A Course Guide To

Life Strategies of Plants
BOT*2100

Dr. T. Akhtar and Dr. I. Tetlow

Department of Molecular and Cellular Biology
University of Guelph

Fall 2016

Course objectives

This course introduces the structures and processes used by plants in the greening of our planet, and how and why plants are basic to the functioning of the biosphere. This course includes hands-on experience in examining the cells, tissues and architectures of plants as well as selected processes of plant function.

Instructors

Dr. Ian Tetlow (Instructor)
Dr. Ian Tetlow was awarded a B.Sc. (Hons) in Plant Science from the Faculty of Agriculture at the University of Newcastle-upon-Tyne, U.K. in 1986. His Ph.D. project, undertaken at University College of North Wales (Bangor), U.K., focused on the physiological responses of plants to attack by biotrophic fungi with an emphasis on the effects of pathogens on plant carbon metabolism. Following his Ph.D. Dr. Tetlow began post-doctoral work at the University of Manchester, U.K. studying the regulation of carbon metabolism in non-photosynthetic plastids. Following post-doctoral studies Dr. Tetlow continued to work in the area of non-photosynthetic carbon metabolism and was awarded a Leverhulme Special Research Fellowship, followed by an Industrial Fellowship, both of which were held at the University of Manchester. In 2002 Dr. Tetlow moved to the University of Guelph and is currently an Associate Professor in MCB. Current research interests involve understanding the role of protein-protein interactions and protein phosphorylation in regulating starch metabolism in crop plants. Dr. Tetlow also teaches Metabolism in the Whole Life of Plants (BOT*4380).

Dr. Tetlow can be contacted by email at itetlow@uoguelph.ca or at extension 52735. His office is in the Science Complex, Room 4471 (laboratory 4409).

Dr. Tariq Akhtar (Instructor)
Dr. Tariq Akhtar obtained a B.Sc. from the University of Waterloo and stayed to complete a MSc. in Environmental Toxicology. His research focused on a how plants adapt to certain environmental contaminants. Based on this research, he was awarded the Natural Sciences and Engineering Research Council (NSERC) post graduate scholarship to pursue a PhD. at the University of Florida to find a viable and cost-effective way to overcome global folate malnutrition through plant 'biofortification'. Dr. Akhtar later began post-doctoral work at the University of Michigan studying plant volatiles, which continues to be a major focus of his research program at the University of Guelph. Dr. Akhtar also teaches Metabolism in the Whole Life of Plants (BOT*4380). Dr. Akhtar can be contacted by email at takhtar@uoguelph.ca or at extension 54794 and his office is in the Summerlee Science Complex, Room 4461 (laboratory 4406).

Dr. Chris J. Meyer (Lab Coordinator)

Dr. Chris Meyer obtained B.Sc. and Ph.D. degrees in Plant Biology from the University of Waterloo. He has contributed to research and teaching in the plant sciences at the Universities of Waterloo, Wilfrid Laurier and Brock. Dr. Meyer continues to explore new approaches in plant science education at Guelph. As the BOT*2100 Lab Coordinator, he manages all aspects of the teaching laboratory. See the Lab Manual for further details. Dr. Meyer can be contacted in SCIE 3507 – Ext. 53955 or E-mail: cmeyer02@uoguelph.ca

Teaching Assistants
Your teaching assistants in the laboratories will be Cole Anderson, Alison Edge, Kathleen Delfosse and Jenelle Patterson.

The TAs are responsible for dealing with your questions and making sure that you understand the procedures. In addition, they will be able to give you help in getting all the exercises to work.

They will grade the LAB REPORTS that are handed in at the end of laboratories (see Grades).

Please note: Electronic Recording of Classes by Students

"Electronic recording of classes is expressly forbidden without prior consent of the instructor. When recordings are permitted they are solely for the use of the authorized student and may not be reproduced, or transmitted to others, without the express written consent of the instructor."

Course Schedule

Lectures 10:00-11:20 Tuesday & Thursday, JTP 214

Look through the readings listed in the lecture schedule (to follow below) **ahead** of time to get the most out of this course. You can print out the notes on courselink but these are NOT complete so you are expected to **take notes during lecture**.

Labs 2:30-5:20 Wednesday (section 1) OR Thursday (section 2), SCIE3304

Make sure that you read the pertinent lab exercises **ahead** of time. Consider any questions posed in each exercise; they can help you in completing the LAB REPORTS.

You are welcome to ask any questions during lectures, the laboratories or at any other times.

Learning Outcomes By the end of this course, students should be able to:

a) critically evaluate ideas and arguments by gathering and integrating relevant qualitative and quantitative information, assessing its credibility, and synthesizing evidence to formulate a position.
b) accurately and effectively communicate ideas, arguments and analyses in graphic, oral and written form.
c) collaborate effectively as part of a team by demonstrating mutual respect, and an ability to set goals and manage tasks and time lines.

d) apply scientific methods and processes to generate and interpret scientific data using quantitative, qualitative and analytical methodologies and techniques.
e) demonstrate knowledge in the molecular and chemical composition of plants and their relationships to structure and function.
f) demonstrate knowledge in the fundamental vegetative and reproductive attributes of plants.
g) demonstrate knowledge in the interaction of plants with biotic and abiotic factors
h) demonstrate knowledge in plant diversity and genetic variability and their relationship to evolution, speciation and adaptation.
i) demonstrate the use of modern techniques in plant research.
j) demonstrate skills to study plants in field or laboratory settings.
k) interpret the evolutionary history of plants through an examination of phylogenetic trees.

Course resources

Textbook:
The required text, available from the bookstore and on 2-hour reserve in the Library is: Raven Biology of Plants, 8th Edition, 2013 by R.F. Evert and S.E. Eichhorn

Lab manual:
The required laboratory manual is: BOT*2100 Life Strategies of Plants, C.J. Meyer, Department of Molecular and Cellular Biology, College of Biological Science, University of Guelph, © Fall 2016. You are responsible for bringing this manual to every laboratory.
Labs begin September 21st and 22nd so you will need to purchase the manual as soon as possible. You are responsible for bringing this manual to every laboratory.

Courselink:
This course will make use of the University of Guelph's course website (*via* Courselink). Consequently, you are responsible for all information posted on the Courselink page for BOT*2100. Please check it regularly.
Undergraduate Calendar:
Is the source of information about the University of Guelph's procedures, policies and regulations, which apply to undergraduate programs. It can be found at: https://www.uoguelph.ca/registrar/calendars/undergraduate/current/.

Course Structure
Important dates

September 8th :	first lecture
September 21st and 22nd :	first lab for section 1 and section 2 students, respectively
October 25th :	midterm examination
Dec 16th :	final examination

Accessibility

The University of Guelph is committed to creating and maintaining a barrier-free University community and to eliminating discrimination against individuals with disabilities. To help provide the best possible service to students, the University has established an

accessibility website at www.uoguelph.ca/accessibility. This site brings together the services, groups and committees at the University devoted to promoting accessibility and to ensuring that individuals have equitable access to services and facilities. The University welcomes feedback on any accessibility issues at this website.

Illness and other authorized absences

If you are absent during laboratory periods, the midterm or final examination, for legitimate medical or other authorized reasons, please make sure you contact us. Provide supporting documentation as soon as you are able.

Where and When

Lectures
Lectures will be in **JTP (John T. Powell Building) Room 214**.
Lectures are on:

Tuesdays at 10:00 - 11:20 AM
Thursdays at 10:00 - 11:20 AM

The first lecture is on **Thursday September 8th** and lectures conclude **Tuesday December 1st.** You are most welcome to ask any questions during lectures, the laboratories, or at any other times.

Laboratories
Laboratories will take place in Room 3304 in the Science Complex.
Laboratories are on:

Wednesdays at 2:30 – 5:20 PM
Thursdays at 2:30 – 5:20 PM

Laboratories start on **Wednesday September 21st** and **Thursday September 22nd**.
Make sure that you read the pertinent lab exercises **ahead** of time. Consider any questions posed in each exercise; they can help you in completing the LAB REPORTS. **Remember that you will be examined on laboratory-based material in the mid-term and final examinations.**

Grades

Your grade for the course will be determined from the total results of one midterm examination, laboratory work including an independent project and a final examination.

The **MIDTERM EXAMINATION** will be held in class at **10:00 – 11:20 a.m. on Thursday October 25th**. It will contribute **30%** towards your final grade. Since the midterm examination occurs during a lecture period no alternative time will be scheduled. If you miss the midterm examination due to illness please notify us immediately or bring documentation as soon as possible.

The **FINAL EXAMINATION** will be on **Wednesday December 16th** (8:30-10:30 am., room to be

announced). This examination will contribute **35%** towards your final grade. The final examination will cover primarily materials not covered in the midterm examination but will include related topics dealt with in the labs.

The examinations will cover the lecture AND laboratory materials. The examinations will consist of an array of multiple choice questions, some questions that require concise written answers, and analysis of visual materials. The answers to the midterm examination will be posted in the laboratory. The midterm examination will be returned to you. Any problems with examinations or questions arising from them must be resolved immediately.

LABORATORY WORK contributes **35%** towards your final grade. The grades come from:

10 scheduled laboratories that each require a lab report to be handed in either before you leave the lab, or the following week. Labs 1 and 8 are each worth 2% of your final grade, Labs 2 – 5 are each worth 3%, Labs 6 – 7 are each worth 4.5%, and the group project report is worth 10%, for a total of 35% of your final grade.

You will require a minimum of 6 hours of **independent study** per week (reading, checking your notes, preparing for the lab) to really get the most out of this course. You will be asked to complete a **Course/Instruction and Teaching Assistant Evaluations** using **Courselink.** The evaluation surveys and comments will be given to the instructors after final grades have been submitted.

Laboratories

Week	**Date**	**Lab #**	**Lab Title**
1	Sept 21-22	1	Evolution of plants, life cycles & flower morphology
2	Sept 28-29	2	Seeds structure & germination Starch hydrolysis with amylase
3	Oct 5-6	3	Seedling growth & morphology Identifying different cell types
4	Oct 12-13	4	Seedling growth & morphology (continued) Meristems Root and stem anatomy
5	Oct 19-20	5	Leaf anatomy Epidermis and stomatal complexes
6	Oct 26-27	6	Photosynthesis in C3 and C4 plants Hill reaction Starch detection in leaves
7	Nov 2-3	7	Visualizing water transport Measuring osmosis **Observing cell turgor and plasmolysis**
8	Nov 9-10	8	Fungal diversity

			Introduction to the group projects
9	Nov 16-17		Group project work
10	Nov 23-24		Group project work
11	Nov 30		No lab scheduled – due date for group project reports

Lectures

Dr. T. Akhtar (lectures 1-11 and mid-term)
Dr. I. Tetlow (lectures 12-22 and final exam)

			Readings (Evert & Eichhorn, 8th edition)
1	Sept 8th	Introduction to the course; Evolution of Plants	3-10, 246-248, 253-254, 348-358, 366-390
2	Sept 13th	Evolution of Plants continued; Life Cycles (seedless plants)	391-456 **but focus on** 406-407, 410-411, 422-423, 442-443
3	Sept 15th	Classification, Reproductive strategies	234-243, 457-465,155-162, 169-171
4	Sept 20th	Angiosperm flowers, Flowering genes	465-476, 477-492, 604-609, 668-670
5	Sept 22nd	Pollination, Embryogenesis - fruits	465-476, 526-532, 492-496
6	Sept 27th	Seeds - Germination & early growth	472-473, 532-537, 675-676
7	Sept 29th	Meristems, cells differentiating into tissues	42-62, 63-71, 538-541, 560-564, 579-583
8	Oct 4th	Cell types and tissues	541-555
9	Oct 6th	Organ types - roots and shoots	558-569, 571-577, 579-588, 607-613
	Oct 10th	**FALL STUDY BREAK NO CLASSES**	
10	Oct 18th	Secondary growth - how plants get bigger	614-635, 569-571
11	Oct 20th	Leaves - structure and function	588-602, 607-613
	Oct 25th	**Mid-term Examination in class**	
12	Oct 27th	Photosynthesis - evolution	94-106, 122-124
13	Nov 1st	Photosynthesis - mechanism	125-135
14	Nov 3rd	Photosynthesis - Carbon acquisition, C3, C4, CAM metabolism	135-148
15	Nov 8th	Respiration	94-95, 107-121
16	Nov 10th	Inorganic nutrients in soils - N symbiosis	683-700, 718

17	Nov 15th	The Fungi (including mycorrhizae)	Chapter 14, and 700-701, 280-281, 312-315
18	Nov 17th	Water - potential and uptake	78-85, 657-658
19	Nov 22nd	Water loss	519-520, 703, 711-712, 720
20	Nov 24th	Moving water and sugars around the plant	708-727
21	Nov 29th	Moving water and sugars around the plant	708-727
22	Dec 1st	Review	

Final examination Thursday December 16th (location TBA)

Note: Reduced versions of the lecture slides will be available on Courselink – it is suggested that you print them out and bring them with you to the lecture so you can take additional notes.