



BIOC31 H3

Plant Development and Biotechnology

COURSE DESIGN AND OBJECTIVES

A central question of developmental biology is how does a single cell become a complex organism? Plants and animals independently evolved multicellularity. Surprisingly, the mechanisms that generate patterns of cells, tissues and organs are similar. However, different genes are used by plants and animals to generate these patterns. In this course, will discuss a) molecular mechanisms that control developmental processes in plants, including embryo, root, shoot and flower development; b) mechanisms of cell-to-cell communication; c) hormone synthesis and signal transduction pathways; d) plant response to the environment. Lastly, we will discuss how discoveries in plant development are being used for biotechnological applications, and which are the target areas in plant biotechnology. An important goal of this course is to prepare student to critically read, discuss and present primary research articles in plant development.

COURSE INSTRUCTOR AND CONTACTS

Instructor: Prof. Sonia Gazzarrini

Time: Wednesdays, 11am – 1pm (online synchronous)

Office hours: By appointment.

email: sonia.gazzarrini@utoronto.ca

Note: Include “BIOC31” in the subject and use only @utoronto.ca email. email only for important matters; questions involving detailed answers about lectures and lecture notes will be addressed during office hours.

TUTORIALS

TA: Eliana Vonapartis

Time: Thursdays, 2pm – 3pm (online synchronous)

email: eliana.vonapartis@mail.utoronto.ca. **Note:** Include “BIOC31” in the subject and use only @utoronto.ca email.

COURSE REQUIREMENTS

BIOB10H (Cell Biology); **BIOB11H** (Molecular Aspects of Cellular & Genetic Processes)

READING MATERIAL AND LECTURE NOTES

This course is based solely on examination of current and past literature.
No textbook is assigned.

- Required reading material for the course will be available as URL on Quercus.
 - *NB: You will be expected to have completed all readings by the indicated tutorial dates.*
- Lecture notes will be posted on Quercus as PDF files before lectures.

REFERENCE BOOKS

Selected chapters from:

1. *Mechanisms in Plant Development*. Leyser O. and Day S.
2. *Molecular Genetics of Plant Development*. Howell S. H.
3. *The Arabidopsis Book* (online):

<https://bioone.org/journals/the-arabidopsis-book/issues>

COURSE WORK AND GRADING:

10% **Quiz 1** (February 3rd, in class)

25% **Midterm Test** (February 24th, in class)

15% **Paper Assignment or Oral Presentation** (April 7th - 8th, in class)

30% **Final Exam** (TBA)

20% **Tutorials (10 x 2%)**

- Format for quizzes, tests: multiple-choice questions and short answers.
- Format for final exam: multiple-choice questions and short answers or take-home assignment
- Tutorials: will analyze papers assigned and discussed during lectures, and will prepare students for the Paper Assignment or Oral Presentation. Before attending the tutorials, students will fill in a questionnaire (Tutorial Handouts) about the assigned papers and submit it **two hours before the tutorial sessions**. This ensures that students come prepared for the tutorials. **Failure to submit the tutorial handouts on time, will result in loss of the tutorial mark (2%).**

Turnitin

Normally, students will be required to submit their course essays to Turnitin.com for a review of textual similarity and detection of possible plagiarism. In doing so, students will allow their essays to be included as source documents in the Turnitin.com reference database, where they will be used solely for the purpose of

detecting plagiarism. The terms that apply to the University's use of the Turnitin.com service are described on the Turnitin.com web site.

Missing Tests or Tutorials

If you are unable to write a quiz, test, assignment or oral presentation, you must notify your Instructor (sonia.gazzarrini@utoronto.ca) within 24h and email Jennifer Campbell (jac.campbell@utoronto.ca). You must attach the UTSC Verification of Illness Form or Biological Sciences Self Declaration Form available at this link (<https://www.utoronto.ca/biosci/missed-term-work>). **Without a valid certificate you will lose the entire mark.**

Religious accommodation

The University has a commitment concerning accommodation for religious observances. I will make every reasonable effort to avoid scheduling tests, examinations, or other compulsory activities on religious holy days not captured by statutory holidays. According to University Policy, if you anticipate being absent from class or missing a major course activity (like a test, or in-class assignment) due to a religious observance, please let me know as early in the course as possible, and with sufficient notice (at least two to three weeks), so that we can work together to make alternate arrangements.

LECTURE TOPICS

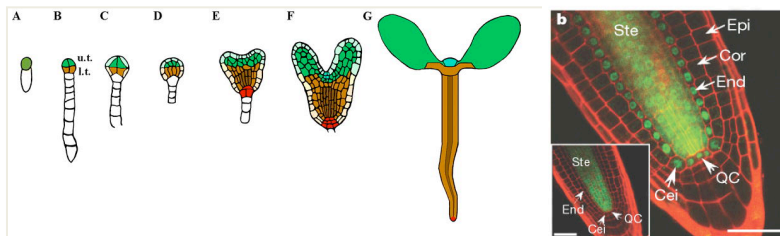
Lectures will be presented once per week (online synchronous) on Collaborate. Lecture slides will be posted on Quercus prior to each lecture. Lecture topics are listed below and may change.

Lecture Topics:

1) Introduction: molecular genetics of plant development

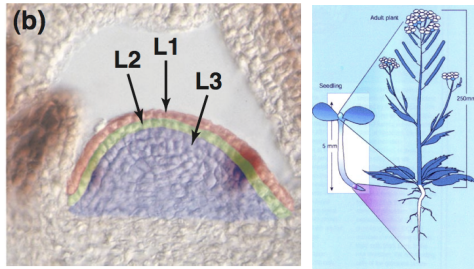
- Molecular analysis: tools to study gene and protein expression patterns
- Gene transfer into plants by *Agrobacterium*: generation of transgenic plants
- Genetic analysis: generation of mutants by forward and reverse genetics

2) Embryo development and root meristem



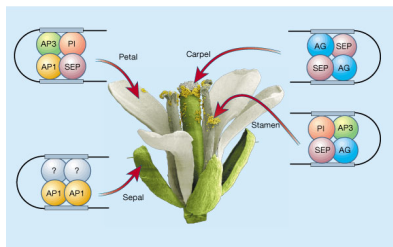
- Cell fate and positional information
- Auxin signaling, polar auxin transport and apical-basal polarity
- Root meristem, stem cells, radial polarity and intercellular signaling

3) Vegetative development and shoot apical meristem



- Initiation and maintenance of the shoot apical meristem
- Stem cells
- Extracellular signaling

4) Reproductive development and floral meristem



- Inflorescence and floral meristems
- Floral organ identity: the ABCD model and homeotic mutations

5) Hormone signaling pathways and abiotic stress



- GA/ABA biosynthesis and signaling pathways
- Abiotic stress

6) Plant Biotechnology



- Plant biotechnology and goals
- Crop yield and quality

COURSE MATERIAL, VIDEO RECORDING AND SHARING

Notice of video recording and sharing (download and re-use prohibited)

This course uses the University's learning management system, Quercus, to post information about the course (<https://q.utoronto.ca>). This includes posting readings and other materials required to complete class activities and course assignments, as well as sharing important announcements and updates. Please make it a habit to log in to the site on a regular basis. This course, including your participation, will be recorded on video and will be available to students in the course for viewing remotely and after each session. Course videos and materials belong to your instructor, the University, and/or other sources depending on the specific facts of each situation, and are protected by copyright. Do not download, copy, or share any course or student materials or videos without the explicit permission of the instructor. For questions about recording and use of videos in which you appear please contact your instructor.

EQUITY DIVERSITY AND INCLUSION

The University of Toronto is committed to equity, human rights and respect for diversity. All members of the learning environment in this course should strive to create an atmosphere of mutual respect where all members of our community can express themselves, engage with each other, and respect one another's differences. U of T does not condone discrimination or harassment against any persons or communities.

ACCESSABILITY STATEMENT

Students with diverse learning styles and needs are welcome in this course. In particular, if you have a disability/health consideration that may require accommodations, please feel free to approach me and/or the AccessAbility Services Office as soon as possible. AccessAbility Services staff (located in Rm AA142, Arts and Administration Building) are available by appointment to assess specific needs, provide referrals and arrange appropriate accommodations 416-287-7560 or email ability@utsc.utoronto.ca. The sooner you let us know your needs the quicker we can assist you in achieving your learning goals in this course

ACADEMIC INTEGRITY STATEMENT

The University treats cases of cheating and plagiarism very seriously. The University of Toronto's Code of Behaviour on Academic Matters (<http://www.governingcouncil.utoronto.ca/policies/behaveac.htm>) outlines the behaviours that constitute academic dishonesty and the processes for addressing academic offences. Potential offences in papers and assignments include using someone else's ideas or words without appropriate acknowledgement, submitting your own work in more than one course without the permission of the instructor, making up sources or facts, obtaining or providing unauthorized assistance on any assignment. On tests and exams cheating includes using or possessing unauthorized aids, looking at someone else's answers during an exam or test, misrepresenting your identity, or falsifying or altering any documentation required by the University, including (but not limited to) doctor's notes.