

BIOL 352 (2009)
Plant Physiology II: Plant Development
COURSE OUTLINE AND INTRODUCTION

Lecture/lab times

3 credits (2 hours lecture/wk, 3 hours lab/wk, optional 1 hour tutorial/wk)
Lectures: Mondays and Wednesdays 10:00 to 11:00 a.m., Rm 303, Frank Forward
Labs: 2:00 to 5:00 pm, Monday to Thursday (starts week of September 14)
Tutorial: Fridays 10:00 to 11:00 a.m., Rm 1, Woodward Instructional Resources Centre

Instructors:

Lectures: Geoffrey Wasteneys and Santokh Singh
Labs: Santokh Singh

Geoffrey Wasteneys

Department of Botany
Office: Biol. Sci. Bldg. 3528
Telephone: 604-822-4662
Email: geoffwas@interchange.ubc.ca
Office hours: Wednesday 2:00 to 4:00pm, or by appointment

Santokh Singh

Department of Botany
Office: Biol. Sci. Bldg. 2528
Lab: Biol Sci. Bldg. 2509/2511
Telephone: 604-822-3330 (lab 604-822-5036)
Email: santokh@interchange.ubc.ca
Office hours: during lab sessions, if time permits (Monday - Thursday: 2:00 to 5:00pm), or by appointment.

Co-requisites:

One of [BIOL 334](#), [FRST 302](#). ([CHEM 233](#) is recommended.)

Required text: Taiz, L. and Zeiger, E. Plant Physiology, fourth edition (2006).
Appropriate reading assignments from the text will be given regularly.

Supplementary reference material: Selected articles, book chapters, and other material will be given.

Web site: <http://www.vista.ubc.ca> (need your CWL ID and password to access the course website)

Evaluation:

35% lab: based on written lab reports and attendance (evaluated by Dr. Santokh Singh and TAs)

15% Exam #1 covering lectures 1-7 (Oct 7): 40 min

15% Exam #2 covering lectures 8-16 (Nov 18): 40 min

35% Final exam - cumulative

If you have a valid excuse (e.g. illness, verified by a medical practitioner's certificate) for missing a quiz, the points will be assigned to the final exam. Any other reason for missing a quiz, such as a religious holiday, must be discussed with one of the Instructors at least 3 weeks prior to the planned absence.

- **Final exam will be cumulative.**
- **In order to pass the course, you must pass both the lab and the lecture components separately.**

Learning objectives

1. to obtain an understanding of concepts, processes, and experimental approaches related to the physiology of plant growth and development.
2. to understand how the scientific process can be used to answer questions concerning the control of plant development. You will be asked to
 - use specific experimental approaches to answer questions and test hypotheses.
 - interpret new data in light of your understanding of concepts and processes.
3. to appreciate the practical importance of plant development .

Thus, in addition to learning **what** is known about plant development, you will be asked to learn **how** this is known and to use this information to solve problems.

We will use clickers in our classes. Please ensure that you register your PRS number on Vista so that it is synchronized with your student number.

Lecture/Tutorial Outline

1. Plant Growth and Development Part I (7 lectures, 4 tutorials)

- Lecture 1 (Sept. 9): Introduction to Plant Development
- *Tutorial 1 (Sept. 11): Plant Anatomy Refresher*
- Lecture 2 (Sept. 14): Plant Cell Biology: Transcription, Translation, Endomembrane Trafficking and Cell-Cell Communication
- Lecture 3 (Sept 16): Plant Cell Wall Synthesis and Secretion
- *Tutorial 2 (Sept 18): Problem Solving: Cell Wall Synthesis*
- Lecture 4 (Sept. 21): Auxin Transport and Action
- Lecture 5 (Sept 23): Cell Expansion Mechanisms
- *Tutorial 3 (Sept 25): Problem Solving: Cell Expansion*
- Lecture 6 (Sept 28): Directional Cell Expansion-1
- Lecture 7 (Sept 30): Directional Cell Expansion-2
- *Tutorial 4 (Oct 2): Directional Cell Expansion*

2. Signal Transduction and Plant hormones Part I (4 lectures, 3 tutorials)

- Lecture 8 (Oct 5): Gene Expression and Signal Transduction
- **Exam 1 (Oct 7): 40 minutes, covering materials in Lectures 1 to 7**
- *Tutorial 5 (Oct 9): Terminology/Techniques in Plant Development.*
- **Thanksgiving Day (Oct 12)**
- Lecture 9 (Oct 14): Introduction to Hormones/Auxin (Part I)
- *Tutorial 6 (Oct 16): Problem Solving: Auxin*
- Lecture 10 (Oct 19): Auxin (Part II)
- Lecture 11 (Oct 21): Cytokinins
- *Tutorial 7 (Oct 23): Problem Solving: Cytokinins*

3. Plant Growth and Development Part II (4 lectures, 2 tutorials)

- Lecture 12 (Oct 26): Meristem Identity
- Lecture 13 (Oct 28): Meristem Maintenance
- *Tutorial 8 (Oct 30): Problem Solving: Meristems*
- Lecture 14 (Nov 2): Tissue Pattern Formation
- Lecture 15 (Nov 4): Cell Fate Determination
- *Tutorial 9 (Nov 6): Pattern Formation*

4. Signal Transduction and Plant hormones Part II (6 lectures, 4 tutorials)

- Lecture 16 (Nov 9): Ethylene
- **Remembrance Day Holiday (Nov 11)**
- *Tutorial 10 (Nov 13): Problem Solving: Ethylene*
- Lecture 17 (Nov 16): Brassinosteroids

- **Exam 2 (Nov 18): 40 minutes, covering materials in Lectures 8 to 16**
- *Tutorial 11 (Nov 20): Problem Solving: Brassinosteroids*
- Lecture 18 (Nov 23): Gibberellins (Part I)
- Lecture 19 (Nov 25): Gibberellins (Part II)
- *Tutorial 12 (Nov 27): Problem Solving: Gibberellins*
- Lecture 20 (Nov 30): Abscisic Acid
- Course review (Dec 2)
- *Tutorial 14 (Dec 4): Problem Solving: Abscisic Acid*

Tutorials

Tutorials will be focused on solving problems relevant to lecture materials. Attendance at tutorials is optional but recommended.

BIOL 352: Plant Physiology II Lecture and Tutorial Schedule (September—December, 2009)

Monday-Lecture	Wednesday-Lecture	Friday-Tutorial
	Sept 9 L1-Introduction to Plant Development Wasteneys, Singh, Chen	Sept 11 <i>T1-Anatomy review-online reading</i> Wasteneys
Sept 14 L2- The Plant Cell – transcription, translation, endomembrane trafficking and cell-cell communication Wasteneys	Sept 16 L3-Cell Walls – polysaccharide synthesis and secretion Wasteneys	Sept 18 <i>T2- Problem solving: Cell walls</i> Wasteneys
Sept 21 L4- Cell and Organ Expansion – transport and actions of auxin Wasteneys	Sept 23 L5- Mechanisms of Cell Expansion – wall loosening Wasteneys	Sept 25 <i>T3- Problem Solving: Cell Expansion</i> Wasteneys
Sept 28 L6- Directional Cell Expansion – tip growth versus diffuse expansion Wasteneys	Sept 30 L7- Directional Cell Expansion – cytoskeleton and cellulose synthesis Wasteneys	Oct 2 <i>T4- problem solving: directional cell</i> expansion Wasteneys
Oct 5 L8-Gene expression & signal transduction Singh	Oct 7 Exam #1 (L1-7)	Oct 9 <i>T5-Terminology/Techniques</i> Singh
Oct 12 Thanksgiving Day	Oct 14 L9- Introduction to Hormones & Auxin (Part I) Singh	Oct 16 <i>T6 Problem solving: auxin</i> Singh
Oct 19 L10- Auxin (Part II) Singh	Oct 21 L11- Cytokinins Singh	Oct 23 <i>T7-: Problem solving: Cytokinins</i> Singh
Oct 26 L12- Meristem Identity Wasteneys	Oct 28 L13- Meristem Maintenance Wasteneys	Oct 30 <i>T8- Problem solving: meristem</i> Wasteneys
Nov 2 L14- Tissue Specification Wasteneys	Nov 4 L15- Cell Fate Determination Wasteneys	Nov 6 <i>T9- Problem solving: cell fate</i> determination Wasteneys
Nov 9 L16- Ethylene Singh	Nov 11 Remembrance Day Holiday	Nov 13 <i>T10- Problem solving: Ethylene</i> Singh
Nov 16 L17- Brassinosteroids Singh	Nov 18 Exam #2 (L8-16)	Nov 20 <i>T11- Problem Solving: BR</i> Singh
Nov 23 L18- Gibberellins (Part I) Singh	Nov 25 L19- Gibberellins (Part II) Singh	Nov 27 <i>T12- Problem solving: GAs</i> Singh
Nov 30 L20- ABA Singh	Dec 2 Course Review Singh, Wasteneys	Dec 4 Last day of class T13- Problem Solving: ABA
FINAL EXAM: TBA (exam period: 12/08—12/22) L: Lecture, 10:00-11:00am, Monday and Wednesday: Rm 303, Frank Forward T: Tutorial, 10:00-11:00am, Friday, Rm 303, Frank Forward		

PLANT PHYSIOLOGY II. Plant Development (BIOL 352)

Introduction to the Plant Physiology II Laboratory

There are four laboratory sections in this course, and each section has the capacity to accommodate a maximum of about 14 students.

Learning objectives:

- to understand key experimental approaches and biological methods related to the physiology of plant growth and development.
- to understand how to conduct an independent lab research project.
- to be able to analyze experimental data and write scientific, journal-style research papers .

List of Laboratory Exercises:

No.	Laboratory Exercise
1	LAB UNIT 1: PLANT ANATOMY Lab 1A: Structure of Stems and Roots Lab 1B: Structure of Stems and Leaves
2	LAB UNIT 2: TISSUE CULTURE OF TOBACCO AND GENERATION OF TRANSGENIC PLANTS
3	LAB UNIT 3: SENESCENCE AND REGREENING OF CUCUMBER COTYLEDONS: LIGHT AND HORMONAL REGULATION OF PROTEINS AND CHLOROPHYLL
4	LAB UNIT 4: PHYSIOLOGY OF SEED GERMINATION AND HYPOCOTYL CELL GROWTH Lab 4A: Phytochrome and hormonal control of lettuce seed germination Lab 4B: Cell growth in lettuce hypocotyls: interaction between gibberellic acid and colchicine
5	LAB UNIT 5 (DEMONSTRATION LAB): ROOT CELL GROWTH IN WILD-TYPE, MOR1-1 AND RSW1-1 MUTANTS OF ARABIDOPSIS THALIANA
6	INDEPENDENT RESEARCH PROJECT

Timetable of Lab Experiments and Research Projects:

WEEK OF	Group 'A'	Group 'B'	Group 'C'
September 7	NO LABS THIS WEEK		
September 14	INTRODUCTION (All Groups)		
September 21	Lab Unit 2	Lab Unit 2	Lab Unit 2
September 28	Lab Unit 4 + Demo Lab Unit 5	Lab Unit 4 + Demo Lab Unit 5	Lab Unit 4 + Demo Lab Unit 5
October 5	Lab Unit 4	Lab Unit 4	Lab Unit 4
October 12*	Lab Unit 3	Lab Unit 3	Lab Unit 3
October 19*	Lab Unit 3	Lab Unit 3	Lab Unit 3
October 26	WRITE GROUP PROJECT PROPOSAL [Submit by <u>October 29th</u>]		
November 2	INDEPENDENT RESEARCH PROJECT EXPERIMENTS		
November 9	INDEPENDENT RESEARCH PROJECT EXPERIMENTS		
November 16	INDEPENDENT RESEARCH PROJECT EXPERIMENTS		
November 23	WRITE INDEPENDENT RESEARCH PROJECT REPORT [NOTE: PROJECT REPORT SUBMISSION DATE IS <u>NOVEMBER 30th</u>]		
	<p><u>Follow-up Schedule of Experiments</u></p> <p>Lab Unit 1 (Experiment 1A, 1B) (optional labs): can be carried out sometime before September 25th. Please make arrangements with Dr. Santokh Singh.</p> <p>Lab Unit 2: Check every week for 6 weeks</p>		
	<p><u>Last date for submission of project proposal and lab reports:</u></p> <p>Lab Unit (short) Reports: First short report: <u>November 5th by 4 PM.</u> Second short report: <u>November 19th by 4 PM.</u></p> <p>Project proposal: <u>October 29th, 2009 by 4 PM.</u></p> <p>Project (Long) report: <u>November 30th, 2009 by 4 PM.</u></p> <p>*Students of Monday section are required to do their experiment scheduled for October 12th on October 19th to compensate for the Thanksgiving day holiday on October 12th</p>		

Lab Faculty, Technician and TAs:

Instructor:

Santokh Singh

Department of Botany

Office: Bioscience Bldg. room# 2528

Lab: Bioscience Bldg. room# 2509/2511/2520

Tel: 604-822-3330

E-mail: santokh@interchange.ubc.ca

Website: <http://www.botany.ubc.ca/singh.html>

Lab Technician:

Jarnail Mehroke

Department of Botany

Lab: Bioscience Bldg. room# 2509/2511/2520

Tel: 604-822-5036

E-mail: mehroke@interchange.ubc.ca

TAs:

Eric Johnson

Department of Botany

Office/Lab: Bioscience Bldg. room# 3502A/3521

Tel: 604-822-3480

E-mail: ericjohn@interchange.ubc.ca

SungSoo Kim

Department of Botany

Bioscience Bldg. Lab room# 3124

Tel: 604-822-6383

E-mail: sskim930@interchange.ubc.ca

Ranganayaki Nandanavanam

Department of Botany

Office/Lab: Bioscience Bldg. room# 3109/3433

Tel: 604-822-3342

E-mail: rangan65@interchange.ubc.ca