



- Abiotic interactions within microbial communities
- Biotic interactions within microbial communities
- Microbial genomics and other molecular tools for understanding microbial communities
- Microbial metabolism and biogeochemical cycling in the ocean

**On completion of the course the students shall be able to:**

- Understand the role of microbes in the environment, and explain it to a non-specialist
- Understand the major techniques that are used to study microbial ecology
- Interpret phylogenetic trees based on SSU rRNA and functional genes
- Debate the major departure in the species concept as it relates to microorganisms versus metazoans
- Calculate bacterial growth rates
- Understand the different method utilized to isolate and culture microbes
- Describe and diagram the major elemental cycle for carbon, nitrogen and sulfur
- Utilize online microbial genome browsers to determine the metabolic potential of selected microbes
- Write concise summaries of assigned scientific literature
- Analyse, extract and present the novel findings from recent scientific articles on microbial ecology published in high-profile journals

**Course Materials**

Recommended text: Brock Biology of Microorganisms 15th , Kindle Edition  
by Michael T. Madigan (Author), Kelly S. Bender (Author), Daniel H. Buckley (Author), W. Matthew Sattley (Author), David A. Stahl (Author) Prentice Hall  
BIOL/MARI 3101 course website: Connect through my.dal.ca on Brightspace  
Scientific literature: Additional readings will be assigned for selected classes.

**Course Assessment**

**Literature summaries:** Two **250-word literature summaries** are required at the beginning of class on **18 January** and **6 February**. In your own words, summarize one of the scientific readings assigned on 11 January (due 18 January) and on 1 February (due 6 February) as listed on the course calendar. Turn in a hard copy of this document at the beginning of class on the due date and submit an e-version to Brightspace. Be prepared to discuss the articles and your personal views during the class discussion as well. Late assignments will not be accepted. Summaries that are not within the word limit (+/-10% of 250 words) will be marked down.

**Exams:** There will be a **mid-term exam** and a **final exam**. Both exams will consist of multiple choice questions (60%) and short answers (40%).

**News and Views article in the style of Nature or Science Magazine and associated presentation:** A list of recent research papers published in an upper tier journal (e.g. Science, Nature, PNAS) will be provided early within the course and students will be asked to select their favorite topic on a first come first serve basis. You can propose your own selection, as long as it meets the following criteria:

1) It has been published in the last 5 years in an upper tier journal relevant to microbial ecology, 2) it has to report on original research- no review papers AND 3) it has to be approved by me-most important aspect.

The assignment consists of two parts:

1) Written assignment: You are expected to submit a 750 to 1000-word essay (double-spaced, 12-pt Times New Roman) that provides a critical analysis of primary research findings reported in your selected paper. The students are expected to read beyond their selected paper, for example from the cited reference list associated with their paper. The first draft version will be submitted on 20 March. Submit an e-version of your paper before class on 20 March on Brightspace. The final version is due on April 7 on Brightspace. After this date, there will be a penalty for late submission of 10% per day. There will be a special handout for the specific directions on content and requirements for this essay, and it will also be discussed in class.

2) Oral presentation: Students will present the assigned paper and their analysis of it during the last 5 lectures of the course. The presentation should be 10 minutes long (no more than 10ppt slides) followed by a 2 minutes question period. I will time you so make sure you stay within your time slot. The powerpoint presentations should be printed and handed in to the instructor on the day of the presentation. I will be very strict with attendances for the classes between 20 March and 3 April, during student presentations. If you miss a class during this period without an appropriate excuse, I will deduct 2 points from your final class mark.

Class participation: There may be unannounced quizzes and occasional problem sets to be worked up in groups during class time, most likely on Thursdays. These will be marked and counted in your final grade.

### **Grade assignments**

<b>Component</b>	<b>Weight (% of final grade)</b>	<b>Date</b>
<i>1st literature summary</i>	<b>2.0 %</b>	<b>18 January</b>
<i>2nd literature summary</i>	<b>2.5 %</b>	<b>6 February</b>
<i>Phylogenetic tree assignment</i>	<b>1.0%</b>	<b>6 February</b>
<i>Mid-term exam</i>	<b>25 %</b>	<b>15 February</b>
<i>Research paper topic selection</i>	<b>2.0%</b>	<b>27 February</b>
<i>Research paper essay 1st draft</i>	<b>5 %</b>	<b>20 March</b>
<i>Oral presentation</i>	<b>10 %</b>	<b>Variable (20 March-3 April)</b>
<i>Final exam</i>	<b>30%</b>	<b>5 April</b>
<i>Research paper final version</i>	<b>15%</b>	<b>7 April</b>
<i>Class quizzes/problems</i>	<b>7.5 %</b>	<b>throughout (1% each)</b>

**Other course requirements: none**

**Conversion of numerical grades to Final Letter Grades follows the Dalhousie Common Grade Scale**

<b>A+</b> (90-100)	<b>B+</b> (77-79)	<b>C+</b> (65-69)	<b>D</b> (50-54)
<b>A</b> (85-89)	<b>B</b> (73-76)	<b>C</b> (60-64)	<b>F</b> (<50)
<b>A-</b> (80-84)	<b>B-</b> (70-72)	<b>C-</b> (55-59)	

**Course Policies**Other course information:

Students are expected to check the course website and read their email regularly for updates on the course.

Lecture slides: An electronic copy (pdf version) of the class slides and notes will be made available on the course website a few hours before the class.

Attendance: will be documented but is not factored into the final grade. However, it is important to attend the class as there will be quizzes, problem sets and discussion that will be marked.

To make the class enjoyable and a valuable learning experience: turn off cell phones and refrain from sending emails, texting, and any other disruptive behavior. Come prepared to discuss the class material.

**COURSE CONTENT AND TIMETABLE**

<b>Class</b>	<b>Date</b>	<b>Topics</b>	<b>Background reading†</b>
1	9 January	Introduction: Microbes are awesome!	1
2	11 January	Origin and evolutionary record of life Assigned readings for the literature summary	13 Fraser et al. (2009) Ward (2006), Barrick and Lenski 2013
3	16 January	Microbial diversity and evolution in the genomic era	13-18
4	18 January	* Species and speciation (Discussion)	13
<b>LITERATURE SUMMARY DUE</b>			
5	23 January	Microbial habitats	20
6	25 January	Microbe: microbe interactions	23
7	30 January	<i>Phylogenetic tree assignment</i>	(Guest instructor)
8	1 February	<i>Assigned reading and critical summary</i>	(No Class)
9	6 February	Microbe: plant/animal interactions	23-24
<b>LITERATURE SUMMARY DUE</b>			
10	8 February	Population ecology and microbial community structure	20
11	13 February	Quantitative ecology: numbers, biomass and metabolism	5, 19
12	15 February	<b>MID TERM EXAM (Lectures 1-10)</b>	
	27 February	Physiological ecology of microbes	20
<b>RESEARCH PAPER TOPIC DUE</b>			
13	1 March	Thermodynamics and microbial ecology	3, 14
14	6 March	Microbes in the carbon cycle	21
15	8 March	Microbes in the nitrogen cycle and sulfur cycle	14, 15
16	13 March	Microbes in extreme environments	16-18
17	15 March	Microbes and global climate change Class discussion	Assigned readings
18	20 March	<b>RESEARCH PAPER DUE (first draft)</b>	

---

		Student mini-symposium day 1
	22 March	Student mini-symposium day 2
<b>19</b>	27 March	Student mini-symposium day 3
<b>20</b>	29 March	Student mini-symposium day 4
<b>21</b>	3 April	Student mini-symposium day 5
<b>22</b>	5 April	<b>Final Exam (Lecture 11-17)</b>

**FINAL RESEARCH PAPER DUE ON  
APRIL 7**

---

### ACCOMMODATION POLICY FOR STUDENTS

Students may request accommodation as a result of barriers related to disability, religious obligation, or any characteristic protected under Canadian Human Rights legislation. The full text of Dalhousie's Student Accommodation Policy can be accessed here:

[http://www.dal.ca/dept/university\\_secretariat/policies/academic/student-accommodation-policy-wef-sep--1--2014.html](http://www.dal.ca/dept/university_secretariat/policies/academic/student-accommodation-policy-wef-sep--1--2014.html)

Students who require accommodation for classroom participation or the writing of tests and exams should make their request to the **Advising and Access Services Centre (AASC)** prior to or at the outset of the regular academic year. More information and the **Request for Accommodation** form are available at [www.dal.ca/access](http://www.dal.ca/access).

### ACADEMIC INTEGRITY

Academic integrity, with its embodied values, is seen as a foundation of Dalhousie University. It is the responsibility of all students to be familiar with behaviours and practices associated with academic integrity. Instructors are required to forward any suspected cases of plagiarism or other forms of academic cheating to the Academic Integrity Officer for their Faculty.

The Academic Integrity website (<http://academicintegrity.dal.ca>) provides students and faculty with information on plagiarism and other forms of academic dishonesty, and has resources to help students succeed honestly. The full text of Dalhousie's **Policy on Intellectual Honesty** and **Faculty Discipline Procedures** is available here:

[http://www.dal.ca/dept/university\\_secretariat/academic-integrity/academic-policies.html](http://www.dal.ca/dept/university_secretariat/academic-integrity/academic-policies.html)

### STUDENT CODE OF CONDUCT

Dalhousie University has a student code of conduct, and it is expected that students will adhere to the code during their participation in lectures and other activities associated with this course. In general:

"The University treats students as adults free to organize their own personal lives, behaviour and associations subject only to the law, and to University regulations that are necessary to protect



# DALHOUSIE UNIVERSITY

- the integrity and proper functioning of the academic and non – academic programs and activities of the University or its faculties, schools or departments;
- the peaceful and safe enjoyment of University facilities by other members of the University and the public;
- the freedom of members of the University to participate reasonably in the programs of the University and in activities on the University's premises;
- the property of the University or its members.”

The full text of the code can be found here:

[http://www.dal.ca/dept/university\\_secretariat/policies/student-life/code-of-student-conduct.html](http://www.dal.ca/dept/university_secretariat/policies/student-life/code-of-student-conduct.html)

**SERVICES AVAILABLE TO STUDENTS**

The following campus services are available to help students develop skills in library research, scientific writing, and effective study habits. The services are available to all Dalhousie students and, unless noted otherwise, are free.

<b>Service</b>	<b>Support Provided</b>	<b>Location</b>	<b>Contact</b>
<b>General Academic Advising</b>	Help with <ul style="list-style-type: none"> <li>- understanding degree requirements and academic regulations</li> <li>- choosing your major</li> <li>- achieving your educational or career goals</li> <li>- dealing with academic or other difficulties</li> </ul>	<b>Killam Library Ground floor</b> Rm G28 <b>Bissett Centre for Academic Success</b>	In person: Killam Library Rm G28 By appointment: <ul style="list-style-type: none"> <li>- e-mail: <a href="mailto:advising@dal.ca">advising@dal.ca</a></li> <li>- Phone: (902) 494-3077</li> <li>- Book online through MyDal</li> </ul>
<b>Dalhousie Libraries</b>	Help to find books and articles for assignments Help with citing sources in the text of your paper and preparation of bibliography	<b>Killam Library Ground floor</b>  Librarian offices	In person: Service Point (Ground floor)  By appointment: Identify your subject librarian (URL below) and contact by email or phone to arrange a time: <a href="http://dal.beta.libguides.com/sb.php?subject_id=34328">http://dal.beta.libguides.com/sb.php?subject_id=34328</a>
<b>Studying for Success (SFS)</b>	Help to develop essential study skills through small group workshops or one-on-one coaching sessions  Match to a tutor for help in course-specific content (for a reasonable fee)	<b>Killam Library 3<sup>rd</sup> floor</b>  Coordinator Rm 3104  Study Coaches Rm 3103	To make an appointment: <ul style="list-style-type: none"> <li>- Visit main office (Killam Library main floor, Rm G28)</li> <li>- Call (902) 494-3077</li> <li>- email Coordinator at: <a href="mailto:sfs@dal.ca">sfs@dal.ca</a> or</li> <li>- Simply drop in to see us during posted office hours</li> </ul> <b>All information can be found on our website: <a href="http://www.dal.ca/sfs">www.dal.ca/sfs</a></b>
<b>Writing Centre</b>	Meet with coach/tutor to discuss writing assignments (e.g., lab report, research paper, thesis, poster) <ul style="list-style-type: none"> <li>- Learn to integrate source material into your own work appropriately</li> <li>- Learn about disciplinary writing from a peer or staff member in your field</li> </ul>	<b>Killam Library Ground floor</b> Learning Commons & Rm G25	To make an appointment: <ul style="list-style-type: none"> <li>- Visit the Centre (Rm G25) and book an appointment</li> <li>- Call (902) 494-1963</li> <li>- email <a href="mailto:writingcentre@dal.ca">writingcentre@dal.ca</a></li> <li>- Book online through MyDal</li> </ul> We are open six days a week  <b>See our website: <a href="http://writingcentre.dal.ca">writingcentre.dal.ca</a></b>