

MBIO 3700: Experimental Microbiology Lab (Fall 2022)

Course Description

This lab course will introduce students to the morphological and physiological study of microorganisms. Students will reinforce their basic lab skills while carrying out discovery-based experiments involving microscopy, antibiotic susceptibility testing, bacterial enumeration, physiology, and identification. Using these tools students will attempt to isolate and characterize a previously undescribed bacterium, reporting their results as scientific journal articles. Small groups will work together to conceive, plan, and carry out a novel experiment of their own design, and then report their results to the class in an end of term poster session.

Resources

You will need a course manual, which is available on the UM Learn site. It is also recommended that you have access to a current microbiology textbook such as Brock, Biology of Microorganisms by Madigan et al., to use as a reference. (Textbooks do not change much from edition to edition, so anything 14th edition and up is fine.)

In addition to the above resources, you will make extensive use of original peer reviewed microbiology journal articles. These can be accessed through U of M Libraries supported search engines such as [PubMed](#) or [Web of Science](#).

Instructor Contact Information

Labs: Dr. Chris Rathgeber

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Phone: 204-474-9967

Office hours: I am available for consultation any time on Mon, Wed, Fri, from 9:00 to 11:00 am, and on Mon from 2:00 to 5:00 pm. Please email me for an appointment. I will also be available for questions during some (but not all) open lab periods. Just look for me in the lab.

Important announcements

Any important announcements will be made through UM Learn, so make sure you keep an eye on the announcement widget on the main course page. (If you haven't done so already, you can set UM Learn announcements to be forwarded directly to you email by going to your personal settings page and modifying the "Notifications" page.)

Please note: the U of M will only use your university email account for official communications, including messages from your instructors, department or faculty, academic advisors, and other administrative offices. [Click this link for more information about the U of M's email policy.](#)

This means that neither instructors nor their TAs will communicate about course material through any social media platform (i.e. Facebook, Telegram, Twitter etc.) If someone joins your Telegram group claiming to be a TA or an instructor, you should assume that it is an imposter and act accordingly.

How the course works

This is an entirely lab-based course. (That means that there are no lectures!) In addition to the scheduled lab period (Tuesday 2:30 to 5:25 pm) the lab room will be open daily for you to monitor and work on ongoing experiments. The course will include individual work (isolation and characterization of an unknown bacterium), short discovery-based experiments without known or expected results, and a term long group project.

A complete schedule of labs is available on the UM Learn site. And open lab times will be posted in the first week of classes.

Attendance policy

Attendance in the scheduled lab period is mandatory. All other lab times are optional, however, there is a general expectation that you will put in up to 6 hours of lab time per week. (And you will probably find that you need 6 hours to accomplish all of the objectives most weeks.)

If you cannot attend a scheduled lab period (Tuesday from 2:30 to 5:25 pm) due to illness you should send a [self-declaration form](#) to the lab instructor by email. When you return to the lab speak to the instructor to obtain cultures and discuss how you can get caught up on missed experiments.

Course topics

1. Review of microbiological techniques
2. Biosafety in the laboratory
3. Phase contrast microscopy, staining, and morphological study of microorganisms
4. Enrichment and isolation of bacteria
5. Bacterial counting methods
6. Antibiotic susceptibility testing
7. Selective and differential media
8. Classical, rapid and DNA based identification tests
9. Morphological and physiological characterization of unknown bacteria
10. Designing, planning and carrying out experiments

Learning goals

At the end of this course students will be able to:

1. Demonstrate proficiency with basic lab techniques used to culture and study microorganisms.
2. Conduct experiments in a biosafety level 2 lab, and handle risk group 2 and unknown microorganisms safely.
3. Demonstrate proficiency with a microscope and use that microscope to describe microorganisms morphologically.
4. Accurately enumerate bacteria in liquid and solid environments.

5. Use selective and differential media, and classic, rapid and DNA based methods for the identification of unknown bacteria.
6. Isolate an unknown bacterium from the environment and describe its morphological, physiological and biochemical properties.
7. Formulate testable hypotheses, and design, plan and carry out novel experiments in microbiology.
8. Research primary literature to incorporate methods into experimental design.
9. Report experimental results in journal article and poster formats.

Evaluation and Grading

Marks will be distributed as follows:

Lab term work (80%)

- Direct observation of lab skills = 4%
- Laboratory notebook = 5%
- 7 data sheets (3% each) = 21%
- 2 lab reports in 'note' format (10% each) = 20%
- Group project (work sheets, procedure, literature review, final poster) = 30%*

Lab exam (20%)

- Covers all theory, techniques and results. Consists of short answer questions = 20%
- Scheduled for Tuesday Nov. 29th during your regular lab period.

* Note that you must achieve a minimum 15 out of 30 on the group project to pass the course.

- A complete list of assignment due dates can be found on the final page of this document.

Grading scale

Letter grades will be assigned by taking into consideration the grade distribution in the class and the University of Manitoba's descriptors; see <https://umanitoba.ca/registrar/grades> for more details.

The goal is to provide grades that represent performance in the context of the class; the grades will not be curved to meet an expected distribution, but conversion of percentages to letter grades will be at the discretion of the instructor.

For this course, the grading scheme generally, but not always, will be close to the following:

Grade	Percent score	Description
A+	93 – 100	Exceptional
A	85 – 92	Excellent
B+	80 – 84	Very good
B	75 – 79	Good
C+	68 – 74	Satisfactory
C	60 – 67	Adequate
D	50 – 59	Marginal

Grade	Percent score	Description
F	Less than 50	Failure

Policy regarding late assignments and missed exams

Lab data sheets and individual lab reports: The due dates for lab data sheets and lab reports are based on expected completion times of the individual experiments and are meant to keep you on track to finish the course in reasonable time (without leaving all the work until the end.) If you have trouble making the due date for a data sheet or lab report, you are asked to speak to the Lab instructor in-person in the next lab period. (This is so that we can discuss how to get you on track to complete the assignment and not fall behind on the remaining lab work.) You don't need to email. Due dates on individual assignments will be flexible.

Group project components: Because the group project is team based, and your team is relying on you, the group project due dates should be considered strict. Each new component of the group project builds on feedback from the last, so it is imperative that each part is completed in a timely manner. Please do everything in your power to meet group project due dates (including asking for extensions on the individual work if necessary.) If the group cannot meet a due date, then all group members should arrange to meet with the instructor as soon as possible to plan a schedule to get back on track.

Lab exam: If you miss the lab exam due to illness or compassionate reasons, you must contact the instructor within 5 days to arrange for a deferral.

Academic Integrity

The Faculty of Science regards acts of academic dishonesty in quizzes, tests, examinations, laboratory reports or assignments as serious offences and may assess a variety of penalties depending on the nature of the offence. Acts of academic dishonesty include but are not limited to using unauthorized materials during an exam, copying from another individual, sharing screenshots during exams, using answers provided by tutors, forging documents, plagiarism, and examination personation. Guidelines are stated in your calendar regarding University policy with respect to academic dishonesty (particularly plagiarism and cheating) and behaviour and absence from final exams.

The [Faculty of Science web page has detailed information on academic integrity](#). Please read and follow these guidelines and ask if you have any questions. You are also encouraged to view [this video message from Associate Dean Krystyna Koczanski](#).

All instructors in the Faculty of Science, and their teaching assistants have been instructed to remain vigilant and report all incidents of academic dishonesty. In cases of cheating on lab assignments, or during quizzes and examinations, the assignment or test in question will be given a grade of 0% and the student will be referred to the appropriate authorities for disciplinary action.

Technology Requirements:

Even though this is an in-person labs course, the pre-labs will be primarily delivered as online videos, and all assignments will be submitted online. You must ensure that you can meet the following minimum requirements:

1. A computing device that can be used to create and edit documents.
2. An internet connection capable of streaming videos and downloading software.

If you encounter technical difficulties with UM Learn or other University of Manitoba computer services you should contact the [IST help desk](#), which is open Monday to Friday, from 8:00 am to 8:00 pm.

Student Accessibility Services

The University of Manitoba is committed to providing an accessible academic community. [Student Accessibility Services \(SAS\)](#) offers academic accommodation supports and services such as note-taking, interpreting, assistive technology and exam accommodations. Students who have, or think they may have a disability (e.g. mental illness, learning, medical, hearing, injury-related, visual) are invited to contact SAS to arrange a confidential consultation.

Student Accessibility Services
520 University Centre

Phone: (204) 474-7423
Email: Student_accessibility@umanitoba.ca

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Exercise list

Lab topics

Individual experiments (done independently)

1. Exercise 1: Review of microbiology techniques
2. Exercise 2: The biosafety cabinet
3. Exercise 3: Phase contrast microscopy
4. Exercise 4: The Gram stain
5. Exercise 5: The MIC test
6. Exercise 6: The Kirby-Bauer disk diffusion assay
7. Exercise 7: Biochemical identification of *Enterobacteriaceae*
8. Exercise 8: Counting bacteria in soil
9. Exercise 9: Selective and differential media
10. Exercise 10: Isolation of an antibiotic producer
11. Exercise 11: Rapid identification using API 20E

Individual project (isolate and characterize a new bacterium)

1. Enrichment for a denitrifier
2. Gram stain and phase contrast microscopy
3. Biochemical characterization and antibiotic susceptibility
4. Metabolic testing using Biolog plates
5. 16S rRNA sequencing and identification
6. Identification using API 20NE (if necessary)

Group project (design an experiment)

1. 'Four questions' brainstorming worksheet (1%)
2. Initial project proposal worksheet (1%)
3. Second project proposal (if necessary)
4. Project procedure and materials list 1st draft (6%)
5. Project procedure and materials list 2nd draft (3%)
6. Literature review (6%)
7. Perform the experiment (2%)
8. Present results in scientific poster format (10%)
9. Poster session worksheet (1%)

List of due dates

Assessment	Type of assessment	Value	Due date
Four questions	Worksheet	1%	Sept. 13
Group project proposal	Worksheet	1%	Sept. 20 (at the end of the lab)
Review of microbiology	Data sheet	3%	Sept. 23
Second project proposal	Worksheet		Sept. 27 (if necessary)
Antimicrobial susceptibility	Data sheet	3%	Oct. 4
Group project procedure 1 st draft	Written report	6%	Oct. 11
Biochemical identification	Data sheet	3%	Oct. 14
Selective and differential media	Data sheet	3%	Oct. 18
Group project procedure 2 nd draft	Written report	3%	Oct. 25
Counting bacteria in soil	Data sheet	3%	Oct. 28
Individual project: first description	Lab report	10%	Nov. 1
Materials list revisions			Nov. 1 (if necessary)
Identification using API 20E	Data sheet	3%	Nov. 4
Group project literature review	Written report	6%	Nov. 15
Voluntary withdrawal date			Nov. 22
Group project: performing the experiment	Direct observation	2%	Nov. 14 to 25
Isolation of antibiotic producer	Data sheet	3%	Nov. 25
Lab exam	In-person exam	20%	Nov. 29
Group project poster	Written report	10%	Dec. 5
Poster presentation worksheet	Worksheet	1%	Dec. 6 (at the end of the lab)
Individual project: second description	Lab report	10%	Dec. 12
Individual lab skills	Direct observation	4%	Observed throughout the term from Sept. 20 to Nov. 25.
Record keeping	Lab notebook	5%	Can be marked at any time!

Feedback on lab reports and data sheets will generally be provided within 10 days of the due date. (For short data sheets, the feedback may come a little quicker, for the most complex projects like the literature review, marking may take a little longer.)

The lab exam is considered a final exam for summative evaluation purposes only. Therefore, no written feedback will be provided. Marked exams can be viewed by making an appointment with the instructor. However, they will have only a numerical score without any markup.