

# PBIO\*4000 - Molecular and Cellular Aspects of Plant-Microbe Interactions

## Fall 2023 Course Outline

**Section: 01**

**Credits: 0.50**

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## Land Acknowledgement: Guelph

The University of Guelph resides on the ancestral lands of the Attawandaron people and the treaty lands and territory of the Mississaugas of the Credit. We recognize the significance of the Dish with One Spoon Covenant to this land and offer respect to our Anishinaabe, Haudenosaunee and Métis neighbours. Today, this gathering place is home to many First Nations, Inuit, and Métis peoples and acknowledging them reminds us of our important connection to this land where we work and learn.

## Calendar Description

This course examines molecular and cellular aspects of the interaction between plants and microorganisms such as mycorrhizae, pathogenic fungi, Agrobacterium, pathogenic bacteria, and plant viruses. Topics include microbial virulence, signaling, gene expression, and disease resistance in plants.

**Prerequisite(s):** 1 of BOT\*2100, MICR\*2030, (BIOL\*1070, BIOL\*1090, MBG\*2040)

**Department(s):** School of Environmental Sciences

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## Lecture Schedule

TuTh 8:30am-9:50am in ALEX\*265 (9/7 to 12/15)

## Instructor Information

Paul Goodwin

Email: pgoodwin@uoguelph.ca

Office: BOVEY 2329

Fall 2023 Office Hours:

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Please email to arrange a meeting.

No questions directly addressed via email. Please make appointment with Professor.

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## Learning Resources

### Course Resources

The following papers are the basis of the **oral quizzes** and are in order following the lectures in class:

Topic of plant disease defenses: Guo, A., Salih, G. and Klessig, D.F. 2000. Activation of a diverse set of genes during the tobacco resistance response to TMV is independent of salicylic acid; induction of a subset is also ethylene independent. *Plant Journal* 21: 409-418.

Topic of host-pathogen recognition and PAMPs: Segonzac, C., Feike, D., Gimenez-Ibanez, S., Hann, D.R., Sipfel, C. and Rathjen, J.P. 2011. Hierarchy and roles of pathogen-associated molecular pattern-induced responses in *Nicotiana benthamiana*. *Plant Physiology* 156: 687-699.

Topic of host-pathogen recognition and effectors: Swiderski, M.R. and Innes, R.W. 2001. The Arabidopsis PBS1 resistance gene encodes a member of a novel protein kinase subfamily. *Plant Journal* 26: 101-112.

Topic of induced disease resistance: Van der Ent, S., Van Hulten, M. and Pozo, M.J., et al. 2009. Priming of plant innate immunity by rhizobacteria and beta-aminobutyric acid: differences and similarities in regulation. *New Phytologist* 183: 419-431.

Topic of fungal pathogenicity: Voigt, C.A., Schäfer, W. and Salomon, S. 2005. A secreted lipase of *Fusarium graminearum* is a virulence factor required for infection of cereals. *Plant Journal* 42: 364-375.

Topic of bacterial pathogenicity: Wei Guo, Lu-Lu Cai, Hua-Song Zou, Wen-Xiu Ma, Xi-Ling Liu, Li-Fang Zou, Yu-Rong Li, Xiao-Bin Chen and Gong-You Chen. 2012. Ketoglutarate transport protein KgtP is secreted through the type III secretion system and contributes to virulence in *Xanthomonas oryzae* pv. *oryzae*. *Applied and Environmental Microbiology* 78: 5672-5681.

Topic of endophytes: Gagné-Bourque F, Mayer BF, Charron J-B, Vali H, Bertrand A, Jabaji S. 2015. Accelerated growth rate and increased drought stress resilience of the model grass *Brachypodium distachyon* colonized by *Bacillus subtilis* B26. *PLoS ONE* 10: e0130456.

Topic of viral pathogenicity: Kramer, S.R., Goregaoker, S.P. and Culver, J.N. 2011. Association of the Tobacco mosaic virus 126 kDa replication protein with a GDI protein affects host susceptibility. *Virology* 414: 110-118.

## Campus Resources

If you are concerned about any aspect of your academic program: Make an appointment with a Program Counsellor (<https://www.uoguelph.ca/uaic/programcounsellors/>) in your degree program. If you are struggling to succeed academically: There are numerous academic resources offered by the Learning Commons (<https://www.lib.uoguelph.ca/using-library/spaces/learning-commons/>) including, Supported Learning Groups for a variety of courses, workshops related to time management, taking multiple choice exams, and general study skills.

## Course Learning Outcomes

1. Memorize examples of the components of molecular and cellular biology of plant-microbe interactions.
2. Apply the concepts of plant-microbe interactions to the study of particular microbial virulence and plant defense response mechanisms.
3. Orally present results and conclusions in class for selected research papers in molecular plant-microbe interactions.
4. Evaluate and analyze results and conclusions in class for selected research papers in molecular plant-microbe interactions.
5. Demonstrate the ability to observe similarities and differences in the techniques and approaches used to generate new knowledge in molecular plant-microbe interactions.

## Teaching and Learning Activities

### Weekly Activities

Topics:

Introduction

Plant disease defenses

Host-pathogen recognition and PAMPs

Host-pathogen recognition and Effectors

Induced disease resistance

Fungal pathogenicity

Bacterial pathogenicity

Endophytes

Viral pathogenicity

Colloquium of graduate student presentations of research articles

## Assessment Breakdown

Description	Weighting (%)	Due Date
Midterm	35%	Following induced resistance topic
Oral quizzes	30%	Following each topic
Final Exam	35%	TBD

## Assessment Details

### Midterm

#### Midterm

**35%**

Mid-term exam is taken during class period in person and will occur following the induced resistance topic.

**Course Learning Outcomes Assessed:** 1, 2

### Quizzes

#### Oral Quizzes

**30%**

Oral quizzes are part of in-class discussions of each research paper linked to a specific lecture topic (topics listed above in the lecture content).

They will be held in class like the lectures.

The date of the oral quiz of each research paper (papers listed as course resources) will be announced in class following completion of the lecture material for the corresponding topic.

It is important to thoroughly read, analyze and prepare to answer questions for the oral quiz of each research paper.

**Course Learning Outcomes Assessed:** 3, 4, 5

### Exam

#### Final Exam

**35%**

Exam essay questions to be completed using full sentences and paragraphs.

Examination questions include information from class discussions of research papers, graduate student colloquium presentations and lecture material.

**Course Learning Outcomes Assessed:** 1, 2, 3, 4, 5

## Final Exam

Date: Dec 6

Time: Wed 8:30am-10:30am

Location: TBA *Please see Web Advisor closer to the date of scheduled final for location.*

To understand rules and regulations regarding Examinations students are encouraged to read Student's Responsibilities (<https://calendar.uoguelph.ca/undergraduate-calendar/undergraduate-degree-regulations-procedures/examinations/>)

If the student is unable to meet the final exam requirements due to medical, psychological or compassionate circumstances they are encouraged to review Student's Responsibilities in the Academic Consideration, Appeals and Petitions (<https://calendar.uoguelph.ca/undergraduate-calendar/undergraduate-degree-regulations-procedures/academic-consideration-appeals-petitions/>) section of the Academic Calendar.

## Last Day to Drop Course

The deadline to drop Fall 2023 courses without academic penalty is the last day of classes: December 01

After this deadline, a mark will be recorded, whether course work is completed or not (a zero is assigned for missed tests/assignments). This mark will show on the student's transcript and will be calculated into their average.

## Course Grading Policies

### Missed Assignment

Missed oral quizzes must be made up. Consult with instructor to determine a suitable time.

## Standard Statements for Undergraduate Courses

### Academic Integrity

The University of Guelph is committed to upholding the highest standards of academic integrity and it is the responsibility of all members of the University community – faculty, staff, and students – to be aware of what constitutes academic misconduct and to do as much as possible to prevent academic offences from occurring. University of Guelph students have the responsibility of abiding by the University's policy on academic misconduct regardless of their location of study; faculty, staff and students have the responsibility of supporting an environment that discourages misconduct. Students need to remain aware that instructors have access to and the right to use electronic and other means of detection.

Please note: Whether or not a student intended to commit academic misconduct is not relevant for a finding of guilt. Hurried or careless submission of assignments does not excuse students from responsibility for verifying the academic integrity of their work before submitting it. Students who are in any doubt as to whether an action on their part could be construed as an academic offence should consult with a faculty member or faculty advisor.

The Academic Misconduct Policy (<https://calendar.uoguelph.ca/undergraduate-calendar/undergraduate-degree-regulations-procedures/academic-misconduct/>) is outlined in the Undergraduate Calendar.

### Accessibility

The University promotes the full participation of students who experience disabilities in their academic programs. To that end, the provision of academic accommodation is a shared responsibility between the University and the student.

When accommodations are needed, the student is required to first register with Student Accessibility Services (SAS). Documentation to substantiate the existence of a disability is required; however, interim accommodations may be possible while that process is underway.

Accommodations are available for both permanent and temporary disabilities. It should be noted that common illnesses such as a cold or the flu do not constitute a disability. Use of the SAS Exam Centre requires students to make a booking at least 10 days in advance, and no later than the first business day in November, March or July as appropriate for the semester. Similarly, new or changed accommodations for online quizzes, tests and exams must be approved at least a week ahead of time. For students at the Guelph campus, information can be found on the SAS website. (<https://www.uoguelph.ca/sas/>)

### Accommodation of Religious Obligations

If you are unable to meet an in-course requirement due to religious obligations, please email the course instructor within two weeks of the start of the semester to make alternate arrangements.

See the Academic calendar for information on regulations and procedures for Academic Accommodations of Religious Obligations (<https://calendar.uoguelph.ca/undergraduate-calendar/undergraduate-degree-regulations-procedures/academic-accommodation-religious-obligations/>).

### Copies of Out-of-class Assignments

Keep paper and/or other reliable back-up copies of all out-of-class assignments: you may be asked to resubmit work at any time.

### Drop Date

Students will have until the last day of classes to drop courses without academic penalty. The deadline to drop two-semester courses will be the last day of classes in the second semester. This applies to all undergraduate students except for Doctor of Veterinary Medicine and Associate Diploma in Veterinary Technology (conventional and alternative delivery) students. The regulations and procedures for course registration are available in the Undergraduate Calendar - Dropping Courses (<https://calendar.uoguelph.ca/undergraduate-calendar/undergraduate-degree-regulations-procedures/dropping-courses/>).

### Email Communication

As per university regulations, all students are required to check their <uoguelph.ca> e-mail account regularly: e-mail is the official route of communication between the University and its students.

### Health and Wellbeing

The University of Guelph provides a wide range of health and wellbeing services at the Vaccarino Centre for Student Wellness (<https://wellness.uoguelph.ca/>). If you are concerned about your mental health and not sure where to start, connect with a Student Wellness Navigator (<https://wellness.uoguelph.ca/navigators/>) who can help develop a plan to manage and support your mental health or check out our mental wellbeing resources (<https://wellness.uoguelph.ca/shine-this-year/>). The Student Wellness team are here to help and welcome the opportunity to connect with you.

## **Illness**

Medical notes will not normally be required for singular instances of academic consideration, although students may be required to provide supporting documentation for multiple missed assessments or when involving a large part of a course (e.g., final exam or major assignment).

## **Recording of Materials**

Presentations that are made in relation to course work—including lectures—cannot be recorded or copied without the permission of the presenter, whether the instructor, a student, or guest lecturer. Material recorded with permission is restricted to use for that course unless further permission is granted.

## **Resources**

The Academic Calendars (<http://www.uoguelph.ca/registrar/calendars/?index>) are the source of information about the University of Guelph's procedures, policies and regulations which apply to undergraduate, graduate and diploma programs.

## **When You Cannot Meet a Course Requirement**

When you find yourself unable to meet an in-course requirement because of illness or compassionate reasons please advise the course instructor (or designated person, such as a teaching assistant) in writing, with your name, id#, and e-mail contact. See the Undergraduate Calendar for information on regulations and procedures for Academic Consideration. (<https://calendar.uoguelph.ca/undergraduate-calendar/undergraduate-degree-regulations-procedures/academic-consideration-appeals-petitions/>)