Plant Pathology 526
Advanced Fungal Biology
Spring 2018

INSTRUCTOR: Tobin Peever, 357 Johnson Hall, 335-3754, tpeever@wsu.edu

COURSE WEBSITE: Blackboard Learn (https://learn.wsu.edu)

COURSE OBJECTIVES:

a) For each student to develop an understanding of fungal biology, including ecology and evolution, population genetics, systematics, and evolution of fungus-host interactions;

b) For each student to develop a good working knowledge of modern molecular tools and how they can be used to answer questions relating to fungal biology, ecology, population genetics and systematics;

c) To provide each student with the tools to critically evaluate scientific literature and to promote critical thinking

COURSE ORGANIZATION:

Lectures/case study & discussions:

Two hours per week, Tuesday/Thursday 1:25-2:15 pm

Laboratories/Discussion and evaluation of research papers:

Five hours per week, Tuesday/Thursday 2:30-5 pm or by arrangement

This course was designed as a non-lecture graduate mycology class focusing on fungal population biology, ecology, evolution and systematics. We will have some lectures (see schedule), mostly during the first half of the semester, in order to provide you with a foundation for the case studies, laboratories and paper discussions. The remainder of the course will consist of case study discussions, structured paper discussions, laboratory project discussions, and hands-on wet laboratory components. Case studies will focus on selected topics including a few disease systems that highlight different aspects of fungal biology, ecology, population genetics and evolution. Some of the possible topics are: *Cryphonectria parasitica*, an ascomycete fungus that causes chestnut blight; *Ustilago maydis*, a basidiomycete fungus that causes corn smut; *Phytophthora ramorum*, a fungal-like oomycete that causes sudden oak death; and *Batrochochytrium dendrobatidis*, a chytrid fungus that causes chytridiomycosis in frogs and other amphibians. These systems will be explored through assigned readings of key literature, discussions and other types of group active learning activities.

We will critically evaluate four research papers throughout the semester dealing with various aspects of fungal biology, genetics, population biology, ecology and evolution. Each student is

expected to be prepared to facilitate one of these discussions each time they are held and facilitators will be selected at random at the beginning of each discussion. Because you could be selected to lead the discussion on any given day, you will need to read the papers carefully and be prepared to facilitate the discussion each time. Each student will be expected to participate actively in each discussion and will be graded on participation and facilitation (15% of grade). We will employ the "Waterman & Rissler (W&R) Method" to accomplish our reviews of the scientific literature and you will be introduced to this method during the second week of class. In order to help you understand how the W&R method works in practice, we have posted a sample W&R analysis as well as a PDF of the scientific paper the analysis was based upon (Takano et al.). The instructor will lead the first W&R discussion during the week of Jan 16 to give you an idea of how they work and student-led discussions will start the week of January 30.

Laboratory meeting times and schedule will be mostly unstructured and flexible after approximately the first month of class. Students will be expected to work cooperatively with others in their group in their location to accomplish their objectives. Members of each lab group in Pullman will need to coordinate their activities both within the group and with permanent members of Peever's lab. Personnel in the Peeverlab have priority in terms of equipment and space so you will need to be communicative and considerate and work around their schedules. Similarly, students in Wenatchee and Mount Vernon will be utilizing research lab facilities so will need to work around the schedules and use patterns of those labs. Students will also need to work closely with the instructor to keep the project moving on schedule. Each student will be graded on his/her contribution to the group project by other members of the group (5% of final grade). The lab projects you will pursue do not fit neatly into a 3-hour lab format so will be carried out in research labs. The instructor does not believe that "cookbook" labs are particularly valuable at the graduate level. Therefore, you will be required to work with other members of your group outside of normal class hours to accomplish your project objectives. The instructor will be available during laboratory times and by appointment to help you formulate research questions, design experiments and to help you accomplish your objectives. Each group of students is responsible for making appointments to meet with the instructors on a regular basis (at least every 2 weeks) in order to receive feedback about the progress of the projects. The laboratory component of this class may be somewhat less "cookbook" than what many of you have experienced in the past but should hopefully be much more realistic, satisfying and fun.

Laboratory Projects

Diversity of chanterelles (*Cantharellus* spp.) in the inland US Pacific Northwest

Diversity of morels (Morchella spp.) in the inland US Pacific Northwest

Exams

One written mid-term exam is scheduled for Feb 20 and one final oral exam will be scheduled during the regular exam week, April 30 to May 4.

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References and Textbook

There is no textbook available which is completely suitable for a fungal genetics, ecology and evolution course at this level. There are, however, several good texts that are suitable for various parts of the course that we will refer to from time to time. These textbooks or copies of the relevant sections will be made available to you via Blackboard. Some of the texts may be available in the classroom in Pullman as well. You can make photocopies of relevant articles from these books but please do not take these books home or remove them from the classroom. Other students need to have access to them. The main reference we will use for the first few lectures is *Fungal Genetics* 4th edition by Fincham, Day, and Radford. 1979. An excellent (but dated) book which deals mainly with the "classical" genetics of fungi.

Readings

A list of references for each section of the course will be provided on Blackboard. These will generally be review articles and/or articles from the primary scientific literature. These lists will be posted on the class site and Adobe PDF files of the required readings will also generally be available on the site. If the readings are not available in electronic format, paper copies will be provided in the classroom and we will make PDFs available to students located off-campus.

Evaluation

You will be evaluated on 7 different components. Each component is presented as a percentage of your final grade:

a) Written midterm examination - 20%
b) Oral final examination - 20%
c) Discussion participation - 15%
d) Case Study assignments – 10%
e) Laboratory Project report – 20%
f) Peer evaluation - 15%

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Course Schedule

Week 1—Jan 9, 11	**Lecture**: Introduction to fungal life cycles; Meiotic Analysis
	Laboratory: Introduction to Waterman & Rissler
Week 2—Jan 16, 18	**Lecture**: Meiotic Analysis
	Laboratory: Set up crosses of *Sordaria fimicola*; 1st Waterman & Rissler discussion
Week 3—Jan 23, 25	**Case Study:** One gene-one enzyme
	Laboratory: Set up more crosses of *Sordaria fimicola*; Laboratory group project
Week 4—Jan 30, Feb 1	**Lecture**: Fungal Mating Genes; Fungal Mating Systems
	Laboratory: Score *Sordaria fimicola* tetrads; Laboratory group project
Week 5—Feb 6, 8	**Lecture**: Vegetative Incompatibility; Molecular Markers
	Laboratory: Meiotic data analysis; Laboratory group project; 2nd Waterman & Rissler discussion
Week 6—Feb 13, 15	**Midterm Exam**
	Laboratory: 3rd Waterman & Rissler discussion; Laboratory group project
Week 7—Feb. 20, 22	**Lecture**: What is a fungal species?
	Laboratory: Basic bioinformatics and molecular systematics analyses
Week 8—Feb 27, Mar 1	**Lecture**: Systematics and Speciation
	Laboratory: 4th Waterman & Rissler discussion
Week 9—March 6, 8	**Lecture**: Genomics
	Laboratory: Basic bioinformatics and molecular systematics analyses
March 12-16	**Spring Break**
Week 10—March 20, 22	**Lecture** & **Case Study**—*Cryphonectria parasitica*
	Laboratory: Laboratory group project
Week 11—March 27, 29	**Lecture** & **Case Study**—*Ustilago maydis*

Plant Pathology 526
Advanced Fungal Biology
Spring 2018

	Laboratory: Laboratory group project
Week 12—April 3, 5	**Lecture** & **Case Study**—*Phytophthora ramorum*
	Laboratory: Laboratory group project
Week 13—April 10, 12	**Lecture** & **Case Study**-- *Batrachochytrium dendrobatidis*
	Laboratory: Laboratory group project
Week 14—April 17, 19	**Laboratory**: Laboratory group project
Week 15—April 24, 26	**Laboratory**: Laboratory group project
Final Exam Week—April 30 to May 4	Individual oral exams scheduled throughout the week