Students will be able to execute different inoculation techniques, examine results, and distinguish the appropriateness for their use in different experimental designs.

Learning outcome 2.3: Students will be able to implement fungicide spray applications on a small scale as well as determine the fungicides effectiveness.

Learning outcome 2.4: Students will be able to effectively set up and navigate different spore collection techniques.

Learning goal 3: The execution of basic molecular techniques involving fungal genomes.

Learning outcome 3.1: Students will be able to extract fungal DNA and examine genes of interest through primer design, PCR, and sequencing.

Nematode Pathology:

Learning goal 1: Identify and describe the symptomology of common plant-parasitic nematodes.

Learning outcome 1.1: Students will be able to recognize and describe common nematodes found in crop plants.

Learning goal 2: Isolate nematodes from plants.

Learning outcome 2.1: Students will be able to isolate nematodes according to their location and biology.

Learning outcome 2.2: Students will be able to describe the pros and cons for the various isolation procedures used.

Learning goal 3: Execute and analyze test to determine host range and virulence of nematodes.

Learning outcome 3.1: Students will design and test experiments that test the host range of various plant-parasitic nematodes.

Learning outcome 3.2: Students will design and test experiments that test the virulence of some common plant-parasitic nematodes on a common host plant.

Content Topic List

- **Fungi:** culturing, hyphal tip transfer, Begin Environmental morphology
Plant inoculation methods
Fungal isolation from plant material, finish Environmental morphology
- **Fungi:** DNA Extraction and barcode PCR, Fungicide mixing and application
PCR purification, sequencing set up, Spore traps, mycotoxin testing, analysis of fungicide trial
Fungal Structures, sequence analysis
- **Nematodes:** How to identify nematode damage on plants; Nematode isolation methods;
Nematode staining techniques; Nematode host range and virulence