



# **BOT\*3310 Plant Growth and Development**

Winter 2021

Section(s): C01

Department of Molecular and Cellular Biology

Credit Weight: 0.50

Version 2.00 - January 12, 2021

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## **1 Course Details**

### **1.1 Calendar Description**

In this course the unique function and structure of plants is explored in relation to their growth, survival and adaptation to the environment. The control of growth and development by environmental and hormonal signals is explained through lectures and "hands-on" laboratories.

**Pre-Requisites:** BIOL\*1090, (BIOL\*1070 or BIOL\*1080)

### **1.2 Course Description**

This course explores the basic foundations of plant growth and development. Emphasis will be on unique aspects of plants, ranging from the single cell to the whole organism, and integration of events at the cellular level with whole plant development. Topics include basic plant structure and morphology, developmental physiology, growth regulators, hormones and signaling, photomorphogenesis, vegetative and reproductive development, cellular and sub-cellular components and their connection to plant form, and plant/environment interactions. Molecular and genetic mechanisms underlying plant physiology will be a central theme of this course. The "laboratory" component has been adapted to the current COVID-related restrictions and will offer students on-line modules in modern methods of plant analysis using the model plant *Arabidopsis thaliana*.

**This is a draft course outline and is subject to change up to the first day of classes, in keeping with the policy described in the University of Guelph Academic Calendar.**

**Make sure that you have access to Microsoft Teams.**

### **1.3 Timetable**

## Lectures and Laboratories:

- **Lectures:** Links to lecture notes and to recordings will be provided via courselink. On-line discussions of the lectures are to be held at **12:30-1:20 on Monday, Wednesday and Friday via Microsoft Teams**. "Lectures" start on January 11.
- **Laboratories:** The laboratory component is expected to be conducted through **Microsoft Teams on Tuesdays 2:30-5:20** (courselink platform is available as a secondary/backup video platform). "labs" start on January 12.

**You are expected to attend all MS Teams meetings for lectures and labs - information provided during these periods is included in the material you are responsible for at the tests, exams and the assignments.**

## 1.4 Final Exam

**Tentatively scheduled for Saturday April 17, 2021 11:30-1:30**

Exact procedure will be announced closer to exam time. Check CourseLink.

# 2 Instructional Support

## 2.1 Instructional Support Team

|                      |   |
|----------------------|---|
| <b>Instructor:</b>   | Annette Nassuth   |
| <b>Email:</b>        | anassuth@uoguelph.ca  |
| <b>Telephone:</b>    | +1-519-824-4120 x588787   |
| <b>Office:</b>       | SSC 4459  |
| <b>Office Hours:</b> | Questions can be e-mailed to me ahead of, or during the scheduled discussion periods. Contact me by email if you still have questions that were not resolved. |

|                          |                        |
|--------------------------|------------------------|
| <b>Lab Co-ordinator:</b> | Chris Meyer            |
| <b>Email:</b>            | cmeyer02@uoguelph.ca   |
| <b>Telephone:</b>        | +1-519-824-4120 x53955 |
| <b>Office:</b>           | SSC 3507               |

## 2.2 Teaching Assistants

|                   |                      |
|-------------------|----------------------|
| Nathan Doner      | donern@uoguelph.ca   |
| Caroline Reisiger | creisige@uoguelph.ca |

## 3 Learning Resources

A basic understanding of Genetics and Molecular Biology is required for understanding important aspects of this course. Students might also want to read basic information on Plant Physiology to more easily follow the lectures.

### 3.1 Required Resources

#### Notes on lectures (Notes)

**PDF files of lectures slides**, as well as links to recorded lectures (usually ~ 20 minutes) will be provided.

YOU ARE EXPECTED TO **listen to the pre-recorded lectures and take notes** (can be on your PDF file). You can do this in your own time, whenever is convenient for you. Questions can be posted in the discussion group in courselink, AHEAD of the scheduled lecture discussion time periods.

YOU ARE EXPECTED TO **participate in the MS Teams meetings** scheduled during the "lecture" periods. These meetings will be used in a variety of ways to engage in the material via MS Teams. This might include a discussion of questions from students, trying out sample questions, quizzes etc. You will be responsible to know the information provided during these time period for the various assessments.

#### Information supplied during lectures (Readings)

Sources of information and accessory information, for example scientific papers, web site URLs or videos, or links to those, will be provided in the pre-recorded lecture, during the lab sessions and/or posted on *CourseLink*.

### 3.2 Recommended Resources

#### Genetics (Notes)

Students are encouraged to consult the information provided in previous courses regarding **Genetics** to make it easier for them to follow BOT3310 lectures and labs

#### Plant Biology (Notes)

Students are encouraged to consult the information provided in previous courses regarding **Plants** (for BOT\*2100, for example) to make it easier for them to follow BOT3310 lectures and labs.

### 3.3 Additional Resources

#### Plant Physiology and Development (Notes)

No text book is assigned to the course due to the COVID-related restrictions and the absence of many students from campus. The idea is that we provide sufficient information to help you understand the material.

## 4 Learning Outcomes

### 4.1 Course Learning Outcomes

By the end of this course, you should be able to:

1. Understand structure and function of tissue and organs of higher plants.
  2. Demonstrate knowledge of plant growth regulating substances and their roles in plant development.
  3. Decipher molecular signal transduction pathways based on genetic makeup.
  4. Understand the role of environmental interactions in plant growth.
  5. Design experimental protocols to identify mutant phenotypes.
  6. Collaborate effectively with fellow students in performing lab experiments. This outcome has been modified because of COVID-related restrictions to collaborate effectively with fellow students in designing lab experiments
  7. Carry out lab experiments with minimal supervision. This outcome has been modified because of COVID-related restrictions to: understand lab experiments
  8. Interpret data and findings in the context of primary scientific literature.
  9. Design a scientific poster describing qualitative and quantitative data. This outcome has been modified because of COVID-related restrictions to: prepare an oral presentation about a new, comprehensive research project to investigate a key aspect in plant growth and development
  10. Explain data on poster to colleagues and defend conclusions. This outcome has been modified because of COVID-related restrictions to: give an oral presentation about a new, comprehensive research project to investigate a key aspect in plant growth and development
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## 5 Teaching and Learning Activities

### 5.1 Lab

Weeks from January 11 to Mar 28

Topics:

**DETAILED INFORMATION WILL BE PROVIDED IN THE  
LABORATORY MANUAL FOR WINTER 2020**

**See courselink ... READ IT!**

- Week 1: Jan 12
  - Introduction
- Week 2: Jan 19
  - Observe *Arabidopsis* plants
  - Details on *Arabidopsis* growth and development
- Week 3: Jan 26
  - Using on-line tools
  - **FIRST assignment due Monday Feb 1**
- Week 4: Feb 2
  - Observe photographs of plants
  - Tutorials on Figure formatting and analysis, basic statistics
  - Begin group creation
  - **SECOND assignment due Monday Feb 8**
- Week 5: Feb 9
  - Student groups identifies genes to study within their assigned topic
  - Details on reading scientific articles, and writing a critique
  - Selection of article for critique
  - **CRITIQUE due Monday Feb 22**
- WINTER BREAK: February 15-19, 2021
- Week 6: Feb 23
  - Groups select gene = mutant to focus on
  - Details of literature review assignment
  - **LITERATURE REVIEW due Monday March 8**
- Week 7: Mar 2
  - Details on research proposal
  - Overview of experimental design principles
  - Design experiments to test your hypotheses
- Week 8: Mar 9
  - Open discussion period
  - Proposal presentation Q&A
- Week 9-12: Mar 16-Apr6
  - **Research proposal presentations**

## 5.2 Lecture Schedule

- Week 1: Jan 11 - Jan.15: lecture 1-3
  - Course overview
  - Introduction to *Arabidopsis*, features of plants
  - Embryogenesis, SAM development and maintenance
- Week 2: Jan 18 - 22: lecture 4-6
  - **Jan 17/18: Test 1**
  - Methods used to identify gene involvement in plant development:
  - Mutants, transformation, reporter constructs, in situ hybridization
  - Molecular circuits of meristem development, feedback loops in SAM
  - Leaf initiation, patterning and phyllotaxy
- Week 3: Jan 25 - 29: lecture 7-9
  - **Jan 24/25: Test 2**
  - Floral meristem and RAM
  - Lateral roots, lineage vs position, periclinal chimeras
  - Leaf development
- Week 4: Feb 1-5: lecture 10-12
  - **Jan 31/Feb 1: Test 3**
  - Stomata development
  - Red light signalling
- Week 5: Feb 8-12: lecture 13
  - **Feb 7/8: Test 4**
  - Blue light signalling
  - REVIEW questions
- **MIDTERM EXAM Friday February 12, 2021 (50 min)      TENTATIVE**
- WINTER BREAK: February 15-19, 2021
- Week 6: Feb 22-26: lecture 14-16
  - Auxins
  - Gibberellins
- Week 7: Mar. 1-5: lecture 17, 18a, b
  - **Feb 29/Mar 1: Test 5**
  - Gibberellins
  - Cytokinins
  - Ethylene
- Week 8: Mar 8 - 12: lecture 19-21

- **Mar7/8: Test 6**
  - Absciscic acid
  - Abiotic stress
  - Week 9: Mar 15 - 19: lectures 22-24
    - **Mar 14/15: Test 7**
    - Jasmonic acid
    - Brassinosteroids
    - Water movement
  - Week 10: Mar 22 -26: lectures 25-27
    - **Mar 21/22: Test 8**
    - photoperiod
    - flowering
    - photosynthesis
  - Week 11: Mar 29 - Apr 2: lectures 28-29
    - **Mar 28/29: Test 9**
    - phloem transport
    - summary of signalling pathways etc
  - NO discussion session on Apr 2, 2021, Good Friday
  - Week 12: Apr 5 - 9 & Apr 12: lecture 30
    - **April 4/5: Test 10**
    - REVIEW questions
  - **FINAL EXAM:** scheduled timeslot is Saturday, April 17, 2020 11:30-1:30.  
**TENTATIVE**
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## 6 Assessments

### 6.1 Marking Schemes & Distributions

| Name                        | Scheme A (%) |
|-----------------------------|--------------|
| Midterm Exam                | 20           |
| Written lab assignments (4) | 28           |
| Lab presentation            | 12           |
| Final Exam                  | 30           |
| Short tests (10)            | 10           |

| Name  | Scheme A (%) |
|-------|--------------|
| Total | 100          |

## 6.2 Assessment Details

### Ten short tests, most weeks (1% each) (10%)

**Date:** On-line

To reduce the pressure on the mid term and final exams, and to better gauge how well you understand the material, regular quizzes are to be given.

### Midterm Exam (20%)

**Date:** Fri, Feb 12, 12:30 PM - Fri, Feb 26, 1:30 PM, on line

**Learning Outcome:** 1, 2, 3, 4, 8

**(TENTATIVE)**

### Final Exam (30%)

**Due:** Sat, Apr 17, 11:30 AM - 1:30 AM, on line

**Learning Outcome:** 1, 2, 3, 4, 8

Detailed information regarding format will be provided at a later date

**(TENTATIVE)**

### Four independently written assignments (28%)

**Learning Outcome:** 1, 2, 3, 4, 5, 6, 7, 8

- Assignment 1: due Monday, Feb 1 (4% total)
- Assignment 2: due Monday, Feb 8 (4% total)
- Critique: due Monday, Feb 22 (8% total)
- Literature review: due Monday, March 8 (12% total)

### Proposal presentation (12%)

**Date:** Tue, Mar 16 - Tue, Apr 6

**Learning Outcome:** 1, 2, 3, 4, 5, 6, 7, 8

## 7 Department of Molecular and Cellular Biology Statements

### 7.1 Academic Advisors

If you are concerned about any aspect of your academic program:



- Make an appointment with a program counsellor in your degree program. [B.Sc. Academic Advising](#) or [Program Counsellors](#)

## 7.2 Academic Support

If you are struggling to succeed academically:

- Learning Commons: There are numerous academic resources offered by the Learning Commons including, Supported Learning Groups for a variety of courses, workshops related to time management, taking multiple choice exams, and general study skills. You can also set up individualized appointments with a learning specialist. <http://www.learningcommons.uoguelph.ca/>
- Science Commons: Located in the library, the Science Commons provides support for physics, mathematic/statistics, and chemistry. Details on their hours of operations can be found at: <http://www.lib.uoguelph.ca/get-assistance/studying/chemistry-physics-help> and <http://www.lib.uoguelph.ca/get-assistance/studying/math-stats-help>

## 7.3 Wellness

If you are struggling with personal or health issues:

- Counselling services offers individualized appointments to help students work through personal struggles that may be impacting their academic performance. <https://www.uoguelph.ca/counselling/>
- Student Health Services is located on campus and is available to provide medical attention. <https://www.uoguelph.ca/studenthealthservices/clinic>
- For support related to stress and anxiety, besides Health Services and Counselling Services, Kathy Somers runs training workshops and one-on-one sessions related to stress management and high performance situations. <http://www.selfregulationskills.ca/>

## 7.4 Personal information

Personal information is collected under the authority of the University of Guelph Act (1964), and in accordance with Ontario's Freedom of Information and Protection of Privacy Act (FIPPA) <http://www.e-laws.gov.on.ca/index.html>. This information is used by University officials in order to carry out their authorized academic and administrative responsibilities and also to establish a relationship for alumni and development purposes.

For more information regarding the Collection, Use and Disclosure of Personal Information

policies please see the Undergraduate Calendar.  
(<https://www.uoguelph.ca/registrar/calendars/undergraduate/current/intro/index.shtml>)

## 8 University Statements

### 8.1 Email Communication

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

### 8.2 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. The grounds for Academic Consideration are detailed in the Undergraduate and Graduate Calendars.

Undergraduate Calendar - Academic Consideration and Appeals  
<https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-ac.shtml>

Graduate Calendar - Grounds for Academic Consideration  
<https://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/index.shtml>

Associate Diploma Calendar - Academic Consideration, Appeals and Petitions  
<https://www.uoguelph.ca/registrar/calendars/diploma/current/index.shtml>

### 8.3 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 students (undergraduate, graduate and diploma) 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 their respective Academic Calendars.

Undergraduate Calendar - Dropping Courses  
<https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-drop.shtml>

Graduate Calendar - Registration Changes  
<https://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/genreg-reg-regchg.shtml>

Associate Diploma Calendar - Dropping Courses  
<https://www.uoguelph.ca/registrar/calendars/diploma/current/c08/c08-drop.shtml>

### 8.4 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.

## 8.5 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 book their exams at least 7 days in advance and not later than the 40th Class Day.

For Guelph students, information can be found on the SAS website  
<https://www.uoguelph.ca/sas>

For Ridgetown students, information can be found on the Ridgetown SAS website  
<https://www.ridgetownc.com/services/accessibilityservices.cfm>

## 8.6 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 encourages academic integrity. 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.

Undergraduate Calendar - Academic Misconduct  
<https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-amisconduct.shtml>

Graduate Calendar - Academic Misconduct  
<https://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/index.shtml>

## 8.7 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.

## 8.8 Resources

The Academic Calendars are the source of information about the University of Guelph's procedures, policies, and regulations that apply to undergraduate, graduate, and diploma programs.

Academic Calendars  
<https://www.uoguelph.ca/academics/calendars>

## 8.9 Disclaimer

Please note that the ongoing COVID-19 pandemic may necessitate a revision of the format of course offerings and academic schedules. Any such changes will be announced via CourseLink and/or class email. All University-wide decisions will be posted on the COVID-19 website (<https://news.uoguelph.ca/2019-novel-coronavirus-information/>) and circulated by email.

## 8.10 Illness

The University will not normally require verification of illness (doctor's notes) for fall 2020 or winter 2021 semester courses. However, requests for Academic Consideration may still require medical documentation as appropriate.

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