



**REVISED COURSE OUTLINE FOR REMOTE LEARNING**

To account for the necessary transition to remote learning from March 13 onward, adjustments have been made to assessment deadlines and requirements so that all coursework tasks are in line with the necessary and evolving health precautions for all involved (students and staff). If you are unable to meet the deadlines or requirements specified, please connect with your course instructor to work out alternative dates/assessments.

1. **Course:** CMMB 545, Petroleum Microbiology - Winter 2020

Lecture 01: MWF 11:00 - 11:50 - Remote Learning (check with your instructor or coordinator for details)

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

**Course Site:**

D2L: CMMB 545 L01-(Winter 2020)-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	25%	February 7 In-Class
Midterm 2	25%	March 9 In-Class
*Final Exam	25%	
*Term Project	25%	

\*We have altered the Term Project to be worth 25% of the grade (up from 25%), and the Final Exam to also be worth 25% (down from 30%). The format of the final exam will be a take-home exam, provided to the students one week before (April 14 at 8:30 am) the originally scheduled final exam (April 21, 8:30-11:30 am). The take-home exam will be due at 11:30 am on April 21.

The term project, which was originally a F2F group poster session, has been revised. Groups of students selected a scientific paper to prepare a poster from and present this. In the revised term project, the students will now instead prepare critical review of their paper (e.g., as if they were reviewers or editors) as a group, as well as prepare a short individual critical review analysis. Groups of students (4 per group) can still meet virtually to carry out this assignment. The Group assignment will be due April 9 and the Individual assignment will be due April 15.

Remaining lectures are being given via narrated powerpoint presentations, but may change to another format (e.g., offered via Zoom).

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 %

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

The University has suspended requirements for students to provide evidence for reasons for absences so please do not attend medical clinics for medical notes or Commissioners for Oaths for statutory declarations. Please let your instructor know immediately if you are ill and cannot meet the deadlines specified.

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

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

#### 6. Course Materials:

No textbook 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.

#### • Examination Policy:

No aids are allowed on tests or examinations.

Students should also read the Calendar, [Section G](#), on Examinations.

#### • Approved Mandatory And Optional Course Supplemental Fees:

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

#### • 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.

#### • 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.

#### • 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 **ten business 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 submit the Reappraisal of Graded Term work form to the department in which the course is offered within 2 business days of receiving the decision from the instructor. The Department will arrange for a reappraisal of the work within the next ten business days. The reappraisal will only be considered if the student provides a detailed rationale that outlines where and for what reason an error is suspected. See sections [1.1](#) and [1.2](#) of the University Calendar
- b. **Final Exam:** The student shall submit the request to Enrolment Services. See [Section 1.3](#) of the University Calendar.
- **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](http://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](mailto: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](mailto: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](tel: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](tel:403-220-3911) Email: [suvpaca@ucalgary.ca](mailto:suvpaca@ucalgary.ca). SU Faculty Rep., Phone: [403-220-3913](tel: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.

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**Tentative schedule of lecture topics (subject to change)**

1. Jan. 13 LG Introduction to the oil industry and petroleum microbiology
2. Jan. 15 LG What is petroleum? How is oil classified? Hydrocarbon classes & structures
3. Jan. 17 LG How is oil formed? Diagenesis and biomarkers
4. Jan. 20 LG Oil reservoirs, oil recovery & refining
5. Jan. 22 LG Generation of heavy oil/Biodegradation in oil reservoirs
6. Jan. 24 LG General microbial principles - anaerobes I
7. Jan. 27 LG General microbial principles - anaerobes II + mass balances
8. Jan. 29 LG Hydrocarbon biodegradation pathways, aerobic
9. Jan. 31 LG Hydrocarbon biodegradation pathways, aerobic/anaerobic
10. Feb. 3 LG Determining/enumerating microbes in oilfields
11. Feb. 5 LG Bioremediation I

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**Feb. 7 Midterm 1 - in class - lectures 1-10**

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12. Feb. 10 LG Bioremediation II
  13. Feb. 12 LG Bioremediation III
  14. Feb. 14 LG Bioremediation IV

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**Feb. 17-21 Winter Break - no classes**

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15. Feb. 24 CH Bioremediation V (marine)
  16. Feb. 26 CH Bioremediation VI (marine)
  17. Feb. 28 CH Exploration using microbiology
  18. Mar. 2 CH Hydraulic Fracturing I
  19. Mar. 4 CH Hydraulic Fracturing II
  20. Mar. 6 CH Reservoir Souring I

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**Mar. 9 Midterm 2 - in class - lectures 11-19**

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21. Mar. 11 CH Reservoir Souring II
22. Mar. 13 CH Reservoir Souring III - cancelled
23. Mar. 16 CH Microbially Enhanced Oil Recovery I - cancelled
24. Mar. 18 CH Microbially Enhanced Oil Recovery II - replaced with Reservoir Souring II
25. Mar. 20 LG MIC I - replaced with Reservoir Souring III; other lectures shifted
26. Mar. 23 LG MIC I
27. Mar. 25 LG MIC II
28. Mar. 27 LG MIC III
  
29. Mar. 30 **Group Presentations - cancelled**
30. Apr. 1 **Group Presentations - cancelled**
31. Apr. 3 **Group Presentations - cancelled** - replace with Oil sands I
  
32. Apr. 6 LG Oil sands II
33. Apr. 8 LG Oil sands III

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**Apr. 10-13 Easter break, no classes**

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34. Apr. 15 LG/CH Available for review/questions

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**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

Electronically Approved - Mar 23 2020 12:42

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**Department Approval**

Electronically Approved - Mar 23 2020 13:04

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**Associate Dean's Approval for alternate final examination arrangements or remote learning**