Applied and Environmental Microbiology
BIOL 3573/3570L

Instructor: Dr. Melanie Coombs
Office: BIO 312
Office hours: M 8:30 – 10:30 am or by appointment
E-mail: melanie.coombs@acadiau.ca
Note: *Please note that your emails to me should only come from your Acadia email address. Other email addresses may get blocked by the firewall or spam filters.*

Lecture:
MWF, Patterson Hall 216,
11:30 am - 12:20 pm

Lab: BIO 3570L
M, HSH 420, 1 - 3:50 pm

Evaluation	Percentage	Date
Test	15%	Oct 26
In-class activities/graded Moodle quizzes	10%	Weekly
Lab	25%	weekly
Microbial journal article critique activity	10%	Oct 9 – submit part I (submit database searches and pdf of article you propose to review) Nov 13 – submit part II (final submission of responses to questions and graphical abstract)
Presentation & feedback	10%	Dec 7 – 11th
Final exam (Full term)	30%	Scheduled by the registrar

Part 1: Course Information

Course Description

The Earth could not support life without the activities of microorganisms. This course will examine the essential roles that microbes play in the biosphere, the unusual and surprising ways that they have adapted to harsh niches, and how humans are increasingly exploiting their biochemical abilities in food production, water purification, medicines, soil improvement, and energy recovery (3h lab each week).

Course Pre-requisites

Biol 2053 with a minimum grade of C-; Biol 2013 with a minimum grade of C- or permission of the instructor.
BIOL-3570L - Must be taken at the same time as this course.

Course Textbooks

Nester's Microbiology – A Human Perspective, 10th edition, 2022 Anderson, Salm and Beins, by McGraw Hill Education, ISBN: 978-1-265-06231-6.

Supplemental information:
Microbiology: An Evolving Science 6th edition. (eBook (with courseware) ISBN: 978-1-324-03366-0) or *Paperback ISBN: 978-1-324-03352-3).

Lab textbook
The Science of Fermentation by Robin Sherriff (ISBN-13-979-8217126477).

Student Learning Outcomes

1. Understand the role of microbial metabolism in making foods.
2. Understand the role of diverse microbes in the ecosystem.
3. Understand the effects of microbes in bioremediation, composting, and the generation of biofuels.
4. Understand how microbes are involved in the production of medications.

How to Meet the Learning Outcomes

1. Come to lectures on a regular basis, take notes, and ask for clarification when something is unclear.
2. Take part in weekly class activities. These will give you insight as to how well you understand the information being presented. A phone, tablet or laptop will be needed for class/lab activities to measure understanding/retention weekly.
3. Access the course Moodle https://moodle.acadiau.ca/login/index.php page each week. Lecture images, course outline and contact info will be available on Moodle (https://Moodle.acadiau.ca).
4. Reading the textbook each week.
5. Study on a regular basis.
6. Complete tests (1 tests, 1 final exam) and practice quizzes.
7. Complete journal article activity.
8. Present a beneficial microbe.
9. Participate and ask questions during the Lab. Complete lab assignments.

Part 2: Course Plan

The instructor reserves the right to amend the course plan with reasonable notice, and in consultation with the class.

Lecture schedule:

Sep 9 – Introduction to the course and Metabolism - Fermentation
Sep 11 – Fermented foods and Health
Sep 14 – Lactic acid bacteria fermentation
Sep 16 – Lactic acid bacteria fermentation
Sep 18 – Lactic acid bacteria fermentation
Sep 21 – Lactic acid bacteria fermentation
Sep 23 – Lactic acid bacteria fermentation
Sep 25 – Lactic acid bacteria fermentation
Sep 28 – Mold
– Discuss Microbial journal article activity
Sep 30 – No classes
Oct 2 – Yeasts
Oct 5 – Yeasts
Oct 7 – Yeasts
Oct 9 – Yeasts

- **Microbial application journal article critique activity part I due**

Oct 12 – **Thanksgiving day – No Class**
Oct 14 – **Fall study day – No Class**
Oct 16 – **Fall study day – No Class**
Oct 19 – Yeasts
Oct 21 – Yeasts
Oct 23 – Acetic acid bacteria
Oct 26 – Test (material covered in class Sep 9 – Oct 23, 2026, inclusive)
Oct 28 – Making cacao and metabolism
Oct 30 – Aquatic habitats and photosynthesis
Nov 2 – Aquatic habitats and photosynthesis

Nov 4 – Aquatic habitats and photosynthesis
Nov 6 – Photosynthesis and Biogeochemical cycles - Climate change
Nov 9 – Photosynthesis and Biogeochemical cycles - Climate change
Nov 11 – No class
Nov 13 – Photosynthesis and Biogeochemical cycles - Climate change
- **Microbial application journal article critique activity part II due**

Nov 16 – Water testing and treatment
Nov 18 – Water testing and treatment
Nov 20 – Bioremediation
Nov 23 – Medicines made by microbes
Nov 25 – Medicines made by microbes
Nov 27 – Clone the gene activity
Nov 30 – Clone the gene activity
Dec 2 – Hepatitis B vaccine
Dec 4 – Hepatitis B vaccine
Dec 7 – Presentations
Dec 9 – Presentations
Dec 11 – Presentations

Part 3: Laboratory outline (Fall 2026)

Lab Instructor
Hélène d'Entremont (she/her/hers)
Biology Building, room 333 (office),
e-mail: helene.dentremont@acadiau.ca

Lab Outline
This semester you will use microbes to ferment different foods and beverages. You will be partly responsible for experimental design. Some of these foods/beverages will be monitored for metabolites. Experiments may be interrupted to examine different fermentation pathways. You will be responsible for taking detailed notes during lab and submitting it for grading.

Lab evaluation
Will be posted in the lab Moodle page.

Lab schedule:
See the lab Moodle page. The labs will run weekly and you may have to come in to add ingredients when needed for experiments. These times will be coordinated in advance with the lab instructor.

Lab Attendance
Lab attendance is considered mandatory. Notify the lab instructor **before the lab** if you are ill or unable to attend an upcoming lab. Note that makeup labs are not possible. If the instructor is **not** notified **prior** to the lab period, a grade of zero will be assigned for the missed work.

Lab Teamwork
There will be points allocated for contributing to the overall workflow of the lab. Students will be responsible for collecting materials, ingredients, cleaning up (equipment, bench tops, common areas and floors).

Note: Lab details will be posted on the lab Moodle page.

Part 4: Assessment and Grading

You are required to pass the lab to pass the course.

Grading scheme

A+: 90-100	B+: 77-79	C+: 67-69	D+: 57-59	F: <50
A : 85-89	B : 73-76	C : 63-66	D : 53-56	
A-: 80-84	B-: 70-72	C-: 60-62	D-: 50-52	

Part 5: Course Policies

Tests
Our tests are largely application-based, therefore you may bring in a crib sheet with anything you can fit onto 1 piece of paper (both sides). You should include metabolic pathways, charts and equations that you think you will need to use on the paper. This paper is to be kept on your desk while you are writing and is to be turned in with the exam afterwards. You should bring a calculator.

Note: Students need to contact the instructor with a valid reason for missing a test in advance of the test. Students will also need to fill out a Declaration of Cause form to the Registrar. Make-up tests for poor performance, will not be provided as an option. In the event that you have a *valid* excuse for missing a test, the weight from the missed test will be distributed to the final exam. Missed tests without a valid excuse will result in a mark of zero. University policies on missing classes, etc. can be found here:
https://registrar.acadiau.ca/RecordsandOtherRequests.html

Attend Class (Lectures)
Students are expected to attend all class sessions as listed above. Studies have shown, that students who take notes by hand (rather than typing on a computer) perform significantly better in their ability to retain information. While you will be using laptops or tablets during lectures, please limit their use to classroom material only. Using them for other purposes (i.e. social media) will negatively impact your ability to learn.

Graded Moodle quizzes
10% of your final mark will be based on your final grade in weekly quizzes in Moodle. These quizzes will help your understanding of concepts. You will be able to re-try the quizzes an unlimited amount of times up until the deadline (approximately 1 week after posted). The highest grade attained will be used. Please note quizzes will occur regularly each week and you will be responsible for completing them on time. A missed quiz will result in a '0'. Once the quiz closes you will not be allowed to submit the quiz, and there will be no make-up for the quizzes unless you have contacted me in advance describing the valid reason for requesting an extension.

In-class live quizzes/activities
Participation in in-class live quizzes/activities will be recorded and result in 10% of your final grade. You may miss up to 3 in-class activities for any reason and not lose any points on the term. If however, you miss more than 3, you will lose a proportion of your grade accordingly. You do not need to contact me to let me know if you are missing class (note: you may miss any 3 for any reason). Those who are present for all activities will see a bonus mark added to their grade. These live quizzes/activities will help your understanding of concepts. Please note these quizzes/activities may occur in any class. There will be no make-up for missed live in-class quizzes/activities.

Microbial journal article critique activity
Briefly, you will be asked to search for and critique a journal article related to the identification of a mutation in microbial metabolism, using a microbe for an application or industrial purpose, or the genetic engineering of a microbe for an application or industrial purpose. You will be asked a series of short answer questions about the paper you have chosen and you will be asked to make a graphical abstract of the paper highlighting the impact of the paper.

Beneficial Microbe presentation
Briefly, you will be asked to share an application of a microbe that provides society a benefit and prepare a presentation. For example, using a microbe (with or without genetic engineering) for an application or industrial purpose. You will be asked to prepare a presentation outlining how the microbe can provide a benefit to society, describe what the benefit is and why it is important, show data on how this benefit has been discovered, modified or improved from a published journal article, and share with the class the relevance of the finding. Make sure to include the microbial metabolism or the mechanism of action that explains the microbe benefit.

Late assessments
Late assessments of any kind are not accepted after the deadline. A late assessment will result in a grade of '0' unless there is a discussion (in advance of the deadline) with me describing the valid reason for requesting an extension.

Part 6: University Policies

University policies are available in the Acadia University Academic Calendar or through the Registrar's website: https://registrar.acadiau.ca/welcometotheregistrarsoffice.html

Equity, Diversity and Inclusion

Acadia University is committed to becoming a culturally safe and anti-oppressive community. This can only be achieved where there are simultaneous efforts to eliminate all forms of discrimination and harassment from our campus community, including the elimination of all discrimination, harassment and violence based on one's identity, including but not limited to, gender, race, class, ethnicity, sexual orientation, disability, gender identity, gender expression, and Indigeneity. The policy against harassment and discrimination, and resources for students who believe they may have experienced, or witnessed, discrimination or harassment, are available here: https://www2.acadiau.ca/student-life/equity-judicial/equity.html

Last Drop Day

Last day to drop a course and receive a "W". Please check the Acadia University calendar dates, which are available here: https://registrar.acadiau.ca/AcademicCalendars.html

Inform Your Instructor of Accommodations

Acadia University is dedicated to improving access to campus life for all students with disabilities. While we attempt to ensure that all courses are accessible, we recognize that there are barriers that need to be addressed on an individual basis. Students who require accommodations to complete coursework or otherwise fully participate in class should contact Accessible Learning Services directly as soon as possible: https://www2.acadiau.ca/student-life/accessiblelearning.html. Acadia's Policy for Students with Disabilities can be found here: https://senate.acadiau.ca/tl_files/sites/senate/Senate%20Policies/Jan%202015%20Revised%20Policy%20Regarding%20Support%20for%20Students%20with%20Disabilities.pdf

The Use of Animals in Teaching and Research

The use of animals in teaching and research at Acadia University is done in accordance with guidelines on the care and use of animals published by the Canadian Council on Animal Care (CCAC). For more information on the CCAC, please visit their website at http://www.ccac.ca

Commitment to Integrity

It is standard practice in Biology to check exams and assignments for cheating and plagiarism. Cheating in the class and/or lab, including plagiarism, will not be tolerated. Please read the appropriate sections of the current Acadia University Academic Calendar: https://registrar.acadiau.ca/AcademicCalendars.html

Information on copy-write and course content from Acadia University is available through the Vaughan Memorial Library: http://libguides.acadiau.ca/c.php?g=433650&p=5027078

The spoken and written course content (including the syllabus, handouts, lectures, presentations, labs, assignments, quizzes, tests, and exams) are the intellectual property of the instructor and may only be copied for personal use. Sharing these materials or uploading them where they may be accessed by others is a violation of copyright. If you wish to make audio, video, or photographic recordings in class, you must first obtain the consent of the instructor and of any other persons (e.g., guest speakers, other students) who may be captured in such recordings. The instructor's consent shall not be unreasonably withheld.

Use of artificial intelligence tools by students to assist with their learning is allowed only if: prior permission has been given by the course professor/instructor, and the student properly credits/cites how the AI technology was used in their work. AI must be used in an ethical and responsible manner as a positive learning tool. AI may not be used in ways that violate Acadia's Academic Integrity Policy. Students are reminded that plagiarism, or other forms of cheating, are both types of academic dishonesty.

Share the Air Policy

In consideration of the difficulties that exposure to scented products causes individuals with sensitivities and allergies, all students, faculty, staff, employees of any companies working on university property, visitors, and guests of Acadia University, or of members of the University community are asked to refrain from wearing scented personal care products such as perfumes / aftershave, lotions, hair spray and deodorant. In addition, users of tobacco and cannabis are asked to be aware that odours associated with product use may impact individuals with sensitivities and allergies. Acadia University in consultation with its contracted cleaning staff, have agreed to use products that do not leave residual odors that may cause difficulties for individuals with sensitivities and allergies. https://hr.acadiau.ca/employment/university-policies.html

Part 7: Program Learning Outcomes

Foundations of knowledge		**Course specific examples**	**Proficiency** 1-Introduction 2-Reinforcement 3-Proficient **NA-not applicable**
Scientific method, inquiry and hypothesis testing	Find, understand and apply information from the literature; understand how to use the scientific method to examine problems from different perspectives	Examine published work and critical interpretation of data/findings. Students search for and work through their own protocols for some labwork.	2
Historical concepts and contributions by important figures	Explain foundational concepts in biology, Two-eyed Seeing, and ethical implications of scientific discoveries	Some historical figures are discussed and celebrated with an emphasis on scientists who historically faced challenges.	2
Biodiversity and ecology	Understand the genetic, taxonomic and ecosystem levels of biodiversity; focus on SW Nova including the Acadian Forest and Bay of Fundy ecosystems	Microbes in sewage and water sources.	2
Genetics and evolution	Understand the chemical basis of heredity, genetics and genomics; integrate concepts across disciplines to understand evolution	The use of genetic tools to make medications (insulin and vaccines). Understand impact of mutations on microbial metabolism and industry products.	3
Human and environmental health	Understand form and function in health and disease within a One Health framework, integrating human and environmental health	Microbes in the environment.	2
Lab and field skills			
Experimental design	Gain experience in applying the scientific method	Designing experiments that explore microbes in food.	2
Safety	Work safely and productively in lab and field settings	Food safety with microbes.	2
Lab skills	Gain experience with basic and advanced lab techniques and understand their application in research, health science and industry	Make food with microbes in the lab.	2
Field skills	Gain experience in basic and advanced field skills and understand their application in ecology, conservation biology and environmental change	NA	NA
Data acquisition, analysis and interpretations	Collect data, present results both qualitatively and quantitatively, and interpret outcomes in light of the literature	Students will examine data obtained and compare to published articles and discuss/critique interpretations.	2
Statistical analysis	Use R and or other programs to analyze biological data	NA	NA
Professional skills			
Ethical practices	Demonstrate ethical conduct, apply principles of academic integrity and understand the principles of EDI in science	Discuss the discrepancies in scientific publishing.	2
Collaboration and group work	Work effectively in groups within and across disciplines	Students work in groups during lab work sessions.	2
Critical thinking	Analyze and evaluate information to make science-based decisions	Application based tests.	2
Computer proficiency	Use common and discipline- specific software	Students use databases to search for journal articles.	2
Scientific communication	Communicate science effectively to both scientific and general audiences	Students answer questions about journal articles and make a graphical abstract.	2