Introduction to Biotechnology Syllabus

Department of Biochemistry & Molecular Biology

BIOC 3501, Fall 2026

Dalhousie University operates in the unceded territories of the Mi'kmaw, Wolastoqey, and Peskotomuhkati Peoples. These sovereign nations hold inherent rights as the original peoples of these lands, and we each carry collective obligations under the Peace and Friendship Treaties. Section 35 of the Constitution Act, 1982, recognizes and affirms Aboriginal and Treaty rights in Canada.

We recognize that African Nova Scotians are a distinct people whose histories, legacies, and contributions have enriched the part of Mi'kma'ki known as Nova Scotia for over 400 years.

Course Instructor(s)

Name	Email	Office Hours
Kathryn Vanya Ewart (Instructor)	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.

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 are available in Brightspace.
- There is no assigned textbook.
- 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 Pharmacy (Burbidge) Building, room 310 (third floor) on Mondays, Wednesdays, and Fridays at 10:35 a.m.
2. **Student involvement in lecture sessions:** Some lectures will involve student participation including class discussions and student videos.
3. **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.

4. **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 in BIOC 3501 will include the following components:

Component	Weight (% of final mark)	Exam date or item due date
Guest presentation mini-assignment I	2.5%	Due on October 14th, 2026*
Midterm exam I	15%**	October 9th, 2026
Midterm exam 2	15%**	November 4th, 2026
Guest presentation mini-assignment 2	2.5%	Due on November 20th, 2026*
Atlantic Canadian life sciences company video	20% 1% Choice of company 15% Video 4% Peer feedback	Due October 5th, 2026* Due November 15th, 2026* Due December 9th, 2026*
Product development proposal	15%	Due December 9th, 2026*
Final exam (cumulative)	30%	TBD, within the regular final exam schedule

*Due at 11:59 p.m. on the date indicated.
**The midterm with the higher grade will be worth the entire midterm mark (30%). The midterms are only worth 15% each if the grades on both midterms are equal.

Conversion of numerical grades to final letter grades follows the **undergraduate*** Dalhousie Grade Scale

A+ (90-100)	B+ (77-79)	C+ (65-69)	D (50-54)
A (85-89)	B (73-76)	C (60-64)	F (0-49)
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 a midterm exam is missed (with a Declaration of Absence), the other midterm exam will be worth 30%. If both midterm exams are missed (both with Declarations of Absences), the final exam will be worth 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 on Academic Integrity and Generative AI

- Students are expected to complete their homework assignments independently.

- The only generative AI that is permitted is the Microsoft Copilot accessed through Dalhousie accounts. (This version protects your work.)

- The Copilot chatbot may be used as an aid in searching for appropriate reference material or other information. It may also be used to edit or review writing for grammar or syntax errors.

- Students should not use the chatbot to write their reports. That would be unethical.

- Students should check information received from a chatbot very carefully. Chatbots can hallucinate (make up false information). Chatbots can also omit relevant information in reply to a question. Therefore, students should use their excellent human intelligence (HI) when accessing and reviewing AI information.

Learning Objectives

This course was developed to provide students with a comprehensive introduction to 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 must, of necessity, change frequently as a result of rapid growth and development in the field. Dalhousie students, staff, and faculty members will be welcome to attend the student videos shown in class. Therefore, the video assignment consists of service learning.

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 Accessibility

- In accordance with the Student Accommodation Policy, the aim is to provide an accessible educational environment.
- Students are welcome to bring beverages to class in covered containers.
- Open food is not permitted in the classroom during lectures. Food should be packed in closed containers and away during class.
- Students are eligible for accommodations based on protected characteristics such as religion. If you have religious, cultural, or community-significant observances that conflict with course requirements, please reach out to discuss alternatives for completing the course requirements.
- To begin the process of requesting a formal academic accommodation, please contact the Student Accessibility Centre.

Course Content

DATE	ITEM
September 9th	Lecture 1: Introduction to the course
September 11th	Lecture 2: History and General methods I: applications of annealing I
September 14th	Lecture 3: General methods II: applications of annealing II
September 16th	Lecture 4: General methods III: PCR and new amplification methods
September 18th	Lecture 5: Genome modification I: cloning, transgenics, and knockouts
September 21st	Lecture 6: Genome modification II: CRISPR and related developments
September 23rd	Lecture 7: Small RNAs and their applications
September 25th	Lecture 8: mRNA as a new vaccine technology
September 28th	Lecture 9: Determining sequences of DNA and RNA
September 30th	No class
October 2nd	Lecture 10: Determining sequences of proteins
October 5th	Lecture 11: Producing proteins I: natural sources and synthetic peptides
October 7th	GUEST PRESENTATION: Dr. Antonietta Pietrangelo
October 9th	MIDTERM 1 on lectures 2-10
October 12th	No class
October 14th	Lecture 12: Producing proteins II: expression in E. coli
October 16th	Lecture 13: Producing proteins III: expression in other systems
October 19th	Lecture 14: Metabolic engineering
October 21st	Lecture 15: Protein technologies I: antibody technologies
October 23rd	Lecture 16: Protein technologies II: measurement assays
October 26th	Lecture 17: Protein technologies III: miniaturization and mimetics
October 28th	Lecture 18: NMR and mass spectrometry in diagnostics
October 30th	Lecture 19: Artificial intelligence in biotechnology
November 2nd	Lecture 20: Biotechnology business and ethics
November 4th	MIDTERM 2 on lectures 11-18
November 6th	GUEST PRESENTATION: Dr. John Frampton
November 9th	No class
November 11th	No class
November 13th	No class
November 16th	Student videos
November 18th	Student videos
November 20th	Student videos
November 23rd	Student videos
November 25th	Student videos
November 27th	Student videos
November 30th	Student videos
December 2nd	Student videos
December 4th	Student videos
December 7th	Student videos
December 9th	Review Q&A

Syllabus Appendix

Student supports, university policies, and guidelines are available at the following website:

Syllabus Appendix: Student Supports & University Statements, Policies, and Guidelines