



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. It is the student's responsibility to familiarize themselves with these regulations. See also Section E.3 of the University Calendar.

5. **Scheduled Out-of-Class Activities:**

There are no scheduled out of class activities for this course.

6. **Course Materials:**

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".

7. **Examination Policy:**

No electronic aids or notes or books are permitted during tests and examinations. Non-programmable calculators may be used to answer mathematical questions if such question arise; if so the allowable use of calculators will be communicated to students in advance. For some tests and examinations, questions may be made available to students well in advance of the actual examination. Such questions will never be mandatory, and although students may prepare for them, they will still have to write their answers with no written or electronic aids.

Students should also read the Calendar, Section G, on Examinations.

8. **Approved Mandatory And Optional Course Supplemental Fees:**

There are no mandatory or optional course supplemental fees for this course.

9. **Writing Across the Curriculum Statement:**

For all components of the course, in any written work, the quality of the student's writing (language, spelling, grammar, presentation etc.) **WILL BE** a factor in the evaluation of the work. See also Section E.2 of the University Calendar.

10. **Human & Living Organism Studies Statements:**

Students will not participate as subjects or researchers in human studies.

See also Section E.5 of the University Calendar.

**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 the 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 field work 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 concerns they might have with the Undergraduate Program Director of the Department.

Students are expected to be familiar with Section SC.4.1 of the University Calendar.

## 11. Reappraisal Of Grades:

A student wishing a reappraisal, should first attempt to review the graded work with the Course Coordinator/ Instructor or department offering the course. Students with sufficient academic grounds may request a reappraisal. Non-academic grounds are not relevant for grade reappraisals. Students should be aware that the grade being reappraised may be raised, lowered or remain the same. See Section I.3 of the University Calendar.

- a. **Term Work:** The student should present their rationale as effectively and as fully as possible to the Course coordinator/instructor within 15 days of either being notified about the mark, or of the item's return to the class. If the student is not satisfied with the outcome, the student shall immediately submit the Reappraisal of Graded Term work form to the department in which the course is offered. The department will arrange for a re-assessment of the work if, and only if, the student has sufficient academic grounds. See sections I.1 and I.2 of the University Calendar.
- b. **Final Exams:** The student shall submit the request to Enrolment Services. See Section I.3 of the University Calendar.

## 12. Other Important Information For Students:

- a. **Mental Health:** The University of Calgary recognizes the pivotal role that student mental health plays in physical health, social connectedness and academic success, and aspires to create a caring and supportive campus community where individuals can freely talk about mental health resources available throughout the university community, such as counselling, self-help resources, peer support or skills-building available through the SU Wellness Centre (Room 30, MacEwan Student Centre, Mental Health Services Website) and the Campus Mental Health Strategy website (Mental Health).
- b. **SU Wellness Center:** The Students Union Wellness Centre provides health and wellness support for students including information and counselling on physical health, mental health and nutrition. For more information, see [www.ucalgary.ca/wellnesscentre](http://www.ucalgary.ca/wellnesscentre) or call 403-210-9355.
- c. **Sexual Violence:** The University of Calgary is committed to fostering a safe, productive learning environment. The Sexual Violence Policy (<https://www.ucalgary.ca/policies/files/policies/sexual-violence-policy.pdf>) is a fundamental element in creating and sustaining a safer campus environment for all community members. We understand that sexual violence can undermine students' academic success and we encourage students who have experienced some form of sexual misconduct to talk to someone about their experience, so they can get the support they need. The Sexual Violence Support Advocate, Carla Bertsch, can provide confidential support and information regarding sexual violence to all members of the university community. Carla can be reached by email ([svsa@ucalgary.ca](mailto:svsa@ucalgary.ca)) or phone at 403-220-2208 .
- d. **Misconduct:** 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 Section K. Student Misconduct to inform yourself of definitions, processes and penalties. Examples of academic misconduct may include: submitting or presenting work as if it were the student's own work when it is not; submitting or presenting work in one course which has also been submitted in another course without the instructor's permission; collaborating in whole or in part without prior agreement of the instructor; borrowing experimental values from others without the instructor's approval; falsification/ fabrication of experimental values in a report. These are only examples.
- e. **Assembly Points:** In case of emergency during class time, be sure to FAMILIARIZE YOURSELF with the information on assembly points.
- f. **Academic Accommodation Policy:** 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 [procedure-for-accommodations-for-students-with-disabilities.pdf](#).

Students needing an accommodation in relation to their coursework or to fulfill requirements for a graduate degree, based on a protected ground other than disability, should communicate this need, preferably in

writing, to the Associate Head, Undergraduate of the Department of Biological Sciences, Heather Addy by email [addy@ucalgary.ca](mailto:addy@ucalgary.ca) or phone 403 220-6979. Religious accommodation requests relating to class, test or exam scheduling or absences must be submitted no later than 14 days prior to the date in question. See Section E.4 of the University Calendar.

- g. Safewalk: Campus Security will escort individuals day or night (See the Campus Safewalk website). Call 403-220-5333 for assistance. Use any campus phone, emergency phone or the yellow phones located at most parking lot pay booths.
- h. Freedom of Information and Privacy: This course is conducted in accordance with the Freedom of Information and Protection of Privacy Act (FOIPPA). 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 Legal Services website. VP Academic, Phone: 403-220-3911 Email: [suvpaca@ucalgary.ca](mailto:suvpaca@ucalgary.ca). SU Faculty Rep., Phone: 403-220-3913 Email: [sciencerep@su.ucalgary.ca](mailto:sciencerep@su.ucalgary.ca). Student Ombudsman, Email: [ombuds@ucalgary.ca](mailto:ombuds@ucalgary.ca).
- i. **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: [sciencerep@su.ucalgary.ca](mailto:sciencerep@su.ucalgary.ca). Student Ombudsman, Email: [ombuds@ucalgary.ca](mailto:ombuds@ucalgary.ca)
- j. Internet and Electronic Device Information: Unless instructed otherwise, cell phones should be turned off during class. All communication with other individuals via laptop, tablet, smart phone or other device is prohibited during class unless specifically permitted by the instructor. Students that violate this policy may be asked to leave the classroom. Repeated violations may result in a charge of misconduct.
- k. Surveys: At the University of Calgary, feedback through the Universal Student Ratings of Instruction (USRI) survey and the Faculty of Science Teaching Feedback form provides valuable information to help with evaluating instruction, enhancing learning and teaching, and selecting courses. Your responses make a difference - please participate in these surveys.
- l. Copyright of Course Materials: All course materials (including those posted on the course D2L site, a course website, or used in any teaching activity such as (but not limited to) examinations, quizzes, assignments, laboratory manuals, lecture slides or lecture materials and other course notes) are protected by law. These materials are for the sole use of students registered in this course and must not be redistributed. Sharing these materials with anyone else would be a breach of the terms and conditions governing student access to D2L, as well as a violation of the copyright in these materials, and may be pursued as a case of student academic or non-academic misconduct, in addition to any other remedies available at law.

Department Approval: \_\_\_\_\_ ORIGINAL SIGNED \_\_\_\_\_ Date: \_\_\_\_\_

**Lectures. Tentative schedule. Subject to change depending on enrolment and changes to Dr. Hubert's schedule.**

**1,2,3,** (MH) Introduction. Microbial cells, communities, and populations and their interactions.  
(Jan 13, 15, 17)

**4,5,6,7,8,9** (MH) Signalling and sensing in bacteria. Multicellular behaviour.  
(Jan 20,22,24,27,29,31) Biofilms

**10** (MH) Nutrient cycling by microorganisms; Carbon, Sulphur,  
(Feb 03) Phosphorus, and Iron cycles

**11,12** (MH) Nitrogen cycle, free-living nitrogen fixation  
(Feb 05, Feb 07)

**Midterm 1. Feb 10th. (In class)**

**13,14** (MH) Plant Microbe Interactions: Nodulation and symbiotic N<sub>2</sub> fixation  
(Feb 12, 14)

**FEB 17 to 21 WINTER BREAK**

**15,16,17** (MH) Bacterial plant pathogens; Tumours; Gene for gene theory of  
(Feb 24, 26, 28) resistance, effectors, PAMPs and the arms race

**18** (MH) Fungal and/or viral pathogens of plants  
(March 2)

**19** (MH) Beneficial microbial interactions with plants:  
(March 4) Mycorrhizae and PGPRs, Biocontrol of weeds and disease.

**20,21,22, 23** (MH) Microbial interactions with animals. Rumen microbiology.  
(March 6, 9,11, 13) Invertebrate microbiology and biocontrol of Insects

**24, 25, 26** (MH) Viral Ecology, Predation and "protozoans"; bacteriocins  
(March 16,18, 20)

**Midterm 2. March 23rd (In class)**

**27,28, 29, 30** (CH) Extreme environments. Extremophiles and their Biotechnology  
(March 25, 27, 30, April 1)

**April 10th is Good Friday, April 13th is Easter Monday.**

**Lectures 31,32,33,34** Student presentations. Some of these **may** also have to be  
(April 3,6,8,15) scheduled out of class (by sign-up) during this same period, but this will only happen if enrolment expands much beyond 30 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.

## **LEARNING OUTCOMES**

After completion of this course, students should 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.