



COURSE OUTLINE

1. **Course:** CMMB 545, Petroleum Microbiology - Winter 2019

Lecture 01: MWF 11:00 - 11:50 in SA 129

Instructor	Email	Phone	Office	Hours
Casey Hubert	chubert@ucalgary.ca	403 220-7794	EEEL 509E	By Appointment
Lisa Gieg	lmgieg@ucalgary.ca	403 210-7207	BI 228A	By Appointment

Course Site:

D2L: CMMB 545 L01-(Winter 2019)-Petroleum Microbiology

Note: Students must use their U of C account for all course correspondence.

2. **Requisites:**

See section [3.5.C](#) in the Faculty of Science section of the online Calendar.

Prerequisite(s):

Cellular, Molecular and Microbial Biology 343 or consent of the Department.

3. **Grading:**

The University policy on grading and related matters is described in [F.1](#) and [F.2](#) of the online University Calendar. In determining the overall grade in the course the following weights will be used:

Component(s)	Weighting %	Date
Midterm 1 In Class	25%	February 4
Midterm 2 In Class	25%	March 11
Term project	20%	
Final exam	30%	

Each piece of work (reports, assignments, quizzes, midterm exam(s) or final examination) submitted by the student will be assigned a grade. The student's grade for each component 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.

The conversion between a percentage grade and letter grade is as follows.

	A+	A	A-	B+	B	B-	C+	C	C-	D+	D
Minimum % Required	92 %	85 %	80 %	77%	73%	70 %	67 %	63%	60%	55 %	50 %

This course has a registrar scheduled final exam.

4. **Missed Components Of Term Work:**

In the event that a student misses the midterm or any course work due to illness, supporting documentation, such as a medical note or a statutory declaration will be required (see [Section N.1](#); for more information regarding the use of statutory declaration/medical notes, see [FAQ](#)). Absences must be reported within 48 hrs.

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:**

No text required

Useful Resources– In library and/or available on-line through U of C library system:

Petroleum Microbiology, Eds. B. Ollivier & M. Magot, ASM Press, Washington, DC, 2005. (available in hard copy and online)

Handbook of Hydrocarbon and Lipid Microbiology, Eds. K.N. Timmis, T.J. McGenity, J.R. Van der Meer & V. De Lorenzo, Springer, 2010. (online only)

Any other recommended readings will be available online, with links provided in lecture notes.

7. **Examination Policy:**

Calculators are allowed for examinations (programmable calculators or portable computers are not allowed). The use of wireless devices, such as cell phones, PDAs (Palm OS or pocket PC devices etc.), and camera devices during the examination will not be allowed.

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.) can 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 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 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 concern 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 Exam:** 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 and receive supports when needed. We encourage you to explore the 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 370, 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 or call [403-210-9355](tel: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) or phone at [403-220-2208](tel: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 or phone [403 220-6979](tel: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.
- i. **Student Union Information:** [VP Academic](#), Phone: [403-220-3911](#) Email: suvpaca@ucalgary.ca. SU Faculty Rep., Phone: [403-220-3913](#) Email: sciencerep@su.ucalgary.ca. Student Ombudsman, Email: suvpaca@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.

Tentative schedule of lecture topics (subject to change)

1.	Jan. 11	LG	Introduction to the oil industry and petroleum microbiology
2.	Jan. 14	LG	What is petroleum? How is oil classified? Hydrocarbon classes and structures
3.	Jan. 16	LG	How is oil formed? Diagenesis and biomarkers
4.	Jan. 18	LG	Oil reservoirs, oil recovery and refining
5.	Jan. 21	LG	Generation of heavy oil/Biodegradation in oil reservoirs
6.	Jan. 23	LG	General microbial principles - anaerobes I
7.	Jan. 25	LG	General microbial principles - anaerobes II & mass balances
8.	Jan. 28	LG	Hydrocarbon biodegradation pathways, aerobic
9.	Jan. 30	LG	Hydrocarbon biodegradation pathways, aerobic/anaerobic
10.	Feb. 1	LG	Determining/enumerating microbes in oilfields
	Feb. 4		Midterm 1 - in class - Lectures 1-10
11.	Feb. 6	CH	Souring I
12.	Feb. 8	CH	Souring II
13.	Feb. 11	CH	Souring III
14.	Feb. 13	CH	Hydraulic fracturing I
15.	Feb. 15	CH	Hydraulic fracturing II
	Feb. 18-22		Reading Week - no classes

16.	Feb. 25	LG	Microbiologically influenced corrosion I
17.	Feb. 27	LG	Microbiologically influenced corrosion II
18.	Mar. 1	LG	Microbiologically influenced corrosion III
19.	Mar. 4	LG	Microbiologically influenced corrosion IV
20.	Mar. 6	LG	Microbiologically influenced corrosion V
21.	Mar. 8	LG	Bioremediation I
	Mar. 11		Midterm 2 - in class - Lectures 11-20
22.	Mar. 13	LG	Bioremediation II
23.	Mar. 15	LG	Bioremediation III
24.	Mar. 18	LG	Bioremediation IV
25.	Mar. 20	CH	Bioremediation V (marine)
26.	Mar. 22	CH	Bioremediation VI (marine)
27.	Mar. 25	CH	Microbiology in oil exploration
28.	Mar. 27	CH	MEOR I
29.	Mar. 29	CH	MEOR II
30.	Apr. 1		Group Project Presentations
31.	Apr. 4		Group Project Presentations
32.	Apr. 6		Group Project Presentations
33.	Apr. 8	LG	Oil sands microbiology
34.	Apr. 10	LG	Oil sands microbiology
35.	Apr. 12	LG	Oil sands microbiology/final overview

Course Outcomes:

- Explain the composition of crude oil, how crude oil is classified, how crude oil reservoirs are formed over geological time, and how oil recovery and refining works
- Describe the kinds of microorganisms (and their basic physiologies) that can be found in petroliferous reservoirs, the various ways by which they can be identified, and how their activities can lead to the formation of heavy oil.
- Describe the main metabolic pathways for the aerobic and anaerobic biodegradation of hydrocarbons
- Explain bioremediation, the various approaches that can be used (natural versus engineered) to clean up hydrocarbon-contaminated environments, and the numerous tools that can be used to monitor for evidence of bioremediation
- Describe how microorganisms can be used to enhance oil recovery (microbial enhanced oil recovery, MEOR)
- Explain oilfield souring, and the various microbial-based approaches that can be used to control souring
- Understand the microbial processes that can lead to the corrosion of steel surfaces within petroleum industry infrastructure (microbial influenced corrosion, MIC)
- Explain how Alberta's oil sands are recovered, the environmental issues associated with the oil sands industry, and how microorganisms play a role in the management of oil sands tailings ponds
- Through a group project, communicate a topic or seminal scientific paper related to petroleum microbiology through either an oral presentation or a poster presentation
- Be able to read and comprehend media reports and literature associated with the petroleum industry as presented in the media

Department Approval:

Electronically Approved

Date: 2019-01-09 13:06