Western Science

Department of Biology

Biology 3660B Plant Metabolism
Course Outline

1. Course Information

Course Information
Biology 3660B Plant Metabolism – Winter Term 2025
Mon-Wed-Fri, 09:30-10:20

List of Prerequisites
The prerequisite for this class is Biology 2601A/B or permission of the Department.

Unless you have either the requisites for this course or written special permission from your Dean's Designate (Department/Program Counsellors and Science Academic Advisors) to enroll in it, you may be removed from this course and it will be deleted from your record. This decision may not be appealed. You will receive no adjustment to your fees in the event that you are dropped from a course for failing to have the necessary prerequisites.

2. Instructor Information

Instructors	Email	Office	Phone	Office Hours
Prof. Mark A. Bernards	bernards@uwo.ca	NCB 402	x86477	Via Zoom

Office hours will be held via Zoom every Monday and Wednesday, 11:00-noon.

When contacting the instructor, please use your Western email address, and include "Bio 3660B" in the subject line.

3. Course Syllabus, Schedule, Delivery Mode

Calendar Description
Plants are photoautotrophs and biosynthesize all of their metabolites using CO_2, water, micronutrients and sunlight. This course surveys the major metabolic pathways of plants, including primary (C, N, S and P assimilation, amino acid and nucleotide biosynthesis) and secondary (alkaloids, phenolics, terpenoids) metabolism, with emphasis on enzyme and pathway regulation.

Course Description and List of Topics
Biology 3660B is a course about plant metabolism, and the ways in which plants use metabolites to interact with their environment. Emphasis is placed on chemical structures and the logic inherent in biosynthetic pathways. The main topics include:

1. Bioenergetics
    - Driving Forces - basic principles of bioenergetics in metabolism
    - Light absorption and energy transfer in photosynthesis
    - Photosynthetic electron transport

2. Enzymes, Metabolic Pathways & Metabolic Regulation
    - Enzymes and Enzyme Regulation
    - General Principles of Pathway Organization and Regulation
    - Basic Organic Chemistry of Biosynthesis

3. Primary Metabolism
    - Reductive metabolism - C3 Photosynthesis
    - Oxidative Pentose-P Cycle and Photorespiration
    - Respiratory C-metabolism
    - Respiratory Electron Transport
    - N- assimilation and C/N balance
    - S- assimilation
    - P- assimilation

4. Plant Secondary Metabolism
    - Secondary Metabolism: An Overview
    - Role of Secondary Metabolism in Biotic Stress Response

Learning Objectives

By the end of the course, you should be able to:

- Summarize and explain the major bioenergetic driving forces governing biological processes as they relate to metabolism.
- Use examples to describe how metabolic pathways can be organized and regulated in both the long and short term.
- Describe how enzymes are regulated at both fine and course scales.
- Integrate knowledge and concepts about bioenergetics and the organization and control (regulation) of metabolism.
- Classify the basic chemical reactions of metabolism, and demonstrate how they are used to build complex structures from simple building blocks.
- Classify enzymes and summarize how they catalyze basic chemical reactions.
- Describe how plants convert light energy into chemical energy, and the mechanisms used to regulate the process.
- Describe the basic pathways of C, N, S and P assimilation in plants and summarize their regulation and inter-relationships.
- Distinguish between primary and secondary metabolism and describe the interrelatedness of the two.
- Describe and draw out the metabolic origins and general biosynthesis of representative alkaloid, isoprenoid and phenylpropanoid compounds.

- Draw and identify representative structures of common primary metabolites (e.g., sugars, amino acids, organic acids).
- Draw and identify representative structures of common alkaloids, isoprenoids and phenylpropanoids.
- Demonstrate how plants utilize secondary metabolites, especially alkaloids, isoprenoids and phenylpropanoids, to interact with their environment and relate the control of these processes to the main concepts of metabolic regulation.

Important Sessional Dates

Classes begin: Monday January 6, 2025
Reading Week: February 15–23, 2025
Last Class: April 4, 2025
Exam period: April 7 – 30, 2025

4. Course Materials

Textbook
No one textbook covers the scope of material presented in Biology 3660B. In an effort to keep textbook costs low, Biology 3660B uses the same textbook as the prerequisite course Biology 2601A/B, namely *Plant Physiology and Development* 7th Ed., by Taiz, Møller, Murphy and Zeiger (Sinauer Associates, Inc., 2023). This text is meant to be a resource book, providing background material about plants, plant anatomy, general physiology, etc. Specific sections, relevant to the material presented in class will be assigned. Additional reading material, including book chapters and primary research articles will be assigned throughout the term, and distributed via the course OWL Brightspace site. Several aspects of the course are also covered in basic biochemistry textbooks, which are available at the Taylor Library or through various online options.

Software
Western university has a site subscription for ChemDraw® software. You are encouraged to register and download this software for use in preparing assignments and your major paper. Go to https://informatics.perkinelmer.com/sitesubscription/ to register.

Other Materials
In the event that we need to pivot online for part of the term, you will also need:

- Stable Internet Connection
- Laptop or computer
- Working microphone
- Working webcam

Course Website
All course material, including additional readings will be posted on the Biology 3660B OWL Brightspace site. Students are responsible for checking the course OWL Brightspace site

(https://westernu.brightspace.com) on a regular basis for news and updates. This is the primary method by which information will be disseminated to all students in the class.

If students need assistance with the course OWL Brightspace site, they can seek support on the OWL Brightspace Help page. Alternatively, they can contact the Western Technology Services Helpdesk. They can be contacted by phone at 519-661-3800 or ext. 83800.

5. Methods of Evaluation

The overall course grade, out of 100, will be calculated as listed below. Listed next to the respective components are their maximum contributions toward the course grade.

Component	Notes	Value
In Class Test 1	Monday February 3, 2025	20
In Class Test 2	Friday March 7, 2025	20
Group Presentations	Friday February 28, 2025 (in class)	10
In-Class Quizzes	Fridays at start of class – 9 @ 2.5 % each (best 6 counted)	15
Final Exam		35

General information about missed coursework
Students must familiarize themselves with the *University Policy on Academic Consideration – Undergraduate Students in First Entry Programs* posted on the Academic Calendar: https://www.uwo.ca/univsec/pdf/academic_policies/appeals/academic_consideration_Sep24.pdf,

This policy does not apply to requests for Academic Consideration submitted for **attempted or completed work**, whether online or in person.

The policy also does not apply to students experiencing longer-term impacts on their academic responsibilities. These students should consult Accessible Education.

For procedures on how to submit Academic Consideration requests, please see the information posted on the Office of the Registrar's webpage:
https://registrar.uwo.ca/academics/academic_considerations/
All requests for Academic Consideration must be made within 48 hours after the assessment date or submission deadline.

All Academic Consideration requests normally must include supporting documentation; however, recognizing that formal documentation may not be available in some extenuating circumstances, the policy allows students to make one Academic Consideration request **without supporting**

documentation in this course. However, the following assessments are excluded from this, and therefore always require formal supporting documentation:

- The Final Exam scheduled during official examination periods (Defined by policy)

When a student *mistakenly* submits their one allowed Academic Consideration request **without supporting documentation** for the assessments listed above or those in the **Coursework with Assessment Flexibility** section below, the request cannot be recalled and reapplied. This privilege is forfeited.

Evaluation Scheme for Missed Assessments

When a student misses the Final Exam and their Academic Consideration has been granted, they will be allowed to write the Special Examination (the name given by the University to a makeup Final Exam). See the Academic Calendar for details (under Special Examinations), especially for those who miss multiple final exams within one examination period.

In-Class Tests: there are two in-class tests. The first (scheduled for Monday Feb. 3) covers material from lectures 2-12, inclusive. The second (scheduled for Friday Mar. 7) covers material from lectures 14-23, inclusive. **There are no make-up exams.** For students with valid academic consideration, missed tests will be reweighted to the final exam.

Coursework with Assessment Flexibility
By policy, instructors may deny Academic Consideration requests for the following assessments with built-in flexibility:

Flexible Completion

Quizzes. This course has nine (9) quizzes, and the six (6) quizzes with the highest marks are counted towards your final grade. Should extenuating circumstances arise, students do not need to request Academic Consideration for the first three (3) missed quizzes. Academic consideration requests will be denied for the first three (3) missed quizzes. Academic Consideration requests may be granted when students miss more than three (3) quizzes, and these additional (4^{th}, 5^{th}…) missed quizzes will be reweighted to the final exam.

6. Additional Statements

Religious Accommodation
When conflicts with a religious holiday that requires an absence from the University or prohibits certain activities, students should request an accommodation for their absence in writing to the course instructor and/or the Academic Advising office of their Faculty of Registration. This notice should be made as early as possible but not later than two weeks prior to the writing or the examination (or one week prior to the writing of the test).

Please visit the Diversity Calendars posted on our university's EDID website for the recognized religious holidays:

https://www.edi.uwo.ca.

Accommodation Policies
Students with disabilities are encouraged to contact Accessible Education, which provides recommendations for accommodation based on medical documentation or psychological and cognitive testing. The policy on Academic Accommodation for Students with Disabilities can be found at:

https://www.uwo.ca/univsec/pdf/academic_policies/appeals/Academic Accommodation_disabilities.pdf.

Academic Policies
The website for Registrar Services is https://www.registrar.uwo.ca/.

In accordance with policy,

https://www.uwo.ca/univsec/pdf/policies_procedures/section1/mapp113.pdf,

the centrally administered e-mail account provided to students will be considered the individual's official university e-mail address. It is the responsibility of the account holder to ensure that e-mail received from the University at their official university address is attended to in a timely manner.

No electronic devices of any kind are permitted during tests, quizzes and exams.

Scholastic offences are taken seriously and students are directed to read the appropriate policy, specifically, the definition of what constitutes a Scholastic Offence, at the following Web site:

https://www.uwo.ca/univsec/pdf/academic_policies/appeals/scholastic_discipline_undergrad.pdf.

Support Services
Please visit the Science & Basic Medical Sciences Academic Advising webpage for information on adding/dropping courses, academic considerations for absences, appeals, exam conflicts, and many other academic-related matters: https://www.uwo.ca/sci/counselling/.

Students who are in emotional/mental distress should refer to Mental Health@Western (https://uwo.ca/health/) for a complete list of options about how to obtain help.

Western is committed to reducing incidents of gender-based and sexual violence and providing compassionate support to anyone who has gone through these traumatic events. If you have experienced sexual or gender-based violence (either recently or in the past), you will find information about support services for survivors, including emergency contacts at

https://www.uwo.ca/health/student_support/survivor_support/get-help.html.

To connect with a case manager or set up an appointment, please contact support@uwo.ca.

Please contact the course instructor if you require lecture or printed material in an alternate format or if any other arrangements can make this course more accessible to you. You may also wish to contact Accessible Education at

http://academicsupport.uwo.ca/accessible_education/index.html

if you have any questions regarding accommodations.

Learning-skills counsellors at Learning Development and Success (https://learning.uwo.ca) are ready to help you improve your learning skills. They offer presentations on strategies for improving time management, multiple-choice exam preparation/writing, textbook reading, and more. Individual support is offered throughout the Fall/Winter terms in the drop-in Learning Help Centre, and year-round through individual counselling.

Western University is committed to a thriving campus as we deliver our courses in the mixed model of both virtual and face-to-face formats. We encourage you to check out the Digital Student Experience website to manage your academics and well-being: https://www.uwo.ca/se/digital/.

Additional student-run support services are offered by the USC, https://westernusc.ca/services/.