

**University of Guelph  
College of Biological Science  
Department of Molecular and Cellular Biology**

**COURSE OUTLINE**

**MICR\*3430 Advanced Methods in Microbiology (1-6) [0.75]**

**Winter 2018** (Jan 08, 2018 – Apr. 04, 2018; **Final Exam: 11:30 am -1:30 pm, 2018/04/17**)

**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.

Prerequisites: MBG\*3080 Bacterial Genetics, MICR\*2430 Methods in Microbial Culture & Physiology

Co-requisite: MBG\*3350 Laboratory Methods in Molecular Biology

**Teaching Team:**

Professor: Dr. Lucy Mutharia email: [lmuthari@uoguelph.ca](mailto:lmuthari@uoguelph.ca) Tel: ext 56349  
Office- SSC 3253 (Office hours by appointment)

Laboratory Instructor: Debra Flett email: [dflett@uoguelph.ca](mailto:dflett@uoguelph.ca)

Teaching Assistants: M. Goodyear & S. Yen

**Course Schedule:**

**Laboratories: Monday & Wednesday OR Tuesday & Thursday 2:30 - 5:20 pm SSC 4110**

***Please note that there WILL be full labs on Monday Jan. 08 –to- Thurs. Jan 11!***

Come to the lab SSC 4110, with your lab-coat, a new laboratory notebook (blue hardcover, bound, 8" x 10" page size), permanent marker for plates and tubes, and a pen for your notes (black ink preferable). Students wearing open shoes (exposing skin on tops of feet, soles, toes or heel) **will not be allowed** in the lab.

**Lecture: Wednesday 9:30 - 10:20 am MCKN227 (MACKINNON)-** 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.

**IMPORTANT!** This is a **laboratory-intensive course** and, as such, **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 Dr. Mutharia or Debra Flett in a timely manner.

**Course Content:** A week-by-week outline of the laboratory work in 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 4 weeks of the course, you will carry out and report on a small project **of your own design**, based on work done in earlier weeks.

### Course Presentation:

As the laboratory work involves isolation, growth and characterization of live microbes from natural environments, **you need to recognize that microbes don't grow according to class schedules!** You should expect to visit the laboratory and your cultures two or three days after your formal lab session to record results and transfer isolates. For safety and supervision reasons, you will do this work *only during the regular Monday to Friday hours of 8:30 am to 5 pm.*

In this course, you are going to be “doing science”, rather than performing a series of demonstrations or “canned experiments”, and the emphasis and the style of working is based on how “real” science is done. So the way things turn out may be unexpected – that’s the first lesson you will learn. The second lesson is that it is **your** responsibility to do assigned preparatory work for each week *and* to take personal responsibility for reading background information, both assigned and what you yourself require to have a good understanding of what you are doing in the laboratory. Much of the information that you need to is in the course manual or will be posted on the CourseLink site as we go.

### Learning Outcomes:

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

### Course Resources:

#### Required texts:

Laboratory Manual for MICR\*3430 Microbiology Methods II – (2017), Department of Molecular and Cellular Biology, University of Guelph. *Available for purchase from the Department.*

Knisely, Karin. 2013. A Student Handbook for Writing in Biology. 4th edition. Sinauer.

#### Recommended reference:

Madigan MT, JM Martinko, KS Bender, DH Buckley, DA Stahl, DP Clark. 2015. Brock Biology of Microorganisms 14e, Pearson. (used in other 3000-level courses; the 13e is acceptable).

Bergey's manual for determinative bacteriology (on reserve in the library)

**CourseLink:** 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.

**METHODS OF ASSESSMENT**

As this is a **laboratory-intensive course**, a significant part of your grade will be based on your laboratory competency and comprehension – that is, do you do the work well, in a professional manner and following lab biosafety practices, and do you know what you are doing?

While you are welcome to collaborate with other students in doing some of the “hands-on” work, and to effectively discuss your ideas and results in a collegial and productive manner, please keep in mind that **the assessment of work in this course is INDIVIDUAL**.

It’s **your** lab-book, **your** cultures and results, **your** written submissions, **your** work that determines **your** grade, **not** group work.

Assessment	Weight	How and when assessed	Learning outcome
Laboratory work	35%	throughout the term, with skills tests, culture and date submissions, laboratory notebook checks, short written assignments	Practical skills demonstrated and understood; scientific laboratory record maintained
Laboratory reporting	45%	formal written laboratory reports. The topics, values and due dates are listed below	Ability to clearly and accurately present and discuss scientific results, using standard formats  Ability to design, carry out and report an independent scientific study.
Final examination	20%	Written final exam – selection of questions asking for explanations or applications of techniques used in the lab and/or experiment design	Comprehension and application of techniques and experimental approaches

**Details of Assessments:**

**(1) Laboratory tasks: (35%)** During the term, you will have specific tasks to perform, which will be assessed towards your grade. Your **laboratory notebook** – comprehensive, clear and kept up-to-date – is an essential part of this performance demonstration. This Lab book will be reviewed at intervals and must be submitted at the end of the laboratory work. Skills tests and tasks accomplished will earn credits, and you will also write brief progress reports, quizzes and/or reflections related to the assigned work.

**(2) Laboratory reporting: (45%)** During the semester, you will submit **formal reports** on your work and on the independent study that you will design and carry out, as listed below. Your laboratory notebook must verify the data which you report, and you will submit cultures and/or other data (e.g. photographs) as part of those reports. Specific format information for reports will be posted on CourseLink. Please see the list of Graded reports for Winter 2018 that follows the Laboratory Schedule. This includes an independent hands-on project for 15% of the grade.

**(3) Comprehension and applications: (20%)** There will be a **final examination**, intended to assess your understanding of the course material and ability to apply what you have learned to experimental situations.

**Final Examination:** Date: 17 April, 2018. Time: 11:30 am -1:30 pm; Venue: TBA

Grading in the course is based on the defined standards for each of the numerical grade ranges (letter grades) described in the Undergraduate Calendar ([VIII Grades](#)).

#### **ADDITIONAL COURSE-SPECIFIC INFORMATION AND POLICIES:**

**1. Mandatory laboratory:** As this is a laboratory-intensive course, **you must participate in the laboratory work and show satisfactory completion of the required work and reports in order to pass the course.** 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 Dr. Mutharia or Debra Flett in a timely manner. You are expected to be present for the beginning of each one of your scheduled laboratories to ensure you have complete instructions.

**2. Laboratory safety:** Detailed information about general safety and biosafety practices is given in the course manual, and it is *your* responsibility to read this material *and* follow the practices described. **It is a condition of working in the laboratory** that you will have appropriate dress (lab-coat, shoes, etc.), will carry out your activities in the laboratory in a safe and responsible manner, and will show a professional level of respect for the laboratory, its equipment, and the work of your colleagues.

**3. Laboratory Access:** Under MCB department policy, undergraduates working laboratories must be supervised. *If it is absolutely necessary*, you are welcome to work in the laboratory outside your scheduled laboratory time, but *you must not be the only person* in the lab and you may only work **during regular weekdays from 8:30 am to 5:00 pm.** The laboratory is **not available** in evenings, *nor* on weekends *or* holidays, *nor* during another section's scheduled lab.

**4. Laboratory notebook:** It is essential that you keep an up-to-date, professional record of the work you do in the laboratory and that that record be available for inspection by the course instructors and assistants. For the purposes of this course, the record is a written record and written in ink, kept in a standard, dedicated Lab notebook, and kept up to date **during** your work. That is, do **not** make "rough notes" with the intention of making a "good copy" in your book later.

**5. Late and 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 2 marks per each day late.*

**6. Use of resources provided:** Please use only the equipment and supplies provided for this course in doing your work ... that is, it is quite improper to swipe stuff from a research or testing laboratory for your course work, or have your friend run your samples on their gee-whiz machines!

**W2018 SCHEDULE OF LABORATORY WORK (*subject to revision*)**

Week #	Dates	In lab	during the week	Items Due in Lab THIS week
1	Jan 8-11	Safety and procedures review  Lab Notebook  Belly button cultures – (individually)  Indoor Environment Project “design” and sampling (done with a partner)  Isolations of Gram-negative bacteria ( <i>Enterobacteriaceae</i> )	Observe & record belly button cultures (individually)    Examine plates from week 1 experiment; from these plates <b>select 6</b> colonies and re-streak for pure cultures.	-
2	Jan 15-18	<b>Visit: MCB Prep Room</b> Soil isolations for endospore-formers and actinomycetes  Inoculate <u>primary</u> biochemical tests for G- isolates	<b>Select 6 Gram-positive</b>  Try re-isolations if needed <b>Read</b> test results for Gram-negatives – <b>select 3 isolates</b> , <u>look for ones that use glucose!</u>	<b>SAFETY QUIZ</b>  Lab book check
3	Jan 22-25	Continue characterization of 3 selected Gram-negative isolates by morphology and secondary biochemical tests;  Morphology; Phase microscopy & photography of Gram-positives  Set up <b>Cyanobacteria</b> cultures.	Examine plates; pure culture isolations; <b>Select spore-former cultures from plates (~3 cultures)</b>	<b>Design project reports</b> due (individual)  <b>Phase microscopy proficiency test</b> – 1 <sup>st</sup> week, to be completed <b>by</b> week 7
4	Jan 29-Feb.01	<b>Endospore-former tests</b>	Have a <u>fresh</u> Gram-negative culture for DNA isolation ( <u>one</u> of your 3) and API	
5	Feb 5-8	<b>Visit: Fish Health Lab</b>  <b>Aquatic bacteria</b> isolations on low nutrient medium.  <b>DNA isolation</b> for PCR and 16S rRNA sequencing (Gram-negative isolate);  <b>API 20E test strip</b> of chosen Gram-negative isolation	continue DNA isolation, preparation for PCR run	<b>Report #1</b> on Gram-negative isolations and Identifications due, with 3 cultures.

		<b>Independent Project</b>		
6	Feb 12-15	<b>Make observations and plate counts of aquatic cultures; Choose 6 isolates</b>  Culture preservation.	Save your aquatic cultures for after the break. <b>Project proposal</b> – prepare a ~1 page written plan and discuss your proposal with instructors before Friday; submit media needs ASAP	<b>Report #2 DUE</b> <b>Project proposal DUE</b>  <b>NOTE: Lab books will be due during your lab period on Mon and Tue Feb 26 &amp; 27 (i.e. after the break). So finish up your books now!</b>
	Feb 19-23	<b>Break Week</b>		
7	Feb 26 – Mar. 01	<b>Transfer aquatics.</b> Media orders DUE  <b>Lab book DUE on Monday</b> Feb 26 & <b>Tuesday</b> Feb. 27	Examine aquatic plates;  <b>Independent Project Proposal review with instructors</b>  Planning and pilot tests as needed	- Mid-term skills reflection letter DUE
8	Mar 5-8	Begin Independent Project Work Continue other work as needed	<b>Class presentation by Dr. Durda Slavic, AHL (*to be confirmed)</b>	<b>Report #4</b> on selected Gram-negative profile DUE on the Friday. [rRNA, API]
9	Mar 12-15	Examine cyanobacteria tubes and plates  Continue other work as needed	Independent work  <b>Last week for Primary Media orders</b>	Lab-book check  <b>Report #5</b> on Aquatic heterotrophs DUE.
10	Mar 19-22	Independent Project Work	Independent project continues  <b>Last week for Secondary test orders</b>	
11	Mar 26-29  Wed Mar. 28	Labs: Independent Project Work  <b>During class-</b> present your 1 min. Elevator talk/pitch on your project	Independent project continues	<b>Report #3</b> <b>Cyanobacteria report due.</b>
12	Apr 2 & 3	<b>Independent project report and lab book to be submitted on your lab day (Apr 2 or 3) this week.</b> <b>Also submit - Skills Reflection</b> one-page Letter (see posted instructions)	Submit any cultures, and CLEAR OUT <u>all</u> other lab materials	<b>Submit the following,</b> <b>1. Report #6 on Independent Project</b>  <b>2. Lab book for grading</b>  <b>3. Skills reflection</b>

**SUMMARY OF 2018 Required Reports:** mark values as indicated for a total value of 45 marks. **All reports are due by 2:30 pm on Friday in the week indicated.**

**(1) Isolations and Identification of Gram-negative Bacteria** (8 marks, due Week 5)

Describe sources, procedures and results used to isolate 6 target Gram-negative bacteria; report on Primary test results and possible identifications of all 6; select 3 isolates that ferment glucose, and test with secondary biochemical tests. Include table of results, and identifications (with justifications). Submit 3 cultures.

**(2) Isolation of Gram-positive Bacteria** (9 marks; due in Week 6) *Short Report*

Describe sources, procedures and results for 6 Gram-positive isolates including endospore-formers and actinomycete isolations from soil. Include colony photographs from plates of both Gram-positive spore-formers and Actinomycetes, calculations from dilutions and colony descriptions; describe isolates selected from plates for further study of 3 endospore-formers - indicate codes assigned. Describe phenotypic and biochemical characterization of 3 isolates of endospore-forming aerobes or facultative anaerobes. Include information about original sources, light-microscopy micrographs, and identification and justifications. Hand in your three cultures.

**(3) Cyanobacteria** (4 marks, due Week 11)

Provide MPN results for Cyanobacteria [and do the calculations]. Describe microscopic morphology of cyanobacteria and describe any success you had in sub-culturing or other isolations. Include Cyanobacteria plate pictures and microscope photographs and attempts at identification.

**(4) Gram-negative profile** (4 marks, due Week 8)

You will select one of your Gram-negative isolates (one of your glucose fermenters!) and use it for the API 20E; DNA isolation and 16S rRNA sequencing. Report the results, including comparing with data from your initial identification report #1. **Again**, you will turn in a fresh culture of this isolate ..... showing you've kept it alive!

**(5) Aquatic Heterotrophs** (5 marks; due Week 9).

Describe sources, procedures and results for 3 aquatic heterotrophs from Speed River water samples with further characterization of one selected aquatic heterotroph. Provide the plate count results for aquatic bacteria on dilute media and do the calculations

**(6) Independent Project** (15 marks; due Week 12 **on your lab day on April 2 or 3**) - You will design and carry out a small scale experimental inquiry, which may be based on the work done in one of the earlier studies, or focus on a particular group of isolates (taxonomic study). (Please note that you **are restricted** to study isolates from soil, water and/or plant material.) This study will be your own curiosity-driven question .... aided by discussions with the instructor and TAs so that your bright ideas are triggered – *or restrained* – as needed. You will carry this work through to Week 11, and submit as a final report in your lab period, Week 12. Brief oral reports will be given in Wednesday's class in Week 12.

Also DUE on Apr. 2 or 3: **Final Reflections of Skills** self-reference Letter (value: up to 5 lab points) \_\_\_\_\_

## UNIVERSITY STATEMENTS

### Electronic recording

*Electronic recording of lectures or presentations which are made in relation to course work -is expressly forbidden except with prior consent of the instructor. When permitted, the recordings are to be used solely for the use of the authorized student and may not be reproduced or transmitted to others without the express written permission of the instructor. Please do not use electronic media in the class except for the sole purpose of the material covered (e.g. following the lecture slides or taking lecture notes)*

### E-mail communication:

As per University regulations, students are required to check their UoGuelph email account regularly: email is the official route for communication between the University (instructors) and the students.

### ABSENCE AND ILLNESS & when a student cannot meet the course requirements:

Students who miss lectures are expected to obtain the materials through reading or discussion with their colleagues. Where requested, Academic Consideration can only be given for *missed labs* providing appropriate supporting / written (and signed) documentation is submitted as soon as possible following the event/circumstance for which consideration is requested.

In the case of a missed final exam, the student must fill out a "Request for Academic Consideration" form, available in the BSc academic advising office < <http://www.bsc.uoguelph.ca/>>. Consideration is only granted by the Academic Review Subcommittee, as described in section VIII of the UofG Undergraduate Calendar, **Undergraduate degree regulations & procedures: Undergraduate Calendar**. In addition to providing information on the university academic policies and procedures, the section describes **what constitutes Academic misconduct, plagiarism & associated penalties**. Students are strongly encouraged to become familiar (and understand) this information as **ignorance of the rules is not an accepted defense for committing academic misconduct**.

### Drop Date

The last date to drop one-semester courses, without academic penalty, is the 40th class day. To confirm the actual date please see the schedule of dates in the Undergraduate Calendar. For regulations and procedures for Dropping Courses, see the Undergraduate Calendar:  
(<https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c03/c03-wintersem.shtml>)

### Accessibility

The University of Guelph is committed to creating a barrier-free environment. Providing services for students is a shared responsibility among students, faculty and administrators. This relationship is based on respect of individual rights, the dignity of the individual and the University community's shared commitment to an open and supportive learning environment. Students requiring service or accommodation, whether due to an identified, ongoing disability or a short-term disability should contact the Student Accessibility Services as soon as possible.

For more information, contact SAS at 519-824-4120 ext. 56208 or email [csd@uoguelph.ca](mailto:csd@uoguelph.ca) or see the website: [Centre for Student with Disabilities/ Student Accessibility Services \(SAS\)](#).

Other useful sites and services include, [Student Health Services](#), [Counselling Services](#) and CBS BSc student academic advising [bscweb@uoguelph.ca](mailto:bscweb@uoguelph.ca)

## **Academic Misconduct**

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 discourages misconduct. 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. The Academic Misconduct Policy is detailed in the Undergraduate Calendar at:

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

This calendar section also describes what constitutes Academic misconduct, plagiarism & associated penalties. Students are strongly encouraged to become familiar (and understand) this information as **ignorance of the rules is not an accepted defense** for committing academic misconduct.

## **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.

## **Campus Resources**

*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](#)

*If you are struggling to succeed academically:*

- 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. [The Learning Commons](#)

*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. [Counselling Services](#)
- Student Health Services is located on campus and is available to provide medical attention. [Student Health Services](#)
- 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. [Stress Management and High Performance Clinic](#)

*If you have a documented disability or think you may have a disability:*

The Centre for Students with Disabilities (CSD) can provide services and support for students with a documented learning or physical disability. They can also provide information about how to be

tested for a learning disability. For more information, including how to register with the center please see: [Centre for Students with Disabilities](#)