



UNIVERSITY OF CALGARY
FACULTY OF SCIENCE
DEPARTMENT OF BIOLOGICAL SCIENCES
COURSE OUTLINE

1. **Course: CMMB 545 – PETROLEUM MICROBIOLOGY**

Lecture Sections: L01 MWF 11:00-11:50 ST 127 WINTER 2017

Course Coordinator: Dr. Gieg

Instructor: Dr. L. Gieg BI 228A 210-7207 lmgieg@ucalgary.ca
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D2L: CMMB 545 L01 (Winter 2017) Petroleum Microbiology
Biological Sciences Department BI 186; (403) 220-3140; biosci@ucalgary.ca

2. **PREREQUISITE(S):** CMMB 343 or Consent of the Department
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 sections F.1 and F.2 of the online University Calendar. In determining the overall grade in the course the following weights will be used:

Midterm 1	20%	(February 6, in class, lectures 1-10)
Midterm 2	20%	(March 6, in class, lectures 11- 21)
Special Project	25%	
Final Examination	35%	(To be scheduled by the Registrar)

Each piece of work (Special Project, midterm tests or 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.

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](#). It is the student's responsibility to familiarize himself/herself with these regulations. See also [Section E.6](#) of the University Calendar

5. **Scheduled out-of-class activities:** There are no out-of-class activities scheduled for this class.

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

STUDIES IN THE BIOLOGICAL SCIENCES INVOLVE THE USE OF LIVING AND DEAD ORGANISMS. Students are expected to be familiar with <http://www.ucalgary.ca/pubs/calendar/current/sc-5-1.html> of the on-line calendar.

See also <http://www.ucalgary.ca/pubs/calendar/current/e-5.html>.

9. OTHER IMPORTANT INFORMATION FOR STUDENTS:

- (a) **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.
- (b) **Assembly Points:** In case of emergency during class time, be sure to FAMILIARIZE YOURSELF with the information on [assembly points](#).
- (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 (FOI/PPA). 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: 220-3911 Email: suvpaca@ucalgary.ca.
SU Faculty Rep. Phone: 220-3913 Email: sciencerep@su.ucalgary.ca; [Student Ombudsman](#)
- (g) **Internet and Electronic Device Information:** You can assume that in all classes that you attend, your cell phone should be turned off unless instructed otherwise. 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) **U.S.R.I.:** 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 _____ Date _____

M545 co W17; 11/23/2016 11:31 AM

Mark Breakdown:

Cut-off Letter Grade

> 90.0 %	A +
85.0	A
80.0	A –
77.0	B+
73.0	B
70.0	B –
67.0	C +
63.0	C
60.0	C –
55.0	D +
50.0	D
< 50.0 %	F

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

1. Jan. 9	LG	Introduction to the oil industry and petroleum microbiology
2. Jan. 11	LG	What is petroleum? How is oil classified? Hydrocarbon classes & structures
3. Jan. 13	LG	How is oil formed? Diagenesis and biomarkers
4. Jan. 16	LG	Oil reservoirs, oil recovery & refining
5. Jan. 18	LG	Generation of heavy oil/Biodegradation in oil reservoirs
6. Jan. 20	LG	General microbial principles – anaerobes I
7. Jan. 23	LG	General microbial principles – anaerobes II
8. Jan. 25	LG	General microbial principles – anaerobes III
9. Jan. 27	GV	Determining/enumerating microbes in oilfields - who's there?
10. Jan. 30	GV	Metagenomics in hydrocarbon resource environments
11. Feb. 1	LG	Hydrocarbon biodegradation pathways, aerobic
12. Feb. 3	LG	Hydrocarbon biodegradation pathways, aerobic/anaerobic

13. Feb. 6 Midterm 1, in class, Lectures 1-10

14. Feb. 8	LG	Bioremediation
15. Feb. 10	LG	Bioremediation
16. Feb. 13	LG	Bioremediation
17. Feb. 15	LG	Bioremediation
18. Feb. 17	LG	Bioremediation

Feb. 20-24 Reading Week, no classes

19. Feb. 27	LG	Microbial enhanced oil recovery
20. Mar. 1	LG	Microbial enhanced oil recovery
21. Mar. 3	LG	Microbial enhanced oil recovery

22. Mar. 6 Midterm 2, in class, Lectures 11-21

23. Mar. 8	GV	Oilfield souring and treatment
24. Mar. 10	GV	Oilfield souring and treatment
25. Mar. 13	GV	Oilfield souring and treatment
26. Mar. 15	GV	Oilfield souring and treatment
27. Mar. 17	GV	Microbially influenced corrosion
28. Mar. 20	GV	Microbially influenced corrosion
29. Mar. 22	GV	Microbially influenced corrosion
30. Mar. 24	GV	Microbially influenced corrosion
31. Mar. 27		Special topic - guest lecturer
32. Mar. 29		Special topic - guest lecturer
33. Mar. 31		Project Presentations
34. Apr. 3		Project Presentations
35. Apr. 5		Project Presentations
36. Apr. 7	LG	Microbiology of oil sands and tailings ponds
37. Apr. 10	LG	Microbiology of oil sands and tailings ponds
38. Apr. 12	LG	Microbiology of oil sands and tailings ponds

LEARNING OUTCOMES

From Calendar: This course will provide a comprehensive overview of microbial communities found in petroleum-associated environments, their metabolic capabilities under aerobic and anaerobic conditions, and their beneficial and detrimental impacts on the petroleum industry. Topics will include oilfield souring and treatment, biocorrosion, biodegradation in petroleum reservoirs, microbially-enhanced oil recovery, bioremediation of hydrocarbon-contaminated sites, genomics of petroleum systems, biotechnological upgrading of petroleum, and oil sands tailings pond microbiology.

At the end of this course, students should be able to:

1. 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.
2. 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.
3. Describe the main metabolic pathways for the aerobic and anaerobic biodegradation of hydrocarbons.
4. 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.
5. Describe how microorganisms can be used to enhance oil recovery (microbial enhanced oil recovery, MEOR).
6. Explain oilfield souring, and the various microbial-based approaches that can be used to control souring.
7. Understand the microbial processes that can lead to the corrosion of steel surfaces within petroleum industry infrastructure (microbial influenced corrosion, MIC).
8. 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.
9. Through a group project, communicate a topic or seminal scientific paper related to petroleum microbiology through either an oral presentation or a poster presentation.
10. Be able to read and comprehend media reports and literature associated with the petroleum industry as presented in the media.