

**BIOL 2053 FA01: Microbial Biodiversity****Part 1: Course information****Professor**

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**note:** send e-mail from your Acadia e-mail address only

**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), and BIOL3583 (Eukaryotic Microbiology).

**Textbook (strongly recommended)**

*Prescott's Microbiology*, twelfth edition

Willey JM, Sandman KM, Wood DH

McGraw-Hill Companies Inc, 2023

**Course requirements**

- computer, tablet, or phone to access PowerPoint lecture slides and Word documents (i.e., syllabus, other documents) from the Moodle page for the course

**Course structure**

- lecture material will be presented as 50-min lectures in Slot 3 (Monday, Wednesday, and Friday from 10:30 to 11:20) in BAC 244 (see **Section 2.1: Lecture outline** for more details):
- laboratory sections will meet bi-weekly in BIO 250 with a few exceptions (see **Section 2.2: Laboratory outline** for more details):

**Week 1: BIOL 2053L FA01** (Tuesday 13:00 to 15:50, Lab 1 will begin on September 17)

**BIOL 2053L FA02** (Wednesday 13:00 to 15:50, Lab 1 will begin on September 18)

**Week 2: BIOL 2053L FA03** (Tuesday 8:30 to 11:20, Lab 1 will begin on September 24)

**BIOL 2053L FA04** (Tuesday, 13:00 to 15:50, Lab 1 will begin on September 24)

**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:
  - reading the relevant topics in the textbook before each lecture, and 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)

<b>Date</b>	<b>Lecture</b>	<b>Topic</b>
September 4	1	Introduction to Microbial Biodiversity
September 6	2	What are microbes? (Chapter 1)
September 9	3	Bacterial cell structure (1) (Chapter 3)
September 11	4	Bacterial cell structure (2) (Chapter 3)
September 13	5	Microbial growth (Chapter 7)
September 16	6	Metabolism (Chapter 10)
September 18	7	Catabolism (Chapter 11)
September 20	8	Anabolism (Chapter 12)
September 23	9	Bacterial genome replication and expression (Chapter 13)
September 25	10	Regulation of bacterial cell process (Chapter 14)
September 27	11	Mechanisms of genetic variation (Chapter 16)
September 30		DAY FOR TRUTH AND RECONCILIATION
October 2	12	Microbial evolution (Chapter 1, Chapter 26)
October 4	13	Photosynthetic bacteria (Chapter 20)
October 7	14	Gram negative non-Proteobacteria, part 1 (Chapter 20)
October 9	15	Gram negative non-Proteobacteria, part 2 (Chapter 20)
October 11	16	Proteobacteria, part 1 (Chapter 21)
October 14		THANKSGIVING DAY
October 16		READING WEEK
October 18		READING WEEK

October 21	17	Proteobacteria, part 2 (Chapter 21)
October 23	18	Actinomycetota (Chapter 22)
October 25	19	Mycoplasmata and spore-forming Firmicutes (Ch 22)
October 28	20	Firmicutes that do not form spores (Chapter 22)
October 30	21	Archaea (Chapter 4, Chapter 19)
November 1	22	Eukaryotic microbes: cell structure (Chapter 5)
November 4	23	Eukaryotic microbes: protists (Chapter 23)
November 6	24	Eukaryotic microbes: fungi (Chapter 24)
November 8	25	Viruses (Chapter 6)
November 11		REMEMBRANCE DAY
November 13	26	Viral diversity: DNA viruses (Chapter 25)
November 15	27	Viral diversity: RNA viruses (Chapter 25)
November 18	28	Environmental microbiology (Chapter 28)
November 20	29	Microbial ecology (Chapter 29 and 30)
November 22	30	Microbial interactions (Chapter 27)
November 25	31	Immunology: innate defences (Chapter 31)
November 27	32	Immunology: acquired defences (1) (Chapter 32)
November 29	33	Immunology: acquired defences (2) (Chapter 32)
December 2	34	Pathogenicity and infection (Chapter 33)
December 4	35	OVERFLOW DAY

## Part 2.2: Laboratory outline

### Instructor

Hélène d'Entremont (she/her/hers)

Biology Building, 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

Biology Building, 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	8%
Lab reports and assignments	16%
Lab exam	6%
<b>Total</b>	<b>30%</b>

## 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

Lab 2: Cell counts, colony isolation, microscopy, Gram stains

Lab 3: Isolation and identification of Gram negative pathogens from urine

Lab 4: Isolation and identification of Gram positive bacteria from nasal isolates

Lab 5: Bacteriophage and determination of phage titre

Lab 6: Lab exam: applied skills test

## Comeback time

Each lab is scheduled for 3 hr, but you are expected to return to the lab outside of the scheduled lab slot to set up Lab 3 and Lab 5. The necessary time may vary from 30 min to 3 hr. Allotted times when the lab will be open and supervised will be posted next on Moodle.

## Lab reports

Refer to Moodle to see when lab reports are due. Unless stated otherwise, reports must be handed in on your next lab day. 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 computer generated or drawn by hand. 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 example 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. More information will be posted on Moodle as we approach the date for the exam.

### 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 absolutely 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.

## Part 3: Grading policy

### Graded course activities

Lecture test 1 on Lectures 2 to 11 on Tuesday, October 1 at 18:30 in HSH 010	20%
Lecture test 2 on Lectures 12 to 21 on Tuesday, November 5 at 18:30 in HSH 010	20%
Lecture test 3 on Lectures 22 to 34 during exam period on <b>date TBA</b> in <b>room TBA</b>	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 class
  - 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 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 the Lecture tests 1 to 2 will be as follows (Lecture test 3 is during the exam period and will have some specific changes with regard to time, location, and timing):
  - tests will be run in the evening, from 18:30 to 20:30 in HSH 010, outside of lecture and laboratory slots
  - this special 120 min (i.e., 2 hr) time slot should ensure that you have enough time to write a 50-min test, i.e., time should not be a factor for completing the test
  - tests will be run on Moodle on your laptop, and can be accessed between 18:30 and 20:30 in the designated classroom
  - 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
  - special considerations to ensure academic integrity, including restrictions on access to other laptop programs and the presence of extra invigilators, will be in place
- 5 you will be allowed a crib sheet to use during tests, with specific instructions as follows:
  - you can write anything on **both** 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; writing on an iPad and then printing is fine, but tablet notes cannot be shrunk to a size that I cannot read (i.e., with my glasses on)

- 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 H  l  ne (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, helping friends move their belongings to another house (!)
- 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 form: [https://registrar.acadiau.ca/files/sites/registrar/Forms/Forms/Declaration of Cause fillable.pdf](https://registrar.acadiau.ca/files/sites/registrar/Forms/Forms/Declaration%20of%20Cause%20fillable.pdf)
- 3 I will attempt to reschedule a missed test at some point **after** the regularly scheduled date, but not **before**
  - contact H  l  ne for her policy on rescheduling missed laboratories
- 4 if you or the Registrar do not provide me or H  l  ne 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>

### 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>

### Students requiring accommodations

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 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 as soon as possible at: [accessible.learning@acadiau.ca](mailto:accessible.learning@acadiau.ca)

**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 the Department of Biology to check exams and assignments for cheating and plagiarism. Cheating in the lecture or laboratory sections of the course, including plagiarism, will absolutely not be tolerated. Please read the appropriate sections of the current Acadia University Academic Calendar: <https://registrar.acadiau.ca/AcademicCalendars.html>

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>



## 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; construction 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