

Introduction to Biotechnology Syllabus

Department of Biochemistry & Molecular Biology

BIOC 3501, Fall 2024

Dalhousie University acknowledges that we are in Mi'kma'ki, the ancestral and unceded territory of the Mi'kmaq People and pays respect to the Indigenous knowledges held by the Mi'kmaq People, and to the wisdom of their Elders past and present. The Mi'kmaq People signed Peace and Friendship Treaties with the Crown, and section 35 of the Constitution Act, 1982 recognizes and affirms Aboriginal and Treaty rights. We are all Treaty people.

Dalhousie University also acknowledges the histories, contributions, and legacies of African Nova Scotians, who have been here for over 400 years.

Course Instructor

Name	Email	Office Hours
Kathryn Vanya Ewart	vewart@dal.ca	Book meeting

Course Description

Topics covered include (1) the history and scope of biotechnology, (2) genetic, molecular and analytical approaches central to biotechnology, (3) production of macromolecules and small molecules using cells or biological materials, (4) detection of molecules using cells or biological materials, (5) biotechnology in Atlantic Canada, and (6) responsibilities in biotechnology.

Notes

1. Does not count as a Biochemistry & Molecular Biology credit towards a Major or Honours in Biochemistry & Molecular Biology, but can be taken as a general elective
2. Can be counted towards a Minor in Biochemistry & Molecular Biology

Course Prerequisites

BIOC 2300, and BIOL 2020, and BIOL 2030 or instructor's permission

Course Exclusions

Not applicable

Student Resources/Course Material

- Study materials, including PDF lecture notes, recorded lectures, assigned readings and links to online videos will be available in Brightspace.
- The course textbook will be “Molecular Biotechnology: Principles and Applications of Recombinant DNA, 6th edition” (2022) by B.R. Glick and C.L. Patten (ASM Press).
- Research materials required for the video and product development assignments should be available through the Dalhousie library as well as through the websites of the Life Sciences Industry associations or individual companies.
- Information on companies, trade associations or other organizations shared in this course are not endorsements of those entities but are included for educational purposes only.
- Meetings within office hours are available at [Book meeting](#). Students who cannot meet in these intervals are welcome to contact me by email to schedule different meeting times.

Course Structure

The course will involve several components.

1. **Lectures:** There will be lectures in the Collaborative Health Education Building (CHEB) room C140 at 4:05 p.m. on Mondays and Wednesdays, excluding holidays. Some lectures will involve substantial student participation including class discussions and student videos.

2. **Independent study:** In addition to lecture attendance, this course will require substantial independent study of the material in order to develop broadly based and in-depth knowledge of the methods and concepts covered. Preparation of assignments will also require responsible planning and time management.

3. **Communication and assistance:** Appointments for consultation or extra help can be set up by scheduling a meeting using the link above. As noted above, students who cannot meet in these intervals are welcome to contact me by email to schedule different meeting times.

Assessment

Evaluation will include the following components:

Component	Weight (% of final mark)	Exam date or item due date
Critical analysis of a ChatGPT-generated biotechnology description	5%	Wednesday, Sept. 25th , 2024
Midterm exam	25%*	Wednesday, October 16th , 2024
Atlantic Canadian life sciences company video	20% 1% Choice of company 15% Video 4% Peer feedback	Wednesday, October 2nd , 2024 Monday, November 18th , 2024 Wednesday, December 4th , 2024
Product development proposal	15%	Wednesday, December 4th , 2024
Final exam	35%*	TBD , within the regular final exam schedule

*NOTE: When a student earns a higher grade on the midterm than on the final exam, both exams will be adjusted to 30% for that student.

Conversion of numerical grades to Final Letter Grades follows the Dalhousie Common Grade Scale

A+ (90-100)	B+ (77-79)	C+ (65-69)	D	(50-54)
A (85-89)	B (73-76)	C (60-64)	F	(<50)
A- (80-84)	B- (70-72)	C- (55-59)		

Course Policies on Missed or Late Academic Requirements

- Assignments will be docked 20% per day if submitted late (-20% if up to 24 hours past due, -40% if 24 - 48 hours past due, etc.).
- If a student is unable to complete an exam or assignment at the scheduled time due to illness or for other valid reasons, the student must submit a **Student Declaration of Absence** form (available on Brightspace) either electronically or in printed form within 3 days of the event. A maximum of 2 declarations of absence will be accepted per student. When a declaration of absence is submitted for an assignment, students then have five extra days to complete the assignment before marks are docked as described above.
- There will be **no make-up midterm** exam. If the midterm exam is missed (with a Declaration of Absence), the final exam will count for the full grade percentage of both exams, which is 60%.
- **Travel for holidays will not be accommodated.**
- If a video feedback assignment is missed, for exceptional reasons, **the student must contact** the instructor for alternate evaluation arrangements. (A declaration of absence must also be submitted.)

Course Policies related to Academic Integrity

- Students are expected to work independently for all assignments. ChatGPT is required for the first assignment, but it should not be used for subsequent work.

Classroom policies

- Water and covered beverages will be permitted into the classroom; however, there will be **no food allowed** in the classroom during this course. If a student has food with them, it must be stored neatly away in a closed package or container for the duration of the class.
- All interaction among students and with the instructor should be respectful. Everyone is welcome.
- Anonymous feedback can be provided at any time over the course of the semester by completing the form at [Feedback](#).

Learning Objectives

This course was developed to provide students with a comprehensive understanding of biotechnology, extending from its initial development to its current breadth. Although the foundations introduced in the course might generally remain steady over time, the current developments featured in the course will, of necessity, change frequently as a result of rapid growth and development in the field. In-class video presentations will allow students to learn about Atlantic Canadian biotechnology companies from one another. The video sessions in this year's course will be open to all those working or studying at Dalhousie (within room capacity), as these are service-learning events. Local guest lectures will also allow students to become familiar with regional biotechnology initiatives.

At the end of this course, students will be able to:

1. Describe in general what is encompassed by biotechnology, from its origins to the present day,
2. Explain the molecular fundamentals and key developments in the manipulation, amplification and detection of specific stretches of DNA,
3. Describe examples of whole-organism biotechnology, including genome-wide association for trait selection, transgenic technology and the use of emerging gene editing techniques,
4. Explain how heterologous proteins can be produced in cells,
5. Explain protein engineering strategies,
6. Describe examples of metabolic engineering and cell-free systems for the production of select molecules of interest,
7. Describe examples of genetic modification or selection for environmental remediation,
8. Describe new and emerging technologies for the detection and analysis of biological molecules of interest,
9. Describe some of the current developments underway in biotechnology in Atlantic Canada,
10. Appreciate the importance of ethical benefit sharing in biotechnology and aspects of intellectual property protection and regulatory approval processes for products.

Course Schedule

DATE	DAY	TOPIC
September	4 th	Wednesday Overview, syllabus and assignments
	9 th	Monday Development and general methods I
	11 th	Wednesday General methods II
	16 th	Monday Transgenics
	18 th	Wednesday Nucleic acid sequences I
	23 rd	Monday Nucleic acid sequences II
	25 th	Wednesday Protein sequences
	30 th	Monday No class
October	2 nd	Wednesday Heterologous protein production
	7 th	Monday Synthetic biology and metabolic engineering
	9 th	Wednesday Protein technologies I
	14 th	Monday No class
	16 th	Wednesday Midterm exam (up to synthetic biology)
	21 st	Monday Protein technologies II
	23 rd	Wednesday Guest speaker: Dr. Morgan Langille
	28 th	Monday RNA as a novel vaccine technology
30 th	Wednesday NMR and mass spectrometry for diagnostics	
November	4 th	Monday Artificial intelligence in biotechnology
	6 th	Wednesday Guest speaker: Dr. John Frampton
	11 th	Monday No class
	13 th	Wednesday No class
	18 th	Monday Biotechnology ethics and business
	20 th	Wednesday Student video presentations
	25 th	Monday Student video presentations
27 th	Wednesday Student video presentations	
December	2 nd	Monday Student video presentations
	3 rd	Tuesday* Student video presentations (*counts as a Monday)
	4 th	Wednesday Student video presentations

*See https://www.dal.ca/academics/important_dates.html for more detailed information.

University Policies and Statements

Recognition of Mi'kmaq Territory

Dalhousie University would like to acknowledge that the University is on Traditional Mi'kmaq Territory. The Elders in Residence program provides students with access to First Nations elders for guidance, counsel, and support. Visit or e-mail the Indigenous Student Centre at 1321 Edward St or elders@dal.ca. Additional information regarding the Indigenous Student Centre can be found at: https://www.dal.ca/campus_life/communities/indigenous.html

Internationalization

At Dalhousie, 'thinking and acting globally' enhances the quality and impact of education, supporting learning that is "interdisciplinary, cross-cultural, global in reach, and orientated toward solving problems that extend across national borders." Additional internationalization information can be found at: <https://www.dal.ca/about-dal/internationalization.html>

Academic Integrity

At Dalhousie University, we are guided in all our work by the values of academic integrity: honesty, trust, fairness, responsibility, and respect. As a student, you are required to demonstrate these values in all the work you do. The University provides policies and procedures that every member of the university community is required to follow to ensure academic integrity. Additional academic integrity information can be found at: https://www.dal.ca/dept/university_secretariat/academic-integrity.html

Accessibility

The Student Accessibility Centre is Dalhousie's centre of expertise for matters related to student accessibility and accommodation. If there are aspects of the design, instruction, and/or experiences within this course (online or in-person) that result in barriers to your inclusion, please contact the Student Accessibility Centre (https://www.dal.ca/campus_life/academic-support/accessibility.html) for all courses offered by Dalhousie with the exception of Truro. For courses offered by the Faculty of Agriculture, please contact the Student Success Centre in Truro (<https://www.dal.ca/about-dal/agricultural-campus/student-success-centre.html>)

Conduct in the Classroom – Culture of Respect

Substantial and constructive dialogue on challenging issues is an important part of academic inquiry and exchange. It requires willingness to listen and tolerance of opposing points of view. Consideration of individual differences and alternative viewpoints is required of all class members, towards each other, towards instructors, and towards guest speakers. While expressions of differing perspectives are welcome and encouraged, the words and language used should remain within acceptable bounds of civility and respect.

Diversity and Inclusion – Culture of Respect

Every person at Dalhousie has a right to be respected and safe. We believe inclusiveness is fundamental to education. We stand for equality. Dalhousie is strengthened in our diversity. We are a respectful and inclusive community. We are committed to being a place where everyone feels welcome and supported, which is why our Strategic Direction prioritizes fostering a culture of diversity and inclusiveness (Strategic Priority 5.2). Additional diversity and inclusion information can be found at: <http://www.dal.ca/cultureofrespect.html>

Student Code of Conduct

Everyone at Dalhousie is expected to treat others with dignity and respect. The Code of Student Conduct allows Dalhousie to take disciplinary action if students don't follow this community expectation. When appropriate, violations of the code can be resolved in a reasonable and informal manner - perhaps through a restorative justice process. If an informal resolution can't be reached, or would be inappropriate, procedures exist for formal dispute resolution. The full Code of Student Conduct can be found at: https://www.dal.ca/dept/university_secretariat/policies/student-life/code-of-student-conduct.html

Fair Dealing Policy

The Dalhousie University Fair Dealing Policy provides guidance for the limited use of copyright protected material without the risk of infringement and without having to seek the permission of copyright owners. It is intended to provide a balance between the rights of creators and the rights of users at Dalhousie. Additional information regarding the Fair Dealing Policy can be found at:

https://www.dal.ca/dept/university_secretariat/policies/academic/fair-dealing-policy-.html

Originality Checking Software

The course instructor may use Dalhousie's approved originality checking software and Google to check the originality of any work submitted for credit, in accordance with the Student Submission of Assignments and Use of Originality Checking Software Policy. Students are free, without penalty of grade, to choose an alternative method of attesting to the authenticity of their work and must inform the instructor no later than the last day to add/drop classes of their intent to choose an alternate method. Additional information regarding Originality Checking Software can be found at: <https://www.dal.ca/about/leadership-governance/academic-integrity/faculty-resources/ouriginal-plagiarism-detection.html>

Student Use of Course Materials

Course materials are designed for use as part of this course at Dalhousie University and are the property of the instructor unless otherwise stated. Third party copyrighted materials (such as books, journal articles, music, videos, etc.) have either been licensed for use in this course or fall under an exception or limitation in Canadian Copyright law. Copying this course material for distribution (e.g. uploading to a commercial third-party website) may lead to a violation of Copyright law.