BIOL 2053 FA01: Microbial Biodiversity

Part 1: Course information

Professor

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Course description and prerequisites

This course is an overview of the diversity of microorganisms on the planet, including archaea, bacteria, protista, fungi, and viruses, and will focus on the unique and vital roles that these organisms play in their environment. Prerequisites: BIOL 1113/BIOL 1123 (Organisms in their Environment 1 and 2) or BIOL 1813 (Human Biology 1), and CHEM 1013/CHEM 1023 (General Chemistry 1 and 2), all with a minimum grade of C-. Antirequisite: Credit can only be obtained for one of BIOL 2053 and BIOL 2253. This course is a prerequisite for BIOL3553 (Immunology), BIOL3573 (Applied and Environmental Microbiology), BIOL3583 (Eukaryotic Microbiology), and BIOL 3693 (Ecoimmunology and Disease Ecology)

Course format, material, and communications

- lecture material will be presented in-person as 50-min lectures in Slot 3 (i.e., MWF from 10:30 to 11:20) in KCIC 012 (see **Section 2.1: Lecture outline** for more details)
- laboratory sections will meet in BIO 250 either for a 3-h or 1.5-h session (see **Section 2.2: Laboratory outline** for more details, and check the lab Moodle page for a full schedule):
  Week 1: **BIOL 2050L FA01** (Tuesday 13:00 to 15:50, Lab 1 will begin on September 15)
  BIOL 2050L FA02 (Wednesday 13:00 to 15:50, Lab 1 will begin on September 16)
  BIOL 2050L FA03 (Thursday 13:00 to 15:50, Lab 1 will begin on September 17)
  Week 2: **BIOL 2050L FA04** (Tuesday, 13:00 to 15:50, Lab 1 will begin on September 22)
  BIOL 2050L FA05 (Wednesday, 13:00 to 15:50, Lab 1 will begin on September 23)
- students must attain a minimum grade of 60% in the laboratory section of the course to obtain major credit
- this course requires either a computer, tablet, or phone to access PowerPoint lecture slides and Word documents (i.e., syllabus, other documents) from the Moodle page for the course
- the recommended textbook for the course is: Willey JM, Sandman KM, Salm SN, Rigel NW. 2026. ***Prescott's Microbiology***, 2026 release, McGraw-Hill Companies Incorporated.
- I prefer to communicate by e-mail, either to the entire class from Moodle e-mail or to individual students by standard e-mail, and whenever possible on Monday to Friday between 7:00 and 17:00
- please communicate by e-mail **from your Acadia e-mail address**, and not by text or by Teams, and do so whenever possible on Monday to Friday between 7:00 and 17:00
- you are free to send messages outside these times, but I cannot guarantee that I will respond to your message until the next business day
- if I have to cancel a lecture or laboratory section, I will communicate this action, as well as any rescheduling, as soon as possible by Moodle e-mail

Student learning outcomes

- understand the diversity of all major groups of microbes
- understand microbial structure, growth, metabolism, and genetics
- understand the role of microbes in environments and their role in cycling of nutrients
- understand the interactions of microbes with other organisms
- understand the role of microbes in disease and the immune responses to these invaders
- become proficient in isolating and culturing bacteria isolated from everyday surfaces
- identify common species of bacteria using a variety of modern biochemical tests
- you will meet the objectives listed above through a combination of:
  - attending all lectures, taking notes during lecture, and asking for clarification in lecture or during office hours if you are unsure of material
  - studying on a regular basis: for each hour of lecture, students should spend at least one hour rereading or rewriting lecture notes, and reviewing and studying material for tests
  - preparing for, attending, and actively participating in, all laboratories (see **Part 2.2: Laboratory outline**)

Part 2.1: Lecture outline

List of lecture topics (chapters refer to Prescott textbook)

Date	Lecture	Topic
September 9	1	Introduction to Microbial Biodiversity
September 11	2	What are microbes? (Chapter 1)
September 14	3	Bacterial cell structure (1) (Chapter 3)
September 16	4	Bacterial cell structure (2) (Chapter 3)
September 18	5	Microbial growth (Chapter 7)
September 21	6	Metabolism (Chapter 10)
September 23	7	Catabolism (Chapter 11)
September 25	8	Anabolism (Chapter 12)
September 28	9	Bacterial genome replication and expression (Chapter 13)
September 30		TRUTH AND RECONCILIATION DAY
October 2	11	Mechanisms of genetic variation (Chapter 16)
October 5	12	Microbial evolution (Chapter 1, Chapter 26)
October 7	13	Photosynthetic bacteria (Chapter 20)
October 9	14	Gram negative non-Proteobacteria, part 1 (Chapter 20)
October 12		THANKSGIVING DAY
October 14		READING WEEK
October 16		READING WEEK
October 19	15	Gram negative non-Proteobacteria, part 2 (Chapter 20)
October 21	16	Proteobacteria, part 1 (Chapter 21)
October 23		Annual meeting of the Atlantic Canada Association of Parasitologists

October 26	17	Proteobacteria, part 2 (Chapter 21)
October 28	18	Actinomycetota (Chapter 22)
October 30	19	Mycoplasmatota and spore-forming Firmicutes (Ch 22)
November 2	20	Firmicutes that do not form spores (Chapter 22)
November 4	21	Archaea (Chapter 4, Chapter 19)
November 6	22	Eukaryotic microbes: cell structure (Chapter 5)
November 9	23	Eukaryotic microbes: protists (Chapter 23)
November 11		REMEMBRANCE DAY
November 13	24	Eukaryotic microbes: fungi (Chapter 24)
November 16		Lecture test 2 on Lectures 12 to 21
November 18	26	Viruses (Chapter 6)
November 20	27	Viral diversity: DNA viruses (Chapter 25)
November 23	28	Viral diversity: RNA viruses (Chapter 25)
November 25	29	Environmental microbiology (Chapter 28)
November 27	30	Microbial ecology (Chapter 29 and 30)
November 30	31	Microbial interactions (Chapter 27)
December 2	32	Immunology: innate defences (Chapter 31)
December 5	33	Immunology: acquired defences (1) (Chapter 32)
December 7	34	Immunology: acquired defences (2) (Chapter 32)
December 9	35	Pathogenicity and infection (Chapter 34)

Part 2.2: Laboratory outline

Instructor

Hélène d'Entremont (she/her/hers)
MacAskill Hall, room 333 (office), room 250 (teaching laboratory)
e-mail: helene.dentremont@acadiau.ca
office hours: Thursday from 10:30 to 12:30 or by appointment

Technician

Alanna Maynard
MacAskill Hall, room 330 (office), room 250 (teaching laboratory)

Outline

This semester you will grow a wide variety of bacteria, including those normally found on your body, others that may cause disease, and a number of species that are crucial to ecosystems. You will also work with the T4 bacteriophage, which is a virus that infects bacterial cells.

Safety

Many of the microorganisms used in this laboratory are not too pathogenic, but they could give you a bout of gastroenteritis if handled improperly or carelessly. Therefore, to avoid infecting yourself or any of your colleagues, follow the laboratory rules outlined in the manual and posted on Moodle.

Lab evaluation

Flowcharts and pre-lab quizzes	10%
Lab reports and assignments	14%
Lab exam	6%
Total	**30%**

Attendance

Lab attendance is considered mandatory. Notify the lab instructor **as soon as possible** if you are ill or unable to attend an upcoming lab, so that a makeup lab can be arranged. Note that makeup labs are not always possible. If a lab slot is not available, the grade from the missed lab will be transferred and added to the grade for the lab exam. If the instructor is **not** notified **prior** to the lab period, then a grade of zero will be assigned for the missed work.

Lab schedule

Lab 1: Safety, techniques, pure cultures, morphology (3 h)
Lab 2: Colony counts, colony isolation, Gram stains (1.5 h)
Lab 3: Microscopy, identification, set up Lab 4 (1.5 h)
Lab 4: Plating of Gram negative pathogens from urine (during Lab 3)
Lab 5: Isolation and identification of Gram negative pathogens from urine (1.5 h)
Lab 6: Inoculation of plates using nasal sample (1.5 h)
Lab 7: Bacteriophage and determination of phage titre (during Lab 6)
Lab 8: Identification of Gram positive bacteria from nasal isolates (3 h)
Lab 9: Lab exam: applied skills test (1 h)

Comeback time

You are expected to return to the lab outside of the scheduled lab slot for Lab 5 and Lab 7. Follow up observations are required to complete these labs, and the necessary time may vary from 15 to 30 minutes. Allotted times when the lab will be open and supervised will be posted on Moodle.

Lab reports

Refer to Moodle to see when lab reports are due. A penalty will be assessed for every day the report is late. More information is posted on Moodle. **Note on Free Days:** throughout the semester, you can avail yourself of two free days to submit a report, which allows you to have one extra day for each of two reports, or two extra days for one report, without any penalty.

Flowchart

Flowcharts may be drawn by hand or generated electronically (iPad/BioRender). Think of the flowchart as your cheat sheet for what you will be doing in lab that day. You do not want to be re-writing the lab manual here, just putting boxes, arrows, and small sketches to illustrate the experimental procedures. There is a document with guidelines and an exampled posted on Moodle.

Lab exam

The lab exam will be held in the lab room (BIO 250). You will be required to perform basic microbiological techniques, interpret tests or data, and answer questions based on laboratory theory.

Plagiarism

You are required to submit your lab reports electronically to turnitin.com, where content will be scrutinized for any forms of plagiarism. **Plagiarism is NOT tolerated at Acadia University.** Although you may work in pairs or in groups, all flowcharts, assignments, and reports are to be written as individual efforts. Any submission found to contain plagiarized information will receive a mark of zero. You can review the university policies on plagiarism by following the link on Moodle. **The use of any algorithm that incorporates artificial intelligence (AI) is not allowed in any lab assignment unless specifically permitted by the Instructor.**

Part 3: Grading policy

Graded course activities

Lecture test 1 on Lectures 2 to 11 on Tuesday, October 6 at 18:30 in HSH 010	20%
Lecture test 2 on Lectures 12 to 21 on Monday, November 16 at 10:30 in KCIC Auditorium	20%
Lecture test 3 on Lectures 22 to 35 on December 11 at 9:00 to 12:00 in HSH 010	30%
Laboratory assignments and reports (see Part 2.2: Laboratory outline)	30%

Grading system (for all courses at Acadia University that use a numerical grading scheme)

A+	90-100	C+	67-69
A	85-89	C	63-66
A-	80-84	C-	60-62
B+	77-79	D+	57-59
B	73-76	D	53-56
B-	70-72	D-	50-52
		F	0-49

Part 4. Course policies

Lectures

1 PowerPoint slides for each lecture are posted on Moodle before each lecture
   - download or print off slides, take supplementary notes during lecture
   - research has shown that students who take notes by hand perform significantly better in situations that evaluate their ability to retain information
2 not **all** the information in the lecture is included on slides
   - you are expected to attend every lecture in person whenever possible; please do not skip lectures, or you will miss material that I provide verbally (i.e., not on slides)
3 when using electronic devices during lectures, limit their use to classroom material **only**
   - using these devices for other purposes (e.g., social media) will negatively impact your ability to learn, and is rude and disrespectful to other students
4 do not chat about topics unrelated to the course to other students during lectures
   - this behaviour is disruptive to me, and is disruptive to students who are not involved in the conversation

Tests

1 there will be three tests on lecture material (i.e., Lecture tests 1 to 3 in Part 3: Grading policy), and lab material will **not** be included on these tests
2 tests are based on topics covered on slides in lecture, information provided verbally in lecture, and any assigned readings or articles
3 for some test questions, you will be asked to apply what you have previously learned in lecture to new situations
4 format of Lecture tests 1 and 2 will be as follows (i.e., Lecture test 3 is during the exam period and will have some specific changes with regard to date, location, and timing):
   - tests will be run in the regular lecture slot, from 10:30 to 11:20 (50 min) in KCIC 012 (KCIC Auditorium)
   - tests will be run on Moodle on your laptop, and can be accessed between 10:30 and 11:20 in KCIC 012
   - questions consist of long-answer questions and multiple-choice questions, and you may navigate between questions as often as you wish during the time limit
   - there is **not** a penalty for changing your answer or choosing a wrong answer on the multiple-choice questions
   - any test that is still open at the time limit will be submitted automatically, i.e., you do not have to submit the test before time expires
5 you will be allowed a crib sheet to use during tests, with specific instructions as follows:
   - you can write anything on **two** sides of **one** 8.5" x 11" sheet of paper that is to be kept on your desk when writing and then handed to me when you leave the test room
   - all writing must be transcribed by hand at a size that I can read (i.e., with my glasses on); ask me before the test if you are not sure about the size of your writing
   - you are **not** allowed to cut and paste textbook diagrams or other media (e.g., photos) from lecture slides onto the sheet, i.e., everything must be written or drawn by hand

Missed tests or laboratories

1 if a **legitimate** activity is scheduled at the same time as a test or laboratory, please inform me (for a test) or Hélène (for a laboratory) at least two weeks prior to the scheduled date
   - list of legitimate activities: varsity or club games, essential appointments
   - list of illegitimate activities: varsity or club practices, vacations, lack of time to study due to other commitments
2 if you are unable to write a test or attend a laboratory due to a sudden medical or compassionate issue, provide the Registrar with a Declaration of Cause for Absence form: https://registrar.acadiau.ca/files/sites/registrar/Forms/Forms/Declaration of Cause fillable.pdf
3 I will attempt to reschedule a missed test at some point **after** the regularly scheduled date, but not **before**
   - contact Hélène for her policy on rescheduling missed laboratories
4 if you or the Registrar do not provide me or Hélène with a legitimate reason for missing a test or laboratory, you will be assigned a mark of zero for that test or laboratory
5 I do not provide opportunities for make-up tests for poor performance, nor do I drop the lowest test mark or adjust the values of previously written tests

Part 5. University policies

University policies

University policies, including important calendar dates and the last day to drop a course and receive a W, are available in the Acadia University Academic Calendar: https://registrar.acadiau.ca/AcademicCalendars.html

Academic integrity

Academic integrity demands responsible use of the work of other scholars. It is compromised by academic dishonesty such as cheating and plagiarism. A student who is uncertain whether or not a course of action might constitute cheating or plagiarism should seek in advance the advice of the instructor involved. The following are considered infractions of academic integrity and may lead to sanction:

- cheating is copying or the use of unauthorized aids or the intentional falsification or invention of information in any academic exercise
- plagiarism is the act of presenting the ideas or words of another person as one's own; students are required to acknowledge and document the sources of ideas that they use in their written work
- self-plagiarism is also a form of plagiarism, i.e., it is the presentation of the same work in more than one course without the permission of the instructors involved.
- a student who knowingly helps another to commit an act of academic dishonesty is equally guilty

Penalties are levied in relation to the degree of the relevant infraction. They range from requiring the student to re-do the piece of work, through failure on that piece of work, to failure in the course, and to dismissal from the University. See page 40 of the Acadia University Academic Calendar at https://registrar.acadiau.ca/AcademicCalendars.html for more information.

Copyright and intellectual property

Spoken and written course content, including the syllabus, lectures, laboratories, 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 other people may access them 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. In the case of personal use by students with disabilities, the instructor's consent shall not be unreasonably withheld. Information on copyright and course content from Acadia University is available through Vaughan Memorial Library: http://libguides.acadiau.ca/c.php?g=433650&p=5027078

Accessible Learning Services

Acadia University is dedicated to improving access to campus life for all students with disabilities. Although we attempt to ensure that all courses are accessible, we recognise 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 at accessible.learning@acadiau.ca as soon as possible. More information is also available at the Acccesible Learning Services website.

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

Artificial intelligence (AI) policy

Students are not allowed to use generative AI (Gen AI) tools, including AI chatbots (e.g., ChatGPT, Google Gemini, Claude, CoPilot) AI image generators (e.g., DALL-E, Midjourney, Stable Diffusion, Adobe Firefly), AI code generators (e.g., CoPilot, Tabnine, Cody), or AI audio or music generators (e.g., Amper, AIVA, Soundful), **on any assignment in this course unless specific permission is granted**. Gen AI output 1) imitates or summarises existing content without permission of original content owners, 2) has ethical, social, and human costs during RLHF (Reinforcement Learning from Human Feedback), 3) has an absolutely enormous carbon footprint, consuming huge amounts of power and water, and, in order to build more data centres, massive tracts of land, 4) greatly weakens the ability of humans to create, to reason, to think critically and show judgement, to solve complex problems, and to retain memories, and 5) is inequitable in that some students with challenging financial situations cannot access the same Gen AI tools as other students.

If you as a student are struggling and feeling pressure in this course or others, do not resort to chatbots as a shortcut to completing assignments. Please arrange to meet with me to discuss your challenges so that we can discuss solutions that will help you succeed.

Part 6. Program level outcomes

Foundations of knowledge		**Course specific examples**	**Proficiency** 1-Introduction 2-Reinforcement 3-Proficient
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	Emphasis throughout course on observation, hypothesis testing, methodologies (microbiological, molecular biological, ecological), data analysis, and interpretation	2
Historical concepts and contributions by important figures	Explain foundational concepts in biology, Two-eyed Seeing, and ethical implications of scientific discoveries	Foundational concepts in microbiology; contributions to field by important historical figures, with emphasis on contributions by women and BIPOC	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	Biodiversity is one of the overarching themes of course, i.e., evidenced by title; survey of all groups of microbes, presented in an ecological context	2
Genetics and evolution	Understand the chemical basis of heredity, genetics, and genomics; integrate concepts across disciplines to understand evolution	Three-lecture unit on bacterial vs eukaryotic genetics; constuction and interpretation of phylogenetic trees; emphasis on coadaptation and coevolution	2
Human and environmental health	Understand form and function in health and disease within a One Health framework, integrating human and environmental health	Heavy emphasis on microbes of human importance, and emphasis on microbes of environmental importance; three-lecture unit on human immune system	2
Lab and field skills			
Experimental design	Gain experience in applying the scientific method	Gain experience in identification of unknown bacterial samples, either provided in lab or sampled from various locations on the human body	2
Safety	Work safely and productively in lab and field settings	Learn that food and drink are not allowed in lab and that hands must stay away from face; safe use of Bunsen burners and ethanol to sterilise loops and plate spreaders	2
Lab skills	Gain experience with basic and advanced lab techniques and understand their application in research, health science, and industry	Learn aseptic techniques, proper handling of materials, pipetting, dilutions, plate methods (T-streak, spread, pour), transfer and growth of bacterial cultures, viral titres	2
Field skills	Gain experience in basic and advanced field skills and understand their application in ecology, conservation biology, and environmental change	Obtain bacterial samples from various locations on human body and on environmental surfaces for identification using sterile equipment and aseptic techniques	2
Data acquisition, analysis, and interpretation	Collect data, present results both qualitatively and quantitatively, and interpret outcomes in light of the literature	Observation of colony and cell morphology, interpretation of biochemical tests, determination of culture concentrations, and writing of scientific reports	2
Statistical analysis	Use R and or other programs to analyze biological data	Creation and organization of tables using Word to stand alone for scientific reports; construction of tables that are concise and easy to view and read	2

Professional skills			
Ethical practices	Demonstrate ethical conduct, apply principles of academic integrity, and understand the principles of EDI in science	Biomedical ethics and ethical use of animals in research; emphasis on inequities of health care amongst and within nations, and resulting prevalence of disease	2
Collaboration and group work	Work effectively in groups within and across disciplines	Students work in pairs or as a four-person bench in laboratory sections; resolution of conflicts is encouraged at student level before intervention by TA's or Instructor	2
Critical thinking	Analyze and evaluate information to make science-based decisions	Tests do not involve regurgitation of material, but rather application of knowledge and concepts from lectures and laboratories to answer novel, critical-thinking questions	2
Computer proficiency	Use common and discipline- specific software	Expectation and enhancement of proficiency with websites, databases, Word, Excel, and PowerPoint for both lectures and laboratory sections	2
Scientific communication	Communicate science effectively to both scientific and general audiences	Emphasis in lectures and laboratories of disseminating novel results in literature and on using multiple sources to build lectures and lab exercises	2