

The University of Manitoba  
Faculty of Agricultural and Food Sciences



**COURSE TITLE**

Molecular Plant-Microbe Interactions

**Department**

Plant Science

**Course Number**

PLNT4580

**Academic Session**

Fall

**Credit Hours**

3

**Prerequisites and how they apply to this course**

PLNT 3570 (or 039.357)

**Classroom Location**

TBA

**Meeting Days and Class Hours**

Variable

**Lab/Seminar Location**

Variable

**Lab/Seminar/Hours**

Variable

**Department Office location**

222 Agricultural Building

**Phone Number**

**Course Web Page (if applicable)**

<http://home.cc.umanitoba.ca/~daayff/outlinePLNT4580.html>

Instructor Information

**Name & Title**

|                 | Office               | Telephone    | E-mail                 |
|-----------------|----------------------|--------------|------------------------|
| Dr. Fouad DAAZF | 228 Agriculture Bldg | 204-474-6096 | Daayff@cc.umanitoba.ca |

**Office Location:** 228 Agricultural Building    **Office Phone Number** 204-474-6096

**Office Hours**

**Email Address:**        Fouad.Daayf@umanitoba.ca

**Teaching Assistant(s) (if applicable)**

**TA Office Hours and Location**

## Course Philosophy

### **Students' Learning Responsibilities**

Students will attend lectures by the instructor and invited speakers, and will participate in class discussions on specific subjects. Throughout the term, students will present three research papers directly related to the topics studied in the lectures. They will also have to prepare a term paper and present it in front of an audience.

### **Why this course is useful?**

This course will provide students with an overview of general mechanisms, as well as very specific details, on selected microbial pathogenesis and plant defense themes. For example, students will learn the basis of plant resistance to diseases in different models and the mechanisms involved. They will also learn the specific strategies used by certain pathogens to infect plants and defeat plant defenses.

### **Who should take this course?**

Students interested in further specialization in plant pathology, and those specializing in other related areas but willing to have a good understanding of how plants and pathogens deal with each other. This course will also be of interest to students from other biological sciences looking to broaden their knowledge in adjacent and complementary disciplines.

### **How this course fits into the curriculum**

This course is part of the Biotechnology stream, and is one of the three Plant Pathology courses suggested to students wanting to specialize in plant pathology. It could also be beneficial to students specializing in Genetics/Breeding, as many research projects in plant breeding, in the industry as well as universities, are based on plant disease resistance. This course is very useful to students willing to continue their graduate studies in Molecular Plant Pathology.

## Course Description/Objectives

### **Undergraduate Calendar Description**

PLNT 4580 Molecular Plant-Microbe Interactions (Formerly O39.458) Course will cover general principles and mechanisms related to plant-pathogen interactions, such as in gene-to-gene and toxin models. Emphasis will be on biochemical/molecular mechanisms of plant-microbe recognition, pathogenesis, and plant reactions to infections. Both beneficial and deleterious associations will be covered. Prerequisite: PLNT 3570 (or O39.357). This course is offered in alternate years.

## Instructional Methods

This course is given in the form of lectures by the instructor as well as invited speakers to cover specific topics of specialization. Students will make a number of presentations of both research and review papers, as well as a term paper. All presentations are meant to have discussions on the topics presented. There is no laboratory in this course.

## Course Objectives

Understanding the principles of plant-microbe interactions at the biochemical/molecular levels, through study of the following:

- Host-pathogen models (i.e., gene-for-gene system)
- Plant-Microbe recognition,
- Molecular and biochemical bases of pathogenesis
- Molecular and biochemical mechanisms of plant defenses (Structural *versus* induced defenses, Local versus systemic resistance, Signaling in plant-disease resistance, The Hypersensitive Response, Systemic Acquired Resistance (SAR) *versus* Induced Systemic Resistance (ISR)
- Signaling in plant-microbe interactions
- Introduction to beneficial associations of microbes with plants (Symbiosis, PGPRs for biocontrol)

## Learning outcomes

Students will learn how pathogens infect plants, how plants defend themselves, and how pathogens counter-attack. The student will be offered the genetic, pathological, and biochemical angles. Students will also be introduced to specific terminology that will prepare them to understand specialized papers more easily, and to communicate such knowledge in more lay terminology to their audiences. Such skills are important for students intending to work for the industry, the government, as well as those planning to continue their graduate studies.

## Additional Comments:

## Description of Examinations

There will be a mid-term written and a final oral exam in this course.

## Description of Assignments

Each student will have to make 3 presentations throughout the term. For each presentation, each student will have one review + one research papers to read and present. The student should present the research paper, but must use the review paper to introduce the audience to concepts, terminology, or recent findings. Also, every student will choose a subject from a list proposed by the instructor, gather the appropriate literature on the subject, and write a term review paper and present it before the end of the term.

### **Assignment Due Dates**

To be given in class for each assignment.

### **Grade Evaluation**

Reading/Presentations: (30%) Each student will make 3 research paper presentations throughout the term. Each presentation is worth 10%.

Participation to class discussion: (10%) Participation to class discussion will be marked.

Term paper project: (20%) Every student will choose a subject from a list proposed by the instructor, gather the appropriate literature on the subject, and write a term review paper (10%). Before the end of the term, each student will have the opportunity to make a presentation of their paper in front of an audience (10%).

Mid-term written exam: (25%)

Final oral exam: (15%)

**Important Dates (e.g., voluntary withdrawal date)**

### **Texts, Readings, Materials**

**Textbook(s) – Authors, Titles, Edition**

- No mandatory textbook.

**Supplementary Reading**

- Suggested books:

- \* Plant Pathology by George N. Agrios, Fifth Edition
- \* Molecular Plant Pathology by Dickinson M. & Beynon J. (eds.)
- \* Biology of Plant-Microbe Interactions, by Leong S.A., Allen C., and Triplett E.W. (eds)
- \* Molecular Aspects of Pathogenicity and Resistance: Requirement for Signal Transduction, by Mills D., Kunoh H., Keen N., and Mayama S. (eds).

## **Additional Materials**

### Course Policies

#### **Late Assignments**

Assignments that are submitted after the stated deadline will be deducted 5% a day of the grade up to the end of the first week and 25% thereafter for each week the assignment is late.

#### **Missed Assignments**

Missed assignments will be given a nil mark unless a valid justification is presented. Assignments, reports, or exams which are illegible or poorly written may be subject to refusal or deduction of the final grade.

#### **Missed Exams**

Missed exams will be given a nil mark unless a valid justification is presented.

#### **Academic Integrity**

Plagiarism or any other form of cheating in examinations, term tests or academic work is subject to serious academic penalty. Cheating in examinations or tests may take the form of copying from another student or bringing unauthorized materials into the exam room. Exam cheating can also include exam impersonation. A student found guilty of contributing to cheating in examinations or term assignments is also subject to serious academic penalty. Students should acquaint themselves with the University's policy on plagiarism, cheating, exam impersonation and duplicate submission (see the University of Manitoba Undergraduate Calendar).

#### **Additional Comments:**

#### **Use of Third Party Detection and Submission Tools**

Electronic detection tools may be used to screen assignments in cases of suspected plagiarism.

## Group Work Policies:

### Course Content

Lectures and paper discussions will cover the following:

- Host-pathogen models in plant pathology
- The gene-for-gene system
- Plant-Microbe recognition
- Molecular and biochemical bases of pathogenesis
- Molecular and biochemical mechanisms of plant defenses:
  - Structural versus induced defenses,
  - Local versus systemic resistance,
  - Signaling in plant-disease resistance,
  - The Hypersensitive Response,
  - Systemic Acquired Resistance (SAR)
  - Induced Systemic Resistance (ISR)
- Signaling in plant-microbe interactions
- Introduction to beneficial associations of microbes with plants (Symbiosis, PGPRs for biocontrol)