2026W Biol 4650 Course Outline (2026-01-10)

Course Title: Biol 4650 Issues in Biotechnology

Instructor:	Dr. Wensheng Qin Email: biot.teaching@gmail.com (The emails sent to biot.teaching@gmail.com will be automatically forwarded to wqin@lakeheadu.ca and kept a copy in biot.teaching@gmail.com) Office: CB 4016 Tel: 807-343 8010 ext. 8467 Fax: 807-343 8023 Office Hours: Tuesdays 10-11 am or by appointment
Meeting Time:	10:00-11:30 AM
Meeting Days:	Tuesdays & Thursdays
Meeting Place:	BB1054
Instructional Type:	Lecture
Course ID:	169565
Teaching Assistant (TA)	Rishnika Boteju (Rish for short) (Biotechnology PhD Student) Email: rboteju1@lakeheadu.ca Office: CB 3037 Tel: 807-343 8010 ext. 7141 Fax: 807-343 8023

Textbook: Introduction to Biotechnology 4th Edition Textbook by W. J. Thieman & M. A. Palladino (Pearson). It is not required to buy the textbook, but you are highly encouraged to purchase a copy of the book. There are no restrictions for students to use a different edition of the textbook or other learning material. The cost of the textbook and learning materials is $ 189.00.

Introduction to Biotechnology brings the latest information to students who need to understand the science and business of biotechnology. The popular text emphasizes the future of biotechnology and the biotechnology student's role in that future with balanced coverage in basic cell and molecular biology, fundamental techniques, historical accounts, new advances, and hands-on applications. The 4th Edition features content updates in every chapter that reflect the most relevant, up-to-date changes in technology, applications, ethical issues, and regulations.

Additionally, every chapter now includes an analytic Case Study that highlights current research and asks students to use what they've learned about the key chapter concepts to answer questions. New Career Profiles, written by biotech professionals and available on the Companion Website along with additional career resources, highlight potential jobs in the biotech industry.

Chapter 1 The Biotechnology Century and Its Workforce
Chapter 2 An Introduction to Genes and Genomes
Chapter 3 Recombinant DNA Technology and Genomics
Chapter 4 Proteins as Products
Chapter 5 Microbial Biotechnology
Chapter 6 Plant Biotechnology
Chapter 7 Animal Biotechnology
Chapter 8 DNA Fingerprinting and Forensic Analysis
Chapter 9 Bioremediation
Chapter 10 Aquatic Biotechnology
Chapter 11 Medical Biotechnology
Chapter 12 Biotechnology Regulations
Chapter 13 Ethics and Biotechnology
The textbook has 13 chapters: 8 chapters (3-9 & 12) will be lectured in class.

Lecturing schedule:

Date	Contents
Week 1	Chapter 2 An Introduction to Genes and Genomes
	Chapter 2 An Introduction to Genes and Genomes
Week 2	Chapter 3 Recombinant DNA Technology and Genomics
	Chapter 3 Recombinant DNA Technology and Genomics
Week 3	Chapter 4 Proteins as Products
	Chapter 4 Proteins as Products
Week 4	Chapter 5 Microbial Biotechnology
	Chapter 5 Microbial Biotechnology
Week 5	Chapter 6 Plant Biotechnology
	Chapter 6 Guest Presentation
Week 6	Chapter 7 Animal Biotechnology
	Exam One (20%) (February 12, 2026, Thursday), cover chapters 3-5
Week 7	**Feb. 16-22, 2026, Winter Reading Week**
Week 8	Chapter 7 Guest Presentation
	Chapter 9 Bioremediation
Week 9	Chapter 9 Bioremediation

	Chapter 11 Medical Biotechnology
Week 10	Chapter 11 Medical Biotechnology
	Chapter 11 Medical Biotechnology
Week 11	Student presentation
	Student presentation
Week 12	Student presentation
	Student presentation
Week 13	March 31 Exam Two (20%, chapter 7, 9, 11)
	April 2 Flexible arrangement (Guest speaker presentation)
Week 14	April 7 Attend the Biology Department Honor's Thesis Presentations

Grades: Total 100% (Class attendance 10%, Midterm exam 20%, Final exam 20%, Student Presentation 20%, Term paper 20%, Guest presentation summaries and/or quizzes 10%, Your evaluation to the peer students 5%).

Notes:
[1] The class attendance 10% (0.5% deduction for each class missing).
[2] The midterm exam (20%) consists of multiple choices and short or long answer questions from the Chapters 2-6 and the lectured information.
[3] The final exam (15%) consists of multiple choices and short or long answer questions from the Chapters 7, 9 and 11 and the lectured information**.**
[4] The quizzes are 10% from the guest presentations and/or from assigned reading materials when necessary.
[5] Student PPT presentation 20%.
[6] Term paper 20%.
[7] Some bonus points may be awarded to the students, when necessary, for example, if the class average marks are too low. Each bonus point can be valued more or less than 1%.

Student PowerPoint presentation (20%): Each student selects one topic of interest in the field of biotechnology. For individual student presentation, you should prepare for ~45 slides and present for ~45 minutes in the public, followed by 10-15 minutes for answering questions from your peer students, instructor, and the audience. Your presentations will be evaluated by your fellow students as well, except the TA and instructor evaluation. Please use the form below for your evaluations. You must email the filled-in forms to BOTH the TA rboteju1@lakeheadu.ca and instructor biot.teaching@gmail.com before April 6, 2026. The presenter students must send their PPT files to biot.teaching@gmail.com, rboteju1@lakeheadu.ca, and **the whole class** by replying to all at least 72 hours before your presentations (late submissions will be deducted 3 marks for each day late). The quality of the PPT file counts for 5% out of the 20% of the presentation.

Presentation Evaluation by Peer Students: Your evaluation of the peer students for bonus points.

In every presentation, the non-speaker students must evaluate each speaker student by giving marks in the topic selection and presentation together.

Presentation Evaluation Forms (you submit the forms by one email or by submitting printed copies one time to the TA at the end of the semester).

Presentation Evaluation Form			
Presenter's name: Evaluator name:		Marks	Evaluation marks & comments
1	Delivered the materials in a clear and structured manner	Up to 2%	
2	Was knowledgeable about the topic and any related issues	Up to 2%	
3	Maintained my interest during the entire presentation	Up to 2%	
4	Answered questions effectively	Up to 2%	
5	Was enthusiastic about the topic	Up to 2%	
6	Was well organized and prepared	Up to 2%	
The presentation			
7	Was concise and informative	Up to 2%	
8	Contained practical examples and useful techniques or knowledge that applied to current work	Up to 2%	
9	Had effective visual aids	Up to 2%	
10	Provided a great deal of novel information	Up to 2%	
Total		Up to 20%	

Combined Form	
Evaluator (Do not include for yourself)	Final grade (out of 20%) The highest marks and lowest marks will not be counted in.
	You must email this filled in combined form and evaluation form of each presentation to both biot.teaching@gmail.com and rboteju1@lakeheadu.ca before the midnight of April 6, 2025 in one email.

	Your evaluation to all the peer students will take 5% out of 100% of your marks. Any point you do not follow, you will lose 1%. Try to keep the average presentation marks of all the presenters except yourself no higher than 80%.
Student name	
Student name	
Student name	
Student name	
Student name	
Student name	
Student name ○ ○ ○ ○ ○ ○	
Your average marks for all your peer students excluding yourself	

Term Paper Writing Guidelines for Biol 4650 Course for Your Reference

1. Structural Framework
Please use this standard academic structure:

- Abstract: A 200–250-word summary covering the problem, the current state of the tech, and your specific conclusion.
- Introduction: Define the biological mechanism and the industrial/medical need. End with a clear thesis statement.
- Technical Discussion: This is the "meat" of the paper. Use subheadings to break down.
- Regulatory & Ethical Landscape: Essential for Canadian biotech. Discuss Health Canada or CFIA regulations if applicable.
- Future Directions/Conclusion: Don't just summarize; predict where the technology is going in the next 5–10 years.

2. Technical Depth & Content
In your fourth year, avoid "textbook" explanations. Instead, focus on Primary Literature.

- Source Selection: Aim for at least 15–20 citations. 80% should be primary research articles (original studies) rather than just review papers.
- Data Integration: If you are discussing a specific protein yield or a diagnostic sensitivity, use specific numbers from literature.
- The "So What?" Factor: Always connect the molecular biology back to the application. If you are discussing a mutation in a CHO cell line, explain how that affects the cost of the final biologic drug.

3. Citation Format in the Literature Cited Section
Journal article

A journal article citation contains last name and initials of all authors, publication year, article title, journal title, volume number, and the pages on which the article appears. Note that the initials of each author appear after the last name. The abbreviated journal title must be used. A list of abbreviated journal titles can be found in Web of Science Core Collection or look up the journal on the Chemical Abstracts Service Source Index: Ricciardi A, Rasmussen JB. 1998. Predicting the identity and impact of future biological invaders: A priority for aquatic resource management. Can J Fish Aquat Sci. 55(7): 1759-1765.

Book
A book citation contains last name and initials of all authors, publication year, title, the city and name of the publishing company, and the total number of pages: Williamson M. 1996. Biological invasions. London: Chapman & Hall. 128 p.

Chapter in an edited book
List the authors of the chapter first, followed by the publication date, chapter title, book editors, city and name of publishing company, and where the chapter appears in the book (e.g., which pages): Leach JH, Mills EL, Dochoda MR. 1999. Non-indigenous species in the Great Lakes: Ecosystem impacts, binational policies, and management. In: Taylor WW, Ferreri CP, editors. Great Lakes Fisheries Policy and Management: A Binational Perspective. East Lansing (MI): Michigan State University Press. p. 185-207.

Feature	Guideline
Tone	Objective, third person, pronouns, and be precise. Avoid "I think" or "I feel." Additionally, avoid exaggerations, clichés, opinionated expressions, and vague wording.
Nomenclature	Use italics for gene names and standard text for proteins (BRCA1).
Units	Use SI units exclusively. Ensure there is a space between the number and unit (e.g., 37 °C, not 37°C).
Figures	Must include a descriptive caption *below* the image. You must cite the source if you didn't create the diagram yourself.

4. Critical Success Factors for Senior Students

- Address Constraints: A common mistake is being too optimistic. Discuss the limitations of technology.
- Canadian Context: If relevant, mention Canadian biotech hubs (like the MaRS Discovery District or Vancouver's antibody cluster) or specific Canadian regulatory hurdles.
- Synthesis: Instead of saying "Author A found X and Author B found Y," try "While Author A found X, the more recent findings of Author B suggest a different mechanism, indicating a shift in the field's understanding of...".

5. Standard Term Paper Length

- Page Count: 12 to 18 pages (double-spaced).
- Word Count: 3,000 to 5,000 words.
- Exclusions: This count usually excludes the title page, abstract, and the reference list (which can easily add another 3–5 pages).

6. Estimated Page Breakdown (15-Page Target)
If you are aiming for a standard 15-page paper, here is a healthy distribution of content to ensure you aren't "padding" the text:

Section	Suggested Length	Focus
Introduction	1.5 – 2 Pages	The "Why": Background, problem, and thesis.
Technical Review	4 – 5 Pages	The "How": Deep dive into molecular/biochemical mechanisms.
Current Applications	3 – 4 Pages	Case studies or recent breakthroughs in the field.
Critical Analysis	3 – 4 Pages	Discussing limitations, ethics, and economic hurdles.
Conclusion/Future	1 – 1.5 Pages	Synthesis and long-term predictions.

7. Technical Formatting Requirements

- Font : 12-point Times New Roman.
- Margins: 1-inch (2.54 cm) on all sides.
- Line Spacing: Double-spaced (2.0).
- Pagination: Page numbers should be at the bottom-right corner.
- Paragraphs: Use a standard indent (0.5 inch) for new paragraphs rather than extra spacing between them.

Term Paper Titles for Students to Select (Each Student Selects One Title to Write a Term Paper)

[1] Gene Editing and Human Health Ethics

1. Crispr-Cas9: The Policy Vacuum Surrounding Heritable Human Genome Editing in Canada.
2. The Ethical Calculus of Germline Modification: Assessing Societal Readiness for "Designer Babies."

3. Beyond Therapy: Examining the Regulatory Challenges of Gene Drive Technology in Pest Control.
4. Precision Medicine or Personalized Paternalism? Ethical Issues in Data Sharing for Genomic Therapies.
5. The Promise and Peril of Somatic Gene Therapy: Analyzing Accessibility and Equity in Canadian Healthcare.

[II] Agriculture, Environment, and Sustainability

6. Genetically Engineered Crops and Global Food Security: A Critical Analysis of Regulatory Barriers in Developing Nations.
7. Bioremediation and the Oil Sands: Evaluating the Efficacy and Public Perception of Microbial Solutions.
8. The Future of Livestock: A Comparative Study of Regulation and Consumer Acceptance of Cultured Meat vs. Conventional Farming.
9. RNA Interference (RNAi) in Pest Management: Assessing Off-Target Effects and Ecological Risks.
10. Synthetic Biology for Carbon Capture: Technological Feasibility and Policy Recommendations for Climate Change Mitigation.

[III] Intellectual Property and Commercialization

11. Patenting Life: An Examination of the Legal Evolution and Economic Impact of Gene Patents in Canada.
12. Open Science vs. Proprietary Platforms: Addressing Intellectual Property Rights in Bioinformatics and AI-Driven Drug Discovery.
13. The Valley of Death: Challenges in Translating Academic Biotechnology Research into Commercial Products in the Canadian Ecosystem.
14. Data Ownership in the Age of Health Tech: Who Controls the Digital Biomarker?
15. Bioprospecting and Benefit Sharing: Analyzing the Policy Gaps in Access and Utilization of Indigenous Knowledge.

[IV] Emerging Technologies and Societal Impact

16. The Convergence of Nanotechnology and Diagnostics: Examining the Regulatory Pathway for Point-of-Care Biosensors.
17. Beyond the Lab Bench: A Socio-Political Analysis of Vaccine Hesitancy and Biotechnology Communication.

18. Tissue Engineering and Organoids: Addressing the Ethical Implications of Human Biological Models in Research.
19. Biodefense and Dual-Use Research: Striking a Balance Between Scientific Freedom and Biosecurity Risk Management.
20. Artificial Intelligence in Drug Repurposing: Evaluating the Efficiency Gains and the Need for Robust Validation Frameworks.

[V] Regulatory and Policy Frameworks

21. Harmonizing the Biotech Regulatory Landscape: A Comparison of Health Canada and FDA Approvals for Novel Therapeutic Agents.
22. The Role of Public Engagement in Biotech Policy: Lessons Learned from Debates on Genetically Modified Organisms (GMOs).
23. Regulating Novel Foods: Assessing the Adequacy of Canada's Framework for Products Derived from Synthetic Biology.
24. Ensuring Equity in Biomanufacturing: An Analysis of Supply Chain Vulnerabilities and Domestic Production Capacity in Canada.
25. The Ethics of Enhancement: Differentiating Between Therapeutic and Non-Therapeutic Uses of Biotechnology in Sports and Cognition.

Winter 2026 Term Courses

First Day of Classes	January 5, 2026
Final Day of Classes	April 7, 2026
Final Date to Register (Add)	January 16, 2026
Final Date to Withdraw (Drop)	March 6, 2026
Study Days	April 8-9, 2026
Examination Period	April 10, 2026 - April 19, 2026 (10 Days)
Exam Contingency Date	April 20, 2026
Marks Due	April 23, 2025