



MICR*3430 Advanced Methods in Microbiology

Winter 2021

Section(s): C01

Department of Molecular and Cellular Biology

Credit Weight: 0.75

Version 1.00 - January 19, 2021

1 Course Details

1.1 Calendar Description

This course will use a hands-on approach to investigate concepts and develop skills needed for the isolation, identification and classification of microorganisms. Classical, molecular, and bioinformatic techniques will be used to isolate and identify bacteria and viruses from natural environments.

Pre-Requisites: MICR*2430, (MBG*3080 or MICR*3240)

Co-Requisites: MBG*3350

1.2 Course Description

Building on introductory microbial techniques, students will merge microbiological, molecular and chemical techniques to explore antimicrobial diversity in soil. Students will learn to pose scientific questions and hypotheses and think critically as they seek to isolate, identify and analyze antimicrobial producing bacterial species.

1.3 Timetable

- **Lecture:** Wednesday, 09:30AM - 10:20AM. On-line by Zoom. This should be considered as your weekly "lab meeting" - not always a "lecture", and not a "pre-lab talk", but an opportunity for us discuss the laboratory work, deal with questions and analyse research plans, methods, and results, and to consider the skills that you are developing. It is a required class meeting. As well as this

meeting, there will be short asynchronous videos available for you to view in your own time to enhance your understanding of concepts taught in class.

- **Virtual Laboratories!**: Monday & Wednesday 02:30PM - 05:20PM OR Tuesday & Thursday 02:30PM - 05:20PM on-line in assigned Zoom break out rooms. This is your scheduled opportunity to complete group work, discussions and other activities, where your instructor and TAs will be available to help you. Attendance is mandatory.
 - **Please note that your first virtual laboratory is scheduled for the first time slot after the initial lab meeting on January 13th.**
- **IMPORTANT!** Your participation in the laboratory work and satisfactory completion of the required work and reports is mandatory. Should you find yourself unable to attend your scheduled virtual laboratory or to meet any course requirement because of illness or compassionate reasons, you should advise Dr. Allen-Vercoe or Amanda van der Vinne in a timely manner.

1.4 Final Exam

There is no final exam for this on-line course. Instead, assessments of your individual and group work will be made throughout the semester that will contribute to your final grade.

2 Instructional Support

2.1 Instructional Support Team

Instructor:	Dr. Emma Allen-Vercoe
Email:	eav@uoguelph.ca
Telephone:	5198244120
Office:	SSC 3252
Office Hours:	Wednesdays after class (until 11am), or by appointment (please request by email)
Lab Co-ordinator:	Amanda van der Vinne
Email:	avander@uoguelph.ca
Office Hours:	Request an appointment by email and a virtual meeting will be arranged.

3 Learning Resources

Your teaching team has been working very hard to produce data for use this semester that have never been seen before, so although you will not actually be in the lab carrying out the hands-on bench research, we hope that the element of discovery will still be very much alive

for this course, and will stimulate your learning. As a group, you will have the opportunity to develop an experiment that will be carried out by your TAs so that you will also have some control over data collection.

3.1 Required Resources

Tiny Earth Manual (Textbook)

Tiny Earth - A Research Guide to Studentsourcing Antibiotic Discovery. Hernandez, Tsang, Bascom-Slack, Broderick and Handelsman. Available for purchase from the University of Guelph Book Store.

Courselink (Website)

<https://courselink.uoguelph.ca>

The course website (MICR*3430) is on the University's Courselink site. Please check it at least weekly for laboratory updates, course information, readings and other resources.

3.2 Recommended Resources

A Student Handbook for Writing in Biology (Textbook)

Knisely, Karin. 2017. A Student Handbook for Writing in Biology. 5th edition. Sinauer.

Norton's Microbiology, an Evolving Science (Textbook)

Microbiology, an Evolving Science, 5th edition. Slonkzewski, Foster and Zinser. ISBN-13: 978-0393420012. If you have an earlier edition of the this text, this will also serve you well.

Bergey's Manual of Determinative Bacteriology.

<https://onlinelibrary.wiley.com/doi/book/10.1002/9781118960608>

4 Learning Outcomes

4.1 Course Learning Outcomes

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

1. Demonstrate advanced, contemporary and practical skills and knowledge in microbiology
 2. Work safely and effectively in the laboratory, with good understanding of biohazards
 3. Perform, analyze and troubleshoot experimental approaches and outcomes
 4. Design and implement experimental work that will answer specific questions or hypotheses
 5. Record and communicate scientific results in a professional manner
 6. Work independently, in an effective, ethical, and collegial manner
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5 Teaching and Learning Activities

A week-by-week outline of the work for this course is given as a table later in this outline. Some familiar procedures (pure culture isolations, aseptic technique, inoculations, biosafety) from MICR*2430 Methods in Microbial Culture & Physiology (formerly: MICR*2430 Microbiology Methods 1) are a starting point for more detailed work on the isolation, characterization and identification of microorganisms. We will also spend some time considering the elements of effective design of experimental studies and how scientific results are recorded and reported. In the last few weeks of the course, your group will design an experiment for your assigned TA to carry out for you. Your results and interpretations will be presented in the form of a poster and a short presentation that will be graded by your instructors as well as your peers.

5.1 Course Presentation

- This is an applied course where you will use the techniques you have learned already in earlier courses, and synthesize it with theoretical knowledge to further support/provide insight into understanding of soil ecology and diversity. Through studying a variety of soil samples and isolates found in them we are providing data to a large global project on antimicrobial discovery. Whether novel antimicrobials are identified or not you are providing valuable data to help understand environments where there may be potential for identifying new antimicrobials. This study is in partnership with Tiny Earth® an international initiative to have students crowdsource discovery for new antibiotics. Ten soil samples have been sourced from coast to coast across Canada; data has been collected for isolates from each of these samples and it is now up to you to “hunt for antibiotics”. You will choose your own adventure and ‘own’ the data that are presented to you. In selecting a location you will become part of a team of researchers studying that soil sample. You will have to communicate with them about your results to gain a deeper understanding of the isolates that have been identified but you will also have to communicate with other groups to understand bacterial diversity between soil samples from different locations across Canada.

Activities

Summary of activities

Week	Theme	Class Activities	Reading	Assessments	Other required tasks

1 (week of Jan 11th)	Introduction to Lab safety audit the course Biosafety		<ul style="list-style-type: none"> • Section 1: Living on a Bacterial Planet (p19-23) • Section 2: More Than Just "Dirt" (p 24-28) 	Lab safety audit report	Review sample site 'postcards' and select site (Students who do not select a site will be allocated at random.)
2 Week of Jan 18th	Soil sampling	For each group: calculating CFU/g; preparation of soil analysis report	<ul style="list-style-type: none"> • Section 3: Redefining "Growth" and "Culture" (p32-41) • Section 4: Bacteria Are What They Eat, Too (p42-47) 	Written report: soil sampling, characteristics, CFU/g calculations, comparison across sampling sites (students will be given access to each of the datasets and need to compare & contrast their sample to others)	
3, 4 Week of Jan 25th, Feb 1st	Working with isolates	Biochemical test quiz Biochemical test lab notebook	<ul style="list-style-type: none"> • Section 8: Getting to Know Your 	Record Results in Lab Notebook; discuss results with classmates; submit report	Select a colony you want to work on

		BLAST analysis			
		Microbial characteristics and identification report		Isolates (p80-89)	
				• Section 11: "Classic" versus "Modern" (p106-111)	
5	Canadian soil in context	Microbial diversity across Canada analysis and report		Record Results in Lab Notebook; discuss results with classmates; submit report	Select an ESKAPE pathogen
Week of Feb 8th		Preparation of ESKAPE pathogen poster		• Section 6: Meet the ESKAPE Pathogens (p56-61)	
6	Control the TA	ESKAPE test notebook entry		Submission of ESKAPE poster, notebook entry	Selection of strain for genome sequence analysis
Week of Feb 22nd (week of Feb 15th is Reading Week)		Start of SOP design		• Section 7: Antibiotics' Discovery, Structure & Targets (p64-79)	
				• Relevant protocols	
7	Selected genome analysis	Use of kBASE to process data and development of 'how to' document	kBASE tutorials and 'ReadMe's	Submission of draft SOP for review & feedback	Provision of genomic sequencing data
Week of March 1st	Control the TA continued				
		Comparative		Submission of	

		genomics		'how-to' genome analysis document
		Introduction to AntiSMASH		
8	Bioinformatics and data	Continued use of kBASE	Literature to be provided	Submission of final version SOP
Week of comparisons				
March 8th		Continued use of anti-SMASH		
		Begin to work on cumulative poster		
9-10 weeks of March 15th, 22nd	TAs run SOPs (week 9). Data return and group analysis (week 10)	TAs will follow prepared SOPs 'to the letter' to carry out experiments. Data will be recorded as instructed and provided to each group for analysis	Literature to be provided	Submission of genome report
		Continue to work on cumulative poster		
week 11	Wrapping up	Final Analysis of Control the TA experiment	Literature to be provided	Submission of Control the TA final report
Week of March				Submission of

29th

poster,
presentation.

Week 12 Posters and presentations Grading of posters and 5 min n/a

Peer grading

Week of April 5th presentation per student. Each 'session' has 1 student from each soil group present (so not too repetitious for the students). Posters and presentations submitted ahead of time and graded asynchronously

5.2 Summary of Required Reports/assignments

Theme	Format	%	Notes
Lab safety and skills	Courselink quiz, safety audit report	5	
Soil analysis	Benchling notebook entry, group soil analysis report	10	
Assigned isolate	Benchling notebook entry, Courselink quiz, isolate report	10	

Theme	Format	%	Notes
Microbial soil diversity	Benchling notebook entry, Group report	5	
ESKAPE pathogens	Benchling notebook entry, poster, peer review	10	Prizes awarded for the best ESKAPE posters
Genomic analysis	Reports (how-to document, and final report)	10	
Control the TA	SOP, results assessment, TA assessment	15	
Cumulative presentation	Poster, oral presentation, peer review	25	Will be shared with soil samplers!
Continual assessment	Participation/engagement, database entries, leadership assessment	10	

6 Assessments

There are no midterm or final exams for this course. Some assessments will be individual, but the bulk of the analyses will be completed as a group. Groups will be assigned during the first week.

6.1 Assessment Details

assessments (100%)

Theme	Format	%	Notes
Lab safety and skills	Quiz (individual), report (individual)	5	
Soil analysis	Notebook entry (individual), report (group)	10	
Assigned isolate	Notebook entry (individual), report	10	

	(individual)		
Microbial soil diversity	Report (group)	5	
ESKAPE pathogens	Notebook entry (individual), poster (individual)	10	Prizes!
Genomic analysis	Report (group)	10	
Control the TA	SOP (group), results assessment (group), feedback from the TA	15	
Cumulative presentation	Poster, oral presentation, peer review (all individual)	25	Will be shared with soil samplers!
Continual assessment	Participation/engagement, database entries, leadership assessment	10	

7 Course Statements

7.1 Mandatory Meeting Times

You are expected to be virtually present as part of your group for your assigned, scheduled section. You should also be present for the lab meetings on Wednesday mornings. All other work can be completed outside of formal meeting times using the resources provided.

7.2 Laboratory Safety

As this is a virtual course, you do not need to be concerned with day-to-day lab safety, although we will explore lab safety early in the course.

7.3 Laboratory Access

Because of pandemic restrictions, this course will be delivered virtually. There will be no requirement to visit the laboratory in person.

7.4 Laboratory Notebook

You will use a (free) electronic notebook for this course. Pages from this can be extracted as PDF files and uploaded to Dropbox on Courselink for grading.

7.5 Late & Missing Submissions

Please advise the instructor and/or lab coordinator promptly, by email, if you have missed graded work for illness or compassionate reasons so that accommodation arrangements can be made. Without acceptable reasons, missed work will be graded “zero”, while formal reports may be accepted up to 1 week late, with a penalty of 10% / day.

8 Department of Molecular and Cellular Biology

Statements

8.1 Academic Advisors

If you are concerned about any aspect of your academic program:

- Make an appointment with a program counsellor in your degree program. [B.Sc. Academic Advising](#) or [Program Counsellors](#)

8.2 Academic Support

If you are struggling to succeed academically:

- Learning Commons: There are numerous academic resources offered by the Learning Commons including, Supported Learning Groups for a variety of courses, workshops related to time management, taking multiple choice exams, and general study skills. You can also set up individualized appointments with a learning specialist. <http://www.learningcommons.uoguelph.ca/>
- Science Commons: Located in the library, the Science Commons provides support for physics, mathematic/statistics, and chemistry. Details on their hours of operations can be found at: <http://www.lib.uoguelph.ca/get-assistance/studying/chemistry-physics-help> and <http://www.lib.uoguelph.ca/get-assistance/studying/math-stats-help>

8.3 Wellness

If you are struggling with personal or health issues:

- Counselling services offers individualized appointments to help students work through personal struggles that may be impacting their academic performance. <https://www.uoguelph.ca/counselling/>

- Student Health Services is located on campus and is available to provide medical attention. <https://www.uoguelph.ca/studenthealthservices/clinic>
- For support related to stress and anxiety, besides Health Services and Counselling Services, Kathy Somers runs training workshops and one-on-one sessions related to stress management and high performance situations. <http://www.selfregulationskills.ca/>

8.4 Personal information

Personal information is collected under the authority of the University of Guelph Act (1964), and in accordance with Ontario's Freedom of Information and Protection of Privacy Act (FIPPA) <http://www.e-laws.gov.on.ca/index.html>. This information is used by University officials in order to carry out their authorized academic and administrative responsibilities and also to establish a relationship for alumni and development purposes.

For more information regarding the Collection, Use and Disclosure of Personal Information policies please see the Undergraduate Calendar. (<https://www.uoguelph.ca/registrar/calendars/undergraduate/current/intro/index.shtml>)

9 University Statements

9.1 Email Communication

As per university regulations, all students are required to check their e-mail account regularly: e-mail is the official route of communication between the University and its students.

9.2 When You Cannot Meet a Course Requirement

When you find yourself unable to meet an in-course requirement because of illness or compassionate reasons please advise the course instructor (or designated person, such as a teaching assistant) in writing, with your name, id#, and e-mail contact. The grounds for Academic Consideration are detailed in the Undergraduate and Graduate Calendars.

Undergraduate Calendar - Academic Consideration and Appeals
<https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-ac.shtml>

Graduate Calendar - Grounds for Academic Consideration
<https://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/index.shtml>

Associate Diploma Calendar - Academic Consideration, Appeals and Petitions
<https://www.uoguelph.ca/registrar/calendars/diploma/current/index.shtml>

9.3 Drop Date

Students will have until the last day of classes to drop courses without academic penalty. The deadline to drop two-semester courses will be the last day of classes in the second semester.

This applies to all students (undergraduate, graduate and diploma) except for Doctor of Veterinary Medicine and Associate Diploma in Veterinary Technology (conventional and alternative delivery) students. The regulations and procedures for course registration are available in their respective Academic Calendars.

Undergraduate Calendar - Dropping Courses

<https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-drop.shtml>

Graduate Calendar - Registration Changes

<https://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/genreg-reg-regchg.shtml>

Associate Diploma Calendar - Dropping Courses

<https://www.uoguelph.ca/registrar/calendars/diploma/current/c08/c08-drop.shtml>

9.4 Copies of Out-of-class Assignments

Keep paper and/or other reliable back-up copies of all out-of-class assignments: you may be asked to resubmit work at any time.

9.5 Accessibility

The University promotes the full participation of students who experience disabilities in their academic programs. To that end, the provision of academic accommodation is a shared responsibility between the University and the student.

When accommodations are needed, the student is required to first register with Student Accessibility Services (SAS). Documentation to substantiate the existence of a disability is required; however, interim accommodations may be possible while that process is underway.

Accommodations are available for both permanent and temporary disabilities. It should be noted that common illnesses such as a cold or the flu do not constitute a disability.

Use of the SAS Exam Centre requires students to book their exams at least 7 days in advance and not later than the 40th Class Day.

For Guelph students, information can be found on the SAS website
<https://www.uoguelph.ca/sas>

For Ridgetown students, information can be found on the Ridgetown SAS website
<https://www.ridgetownc.com/services/accessibilityservices.cfm>

9.6 Academic Integrity

The University of Guelph is committed to upholding the highest standards of academic integrity, and it is the responsibility of all members of the University community-faculty, staff, and students-to be aware of what constitutes academic misconduct and to do as much as possible to prevent academic offences from occurring. University of Guelph students have the responsibility of abiding by the University's policy on academic misconduct regardless of

their location of study; faculty, staff, and students have the responsibility of supporting an environment that encourages academic integrity. Students need to remain aware that instructors have access to and the right to use electronic and other means of detection.

Please note: Whether or not a student intended to commit academic misconduct is not relevant for a finding of guilt. Hurried or careless submission of assignments does not excuse students from responsibility for verifying the academic integrity of their work before submitting it. Students who are in any doubt as to whether an action on their part could be construed as an academic offence should consult with a faculty member or faculty advisor.

Undergraduate Calendar - Academic Misconduct

<https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-amisconduct.shtml>

Graduate Calendar - Academic Misconduct

<https://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/index.shtml>

9.7 Recording of Materials

Presentations that are made in relation to course work - including lectures - cannot be recorded or copied without the permission of the presenter, whether the instructor, a student, or guest lecturer. Material recorded with permission is restricted to use for that course unless further permission is granted.

9.8 Resources

The Academic Calendars are the source of information about the University of Guelph's procedures, policies, and regulations that apply to undergraduate, graduate, and diploma programs.

Academic Calendars

<https://www.uoguelph.ca/academics/calendars>

9.9 Disclaimer

Please note that the ongoing COVID-19 pandemic may necessitate a revision of the format of course offerings and academic schedules. Any such changes will be announced via CourseLink and/or class email. All University-wide decisions will be posted on the COVID-19 website (<https://news.uoguelph.ca/2019-novel-coronavirus-information/>) and circulated by email.

9.10 Illness

The University will not normally require verification of illness (doctor's notes) for fall 2020 or winter 2021 semester courses. However, requests for Academic Consideration may still require medical documentation as appropriate.
