



UNIVERSITY OF CALGARY  
DEPARTMENT OF BIOLOGICAL SCIENCES  
COURSE OUTLINE

1. Course: CMMB 543 – ENVIRONMENTAL MICROBIOLOGY

Lecture Sections: L01 MWF 9:00 SA 147 Winter 2017

Instructor(s): Dr. Michael Hynes BI 429C 220-8473 hynes@ucalgary.ca  
Dr. Casey Hubert EEEL 509E 220-7794 chubert@ucalgary.ca

Desire2Learn: CMMB 543 Environmental Microbiology  
Biological Sciences Department BI 186; (403) 220-3140; biosci@ucalgary.ca

2. PREREQUISITES: CMMB 343

**Note:** A student may not register in a course unless he or she has a grade of at least C- in each prerequisite course. See section 3.5.C in the Faculty of Science section of the online Calendar (<http://www.ucalgary.ca/pubs/calendar/current/sc-3-5.html>)

3. GRADING: The University policy on grading and related matters is described in “Academic Regulations, sections F.1 and F.2” of the online University Calendar (<http://www.ucalgary.ca/pubs/calendar/current/f-1.html> and <http://www.ucalgary.ca/pubs/calendar/current/f-2.html>) In determining the overall grade in the course the following weights will be used:

Midterm Exam (Feb. 6, 2017)	12.5% (in class)
Midterm Exam (March 20, 2017)	12.5% (in class)
Research Grant Proposal	25% (Due March 27, 2017)
Oral Presentation	5%
Final Exam	45%

(There will be a final examination scheduled by the Registrar.)

Each piece of work (proposal, presentation, midterm test/final examination) submitted by the student will be assigned a percentage score. The student’s average percentage score for the various components listed above will be combined with the indicated weights to produce an overall percentage for the course, which will be used to determine the course letter grade according to the table in this course outline”

4. Missed Components of Term Work. The regulations of the Faculty of Science pertaining to this matter are found in the Faculty of Science area of the Calendar in section 3.6: <http://www.ucalgary.ca/pubs/calendar/current/sc-3-6.html> It is the student's responsibility to familiarize himself/herself with these regulations. See also <http://www.ucalgary.ca/pubs/calendar/current/e-3.html>.

5. Dates and times of class exercises held outside of class hours

**Oral Presentations – April 3-12 (sign up for times) - Only if required, depending on enrolment; every effort will be made to fit in all students within the normal lecture time in the last five lectures; if all students cannot thus be scheduled, some students (volunteers) will be accommodated at their convenience in small groups out of class time (usually in the half hour before lecture on regular lecture days).**

**REGULARLY SCHEDULED CLASSES HAVE PRECEDENCE OVER ANY OUT-OF-CLASS-TIME-ACTIVITY.** If you have a clash with this out-of-class-time-activity, please inform your instructor as soon as possible so that alternative arrangements may be made for you.

6. TEXT: No Text Required. Most material taught from research articles and reviews. The following three books may be useful and are available in the Library:  
Atlas, R. & R. Bartha. "Microbial Ecology", 4th edition.  
Madigan *et al.* "Brock Biology of Microorganisms", (Brock), 11th Ed. or higher  
Lynch & Hobbie. "Microorganisms in Action".

7. **EXAMINATION POLICY:** No electronic or written aids (eg. cell phones, tablets, computers, PDAs, notes, textbooks) will be allowed during writing of any exams. Non-programmable calculators will be permitted to answer quantitative questions on exams, if applicable, and permission to do this will be clearly indicated on the examination paper. For the second midterm and final exam, some questions (none of which will be mandatory; total value less than 40% of the total value of the exam) will be assigned a week in advance so that students can prepare a detailed answer if they so choose. Students should also read the Calendar, Section G, on Examinations: <http://www.ucalgary.ca/pubs/calendar/current/g.html>.
8. In this course, the quality of the student's writing on examinations and other assignments will be a major factor in determining the student's grade. See also <http://www.ucalgary.ca/pubs/calendar/current/e-2.html>.
9. **STUDIES IN THE BIOLOGICAL SCIENCES INVOLVE THE USE OF LIVING AND DEAD ORGANISMS.** See also <http://www.ucalgary.ca/pubs/calendar/current/e-5.html>.

**10. OTHER IMPORTANT INFORMATION FOR STUDENTS:**

- (a) **ACADEMIC MISCONDUCT** (cheating, plagiarism, or any other form) is a very serious offence that will be dealt with rigorously in all cases. A single offence may lead to disciplinary probation or suspension or expulsion. The Faculty of Science follows a zero tolerance policy regarding dishonesty. Please read the sections of the University Calendar under K. Student Misconduct (<http://www.ucalgary.ca/pubs/calendar/current/k.html>) to inform yourself of definitions, processes and penalties
- (b) **ASSEMBLY POINTS** in case of emergency during class time. Be sure to **FAMILIARIZE YOURSELF** with the information at <http://www.ucalgary.ca/emergencyplan/assemblypoints>.
- (c) **Student Accommodations:** Students needing an Accommodation because of a Disability or medical condition should contact Student Accessibility Services in accordance with the Procedure for Accommodations for Students with Disabilities available at [http://www.ucalgary.ca/policies/files/policies/procedure-for-accommodations-for-students-with-disabilities\\_0.pdf](http://www.ucalgary.ca/policies/files/policies/procedure-for-accommodations-for-students-with-disabilities_0.pdf).

Students needing an Accommodation in relation to their coursework or to fulfil requirements for a graduate degree, based on a Protected Ground other than Disability, should communicate this need, preferably in writing, to the Associate Head of Biological Sciences, Dr. H. Addy by email [addy@ucalgary.ca](mailto:addy@ucalgary.ca) or phone 403 220-3140.

- (d) **SAFEWALK:** Campus Security will escort individuals day or night (<http://www.ucalgary.ca/security/safewalk>). Call 220-5333 for assistance. Use any campus phone, emergency phone or the yellow phones located at most parking lot pay booths.
- (e) **FREEDOM OF INFORMATION AND PRIVACY:** This course is conducted in accordance with the Freedom of Information and Protection of Privacy Act (FOIPP). As one consequence, students should identify themselves on all written work by placing their name on the front page and their ID number on each subsequent page. For more information see also <http://www.ucalgary.ca/secretariat/privacy>.
- (f) **Student Union Information:** VP Academic Phone: 403 220-3911 Email: [suvpaca@ucalgary.ca](mailto:suvpaca@ucalgary.ca)  
 SU Faculty Rep. Phone: 403 220-3913 Email: [science1@su.ucalgary.ca](mailto:science1@su.ucalgary.ca) , [science2@su.ucalgary.ca](mailto:science2@su.ucalgary.ca) and [science3@su.ucalgary.ca](mailto:science3@su.ucalgary.ca)  
 Student Ombuds Office: 403 220-6420 Email: [ombuds@ucalgary.ca](mailto:ombuds@ucalgary.ca); <http://ucalgary.ca/provost/students/ombuds>
- (g) **INTERNET and ELECTRONIC COMMUNICATION DEVICE Information.** You can assume that in all classes that you attend, your cell phone should be turned off. Also, communication with other individuals, via laptop computers, Blackberries or other devices connectable to the Internet is not allowed in class time unless specifically permitted by the instructor. If you violate this policy you may be asked to leave the classroom. Repeated abuse may result in a charge of misconduct.
- (h) At the University of Calgary, feedback provided by students through the Universal Student Ratings of Instruction (USRI) survey provides valuable information to help with evaluating instruction, enhancing learning and teaching, and selecting courses ([www.ucalgary.ca/usri](http://www.ucalgary.ca/usri)). Your responses make a difference – please participate in USRI Surveys.

Department Approval: \_\_\_\_\_ ORIGINAL SIGNED \_\_\_\_\_  
 M543 co W17; 17/11/2016 11:09

Date: \_\_\_\_\_

**Lectures. Tentative schedule.**

<b>1,2,3,</b> (Jan 9, 11, 13)	(MH)	Introduction. Microbial cells, communities, and populations and their interactions.
<b>4,5,6,7,8</b> (Jan 16,18,20,23,25)	(MH)	Signalling in bacteria. Multicellular behaviour. Biofilms
<b>9,10</b> (Jan 27, 30)	(MH)	Nutrient cycling by microorganisms; Carbon, Sulphur, Phosphorus, and Iron cycles
<b>11,12</b> (Feb 1,3)	(MH)	Nitrogen cycle, free-living nitrogen fixation

**Midterm 1. Feb 6th. (In class)**

<b>13,14</b> (Feb 8,10)	(MH)	Plant Microbe Interactions: Nodulation and symbiotic N fixation
<b>15,16,17</b> (Feb 13,15,17)	(MH)	Bacterial plant pathogens; Tumours; Gene for gene theory of resistance. effectors, PAMPs and the arms race

**FEB 20 to 24**

**READING WEEK**

<b>18,19</b> (Feb 27, March 1)	(MH)	Fungal and viral pathogens of plants
<b>20</b> (March 3)	(MH)	Beneficial microbial interactions with plants: Mycorrhizae and PGPRs, Biocontrol of weeds and disease.
<b>21,22,23,24</b> (March 6, 8,10, 13)	(MH)	Microbial interactions with animals. Rumen microbiology. Invertebrate microbiology and biocontrol of Insects
<b>25, 26</b> (March 15,17)	(MH)	Phage Ecology, Predation and protozoans

**Midterm 2. March 20th (In class)**

<b>26, 27, 28, 29,30</b> (March 22, 24,27, 29, 31)	(CH)	Extreme environments. Extremophiles and their Biotechnology
---	------	---

**Lectures 31-35**  
(April 3,5,7,10,12)

Student presentations. Some of these **may** also have to be scheduled (by sign-up) during this same period.. It may be possible to do the bulk of these at 8:30 AM MWF in the same lecture room as normal classes, the same days as other student. Students will be accommodated in normal lecture slot to extent possible.

**Mark breakdown**

A+	= 90%	B	= 73%	C-	= 60%
A	= 85%	B-	= 70%	D+	= 55%
A-	= 80%	C+	= 66%	D	= 50%
B+	= 77%	C	= 63%	F	< 50%

## **LEARNING OUTCOMES**

Students will be able to:

1. Describe the role of microorganisms in biogeochemical cycling, with specific emphasis on the Nitrogen, Carbon, and Sulfur cycles.
2. Explain how microbial cells sense their environment and respond to as single cells, and as multicellular aggregates and communities
3. Outline fundamental concepts in plant pathology, including the gene-for-gene hypothesis, avirulence genes, and the hypersensitive response
4. Describe important mutualistic symbioses between microbes and plants or animals, and how these symbioses have been investigated at the molecular level
5. Explain how nutrient availability, predators, and other factors influence and control microbial growth in natural environments
6. Generate hypotheses about mechanisms underlying microbial processes in nature, and design experiments that could test those hypotheses
7. Formulate a proposal for original research in Microbial Ecology in the form of a mock grant application.