MIMM 212: Laboratory in Microbiology

Welcome to MIMM 212! We are excited to have you participate in this course and be a member of Tiny Earth!

General Information

Course #	MIMM 212
Term	Fall 2022
Number of credits	3
Course co-requisite(s)	MIMM 211, BIO 200
Class times	Students must attend lectures and lab sessions (Tuesdays & Thursdays)
Pre-lab Lecture	**Tuesdays**, 2:30 PM – 3:30 PM | Duff Amphitheatre
Laboratory Sessions	**Tuesdays**, immediately following the lecture – 6:00 PM **Thursdays (follow-up),** 2:30 PM – 4:00 PM | Duff cubicles on the C-floor

Course instructor and Coordinator

Jasmin Chahal, Ph.D.
Duff Medical Building
3775 University St., Room 408A
Montreal, QC H3A 2B4
jasmin.chahal@mcgill.ca

Office hours: Fridays 5:00 PM, zoom link: https://mcgill.zoom.us/j/89362703932
*If this time does not work, please send me an email.
Communication plan: Available via email (expect a 1-day response time), meetings can be held in-person or via zoom, office hours will be via zoom

Previous course coordinator:

Samantha Gruenheid, Ph.D.

Teaching Assistants

Communication plan: via email/ after lab sessions

Emma Derrick	emma.derrick@mail.mcgill.ca
Dilhan Perera	dilhan.perera@mail.mcgill.ca
Jessica Pei	jessica.pei@mail.mcgill.ca
Morgane Brouillard-Galipeau	morgane.brouillard-galipeau@mail.mcgill.ca
Lydia Labrie	lydia.labrie@mail.mcgill.ca
Catherine Prattico	catherine.prattico@mail.mcgill.ca
Nicholas Vonniessen	nicholas.vonniessen@mail.mcgill.ca
Ryan Hanula	ryan.hanula@mail.mcgill.ca
Elizabeth Lapshina	elizabeth.lapshina@mail.mcgill.ca
Breanna Landry	breanna.landry@mail.mcgill.ca
Lindsay Burns	lindsay.burns@mail.mcgill.ca

TEAM members

Selina Zhao selina.zhao@mail.mcgill.ca
Vincent Duquette vincent.duquette@mail.mcgill.ca

Course Overview:

The purpose of this course is to engage you in the process of scientific investigation and discovery, while teaching microbiology. Your mission is to discover antibiotic-producing bacteria from soil. We have chosen this research challenge because bacterial diseases that have been successfully treated with antibiotics for decades are now posing a threat to human health due to antibiotic-resistance. Additionally, there are few new antibiotics under development in pharmaceutical companies: most of the major companies abandoned antibiotic discovery in the 1980s and '90s.

Although bacteria have been isolated from soil over the last 130 years, and many antibiotics have been discovered from among them over the last 70 years, there are still more bacteria and antibiotics to discover. Many of the antibiotics you find will have been reported previously in the scientific literature, but some may be new. In order to best complete your mission, this course will provide you the opportunity to develop your knowledge on the scientific method, microbiology theory and methods, biosafety, appropriate record keeping and scientific communication. Learning is best accomplished when actively creating knowledge, so you are expected to be an active participant in this class. Information will be delivered in the reading and lectures, but you will be asked to process that information through analysis and problem solving to ensure that you construct a lasting knowledge base.

Tiny Earth:

TINY EARTH: https://tinyearth.wisc.edu/

Our class is an active partner in "Tiny Earth", a network of instructors and students focused on crowdsourcing antibiotic discovery from soil. The course you are currently enrolled in (or something very similar) is undertaken by nearly 10,000 students annually in 41 U.S. states and 14 countries. You have therefore become part of a special opportunity to do real research alongside a wide community of young scientists who are eager to learn, discover, and tackle our world's challenges together. You and thousands of your student colleagues will develop your scientific inquiry, problem solving, and critical thinking skills all while contributing to solving a critical human health threat: the diminishing supply of effective antibiotics.

Mandatory Materials

- Lab manual: *Tiny Earth: A Research Guide to Studentsourcing Antibiotic Discovery*. Jo Handelsman et al. Publisher: XanEdu, Inc. Available at the Le James McGill Bookstore or at the McGill Book store Web site.
- Lab coat. Due to biosafety regulations, **lab coats used in this course must remain in the lab all term** and will be returned at the end of term.
- Safety glasses/goggles. (If you wear regular glasses in the lab, you do not need goggles)
- Permanent marker (eg "Sharpie") and regular pen.
- Hard cover lab book with lined pages (not spiral bound). Numbered pages if possible, if not pages should be numbered by hand, in ink. These are available at the McGill Bookstore and elsewhere.

Learning Outcomes

By the end of this course, you will be able to:

1. Practice safe microbiology, using appropriate protective procedures and waste disposal.
2. Use aseptic techniques for the transfer and handling of microorganisms.
3. Understand the theory behind each laboratory experiment.
4. Perform common microbiology techniques.
5. Use appropriate microbiological media and test systems.
6. Properly prepare and view microbial specimens using microscopy.
7. Formulate hypotheses and design/optimize experiments based on the scientific method.
8. Work effectively in a team and manage time in a lab setting.
9. Collect, record and organize scientific data in a systematic and appropriate manner.
10. Effectively communicate scientific concepts and data.

Instructional methods

The evidence is very clear that students who come to class and participate in the in-class activities gain a deeper and longer-lasting understanding of the material. This class uses an interactive approach to lectures. We will be using a web-based polling system called **Slido** to facilitate problem solving and other activities during the lecture. These activities are designed to allow you to actively engage with the material and obtain feedback from your peers and the professor during class time.

During a class with polling questions, you will respond to questions from the instructor from a personal device (smartphone, tablet or laptop). Polling will be available through https://accounts.sli.do/login?redirect=aHR0cHM6Ly9hZG1pbi5zbGkuZG8vZXZlbnRz. Please log in with Webex and enter your McGill credentials. For any technical problems with polling, please contact the IT Service Desk: http://www.mcgill.ca/it/get-started-it/need-help.

In this class, we foster an inclusive and supportive learning environment. To view resources regarding how to best learn, please visit Learning Resources. If you experience an overwhelming feeling by your academic work and/or would like to further develop time and workload management skills, please seek support from Student Services.

Evaluation and feedback

In this course you will be evaluated through various assessments that allow the professor to measure your ability to gain the learning outcomes. The mark distribution for the course is as follows:

Assessment	Each assignment	Total worth	Due dates
Lab reports (3)	10	30	See below
Lab performance-based evaluation (2)	5	10	Oct.14 & Nov. 15
Lab book assessment (2)	7.5	15	Oct. 14 & Nov. 22
Lab skill assessment	10	10	Nov. 10, 15 or 17
ESKAPE assignment	5	5	Sept. 29
Pre-lab quizzes (5)	2	10	See below

Powerpoint presentation draft	5	5	Nov. 22
Powerpoint presentation	15	15	Nov 29
TOTAL		100	

A brief description of each assessment is shown below. Further details on the instructions, assessment criteria and logistics will be posted in MyCourses. All deadlines are at **11:59 PM** on the date indicated.

Lab reports

You are required to write 3 lab reports throughout the duration of this course. The deadlines for each are listed in the course schedule below. You are expected to follow the template, guidelines and rubric provided on MyCourses and in the lecture slides. Lab reports must be either sent to your TA via email or printed out and handed in during lab sessions. The deadlines are at 11:59 PM EST on the date indicated below.

	Content	**Due date**
Lab report #1(5%)	Abundance & Diversity of bacteria in soil sample	Oct. 6
Revised lab report #1 (5%)	Same as above but revised based on TAs feedback	Oct. 20
Lab report #2 (10%)	Antibiotic activity screens 1 and 2	Nov. 3
Lab report #3 (10%)	Characterization and identification of the positive producers	Nov. 24

Lab performance-based evaluations

Students will be assessed on their lab-performance to measure "soft skills," which are crucial to careers in the scientific field. You will receive feedback twice during the semester by your TA. This formative feedback will allow you to become aware of your strengths and what to improve over the course of the semester. The rubric is provided on MyCourses.

Lab book assessements

You will be required to keep a detailed lab book. Your TA will assess your lab book twice during the semester using the rubric provided on MyCourses. You are required to bring your lab book to **every lab session.**

Lab skill assessment

By the end of the course, you would have practiced common microbiology techniques countless times. To ensure that you have mastered the techniques, there will be a lab skill assessment where you will be asked to perform common techniques that were taught throughout the semester. Your TA will assess if you were able to perfect your lab skills. The checklist is available on MyCourses.

ESKAPE assignment

This creative assignment will allow you to present one of the ESKAPE pathogens to your cubicle. You are expected to answer a set of questions that are listed in the lecture slides and MyCourses page. This assignment will be presented during lab session as seen in the schedule below.

Pre-lab quizzes

The quizzes will consist of short-answer type questions at the beginning of each laboratory exercise. There will be 6 quizzes and the quiz with the lowest grade will not count towards the total 10%. Each quiz will be 2%. These quizzes will be held in-person before each lab session.

	Content	**Due date**
Pre-lab Quiz #1	Aseptic technique	Sept. 6
Pre-lab Quiz #2	Microscopy and stains	Sept. 13
Pre-lab Quiz #3	Biosafety	Sept. 20
Pre-lab Quiz #4	Dilutions and antibiotic screening	Oct. 4
Pre-lab Quiz #5	16S PCR and gel electrophoresis	Oct. 25
Pre-lab Quiz #6	Biochemical tests and antibiotic resistance	Nov. 8

Powerpoint presentation

You are expected to present your entire semester project with your lab mate to the rest of your cubicle. This is like an oral lab report. You will have the opportunity to give a practice presentation where you will receive feedback. You will then give your final presentation to different TAs. The rubric is on MyCourses and will be discussed in class. This presentation will be given in-person in your assigned cubicle.

Lateness

A 5% deduction will be applied for each day of late submission of an assignment and will received a 0 after a week.

Absences

It is mandatory to attend all lab sessions. If you are unable to attend a class, you are expected to let your TA, lab mate and the professor know. It will then be your responsibility to make-up for your absence.

Course schedule

The following schedule contains the dates, assignment deadlines and the lab activities that will take place.

Week	**Dates**	**Lab Activities**	**Assignments**
1	Thurs Sept. 1	Introduction, outline, background information, course logistics, record keeping, safety intro.	
2	Tues Sept. 6	**Common Techniques A:** Aseptic technique, ubiquity of microorganisms	Pre-lab quiz #1
	Thurs Sept. 8	**Common Techniques A:** Check results of lab, record results, save plates, practice serial dilution with loading dye.	

		Provide one sterile 50 mL conical tube per group	
3	Tues Sept. 13	**Lab 1:** Add 1g of your soil to 9 mL of H2O and plate 100 uL to TSA, 10% TSA, LB and PDA **Common Techniques B:** Microscopy, Gram stain, hanging drop and motility agar	Pre-lab quiz #2
	Thurs Sept. 15	**Lab 1 follow-up:** Characterize soil, record results, incubate plate until next week **Common Techniques B:** Record results, complete Gram stain, microscopy and hanging drop if necessary	
4	Tues Sept. 20	**Lab 1 follow-up:** Record results **Lab 2:** Pipetting, serial diluting and plating of soil samples (TSA, 10% TSA, LB or PDA)	Pre-lab quiz #3
	Thurs Sept. 22	**Lab 2 follow-up:** record results, incubate plates until next week. Patching in duplicate (keep plates)	
5	Tues Sept. 27	**Lab 2 follow-up:** note additional growth, continue/repeat patching if necessary, calculate CFU/g, store plates in fridge	
	Thurs Sept. 29	Plan antibiotic activity screen 1 (**Lab 3** – 1 Gram + and 1 Gram – tester strain, 2 medias)	ESKAPE pathogen assignment presentation
6	Tues Oct. 4	**Lab 3:** Set up antibiotic activity screen 1, Gram stain of tester strains	Pre-lab quiz #4
	Thurs Oct. 6	**Lab 3 follow-up:** Analyze and record results from antibiotic screen 1 (save plates to re-examine on Tuesday), streak plates of positive producers. Continue Gram stain of testers if needed Plan antibiotic screen (**Lab 4)**	Lab report #1
7	Fri Oct. 14 (Tuesday Schedule)	**Lab 3 follow-up:** Re-examine screen 1, record colony morphologies of streaked plates, re-streak or continue streaking. **Lab 4:** Perform antibiotic activity screen 2. Gram stain tester strains	TAs hand back lab report #1 Lab notebook #1 Lab performance-based assessment #1

8	Tues Oct. 18	**Lab 4 follow-up:** Record results, prioritize clones for further characterization 2 clones/group. Re-streak plates of positive producers	
	Thurs Oct. 20	**Lab 5**: Set up 16S PCR, freeze positive producers from plate cultures, Gram stain positive producers	Revised lab report #1
9	Tues Oct. 25	**Lab 5 follow-up:** Run PCR gel, repeat 16S PCR if necessary, continue Gram stain of positive producers	Pre-lab quiz #5
	Thurs Oct. 27	**Lab 5 follow-up:** Repeat 16S PCR if necessary. Streak fresh cultures for biochemical tests, send PCRs for sequencing.	TAs hand back lab report #1
10	Tues Nov. 1	**Lab 6:** Biochemical testing of positive producers.	
	Thurs Nov. 3	**Lab 6 follow-up:** Analyze results from biochemical tests	Lab report #2
11	Tues Nov. 8	**Lab 6 follow-up:** Finish getting results from characterization, perform any extra tests that need repeating. **Lab 7:** Perform the antibiotic sensitivity testing of isolates.	Pre-lab quiz #6
	Thurs Nov. 10	**Lab 7 follow-up:** Check results from characterization. Lab skill assessment.	Lab skill assessment TAs hand back lab report #2
12	Tues Nov. 15	**Lab 7 follow-up:** Re-check results from characterization if necessary. Lab skill assessment. TAs go over sequence analysis and lead discussion about characterization	Lab skill assessment Lab performance-based assessment #2
	Thurs Nov. 17	Extra time for lab skills assessment. Hand in lab coats for washing. Ask TA any questions about presentation.	Lab skill assessment
13	Tues Nov. 22	Peer Practice session for Powerpoint presentations	Powerpoint draft Lab notebook #2
	Thurs Nov. 24		Lab report #3
14	Tues Nov. 29	Powerpoint presentations	
	Thurs Dec. 1	Lab coats and lab notebooks will be returned. Happy Holidays and Good luck on your exams!	

Class recording

The pre-lab lectures will be recorded to allow you to review material outside of scheduled class time. Class recordings do not replace a student's presence in a class; rather, they provide complementary pedagogical support for student learning. The recordings will be uploaded 24 hr after the lecture date on MyCourses.

Intellectual property considerations

"I ask for everyone's cooperation in ensuring that this [video] and associated material are not reproduced or placed in the public domain. This means that each of you can use it for your own purposes, but you cannot allow others to use it by posting it online or giving it or selling it to others who may copy it and make it available. Thank you very much for your help with this."

Inclusive Learning Environment

This course is designed to help you learn to communicate professionally both during your time at McGill and in your future workplaces. In keeping with McGill's policies on student rights and responsibilities, it is expected that during class discussions and small group interactions you will communicate constructively and respectfully. Sexist, racist, homophobic, ageist, and ableist expressions will not be tolerated in the classroom or during group meetings held outside of class.

McGill is committed to providing an inclusive and supportive learning environment. If you experience barriers to learning in this course, do not hesitate to discuss them with your instructor. If you have a special learning need or disability, you are encouraged to contact the Office for Students with Disabilities: https://www.mcgill.ca/osd/.

Health and Wellness

Student wellbeing is a priority for the University. To help students find the support they need as quickly as possible, all of McGill's health and wellness resources have been integrated into a single Student Wellness Hub, a one-stop shop for everything related to physical and mental health. If you need access to services or would like more information, you are strongly encouraged to visit the Virtual Hub: https://www.mcgill.ca/wellness-hub/.

McGill Writing Centre Tutorial Service

Writing well is key to both academic and professional success. The McGill Writing Centre (MWC) offers credit courses in academic and professional writing, and a tutorial service open to all McGill students: https://www.mcgill.ca/mwc/tutorial-service. The tutorial service offers one-to-one sessions with seasoned instructors and experienced tutors who will work with you at any stage of the writing process.

During the campus closure period, there will be no tutors on site and no administrative staff at the MWC to answer inquiries. Tutoring sessions will be conducted online via the Microsoft Teams platform. This application is available for free to all students through Office 365: https://www.mcgill.ca/it/office365-software. For information about how to book an appointment through Microsoft Teams, please go to https://www.mcgill.ca/mwc/tutorial-service.

McGill Library

Discover the McGill Library's rich array of resources. Watch a short welcome video in English, French, Arabic, Chinese, Hindi, Persian, Spanish, or Urdu: https://www.mcgill.ca/library/orientation.

Additional Statements

- McGill University values academic integrity. Therefore, all students must understand the meaning and consequences of cheating, plagiarism and other academic offences under the Code of Student Conduct and Disciplinary Procedures" (see www.mcgill.ca/students/srr/honest/ for more information)

- In accord with McGill University's Charter of Students' Rights, students in this course have the right to submit in English or in French any written work that is to be graded/ *Conformément à la Charte des droits de l'étudiant de l'Université McGill, chaque étudiant a le droit de soumettre en français ou en anglais tout travail écrit devant être noté (sauf dans le cas des cours dont l'un des objets est la maîtrise d'une langue)* **Note: Please contact Dr. Chahal if you wish to submit your assignments in French by the end of the add/drop period so that arrangements can be made for you to achieve the same learning outcomes as your peers**
- The University Student Assessment Policy exists to ensure fair and equitable academic assessment for all students and to protect students from excessive workloads. All students and instructors are encouraged to review this Policy, which addresses multiple aspects and methods of student assessment, e.g. the timing of evaluation due dates and weighting of final examinations.

- Instructor-generated course materials (e.g., handouts, notes, summaries, exam questions, etc.) are protected by law and may not be copied or distributed in any form or in any medium without explicit permission of the instructor. Note that infringements of copyright can be subject to follow up by the University under the Code of Student Conduct and Disciplinary Procedures.

- *As the instructor of this course I endeavor to provide an inclusive learning environment. However, if you experience barriers to learning in this course, do not hesitate to discuss them with me and the* Office for Students with Disabilities, *514-398-6009*

- End-of-course evaluations are one of the ways that McGill works towards maintaining and improving the quality of courses and the student's learning experience. You will be notified by e-mail when the evaluations are available. Please note that a minimum number of responses must be received for results to be available to students.

- In the event of extraordinary circumstances beyond the University's control, the content and/or evaluation scheme in this course is subject to change.

- Additional policies governing academic issues which affect students can be found in the McGill Charter of Students' Rights (see the Handbook on Student Rights and Responsibilities).

- McGill has policies on sustainability, paper use and other initiatives to promote a culture of sustainability at McGill. (See the Office of Sustainability.)

- Guidelines for the use of mobile computing and communications (MC2) devices in classes at McGill have been approved by the APC. Consult the Guidelines for a range of sample wording that may be used or adapted by instructors on their course outlines.

- To maintain a safe and respectful classroom environment, please ensure that any polling responses you submit are appropriate and relevant to the question asked. Please note that unless the poll is labelled as anonymous, your responses are identifiable to the instructor. Please see the Code of Student Conduct and Disciplinary Procedures.