

BIOL4711: APPLIED AND ENVIRONMENTAL MICROBIOLOGY
DRAFT COURSE SYLLABUS: FALL 2026

INSTRUCTOR: Dr. Nathan Basiliko, Professor, Department of Biology
PHONE: 807-343-8010 ext. 8570
EMAIL: nbasilik@lakeheadu.ca
OFFICE HOURS: Tuesdays 10:00-11:30
OFFICE: Centennial Building, Room CB4024

TEACHING ASSISTANT: Raina Burke, MSc-Biology Student
EMAIL: rburke2@lakeheadu.ca

LECTURES: Tuesdays & Thursdays: 8:30 10:00am
ATAC, Room AT2005

COURSE DESCRIPTION AND FORMAT: This course covers key concepts of environmental and applied microbiology. Microorganisms are the most abundant organisms on earth and play many key roles in shaping the biosphere. In aquatic ecosystems microbes are the dominant primary producers upon which all other trophic levels rely. In soil and water microbes produce and consume greenhouse gases that shape the composition of the atmosphere and the functioning of the global climate system. As well they cycle essential nutrients and can both increase and decrease the toxicity of many pollutants. Humans have harnessed the metabolic capabilities of microorganisms isolated from the environment to treat waste, mitigate pollution, and to produce food, fuel, and other valuable compounds for biotechnological and medical applications. Considering these important processes and functions, the course begins by introducing the diversity, physiology, and metabolism of prokaryotic and eukaryotic microbes. It then explores microbial habitats and the broader cycles in the environment and industrial settings they control. Classical and contemporary approaches for analyzing and isolating microorganisms in/from the environment are also covered. **PREREQUISITES:** BIOL2711 or permission of the instructor.

COURSE OBJECTIVES:

- 1) Learn fundamentals of microbial diversity and related cell physiologies and metabolic pathways as they apply to life in the environment and industrial settings as well as gain a general understanding of how microorganisms and microbial communities in the environment and industrial settings are analyzed
- 2) Learn how microorganisms dynamically interact with natural and human-impacted environments (i.e. how they are both shaped by and how they shape their surroundings and the biosphere at large).
- 3) Learn how microbes are both beneficially used and combatted in food production and other industrial settings.

USE OF MYCOURSEINFO/D2L: Course information, assignment instructions, lecture slides (pdf versions), and links to any supplemental readings or materials will be posted on the D2L system.

TEXTBOOK: The **optional** textbook for this course is *Environmental Microbiology: From Genomes to Biogeochemistry* 2nd edition (Blackwell Publishing ISBN: 978-1-118-43960-9) by Eugene L. Madsen. For those of you who took Biology of Microorganisms (BIOL2711) with Dr. Basiliko, the recent textbook used,

Microbiology, 3rd Edition (by Dave Wessner, Christine Dupont, Trevor Charles and Josh Neufeld) may also be a useful resource in the course.

EVALUATION: Assignments (20%); Two term tests (20% each); Final exam (40%); lecture participation with classroom polling (up to 5%, and term-test or final exam will be down-weighted by up to 5%)

LECTURES: Although attendance is not taken in lectures, material presented is the primary information on which the term tests and final exam will be based (the textbook is optional and you will not be tested on any textbook material that was not covered in lecture).

ASSIGNMENTS: Two assignments on microbial habitats and a microbial-industrial processes are due on October 20 and December 1. Specific details and instruction will follow.

MIDTERM TESTS: The in-class midterm tests will be on October 1 and November 5 and will be drawn from lecture materials. The tests will include multiple-choice, true-false, fill-in-the-blank, and long-answer questions. For students with a legitimate documented absence due to a medical condition or other serious event who miss a term-test, the (comprehensive) final exam will be re-weighted accordingly. Sample questions will be available on D2L to give students a general picture of the scope of the test.

FINAL EXAM: The final exam will take place during the scheduled exam period (Dec 11-20) and cover lecture and assignment material from the entire term. It will be similar in format to the term test, and include multiple-choice, true-false, fill-in-the-blank, and long-answer questions.

CLASSROOM POLLING: Classroom polling will occur at each class meeting. More instructions and information will follow in class, and participation points will not be tabulated until the 2nd class.

MISSED TERM WORK: Late assignments will be subject to a penalty of 10% per day of the total marks for the assignment. Assignments submitted five calendar days beyond the due date will be assigned a grade of zero. Accommodation can be made when an assignment is late for legitimate University-verified reasons. There will be no re-writes or make-ups for the term test missed for university-accepted, verifiable reasons. Instead, the final exam will be re-weighted. A student who has missed work must inform the instructor as soon as possible to be considered for accommodation.

COMMUNICATION AND EMAIL POLICY: You are encouraged to ask questions in class and during office hours. If you have a course or other conflict with scheduled office hours, please contact the instructor to arrange a meeting at another time. All e-mails should be from a Lakehead University account, include BIOL4711 in the subject heading, and your full name in the text. I will typically respond within 24hrs.

ACADEMIC INTEGRITY/HONESTY OR ACADEMIC OFFENSES: It is your responsibility as a student at Lakehead University to familiarize yourself with, and adhere to the Code of Academic Integrity that addresses issues of academic dishonesty, among others, including surrounding the use of AI and related tools such as ChatGPT on the assignments: <https://www.lakeheadu.ca/faculty-and-staff/departments/services/provost-vice-president-academic/academic-integrity-plans-policies>

ACCESSIBILITY: Student Accessibility Services at Lakehead provides academic accommodations and services to students who have a physical, sensory, or learning disability, mental health condition, acquired brain injury, or chronic health condition, be it visible or hidden. For more information, please visit: <https://www.lakeheadu.ca/students/student-life/student-services/accessibility>

COURSE SCHEDULE (SUBJECT TO CHANGE): Corresponding readings in parentheses are in the optional Madsen *Environmental Microbiology: From Genomes to Biogeochemistry* text.

Tuesday September 8: Introduction to Applied & Environmental Microbiology & historical perspectives on the field (Madsen Chapter 1)

Thursday September 10: Microbial perspectives on the origins of life and transformations of the biosphere I (Madsen Chapter 2)

Tuesday September 15: Microbial perspectives on the origins of life and transformations of the biosphere II (Madsen Chapter 2)

Thursday September 17: Microbial physiological ecology I (Madsen Chapter 3)

Tuesday September 22: Microbial physiological ecology II (Madsen Chapter 3)

Thursday September 24: The environmental microbial census I: how do we know who is here? (Madsen chapter 5)

Tuesday September 29: Microbial census II: a review of the key groups of microbes (bacteria, archaea, fungi, protozoa, slime molds and viruses) (Madsen chapter 5)

Thursday October 1: Term Test I in class

Tuesday October 6: Microbial habitats I (Madsen chapter 4)

Thursday October 8): Microbial habitats II (Madsen chapter 4)

October 12-16 Study Week

Tuesday October 20: Microbial habitats III (Madsen chapter 4); *Assignment 1 due*

Thursday October 22: Microbial detection, enumeration, and identification I (Madsen chapter 6)

Tuesday October 27: Microbial detection, enumeration, and identification II (Madsen chapter 6)

Thursday October 29: Microbial N cycling (Madsen chapter 7)

Tuesday November 3: Microbial N cycling (Madsen chapter 7)

Thursday November 5: Term test II in class Microbial S and Fe cycling (Madsen chapter 7)

Tuesday November 10: TBA

Thursday November 12: The microbial-to-global C cycle & the role of microbes in global climate change I (Madsen chapter 7)

Tuesday November 17: The role of microbes in global climate change II: microbial cycling of CH₄ (reading TBA)

Thursday November 19: Other organisms as microbial habitat or microbial symbioses in the environment (Madsen chapter 8)

Tuesday November 24: Microbial bioremediation and waste treatment I (Madsen chapter 8)

Thursday November 26: Microbial bioremediation and waste treatment II (Madsen chapter 8)

Tuesday December 1: Microbes in food production and spoilage; Assignment 2 due

Thursday December 3: Case studies in microbial biotech & the issues of antibiotic resistance in the environment (Madsen chapter 8)

*******Students are responsible for knowing the content of the syllabus*******