

## Biology 3660B Plant Metabolism Course Outline

### 1. Course Information

#### Course Information

Biology 3660B Plant Metabolism – Winter Term 2022  
Mon-Wed-Fri, 10:30-11:20 FNB 1250

#### 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 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	By Appointment

If you are contacting your instructor, please use your Western email address, and include “Bio 3660B” in the subject line. Office hours will be held via Zoom. Please e-mail the instructor to arrange an appointment.

### 3. Course Syllabus, Schedule, Delivery Mode

#### Calendar Description

Plants are photoautotrophs and biosynthesize all of their metabolites using CO<sub>2</sub>, 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.

### **Contingency plan for an in-person class pivoting to 100% online learning**

We will start the semester with on-line, synchronous class meetings (via Zoom) until instructed otherwise by the University Administration. As soon as we are permitted, the class will meet in FNB 1250. Notification of the switch will be posted on OWL and sent via e-mail.

In the event of a COVID-19 resurgence during the course that necessitates the course delivery either remaining away from or moving away from face-to-face interaction, all remaining course content will be delivered entirely online synchronously (i.e., at the times indicated in the timetable). The grading scheme will **not** change. Any remaining assessments will also be conducted online as determined by the course instructor.

### **Important Sessional Dates**

Classes begin: Monday January 10, 2022

Reading Week: February 19–27, 2022

Last Class: April 8, 2022

## **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* 6<sup>th</sup> Ed., by Taiz, Zeiger, Moller and Murphy (Sinauer Associates, Inc., 2015). 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. Specific, primary research articles will be assigned throughout the term, and distributed via the course OWL 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**

Since we will be online for at least the first three weeks 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 site. Students are responsible for checking the course OWL site (<http://owl.uwo.ca>) 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 site, they can seek support on the OWL 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 <sup>1</sup>	Value
Assignment 1 Bioenergetics	Due Friday January 21, 2022 (Submitted via OWL)	10
Assignment 2 Enzymes	Due Friday February 11, 2022 (Submitted via OWL)	10
Assignment 3 Primary Metabolism	Due Friday March 011, 2022 (Submitted via OWL)	10
Group Presentations	Mon. Mar. 7, 2022 (in class/on Zoom)	10
Major Paper	Due Friday April 8, 2022 (Annotated Bibliography due March 25)	45
In-Class Quizzes	Various Dates – 12 @ 2.5% each (completed via OWL; best 6 counted)	15

<sup>1</sup>Assignments will be available through the course OWL site one week before they are due. The Major Paper will be discussed in class early in the term.

### Accommodated Evaluations

Since only the best 6 quiz grades will be counted (out of 12 possible quizzes), there will not be any make-up or re-weighting quizzes.

Late assignments be assessed a penalty of 5% of the assigned grade. Assignments will be accepted until marked assignments are returned to the class. Since this is generally more than 48-72 hours past the

assigned due date, no alternative assessments will be available. Outstanding assignments beyond the point that graded assignments are returned to the class will be assigned a grade of zero (0).

The major paper is due no later than the last day of class and may be submitted earlier. The major paper is an essential part of the course. Failure to submit a major paper will result in a failing grade (i.e., 45) for the course. Late papers will be assessed a penalty of 5% of the assigned grade.

## 6. Student Absences

### Academic Consideration for Student Absences

Students who experience an extenuating circumstance (illness, injury or other extenuating circumstance) sufficiently significant to temporarily render them unable to meet academic requirements may submit a request for academic consideration through the following routes:

- (i) Submitting a Self-Reported Absence (SRA) form provided that the conditions for submission are met. To be eligible for a Self-Reported Absence:
  - an absence must be no more than 48 hours
  - the assessments must be worth no more than 30% of the student's final grade
  - no more than two SRAs may be submitted during the Winter term
- (ii) For medical absences, submitting a Student Medical Certificate (SMC) signed by a licensed medical or mental health practitioner to the Academic Counselling office of their Faculty of Registration.
- (iii) Submitting appropriate documentation for non-medical absences to the Academic Counselling office in their Faculty of Registration.

Note that in all cases, students are required to contact their instructors within 24 hours of the end of the period covered, unless otherwise instructed in the course outline.

Students should also note that individual instructors are not permitted to receive documentation directly from a student, whether in support of an application for consideration on medical grounds, or for other reasons. **All documentation required for absences that are not covered by the Self-Reported Absence Policy must be submitted to the Academic Counselling office of a student's Home Faculty.**

For the policy on Academic Consideration for Student Absences – Undergraduate Students in First Entry Programs, see:

[https://www.uwo.ca/univsec/pdf/academic\\_policies/appeals/accommodation\\_illness.pdf](https://www.uwo.ca/univsec/pdf/academic_policies/appeals/accommodation_illness.pdf)

and for the Student Medical Certificate (SMC), see:

[http://www.uwo.ca/univsec/pdf/academic\\_policies/appeals/medicalform.pdf](http://www.uwo.ca/univsec/pdf/academic_policies/appeals/medicalform.pdf).

### Religious Accommodation

When a course requirement conflicts with a religious holiday that requires an absence from the University or prohibits certain activities, students should request accommodation for their absence in

writing at least two weeks prior to the holiday to the course instructor and/or the Academic Counselling office of their Faculty of Registration. Please consult University's list of recognized religious holidays (updated annually) at

<https://multiculturalcalendar.com/ecal/index.php?s=c-univwo>.

## 6. Accommodation and Accessibility

### Accommodation Policies

Students with disabilities work with Accessible Education (formerly SSD), 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](https://www.uwo.ca/univsec/pdf/academic_policies/appeals/Academic_Accommodation_disabilities.pdf),

## 7. Academic Policies

The website for Registrarial Services is <http://www.registrar.uwo.ca>.

In accordance with policy,

[https://www.uwo.ca/univsec/pdf/policies\\_procedures/section1/mapp113.pdf](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 his/her official university address is attended to in a timely manner.

**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:

[http://www.uwo.ca/univsec/pdf/academic\\_policies/appeals/scholastic\\_discipline\\_undergrad.pdf](http://www.uwo.ca/univsec/pdf/academic_policies/appeals/scholastic_discipline_undergrad.pdf).

All assignments and the major paper may be subject to submission for textual similarity review to the commercial plagiarism detection software under license to the University for the detection of plagiarism. All papers submitted for such checking will be included as source documents in the reference database for the purpose of detecting plagiarism of papers subsequently submitted to the system. Use of the service is subject to the licensing agreement, currently between The University of Western Ontario and Turnitin.com (<http://www.turnitin.com>).

## 8. Support Services

Please visit the Science & Basic Medical Sciences Academic Counselling 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/>.

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 (519) 661-2147 if you have any questions regarding accommodations.

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/>.

Learning-skills counsellors at the Student Development Centre (<http://www.sdc.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.

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

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