

**University of Guelph**  
**College of Biological Science**  
**Molecular and Cellular Biology**  
**COURSE OUTLINE**  
**MICR\*3420 Microbial Diversity**  
**Fall 2016**

**Course description:** The cycling of elements (carbon, nitrogen, sulfur) within ecosystems involves the contributions of diverse microorganisms. This course will study the diversity of Bacteria and Archaea in selected environments at an organismal level, investigate the metabolic and enzymatic diversity in microbes that contribute to and thrive within these environments, and examine the methods used to study the relationships and evolution of microorganisms within an ecosystem.

**Credit value:** 0.5

**Prerequisites:** BIOC\*3560; MCB\*2020 (or MCB\*2040); MICR\*2430


**Course Coordinator:** Dr. Emma Allen-Vercoe SCIE 3252 ext: x 53366 email: eav@uoguelph.ca

**Course schedule**

**Presentation:** 2hrs 50 minutes per week Mondays 1.30-4.20 pm SCIE 3306 (NOTE CHANGE OF ROOM)

Table 1

Date	Topics to be covered	Notes
Monday September 12 <sup>th</sup>	First day of class – my ‘rules’ and expectations of you. A tutorial on how to approach reading the literature, and on preparing to write an assignment. Recap of what you should already know about microbial diversity.	In class activities: <ul style="list-style-type: none"> <li>• Masters of grammar quiz (for fun)</li> <li>• Deconstructing the primary literature</li> </ul>
Monday September 19 <sup>th</sup>	Bacterial systematics: definitions and debates. How are new microbial species named? How many microbial species are there? What is a microbial species, anyway? And why are we only now in the golden age of microbial discovery?	In class activities: <ul style="list-style-type: none"> <li>• Requirements for naming a novel species</li> <li>• Building a phylogenetic tree</li> </ul> Please bring your laptop/tablet (with Internet connectivity) for this class, or ensure you

		can share one with a partner
Monday September 26 <sup>th</sup>	Discovering diversity – how do we measure microbial diversity? What tools can we use? How fast can microbes evolve?	In class activity: <ul style="list-style-type: none"> <li>Understanding diversity and sampling methods</li> </ul>
Monday October 3 <sup>rd</sup>	Microbial metabolic diversity: types of microbial metabolism and metabolic diversity: autotrophy, heterotrophy, chemolithotrophy, phototrophy, syntrophy etc. In detail: phototrophy	In class activity: <ul style="list-style-type: none"> <li>A brief history of (Earth) time</li> </ul>
Monday October 10 <sup>th</sup>	Thanksgiving Holiday – no classes	
Monday October 17 <sup>th</sup>	Microbial metabolic diversity continued. In detail: chemolithotrophy, fermentation	In class activity: Fermented food feast
Monday October 24 <sup>th</sup>	Midterm examination 1  Catch up class (if necessary)	Multiple choice exam, first hour of class
Monday October 31 <sup>st</sup>	Meet the microbes part 1: The Proteobacteria, Firmicutes, Tenericutes and Actinobacteria	Note: Friday Nov 4 <sup>th</sup> is the 40 <sup>th</sup> class day
Monday November 7 <sup>th</sup>	Meet the microbes part 2: the Bacteroidetes, Chlamydiae, Planctomycetes and Verrucomicrobia.	In class activity: A quick tour of the Robogut lab <ul style="list-style-type: none"> <li>Case study: should we be concerned about food additives?</li> </ul>
Monday November 14 <sup>th</sup>	Meet the microbes part 3: The hyperthermophilic bacteria and other minority groups. The Archaea.	In class activity: 'Name that Microbe' game
Monday November 21 <sup>st</sup>	Microbial metabolic diversity within elemental cycling. Emphasis on the nitrogen cycle: overview, reactions, enzymes, microbes.	In-class activity: <ul style="list-style-type: none"> <li>'Fixing' the nitrogen cycle</li> </ul>
Monday November 28 <sup>th</sup>	Midterm examination 2  More on elemental cycles: carbon, sulfur and others. Human influences on elemental cycling.	Multiple choice exam, first hour of class

		Take home final exam will be handed out at the end of class.
Friday December 2 <sup>nd</sup>	Review and catch-up class (If no class is needed, Dr. A-V will provide office hours during this time slot)	
Friday December 9 <sup>th</sup>	Take home examination/assignment due	Hand in hard copy and submit electronic version to CourseLink Dropbox.

### Office hours

There are no formal office hours for this course except for as indicated in the course schedule. Dr. A-V can be contacted by email to arrange a mutually convenient meeting time if it is required.

### Assessment and grading

There are 2 midterm examinations and a take-home final exam associated with this course. The breakdown of dates and grades for the course is as follows:

Table 2

Assessment tool	% of final grade	Notes
Midterm 1	25%	During class, Monday October 24 <sup>th</sup>
Midterm 2	25%	During class, Monday November 28 <sup>th</sup>
IFAT card	10%	Each class
Take home exam/assignment	40%	Handed out at the end of class, Monday November 28 <sup>th</sup>

**Learning goals and rationale:** To develop a detailed understanding of the relationships and evolution of microorganisms, the intricacies of a microbial community, the concept of a species, and the classification and naming of microorganisms. The course is intended to build on concepts introduced in the 2000-level microbiology courses.

### ***The specific learning objectives are to:***

1. Develop an understanding of **communities of microorganisms**, including the roles of microbes within an ecosystem, the structure of microbial communities, and the impact of environment on the community (and vice versa).
2. Investigate the participation of diverse microorganisms in maintaining **elemental cycles**.
3. Develop an understanding of **physiological and molecular diversity** within a community of microbes.
4. Understand and evaluate methods and approaches used to study **relationships and evolution (phylogeny) of microbes**, particularly *Bacteria* and *Archaea*, and develop an understanding of the current classification of microbe groups.

5. Explore taxonomic strategies and approaches used to **name microorganisms**, and the criteria used to **define bacterial species** and infrasubspecific divisions within species
6. Understand the principles and methods behind studying and identifying **cultured and uncultured** microorganisms.
7. Developing and improving reading and writing skills. Understanding where facts in textbooks come from. You will be looking at some primary research papers and specialist review articles, and considering the methods that are applied to answer research questions. You will also consider how to find information on microbiology topics - and assess it, and you will practice writing and referencing the information.

### **Course Resources**

**Textbook: Brock *BIOLOGY OF MICRORGANISMS* 14 ed. Madigan, Martinko, Bender, Buckley & Stahl (2015), Pearson ISBN-978-0-321-89739-8.** If you have access to a copy of the 13<sup>th</sup> edition, it will serve you quite well.... *But remember that no text is of any use if you don't read it!*

**Additional materials will be posted on the D2L site for the class.**

### **Electronic sources and ebooks available through the University of Guelph Library:**

✳️ **List of Prokaryotic Names with Standing in Nomenclature:** A regularly updated list of all bacterial names that have standing in nomenclature. <http://www.bacterio.net>

✳️ **The Prokaryotes:** This is an **electronic library resource**, accessible through the University of Guelph Library (QR 72.5 or use the title "Prokaryotes" for a Trellis search). It is the equivalent of seven volumes of general information about bacteria and their taxonomic groups.

✳️ **Bergey's Manual of Systematic Bacteriology, 2<sup>nd</sup> edition.** Again, use the title of this book for a Library search that will take you to this as an electronic book, or shelf copies of some volumes. Just to be clear – this "manual" is in 5 volumes, which were printed as 8 large books of hard copy!

**Warning: Content is Biological Material and as such is subject to mutation, evolution and CHANGE**

## **Course and University Policies**

### **When You Cannot Meet a Course Requirement**

**Please advise Dr. Allen-Vercoe promptly by e-mail if you encounter difficulties meeting any of the above deadlines and have just cause for accommodation to be made.**

**The final exam will be accepted for grading up to 5 calendar days after the deadline, with a 20% paper grade penalty applied per day of lateness.**

**If you miss one of the midterms, there are no make-up exams. Similarly, if you miss the in-class IFAT questions, there are no make-ups. With adequate reason provided for your absence, Dr. A-V will re-weight accordingly.**

When you find yourself unable to meet an in-course requirement because of illness or for compassionate reasons, please advise the course instructor in writing, with your name, id#, and e-mail contact, and be prepared to provide supporting documentation.

See the undergraduate calendar for information on regulations and procedures for Academic

Consideration: <http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-ac.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 Centre for Students with Disabilities as soon as possible.

For more information, contact CSD at 519-824-4120 ext. 56208 or email [csd@uoguelph.ca](mailto:csd@uoguelph.ca) or see the website: <http://www.csd.uoguelph.ca/csd/>

### **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:

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

### **E-mail Communication**

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

**The course has a D2L site, and you are expected to check it at least weekly for updates and information.**

### **Drop Date**

The last date to drop one-semester courses, without academic penalty, is the 40<sup>th</sup> 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:

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

### **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.

### **Recording of Materials**

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

### **Grading**

Please see table.

### **Campus Resources**

The Academic Calendar is the source of information about the University of Guelph's procedures, policies and regulations which apply to undergraduate, graduate and diploma programs:

<http://www.uoguelph.ca/registrar/calendars/index.cfm?index>

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

✳️ make an appointment with a program counselor in your degree program.

<http://www.bsc.uoguelph.ca/index.shtml> or <https://www.uoguelph.ca/uaic/programcounsellors>

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. <http://www.learningcommons.uoguelph.ca/>

If you are struggling with personal or health issues:

✳️ Counseling 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 Counseling Services, Kathy Somers runs training workshops and one-on-one sessions related to stress management and high performance situations. <http://www.uoguelph.ca/~ksomers/>

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 centre please see: <https://www.uoguelph.ca/csd/>