



# **BIOT\*6550 Biodiversity and Biotechnology**

Winter 2023

Section(s): C01

Department of Molecular and Cellular Biology

Credit Weight: 0.50

Version 1.00 - January 11, 2023

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## **1 Course Details**

### **1.1 Calendar Description**

Biological diversity includes the variability among living organisms spanning genetic, species, habitat and geographic scales, thereby encompassing all living things and associated systems. This course provides an overview of DNA-based approaches used to analyze and characterize the main principles of biodiversity followed by discussions of the impact of biologically diverse communities within the biotechnology sector.

**Restrictions:** Restricted to Master of Biotechnology students.

### **1.2 Course Description**

Biodiversity spans a variety of hierarchical levels (e.g. genes, populations, species, and communities) and spatial scales of organization. Biotechnology both enhances our understanding of this diversity and uses it as a substrate for a variety of wide-ranging biotechnological applications. Notably, DNA sequencing has revealed entire new domains of life and is routinely used to identify species, while next-generation sequencing can probe whole genomes and even community assemblages. Understanding species diversity and community interactions can help support crop health and agricultural productivity, while knowledge of microbial communities has applications in human health and a myriad of industrial applications. In this course, we will explore the DNA-based approaches used to characterize and analyse biodiversity followed by discussions of the biological concepts that define diversity within biological communities to investigate its impact on biotechnological applications.

BIOT\*6550 will cover three broad concepts. In-class discussions will provide theoretical information on the biodiversity and interactions within biological systems with a focus on biotechnological application. Secondly, critical readings will be assigned for in-depth class

discussions culminating in written assignments and student presentations of specific concepts. Finally, one practical project will be used to evaluate the theoretical knowledge discussed in class in the context of a specific biotechnological application.

### 1.3 Timetable

A schedule of dates will be discussed in class and provided on CourseLink. It is subject to minor changes.

### 1.4 Final Exam

Not applicable. This course does not have a final exam, but will have several evaluation points during the semester.

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## 2 Instructional Support

**Lectures:** 2x 80-minute lectures per week (Tue/Thu 1:00-2:20 pm). STUDENTS ARE EXPECTED TO ATTEND ALL LECTURES AND PRESENTATIONS.

**Location:** Unless otherwise indicated, we will meet in person in SSC 1304.

**Instructors:** Dr. George van der Merwe

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## 3 Learning Resources

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## 4 Learning Outcomes

### 4.1 Course Learning Outcomes

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

1. Successful students will undertake an advanced critical analysis of current research literature in molecular biology and biodiversity to identify the best approaches for a specific applied research goal, gaining foundational knowledge of biotechnology and biodiversity. They will understand the context in which biodiversity contributes to

biotechnological applications that are globally competitive, and demonstrate a high degree of professional literacy in the process. By the end of the course successful students will have addressed six key learning objectives:

1. Depth and Breadth of Knowledge: achieved through traditional lectures and self-directed enquiry culminating in a literature review pertaining to a focal area of student interest.
2. Scientific Methodology: achieved through critical readings of the literature.
3. Specific Methodology: achieved through learner-centered discussions involving case studies presented in class.
4. Communication: achieved through oral presentations (of proposed project topic, literature review, journal article presentation and final project presentation) and written assignments (literature review, peer reviews, final project summary).
5. Professionalism: achieved through feedback from faculty and fellow students on both oral and written presentations.
6. Advancement of Science: achieved through participation in the peer review process, where students will provide written critiques on the work of their peers.

## 5 Teaching and Learning Activities

### 5.1 Lecture

#### Topics:

#### Course Content

Specialists with expertise in diverse backgrounds of biodiversity and biotechnology will present lectures to introduce the application(s) of the three broad concepts covered in this course.

#### **Broad Concept: Molecular Biodiversity**

In-class presentations and discussions on DNA-based approaches for characterizing biodiversity (prokaryotes, eukaryotes and tools of the trade), considering the targeted development of biological diversity with a focus on application and innovation. Key reading assignments are drawn from the primary literature.

**Topics**

1. Biodiversity: genes to ecosystems
2. Population Genomics and the morphology of the genome

**Broad Concept: Functional Organization**

In-class presentations and discussions on gene evolution & genetic adaptation within biological niches. Genomic adaptation (domestication) will also be discussed. Key reading assignments are drawn from the primary literature.

**Topics**

1. Gene duplication as a force in evolution
2. Genetic adaptation vs. genetic engineering

**Broad Concept: Gene Evolution and Targeted Development**

In-class presentations and discussions on the impact of biological communities and interactions within biotechnological application(s). Group discussions on evaluating the benefits and limitations of microbial systems in different biotechnological settings. Examples include, but are not limited to microbial diversity in the production of alcoholic beverages, probiotics and the human microbiome.

**Topics**

1. Identification & Characterization of population diversity
2. Product development and innovation through diversity

**Biodiversity and Biotechnology Project**

Students will be required to select a specific topic of interest in biodiversity with a biotechnological application to

investigate during the course of the semester. This project will be divided into three assignments. The first is to select a topic of interest and to briefly discuss it with Dr. van der Merwe. The second assignment is to prepare a literature review on the topic. The third assignment should provide an overview of the specific scientific concept(s) applicable to the topic, specific area(s) of development needed, and a critical assessment of the (potential) biotechnological application(s) in the selected topic area. Assignments two and three will have a written and oral presentation components. Each assignment will be anonymously evaluated by peers and Dr. van der Merwe. Students are expected to actively participate in class discussions and in question sessions following presentations. Grades will be assigned for the written assignments, presentations, peer evaluations, and class participation.

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## 6 Assessments

### 6.1 Assessment Details

#### **Written Assignments (30%)**

**Date:** Submission on CourseLink

Detailed instructions and the schedule of dates will be provided in class and on CourseLink.

#### **Presentations (30%)**

**Date:** In Class

Detailed instructions and schedule of dates will be provided in class and on CourseLink.

#### **Peer Review (25%)**

**Date:** In class and submitted on-line

Details will be provided in class.

#### **Class participation (15%)**

**Date:** In class

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## 7 Department of Molecular and Cellular Biology Statements

### 7.1 Academic Advisors

If you are concerned about any aspect of your academic program:

- Make an appointment with a program counsellor in your degree program. [B.Sc. Academic Advising](#) or [Program Counsellors](#)

## 7.2 Academic Support

If you are struggling to succeed academically:

- Learning Commons: There are numerous academic resources offered by the Learning Commons including, Supported Learning Groups for a variety of courses, workshops related to time management, taking multiple choice exams, and general study skills. You can also set up individualized appointments with a learning specialist.  
<http://www.learningcommons.uoguelph.ca/>
- Science Commons: Located in the library, the Science Commons provides support for physics, mathematic/statistics, and chemistry. Details on their hours of operations can be found at: <http://www.lib.uoguelph.ca/get-assistance/studying/chemistry-physics-help> and <http://www.lib.uoguelph.ca/get-assistance/studying/math-stats-help>

## 7.3 Wellness

If you are struggling with personal or health issues:

- Counselling services offers individualized appointments to help students work through personal struggles that may be impacting their academic performance.  
<https://www.uoguelph.ca/counselling/>
- Student Health Services is located on campus and is available to provide medical attention. <https://www.uoguelph.ca/studenthealthservices/clinic>
- For support related to stress and anxiety, besides Health Services and Counselling Services, Kathy Somers runs training workshops and one-on-one sessions related to stress management and high performance situations.  
<http://www.selfregulationskills.ca/>

## 7.4 Personal information

Personal information is collected under the authority of the University of Guelph Act (1964), and in accordance with Ontario's Freedom of Information and Protection of Privacy Act (FIPPA) <http://www.e-laws.gov.on.ca/index.html>. This information is used by University officials in order to carry out their authorized academic and administrative responsibilities and also to establish a relationship for alumni and development purposes.

For more information regarding the Collection, Use and Disclosure of Personal Information policies please see the Undergraduate Calendar.  
(<https://www.uoguelph.ca/registrar/calendars/undergraduate/current/intro/index.shtml>)

## 7.5 Course Offering Information Disclaimer

Please note that course delivery format (face-to-face vs online) is subject to change up to the first-class day depending on requirements placed on the University and its employees by public health bodies, and local, provincial and federal governments. Any changes to course format prior to the first class will be posted on WebAdvisor/Student Planning as they become available.

## 8 University Statements

### 8.1 Email Communication

As per university regulations, all students are required to check their e-mail account regularly: e-mail is the official route of communication between the University and its students.

### 8.2 When You Cannot Meet a Course Requirement

When you find yourself unable to meet an in-course requirement because of illness or compassionate reasons please advise the course instructor (or designated person, such as a teaching assistant) in writing, with your name, id#, and e-mail contact. The grounds for Academic Consideration are detailed in the Undergraduate and Graduate Calendars.

Undergraduate Calendar - Academic Consideration and Appeals

<https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-ac.shtml>

Graduate Calendar - Grounds for Academic Consideration

<https://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/index.shtml>

Associate Diploma Calendar - Academic Consideration, Appeals and Petitions

<https://www.uoguelph.ca/registrar/calendars/diploma/current/index.shtml>

### 8.3 Drop Date

Students will have until the last day of classes to drop courses without academic penalty. The deadline to drop two-semester courses will be the last day of classes in the second semester. This applies to all students (undergraduate, graduate and diploma) except for Doctor of Veterinary Medicine and Associate Diploma in Veterinary Technology (conventional and alternative delivery) students. The regulations and procedures for course registration are available in their respective Academic Calendars.

Undergraduate Calendar - Dropping Courses

<https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-drop.shtml>

Graduate Calendar - Registration Changes

<https://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/genreg-reg-regchg.shtml>

Associate Diploma Calendar - Dropping Courses

<https://www.uoguelph.ca/registrar/calendars/diploma/current/c08/c08-drop.shtml>

## 8.4 Copies of Out-of-class Assignments

Keep paper and/or other reliable back-up copies of all out-of-class assignments: you may be asked to resubmit work at any time.

## 8.5 Accessibility

The University promotes the full participation of students who experience disabilities in their academic programs. To that end, the provision of academic accommodation is a shared responsibility between the University and the student.

When accommodations are needed, the student is required to first register with Student Accessibility Services (SAS). Documentation to substantiate the existence of a disability is required; however, interim accommodations may be possible while that process is underway.

Accommodations are available for both permanent and temporary disabilities. It should be noted that common illnesses such as a cold or the flu do not constitute a disability.

Use of the SAS Exam Centre requires students to make a booking at least 14 days in advance, and no later than November 1 (fall), March 1 (winter) or July 1 (summer). Similarly, new or changed accommodations for online quizzes, tests and exams must be approved at least a week ahead of time.

For Guelph students, information can be found on the SAS website  
<https://www.uoguelph.ca/sas>

For Ridgetown students, information can be found on the Ridgetown SAS website  
<https://www.ridgetownc.com/services/accessibilityservices.cfm>

## 8.6 Academic Integrity

The University of Guelph is committed to upholding the highest standards of academic integrity, and it is the responsibility of all members of the University community—faculty, staff, and students—to be aware of what constitutes academic misconduct and to do as much as possible to prevent academic offences from occurring. University of Guelph students have the responsibility of abiding by the University's policy on academic misconduct regardless of their location of study; faculty, staff, and students have the responsibility of supporting an environment that encourages academic integrity. Students need to remain aware that instructors have access to and the right to use electronic and other means of detection.

Please note: Whether or not a student intended to commit academic misconduct is not relevant for a finding of guilt. Hurried or careless submission of assignments does not excuse students from responsibility for verifying the academic integrity of their work before submitting it. Students who are in any doubt as to whether an action on their part could be construed as an academic offence should consult with a faculty member or faculty advisor.

Undergraduate Calendar - Academic Misconduct  
<https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-amisconduct.shtml>



Graduate Calendar - Academic Misconduct

<https://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/index.shtml>

## 8.7 Recording of Materials

Presentations that are made in relation to course work - including lectures - cannot be recorded or copied without the permission of the presenter, whether the instructor, a student, or guest lecturer. Material recorded with permission is restricted to use for that course unless further permission is granted.

## 8.8 Resources

The Academic Calendars are the source of information about the University of Guelph's procedures, policies, and regulations that apply to undergraduate, graduate, and diploma programs.

Academic Calendars

<https://www.uoguelph.ca/academics/calendars>

## 8.9 Disclaimer

Please note that the ongoing COVID-19 pandemic may necessitate a revision of the format of course offerings, changes in classroom protocols, and academic schedules. Any such changes will be announced via CourseLink and/or class email.

This includes on-campus scheduling during the semester, mid-terms and final examination schedules. All University-wide decisions will be posted on the COVID-19 website (<https://news.uoguelph.ca/2019-novel-coronavirus-information/>) and circulated by email.

## 8.10 Illness

Medical notes will not normally be required for singular instances of academic consideration, although students may be required to provide supporting documentation for multiple missed assessments or when involving a large part of a course (e.g.. final exam or major assignment).

## 8.11 Covid-19 Safety Protocols

For information on current safety protocols, follow these links:

- <https://news.uoguelph.ca/return-to-campus/how-u-of-g-is-preparing-for-your-safe-return/>
- <https://news.uoguelph.ca/return-to-campus/spaces/#ClassroomSpaces>

Please note, these guidelines may be updated as required in response to evolving University, Public Health or government directives.

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