

BIOC31 H3

Plant Development and Biotechnology



COURSE DESIGN AND OBJECTIVES

The central question of developmental biology is how does a single cell become a complex organism. What are the “factors” that control the behavior of cells? Plants and animals evolved multicellularity independently. 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. This course will discuss molecular mechanisms that control developmental processes in plants, such as embryo, root, shoot and flower development through analysis of mutants; hormone signal transduction pathways. Lastly, we will discuss how discoveries in plant development are being used for biotechnological applications, and which are the target areas in plant biotechnology.

COURSE INSTRUCTOR AND CONTACTS

Instructor: Prof. Sonia Gazzarrini

Time/room: Wednesdays, 11am – 1pm; room BV 355

Office hours: Mondays, 11am - noon; room SY222 (New Science Research Building – SRB) or by appointment

email: gazzarrini@utsc.utoronto.ca

Note: email only for important matters; questions involving detailed answers about lectures and lecture notes will be addressed during office hours or by appointment.

TA: Eshan Naik

email: eshan.naik@mail.utoronto.ca

COURSE REQUIREMENTS

Course prerequisites: **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 Blackboard.
 - *NB: You will be expected to have completed all readings by the indicated lecture dates.*
- Lecture notes will be posted on Blackboard 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):* <http://www.bioone.org/loi/arbo.j>

GRADE BREAKDOWN

10% Quiz 1 (~ week 4, in class)
35% Midterm test (week 8, in class)
15% Quiz 2 or Assignment (~ week 11, in class)
40% Final exam (TBA)

- Format for quizzes, tests and final exam: multiple-choice questions and short answers.
- Missing quiz or Midterm test: a UTSC medical certificate filled in by a Medical Doctor will be required.

LECTURE TOPICS (*)

- 1) Introduction: molecular genetics of plant development
- 2) Embryo development and root meristem
- 3) Vegetative development and shoot apical meristem
- 4) Reproductive development and floral meristem
- 5) Hormone signaling pathways and hormone cross-talk
- 6) Plant Biotechnology

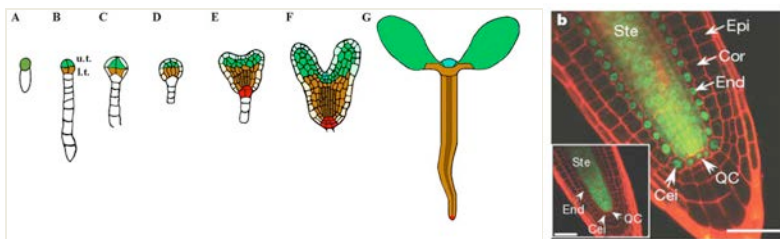
(*) Lecture topics may change

LECTURE TOPICS

1) Introduction: molecular genetics of plant development

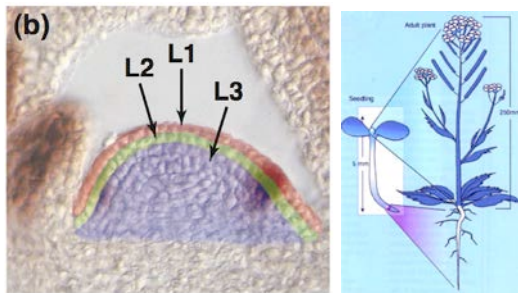
- Molecular analysis: tools to study gene and protein expression patterns
- Gene transfer into plants by *Agrobacterium*: generation of transgenic plants
- Genetic: generation of mutants by forward and reverse genetics

2) Embryo development and root meristem



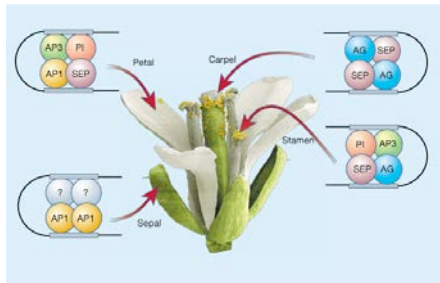
- Cell fate and positional information
- Auxin signaling, polar auxin transport and apical-basal polarity
- Root meristem
- Radial polarity and intercellular signaling

3) Vegetative development and shoot apical meristem



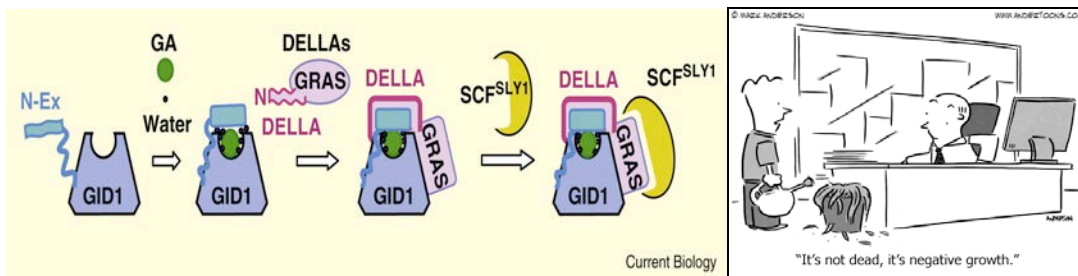
- Initiation and maintenance of the shoot apical meristem
- Extracellular signaling
- Stem cells

4) Reproductive development and floral meristem



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

5) Hormone signaling pathways and hormone cross-talk



- GA biosynthesis and signaling pathways
- ABA biosynthesis and signaling pathways
- GA-ABA crosstalk
- Abiotic stress

6) Plant Biotechnology



- Plant biotechnology and goals
- Crop yield and quality
- Biofuels

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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. I will work with you and AccessAbility Services to ensure you can achieve your learning goals in this course. Enquiries are confidential. The UTSC AccessAbility Services staff (located in S302) are available by appointment to assess specific needs, provide referrals and arrange appropriate accommodations (416) 287-7560 or ability@utsc.utoronto.ca.

ACADEMIC INTEGRITY STATEMENT

Academic integrity is essential to the pursuit of learning and scholarship in a university, and to ensuring that a degree from the University of Toronto is a strong signal of each student's individual academic achievement. As a result, the University treats cases of cheating and plagiarism very seriously. The University of Toronto's Code of Behavior 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 include, but are not limited to:

IN PAPERS AND ASSIGNMENTS: 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: Using or possessing unauthorized aids. Looking at someone else's answers during an exam or test. Misrepresenting your identity.

IN ACADEMIC WORK: Falsifying institutional documents or grades. Falsifying or altering any documentation required by the University, including (but not limited to) doctor's notes. All suspected cases of academic dishonesty will be investigated following procedures outlined in the Code of Behavior on Academic Matters. If you have questions or concerns about what constitutes appropriate academic behavior or appropriate research and citation methods, you are expected to seek out additional information on academic integrity from your instructor or from other institutional resources (see <http://www.utoronto.ca/academicintegrity/resourcesforstudents.html>).