

BIOC31 H3

Plant Development and Biotechnology

(Winter 2016)

COURSE DESIGN AND OBJECTIVES

The central question in development 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 first discuss some of the molecular mechanisms that control developmental processes in plants – such as embryo, root, shoot and flower development – through reading of primary literature. We will then discuss how findings in plant development can be applied to biotechnology, in particular agricultural biotechnology, which has revolutionized traditional plant breeding programs. We will touch on some of the goals of agricultural biotechnology, including generation of drought and pest resistant plants, and the use of plants for biofuels.

COURSE INSTRUCTOR AND CONTACTS

Instructor Prof. Sonia Gazzarrini

Time/room Wednesdays, 11am – 1pm; room MW 120

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.

TUTORIALS

Tutorials will help you with critical reading of primary literature and expand on some of the (more difficult) topics discussed during lectures. They are highly recommended.

TA: Eliana Vonapartis

Time/room Thursdays, 2 – 3 pm; room MW 130

email: eliana.vonapartis@mail.utoronto.ca

COURSE REQUIREMENTS

Course prerequisites: **BIOB10Y3** (Cell Biology and Molecular Aspects of Genetic Processes) or [**BIOB10H3** (Cell Biology) and **BIOB11H3** (Molecular Aspects of Cellular & Genetic Processes)].

Exclusion: **CSB340H, (BOT340H), (BGYC31H3).**

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

(available for consultation at the library or online)

Selected chapters from:

1. *Mechanisms in Plant Development*, Leyser O. and Day S., Wiley-Blackwell
2. *Molecular Genetics of Plant Development*, Howell S. H., Cambridge University press
3. *The Arabidopsis Book* (<http://www.bioone.org/loi/arbo.j>)

Grade Breakdown

10% Quiz 1 (~ week 3 or 4, in class)
35% Midterm test (Feb 24 in class)
15% Quiz 2, or assignment (~ week 10, in class)
40% Final exam (TBA)

Format for quizzes, tests and final exam: multiple-choice questions and short answers.

Missing tests or Midterm exam: a UTSC medical certificate filled in by a Medical Doctor will be required.

LECTURE TOPICS

Introduction: molecular genetics of plant development

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

Embryo development: pattern formation from a single cell

- Cell fate and positional information
- Auxin signaling, polar auxin transport and apical-basal polarity

Root development: pattern formation from a single cell

- Root meristem (RM) and the role of auxin
- Radial polarity and intercellular communication

Vegetative development

- Shoot apical meristem (SAM) initiation, maintenance and extracellular signaling
- Stem cells
- Development of organ polarity

Reproductive development

- Inflorescence (IM) and floral (FM) meristems
- Development of floral organ identities: the ABCD model and homeotic mutations

Hormone signaling pathways and hormone cross-talk

- GA biosynthesis and signaling
- ABA biosynthesis and signaling
- ABA/GA crosstalk

Plant Biotechnology

- Goals of agricultural biotechnology
- Generation of drought and pest resistant plants
- Plants and biofuels

(NB: Lecture topics and dates may change)

The University of Toronto is dedicated to fostering an academic community in which the learning and scholarship of every member may flourish, with vigilant protection for individual human rights, and a resolute commitment to the principles of equal opportunity, equity and justice.

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>).