BOT*3310 Plant Growth and Development

W22

Winter 2022
Section(s): C01

Department of Molecular and Cellular Biology
Credit Weight: 0.50
Version 1.00 - January 11, 2022

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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 will offer students hands-on experience in the modern methods of plant analysis using the model plant *Arabidopsis thaliana*.

1.3 Timetable

Lectures and Laboratories:

- **Lectures: Monday, Wednesday and Friday at 12:30** in **MINS 300**.
- Lectures start on January 10, 2022. Lecture notes will be provided via Courselink.
- **Laboratories**: Laboratories will start the following on January 17/18 and take

place in SSC 3304/3305 on **Mondays and Tuesdays from 2:30 - 5:20 pm**.

- **NOTE**: The first 2 weeks of classes (Lectures 1 to 6) will be delivered remotely. Check Courselink under "Content" to find links to "live" classes and to recorded lectures. (Lecture 1 will start at 12:30 via Zoom.)
- The first labs, on January 17 and 18, will be virtual via MS Teams. Check Courselink.
- **Please be aware**: this is an evolving situation, therefore further remote lectures and laboratories might be necessary.

1.4 Final Exam

FINAL EXAM: Monday, April 18, 7 to 9 pm.

At present, this exam is scheduled to be given in a room on campus.

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2 Instructional Support

2.1 Instructional Support Team

Instructor:	Joseph Colasanti
Email:	jcolasan@uoguelph.ca
Office:	SSC 4467
Office Hours:	Contact me directly via email to arrange a discussion time.
Lab Co-ordinator:	Chris Meyer
Email:	cmeyer02@uoguelph.ca
Telephone:	+1-519-824-4120 x53955
Office:	SSC 3507

2.2 Teaching Assistants

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

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3 Learning Resources

A basic understanding of Genetics and Molecular Biology is required for understanding important aspects of this course.

3.1 Required Resources

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 posted on CourseLink.

3.2 Recommended Resources

Plant Physiology and Development (Textbook) (Textbook)
Plant Physiology and Development (Textbook)

HIGHLY recommended textbook for this course: "**Plant Physiology and Development**, **6th edition (2015) by L. Taiz, E. Zeiger, I.M. Møller and A. Murphy".** Available in the bookstore and on reserve in the library.

Principle of Genetics (Textbook)

The book "Principles of Genetics", by Snustad and Simmons (any edition) provides good background information on genetics and molecular biology. The genetics components from the textbook for BIOL*1090 course also can be useful.

Biology of Plants (Textbook)

"Biology of Plants" 8th edition (2013) by R.F. Evert and S.E. Eichhorn, is recommended for students who like to read a bit simpler text than Taiz et al to prepare themselves. This book is used, and therefore on reserve, for BOT2100.

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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.
7. Carry out lab experiments with minimal supervision.
8. Interpret data and findings in the context of primary scientific literature.
9. Design a scientific poster describing qualitative and quantitative data.

10. Explain data on poster to colleagues and defend conclusions.

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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 2022

See courselink ... READ IT!

- Week 1: Jan 10
  - Introduction
- Week 2: Jan 17
  - Observe *Arabidopsis* plants
  - Details on *Arabidopsis* growth and development
- Week 3: Jan 24
  - Using on-line tools
  - **FIRST assignment due Monday Feb 1**
- Week 4: Jan 31
  - Observe photographs of plants
  - Tutorials on Figure formatting and analysis, basic statistics
  - Begin group creation
  - **SECOND assignment due Monday Feb 8**
- Week 5: Feb 7
  - 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**
- Week 6: Feb 14
  - Groups select gene = mutant to focus on

    - Details of literature review assignment
    - **LITERATURE REVIEW due Monday March 8**
- WINTER BREAK: February 21-25, 2022
- Week 7: Feb 28
    - Details on research proposal
    - Overview of experimental design principles
    - Design experiments to test your hypotheses
- Week 8: Mar 7
    - Open discussion period
    - Proposal presentation Q&A
- Week 9 Mar 14
- Week 10 Mar 21
- Week 11 Mar 28
- Week 12 April 4

5.2 Lecture Schedule

- Week 1: Jan 10 - Jan.14: Lectures 1 - 3
    - Course overview
    - Introduction to ***Arabidopsis,*** features of plants
    - Embryogenesis, SAM development and maintenance
- Week 2: Jan 17 - 21: Lectures 4 - 6
    - 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 24 - 28: Lectures 7 - 9
    - Leaf initiation and Phyllotaxy, Cell fate determination
    - Lateral roots, lineage vs position, chimeras
- Week 4: Jan 31 - Feb 4: Lectures 10 - 12
    - ***de novo*** meristem formation, periclinal chimeras and fate
    - Differential growth and cell patterning, epidermal cell functions
- Week 5: Feb 7 - 11: Lectures 13 - 15
    - Stomata, water movement and balance, vascular structure and trafficking
    - Photosynthesis, carbon fixation, photo-assimilate transport

- Week 6: Feb 14 - 18: Lectures 16 - 17
    - Light Signaling and Development, circadian clocks and diurnal cycles
    - REVIEW
- **MIDTERM EXAM Friday February 18, 2022 (DURING CLASS)**
- WINTER BREAK: February 21 - 25, 2022
- Week 7: Feb 28 - Mar 4: Lectures 18 - 20
    - Photomorphogenesis, Photoreceptors & phototropism
    - Auxin and growth regulators
- Week 8: Mar 7 - 11: Lectures 21 - 23
    - Gravitropism & phototropic movement
    - Auxin signal transduction, apical dominance, leaf vascular development
- Week 9: Mar 14 - 18: Lectures 24 - 26
    - Phytohormones & development, gibberellins in expansion & germination
    - GA signal transduction
- Week 10: Mar 21 - 25: Lectures 27 - 29
    - Cytokinins and meristem function, CK signal transduction
    - Ethylene, ripening & senescence, Abscisic Acid and stress response
- Week 11: Mar 28 - Apr 1: Lectures 30 - 22
    - Other phytohormone and signalling mechanisms, How plants tell time
    - Photoperiodism and the External Coincidence Model
- Week 12: Apr 4 - 8: Lectures 33 - 35
    - Flowering, the floral transition and floral induction,
    - Florigen and long-distance signalling, Vernalization and plant memory
    - OVERVIEW
- **FINAL EXAM**: **April 18, 2022 7** pm to **9** pm

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6 Assessments

6.1 Marking Schemes & Distributions

Midterm Exam (25%)

Fri, Feb 18, 12:30 PM - 1:30 PM, During Class.

Learning Outcomes: 1, 2, 3, 4, 8

Lab Reports (20%)

Four independently written reports worth 20% in total. See Lab 1 supplementary for more information.

Learning Outcomes: 1, 2, 3, 4, 5, 6, 7, 8

Poster Presentations (20%)

Poster Quality, Defense: 15%

Peer Evaluation: 5%

Learning Outcomes: 1, 2, 3, 4, 8, 9, 10

Final Exam (35%)

TBA

Name	Scheme A (%)
Midterm Exam	25
Lab Reports	20
Poster presentation	20
Final Exam	35
Total	100

6.2 Assessment Details

Midterm Exam (25%)
Learning Outcome: 1, 2, 3, 4, 8

Final Exam (35%)
Learning Outcome: 1, 2, 3, 4, 8
Detailed information regarding format will be provided at a later date

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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)

7.5 Course Offering Information Disclaimer

Please note that course delivery format (face-to-face vs online) is subject to change up to the first-class day depending on requirements placed on the University and its employees by public health bodies, and local, provincial and federal governments. Any changes to course format prior to the first class will be posted on WebAdvisor/Student Planning as they become available.

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 make a booking at least 14 days in advance, and no later than November 1 (fall), March 1 (winter) or July 1 (summer). Similarly, new or changed accommodations for online quizzes, tests and exams must be approved at least a week ahead of time.

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, changes in classroom protocols, and academic schedules. Any such changes will be announced via CourseLink and/or class email.

This includes on-campus scheduling during the semester, mid-terms and final examination schedules. 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

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).

8.11 Covid-19 Safety Protocols

For information on current safety protocols, follow these links:

- https://news.uoguelph.ca/return-to-campuses/how-u-of-g-is-preparing-for-your-safe-return/
- https://news.uoguelph.ca/return-to-campuses/spaces/#ClassroomSpaces

Please note, these guidelines may be updated as required in response to evolving University, Public Health or government directives.
