



BIOT*6550 Biodiversity and Biotechnology

Winter 2020

Section(s): C01

Department of Molecular and Cellular Biology

Credit Weight: 0.50

Version 1.00 - December 17, 2019

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 will provide 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.

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 industrial fermentation processes (e.g. beer and wine industries). 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 change.

1.4 Final Exam

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

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: SSC 1304

Instructors: Drs. Robert Hanner and George van der Merwe

3 Learning Resources

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

Industry specialists and the lecturers will present lectures to introduce the application(s) of three broad concepts. Students will be required read an assigned paper for discussion following the lecture.

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 with a biotechnological application to investigate during the course of the semester. This project will be divided into three assignments. The first is to write select a topic and write an abstract outlining the project and the

problem it will be addressing. The second assignment is to prepare a literature review on the topic. Lastly, the final review 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. Each of the three assignments will have a written and oral presentation component. These will be anonymously evaluated by peers and at least one faculty member. 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.

Practicum

Students will undertake group work and prepare a group report on their attempts to characterize the impacts of yeast diversity of product development and innovation during beer production. Students will undertake group work and prepare a group report on their attempts to characterize the impacts of yeast diversity of product development and innovation during beer production.

6 Assessments

6.1 Assessment Details

Written Assignments (32.5%)

Date: Submission on CourseLink

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

Presentations (32.5%)

Date: In Class

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

Peer Review (20%)

Date: In class and submitted on-line

Details will be provided in class.

Class participation (15%)

Date: In class

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/>

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 book their exams at least 7 days in advance and not later than the 40th Class Day.

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>
