



UNIVERSITY OF CALGARY
DEPARTMENT OF BIOLOGICAL SCIENCES
COURSE OUTLINE

1. Course: CMMB 543 – ENVIRONMENTAL MICROBIOLOGY

Lecture Sections: L01 MWF 9:00 SS 006 Winter 2018

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. 5, 2018)	15 % (in class)
Midterm Exam (March 19, 2018)	15 % (in class)
Research Grant Proposal	25% (Due March 26, 2018)
Oral Presentation	5%
Final Exam	40 %

(There will be a 3 hour **CUMULATIVE** 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 below:

Letter Grade	A+	A	A-	B+	B	B-	C+	C	C-	D+	D
Min. Percent Required	90	85	80	77	73	70	66	63	60	55	50

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: None

REGULARLY SCHEDULED CLASSES HAVE PRECEDENCE OVER ANY OUT-OF-CLASS-TIME-ACTIVITY.

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), 12 th Ed. or higher
Lynch & Hobbie. "Microorganisms in Action".

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 them 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. **Human studies statement:** See also [Section E.5](#) of the University Calendar.

ETHICS IN THE BIOLOGICAL SCIENCES

Studies in the Biological Sciences involve the use of living and dead organisms. Students taking laboratory- and field- based courses in these disciplines can expect involvement with and experimentation on such materials. Students perform dissections on dead or preserved organisms in some courses. In particular courses, students experiment on living organisms, their tissues, cells, or molecules. Sometimes fieldwork requires students to collect a variety of living materials by many methods, including humane trapping.

All work on humans and other animals conforms to the Helsinki Declaration and to the regulations of the Canadian Council on Animal Care. The Department strives for the highest ethical standards consistent with stewardship of the environment for organisms whose use is not governed by statutory authority. Individuals contemplating taking courses or majoring in one of the fields of study offered by the Department of Biological Sciences should ensure that they have fully considered these issues before enrolling. Students are advised to discuss any concern they might have with the Undergraduate Program Director of the Department.

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.

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 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
SU Faculty Rep. Phone: 403 220-3913 Email: science1@su.ucalgary.ca, science2@su.ucalgary.ca and science3@su.ucalgary.ca
Student Ombuds Office: 403 220-6420 Email: 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). Your responses make a difference – please participate in USRI Surveys.

Department Approval: _____ ORIGINAL SIGNED
M543 co W18;03/01/2018 11:11

Date: _____

Lectures. Tentative schedule.

1,2,3, (Jan 8, 10, 12)	(MH)	Introduction. Microbial cells, communities, and populations and their interactions.
4,5,6,7,8,9 (Jan 15,17,19,22,24,26)	(MH)	Signalling and sensing in bacteria. Multicellular behaviour. Biofilms
10 (Jan 29)	(MH)	Nutrient cycling by microorganisms; Carbon, Sulphur, Phosphorus, and Iron cycles
11,12 (Jan 31, Feb 2)	(MH)	Nitrogen cycle, free-living nitrogen fixation

Midterm 1. Feb 5th. (In class)

13,14 (Feb 7, 9)	(MH)	Plant Microbe Interactions: Nodulation and symbiotic N ₂ fixation
15,16,17 (Feb 12,14,16)	(MH)	Bacterial plant pathogens; Tumours; Gene for gene theory of resistance. effectors, PAMPs and the arms race

FEB 17 to 25

READING WEEK

18,19 (Feb 26, 28)	(MH)	Fungal and/or viral pathogens of plants
20 (March 2)	(MH)	Beneficial microbial interactions with plants: Mycorrhizae and PGPRs, Biocontrol of weeds and disease.
21,22,23,24 (March 5, 7,9, 12)	(MH)	Microbial interactions with animals. Rumen microbiology. Invertebrate microbiology and biocontrol of Insects
25, 26 (March 14,16)	(MH)	Phage Ecology, Predation and "protozoans"

Midterm 2. March 19th (In class)

27, 28 (March 21,23)	(MH)	Antibiotics and bacteriocins, resistance, and possible roles in nature
29,30, 31, 32 (March 26, 28, April 2, 4)	(CH)	Extreme environments. Extremophiles and their Biotechnology

March 30th is Good Friday.

Lectures 33,34,35,36 (April 6,9,11,13)		Student presentations. Some of these may also have to be scheduled out of class (by sign-up) during this same period, but this will only happen if enrolment expands much beyond 25 students, which seems unlikely. IF these extra sessions are required, it may be possible to do these at 8:45 AM MWF in the same lecture room as normal classes, the same days as other students.
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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 it 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.