

# BIOLOGY 458: PLANT BIOCHEMISTRY AND BIOCHEMICAL ECOLOGY

Fall term 2023/24

Mon/Thurs 10:00 - 11:20 Cun 146

**INSTRUCTORS:** Dr. Peter Constabel (cpc@uvic.ca) & Dr. David Ma (daweima@uvic.ca)

**TEXTBOOK:** none required. Optional textbook (Heldt, "*Plant Biochemistry*" 3rd or 4th ed.) is on reserve at the library. Some material is covered by Taiz and Zeiger's "*Plant Physiology*", also on Reserve. **Readings of original papers will be assigned every other week (5 in total).** You will be asked to do brief summaries of these readings to be handed in.

**WEB CONTENT:** Lecture notes or slides will be available after the lecture on Brightspace. **Be aware that our notes are in condensed form. It is imperative that you attend the lectures.**

## COURSE OBJECTIVES:

You will learn about plant constituents and other plant chemicals, their role in the plant and ecosystem, and the biochemical basis of plant adaptation to the environment. Our focus will be on plant-specific biochemical pathways and processes, including enzymes and regulation. The course is divided into *primary metabolism* (storage carbohydrates, cell wall biosynthesis, lipid metabolism, nitrogen fixation and assimilation) and *secondary metabolism* (biochemistry and ecology of secondary plant metabolites such as isoprenoids, phenolics and alkaloids, and their roles in plant-animal and plant-environment interactions). Students will become familiar with the diversity of plant metabolites, and impacts on health and the environment.

**Learning Outcomes:** At the end of this course, you will be able to:

- describe the primary biochemical pathways which synthesize carbon-based building blocks of plants and how these pathways are regulated
- understand how key special metabolites are made from primary metabolites
- explain the diverse roles of secondary metabolites and how they mediate ecological interactions.
- provide examples of how plants biochemically adapt to a stressful environment.
- be comfortable finding and reading scientific articles about plant biochemistry and ecology.

<b>EVALUATION:</b> Mid-term examination (closed book) ( <b>Oct 23, 2021</b> )	20%
Annotated Bibliography (due <b>Nov 6</b> )	5%
Term Paper Final Draft (due <b>Nov 28</b> )	25%
Reading Assignment Questions	10%
Final exam ( <u>cumulative</u> ): December 2023	<u>40%</u>
	100%

There will be no supplemental exam. Make-up final exams will only be considered following a Request for Academic Concession (<https://www.uvic.ca/registrar/students/appeals/acad-concession/index.php>)

There will be no make-up midterm exams.

Last day for adding courses: **Sept 22**. Last day for dropping courses without penalty of failure: **Oct 31**

The University deals harshly with plagiarism. All submitted work must be your own. See UVic's guidelines on academic integrity ([https://www.uvic.ca/library/help/citation/documents/avoiding\\_plagiarism\\_guide](https://www.uvic.ca/library/help/citation/documents/avoiding_plagiarism_guide)).

Exam time can be very stressful. Try to avoid last minute studying, review the material every week, and discuss it with your classmates. Stay healthy, and talk to me if you have any concerns. UVic Counselling Services is free and can help if you feel overwhelmed. <https://www.uvic.ca/services/counselling/>

<u>LECTURE TOPICS:</u>	<u>Text Readings</u> <u>(Heldt ed. 4th)</u>	<u>Lecture</u> <u>Period #</u>	<u>Dates</u> (approximate)
<u>Introductory lecture</u>			
• Importance of plant biochemistry & biochemical ecology		1	Sept 7
<b><u>Part A. Primary Metabolism (Carbon and Nitrogen)</u></b>			
• Tree Walk on campus. Enzymes review		2	Sept 11
• Calvin cycle & overview of metabolism		3	Sept 14
• Carbohydrates: starch, sucrose, fructans, & other sugars	pp. 241-268	4-5	Sept 18, 21
• Structure and function of the cell wall	pp. 4-9, 268-270	6-7	Sept 25, 28*
<b><i>National Day for Truth &amp; Reconciliation</i></b>		<b><i>no lecture</i></b>	<b>Oct 2</b>
• Fatty acid biosynthesis; plant oils & biotechnological applications	pp. 359-378, 385-387	8-9	Oct 5, 9
<b><i>Thanksgiving Monday (Oct 9)</i></b>		<b><i>no lecture</i></b>	
• Nitrogen assimilation	pp. 273-288	10	Oct 16*
• Nitrogen fixation amino acid synthesis	pp. 307-318	11	Oct 19
<b><u>MIDTERM EXAM</u></b>		<b>12</b>	<b>Oct 23</b>
• Shikimate pathway, aromatic amino acids, herbicides	pp. 297-300	13	Oct 26
• Phenylpropanoid pathway & lignin biosynthesis	pp. 431-440	14	Oct 30*
<b><u>Part B. Secondary Metabolism &amp; Chemical Ecology</u></b>			
• Phenolics: biosynthesis and ecological functions	pp. 399-402, 431-440	15	Nov 2
• Flavonoids and their diverse functions	pp. 442- 449	16	Nov 6
<b><u>TERM PAPER BIBLIOGRAPHIES DUE</u></b>			<b>Nov 6 (Mon)</b>
<b><i>Fall Reading Break (Nov13-15)</i></b>		<b><i>no lectures</i></b>	
• Isoprenoids I - plant volatiles and signals	pp. 409-424	17	Nov 9
• Isoprenoids II - carotenoids, toxins, rubber		18	Nov 16*
• Alkaloids & medicinal plants	pp. 402-404	19-20	Nov 20, 23
• Glucosinolates and cyanogenic glycosides	pp. 404-407	21	Nov 27
<b><u>FINAL TERM PAPERS DUE</u></b>			<b>Nov 28 (Tues)</b>
• Terpenophenolics and Cannabis		22	Nov 30*
• Special Topics / Review		23	Dec 4

NB: Textbook Heldt 3rd edition page numbers will be slightly different but otherwise ok.

\* Reading summaries due date. Readings will be assigned at least one week before.

***We acknowledge and respect the lək̓ʷəŋən peoples on whose traditional territory the university stands and the Songhees, Esquimalt and WSÁNEĆ peoples whose historical relationships with the land continue to this day.***