



# MICR\*3430 Advanced Methods in Microbiology

Winter 2024

Section(s): 01

Department of Molecular and Cellular Biology

Credit Weight: 0.75

Version 1.00 - January 03, 2024

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## 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:** Monday, 09:30AM - 10:20AM, CRSC116. 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 may be short asynchronous videos available for you to view in your own time to enhance your understanding of concepts

taught in class.

Please note - some meetings will be on Zoom. You will receive notice and a zoom link through Courselink.

- **Laboratories:** Monday & Wednesday 02:30PM - 05:20PM OR Tuesday & Thursday 02:30PM - 05:20PM OR Tuesday & Thursday 10:00AM - 12:50PM, SSC4110. This is your scheduled opportunity to complete independent lab components and group work, discussions and other activities, where your instructor and TAs will be available to help you. Attendance is mandatory. There may be other times where you may need to attend to lab activities outside of the scheduled lab periods.

**Labs will commence on January 8, 2024**

- **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 laboratory or to meet any course requirement because of illness or compassionate reasons, you should advise Amanda van der Vinne in a timely manner.

## 1.4 Final Exam

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

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## 2 Instructional Support

### 2.1 Instructional Support Team

<b>Instructor:</b>	Amanda van der Vinne
<b>Email:</b>	avander@uoguelph.ca
<b>Office:</b>	SSC 3519
<b>Office Hours:</b>	By appointment; please request by email.

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## 3 Learning Resources

This semester you will be participating in Tiny Earth, an international network of students conducting research on soil to identify novel antibiotics. As part of this research project you will be studying isolates from a soil sample collected from a unique location within Canada and it is your responsibility to accurately record and report on your findings. In addition to the resources listed below you will need to have access to a computer so that you can record data in an electronic lab notebook and access scientific journals for research on topics and experimental protocols so that you can design a research project to be carried out on the selected organisms of interest.

### 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 Bookstore.

#### **Courselink (Website)**

<https://courselink.uoguelph.ca>

The course website (MICR\*3430) is on the University's Courselink site. It must be checked at least weekly for laboratory updates, course information, readings and other resources.

#### **Lab Materials (Other)**

All students will be required to have a lab coat and an ultra-fine point 'Sharpie' marker.

Safety glasses will be required for some protocols conducted in lab. There are some safety glasses available in the lab. If you have your own you are advised to bring them with you to lab.

### 3.2 Recommended Resources

#### **A Student Handbook for Writing in Biology (Textbook)**

Knisely, Karin. 2021. A Student Handbook for Writing in Biology. 6th edition. Sinauer.

An earlier edition is fine.

#### **Norton's Microbiology, an Evolving Science (Textbook)**

Microbiology, an Evolving Science, 6th edition. Slonkzewski, Foster and Zinser. ISBN-13: 978-0-393-89288-8. 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>

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## 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 or additional methods in a professional manner. This includes lab notes as well as written, oral and poster presentations.
  6. Work independently and collaboratively, in an effective, ethical, and collegial manner
  7. Demonstrate effective time management skills as demonstrated by meeting lab and assignment deadlines
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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. As you are conducting primary research the schedule may change. Any changes will be posted to Courouselink as we progress through the semester. Some familiar procedures (pure culture isolations, aseptic technique, inoculations, biosafety) from MICR\*2430 Methods in Microbial Culture & Physiology 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 second half of the course, your group will design an experiment to be carried out. As a culminating assignment you will select some of your work over the course of the semester to present 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 as well as antimicrobial resistance.. 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.  
Soil samples have been sourced from coast to coast across Canada. It is up to you to collect and analyze data on soil isolates from these samples as you “hunt for antibiotics”. 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.
- The activities below are a flow chart of the semester and are subject to change based

on where the science and data lead us. CourseLink will always have the most up-to-date learning schedule for the semester.

- Additional Literature sources will be listed on CourseLink

#### Activities

Week	Lecture/meeting	Day 1 lab	Day 2 lab	Reading	Assignments due
January 8 <sup>th</sup>	Course overview  Expectations	Lab skills brush up: liquid handling, aseptic technique, colony patching and streaking.  Group selection and group leader nominations. Soil site selection	Serial dilutions and plating with soil samples, incl. endospore treatment.	TE pages 4-18 and section 1	Notebook:  Lab skills write-up – write a protocol for serial dilution and plating
January 15 <sup>th</sup>	Soil microbial ecology	Picking and patching colonies,	Soil report preparation  Centre streak for ESKAPE test	TE sections 2, 3, 4	Notebook check
January 22 <sup>rd</sup>	Guest Lecture:  Dr Kevin Stinson; Program Manager Infection Control, St Mary's Hospital  Antimicrobial Resistance	Cross streaking plates with ESKAPE standards	Re-streaking of strains for purity checks and in preparation for Sanger templates  Gram stains	TE sections 5&6	Notebook check;  Soil report
January	Clones, strains &	16S rRNA gene	PCR amplicon	TE section	Notebook check

29 <sup>th</sup>	<p>species – know what you are working with!</p> <p>Did you isolate a novel species? How can you tell?</p> <p>(overview/refresher of taxonomy and the Bacteriological Code)</p>	<p>amplification for Sanger using crude colony extracts of interesting strains (~10 per group); start brainstorming experimental plans</p> <p>Gram stains</p>	<p>gel check; submit for Sanger sequencing. Making freezer stocks of interesting strains (flash-freezing method)</p> <p>Gram stains</p>	7&8	
February 5 <sup>th</sup>	Designing a scientific research project	<p>BLASTing sequences to ascertain strain closest species IDs. Discussion within group of experimental plan</p>	<p>Continued discussions and write-up of experimental plan</p> <p>Start growth of isolates to be studied</p>	TE sections 9 & 10	<p>Notebook check;</p> <p>Experimental proposal/draft plan</p>
February 12 <sup>th</sup>	<p>Guest Lecture:</p> <p>Dr. Gerry Wright; Scientific Director IIDR McMaster; Executive Director of the Global Nexus School for Pandemic Prevention &amp; Response</p> <p>Isolation of secondary metabolite compounds from microbial species</p>	<p>Short and structured presentation to the class of group findings so far</p> <p><i>This will be assessed to provide a midterm grade</i></p> <p>Project – feedback from course instructors</p>	<p>Project - preparation of materials, plan of action.</p> <p>Create a detailed list of required materials</p>		<p>Notebook check;</p> <p>Isolates report;</p> <p>TE database entry</p>

		on experimental plan, brainstorming and approval			
February 19th	READING WEEK – NO CLASSES/LABS				
February 26 <sup>th</sup>	<p>Guest Lecture:</p> <p>Haley Zubyk; PhD candidate, Wright Lab, McMaster University</p> <p>Antibiotic Dereplication Platform (ARP)</p>	<p>Project and bioinformatics</p> <p>(Nominated team member leader 1)</p>	<p>For the second half of the course, refer to research protocols in Part II of TE manual, as required.</p>	Notebook check	
March 4 <sup>th</sup>	<p>Notable natural products from soil microbes</p> <p>Lab meeting: Discussion of lab techniques/theory as appropriate; brainstorming of ideas; troubleshooting; interesting AMR topics as they arise</p>	<p>Project and bioinformatics</p> <p>(Nominated team member leader 2)</p>	<p>Also look to the literature for ideas. Discuss with your instructors and TAs</p>	Notebook check	
March 11 <sup>th</sup>	<p>Bioinformatics</p> <p>Guest Lectures:</p> <p>Statistical analysis in biological science projects</p>	<p>Project and bioinformatics</p> <p>(Nominated team member leader 3)</p>		Notebook check; Bioinformatics report	
March 18 <sup>th</sup>		Wrap up of bench work		Notebook check	

	Anti-fungals and anti-virulence	(Nominated team member leader 4)		
March 25 <sup>th</sup>	Adjuvant Discovery  Lab meeting: Discussion of lab techniques/theory as appropriate; brainstorming of ideas; troubleshooting; interesting AMR topics as they arise	Time set aside for group project write-up		Group project report
April 1st	Drop in 3MT practice session or poster discussion for instructor feedback_	Individual 3MT presentations		PEAR assessment; individual poster

## 5.2 Summary of Required Reports/assignments

Theme	Format	%
Pre-lab quizzes (weeks 1-5)	Quiz hosted on Courselink	5
Soil analysis report	Group Report	7.5
Isolates report	Group report	7.5
Structured presentation to group (midterm)	Group presentation	7.5
Bioinformatics report	Group report	7.5



Final Project report	Group report	15
Final Poster	Individual poster	20
3MT presentation	Individual oral presentation	10
Peer review score from 3MT/poster	PEAR	5
Notebook quality	Weekly notebook checks	10
Participation/engagement, leadership/teamwork assessment	Continual assessment (instructors) + PEAR	5

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## 6 Assessments

There are no midterm or final exams for this course. Assessments will be a mix of individual and collaborative group work. Groups will be assigned during the first week of the semester.

### 6.1 Assessment Details

#### assessments (100%)

Theme	Format	%
Pre-lab quizzes (weeks 1-5)	Quiz hosted on Courselink	5
Soil analysis report	Group Report	7.5
Isolates report	Group report	7.5
Structured presentation to	Group presentation	7.5

group (midterm)		
Bioinformatics report	Group report	7.5
Final Project report	Group report	15
Final Poster	Individual poster	20
3MT presentation	Individual oral presentation	10
Peer review score from 3MT/poster	PEAR	5
Notebook quality	Weekly notebook checks	10
Participation/engagement, leadership assessment	Continual assessment (instructors) + PEAR	5

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## 7 Course Statements

### 7.1 Mandatory Meeting Times

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

### 7.2 Laboratory Safety

You will be working in a biosafety lab and as such you need to follow all biosafety protocols. During the first week of the semester lab safety will be reviewed; your TAs will also alert you to safety features within the lab and provide instructions on disposal of biological and chemical waste.

In keeping with laboratory safety, you will require a laboratory coat for all lab sessions and may require goggles for some experimental protocols.

### 7.3 Laboratory Access

You will have access to the labs during your scheduled lab section. There may be times that work outside of these hours may be required. Instructions about these requirements will be provided in lab and on Courselink.

### 7.4 Laboratory Notebook

You will use a (free) electronic notebook for this course.

You are conducting primary research. Keeping detailed accurate notes is a requirement and your electronic lab notebook will be monitored by the teaching team. Additionally, the notes you take may be referenced in subsequent semesters as we continue to study the unique isolates you identify.

### 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>)

### 8.5 Course Offering Information Disclaimer

Please note that course delivery format (face-to-face vs online) is subject to change up to the first-class day depending on requirements placed on the University and its employees by public health bodies, and local, provincial and federal governments. Any changes to course format prior to the first class will be posted on WebAdvisor/Student Planning as they become available.

## 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 make a booking at least 14 days in advance, and no later than November 1 (fall), March 1 (winter) or July 1 (summer). Similarly, new or changed accommodations for online quizzes, tests and exams must be approved at least a week ahead of time.

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 Illness**

Medical notes will not normally be required for singular instances of academic consideration, although students may be required to provide supporting documentation for multiple missed assessments or when involving a large part of a course (e.g.. final exam or major assignment).

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