BIOLOGY 438 (CRN 10401)
NUTRIENT CYCLING AND PROKARYOTES
September – December 2018
COURSE OUTLINE

LECTURER:

Réal Roy, Ph.D.

Office: Cunningham 048a ph: 472-5071 email realroy@uvic.ca

Office hours: Monday 10:00-12:00

LECTURES

Room: CUNNINGHAM 146

Monday, Thursday 8:30-9:50

COURSE DESCRIPTION

An introduction to prokaryotes (bacteria and archaea) and their role in nutrient cycling in forests, lakes and oceans. Diversity and evolution of populations and communities of prokaryotes and their role in the major biogeochemical cycles: carbon, nitrogen, sulfur. Genetic, biochemical, physiological and ecological aspects of processes such as nitrogen fixation and methanogenesis; design of experimental approaches to assess cycling of elements in forests, lakes and oceans by prokaryotes.

LEARNING OUTCOMES

At the end of this course you will be able to:

1) Define, explain and analyze populations of prokaryotes in various natural systems.
2) Define, explain and analyze the contribution of prokaryotes to various communities.
3) Explain how prokaryotes contribute to the functioning of ecosystems by analyzing the contribution of prokaryotes in
    a. the cycling of carbon
    b. the cycling of nitrogen.
4) Design observational and experimental approaches to study prokaryotes in various ecosystems:
    a. Soil and sediment
    b. Freshwater and marine systems
    c. Extreme environments.
5) Understand connection between the diversity of prokaryotes and their fundamental contributions to energy transfer and material cycling in natural ecosystems.
6) Evaluate critically primary literature published in the area of microbial ecology.

LECTURE TOPICS

Date		Topics	Ref
Th	Sept. 6	Introduction	1
M	Sept. 10	1. Ecosystem Energetics	2
Th	Sept. 13	2. Decomposition and Nutrient Cycling	
M	Sept. 17		3
Th	Sept. 20	3. Hubbard Brook: A Model Ecosystem	4
M	Sept. 24		5
Th	Sept. 27	MID-TERM 1 (30%)	
M	Oct. 1	4. Biogeochemical Cycles	6-7
Th	Oct. 4	5. Microbial Systematics & Methods	8, 11
M	**Oct. 8**	**Thanksgiving: No Class**	
Th	Oct. 11	6. Carbon Cycle: Photosynthesis	9-10
M	Oct. 15	7. Carbon Cycle: Respiration (bioremediation)	9-10
Th	Oct. 18	8. Carbon Cycle: Fermentation	9-10
M	Oct. 22	9. Carbon Cycle: Methanogenesis	9-10
Th	Oct. 25	MID-TERM 2 (30%)	
M	Oct. 29	10. Carbon Cycle: Methane Oxidation	9-10
Th	Nov. 1	11. Nitrogen Cycle: Nitrogen fixation	9-10
M	Nov. 5	12. Nitrogen Cycle: Nitrification	9-10
Th	Nov. 8	13. Nitrogen Cycle: Denitrification	9-10
M	**Nov. 12**	**Remembrance Day & Reading Break: No class**	
Th	Nov. 15	14. Localization of Prokaryotes: Soil & Sediment	12
M	Nov. 19	15. Localization of Prokaryotes: Aquatic Systems	12
Th	Nov. 22	16. Localization of Prokaryotes: Extreme Systems	12
M	Nov. 26	17. Microbial Symbiosis	13
Th	Nov. 29	18. Biogeochemical Cycles and the Origin of Life	8
M	Dec. 3		
	Dec. 6-22	FINAL EXAMINATION (40%)	

Ref numbers are chapters in the Pearson Customized Textbook

EVALUATION

1. Midterm 1: 30% (September 28)
2. Midterm 2: 30% (October 26)
3. Final: 40% (December in exam period)
4. Bonus:
   Critical presentation of a scientific article.
   1) 2 page summary and critique of a published article.
   2) Powerpoint presentation (5 minutes, 5 slides maximum)

IMPORTANT: any delays in submitting assignments will be penalized (10% per day).

Grading scheme: A+ (90-100%), A (85-89.9%), A- (80-84.9%), B+ (77-79.9%), B (73-76.9 %), B- (70-72.9%), C+ (65-69.9%), C (60-64.9%), D (50-59.9%), F (<50%, after final)

NO CLASSES ON OCTOBER 12 AND NOVEMBER 9 BECAUSE OF THANKSGIVING AND READING BREAK.

THE DEPARTMENT OF BIOLOGY DOES NOT OFFER SUPPLEMENTAL FINAL EXAMS.

ABSENCE TO THE EXAMS FOR HEALTH PROBLEM WILL BE GRANTED ONLY WITH THE SUBMISSION OF A DOCTOR'S NOTE.

***UVic is committed to promoting, providing and protecting a supportive and safe learning and working environment for all its members*.**

RECOMMENDED TEXTBOOK AND REFERENCES

Recommended textbook

Pearson Custom Library. Symbiosis. BIOL 438 Nutrient Cycling and Prokaryotes, University of Victoria. (available at UVic Bookstore)

Krebs, Charles J. 2016. Why Ecology Matters. The University of Chicago Press. 193 p.

Required Coursepack

Roy, Réal. 2012. BIOL438 / BIOL538. Course reading.

Other references

General textbooks

Madigan, M., J.M. Martinko, P.V. Dunlap, D.P. Clark. 2012. Brock Biology of Microorganisms. 13th ed. Pearson-Benjamin Cummings, San Francisco, CA, USA.

Smith, T.M. and R.L. Smith. 2015. Elements of Ecology. 9th Ed. Pearson, Bostpon, MASS, USA.

Hubbard Brook Ecosystem Study

Likens, G. E. 2013. Biogeochemistry of a Forested Ecosystem. 3rd Ed. Springer, New York, NY, USA.

Bormann, F.H. and G. E. Likens. 1979. Pattern and Process in a Forested Ecosystem. Springer, New York, NY, USA.

Likens, G.E. (Ed.). 1985. An Ecosystem Approach to Aquatic Ecology. Springer, New York, NY, USA.

Other textbooks

Atlas, R.M., and R. Bartha. 1998. Microbial Ecology. 4th ed. Benjamin Cummings, Menlo Park, CA.

Schlegel, H.G. 1997. General Microbiology. 7th Ed. Cambridge University Press, Cambridge, UK.
Stolp, H. 1988. Microbial Ecology: Organisms, Habitats, Activities. Cambridge Studies in Ecology. Cambridge University Press. Cambridge, UK.

Taxonomy

Garrity, G.M. 2001-2009. Bergey's Manual of Systematic Bacteriology. Second Edition. Vol. 1 (Archaea), Vol 2 (Parts A, B, C) (Proteobacteria), Vol. 3 (Firmicutes), Vol. 4 (Miscellaneous Phyla). Springer, NY, USA.

Genetic diversity

Hopwood, D. A., and K.F. Chater (eds.). 1989. Genetics of Bacterial Diversity. Academic Press, London, UK.

Biogeochemical cycling

Fenchel, T., G. King, and T.H. Blackburn. 1998. Bacterial Biogeochemistry. The Ecophysiology of Mineral Cycling. Academic Press, London, UK.

Nitrogen cycle

Sprent, J. 1987. The Ecology of the Nitrogen Cycle. Cambridge Studies in Ecology. Cambridge University Press, Cambridge, UK.
Postgate, J. R. 1998. Nitrogen Fixation. Cambridge University Press, Cambridge, Cambridge, UK.
Payne, J.W. 1982. Denitrification. John Wiley & Sons, New York, NY.

Soil Microbiology

Paul, E.A. and . 1998. Soil Microbiology and Biochemistry. Academic Press, San Diego, CA.
Sylvia, D.M., J.J. Fuhrman, P.G. Hartel, D.A. Zuberer (Eds.). 1999. Principles and Applications of Soil Microbiology. Prentice Hall, Upper Saddle River, NJ.

Aquatic Microbiology

Kirchman, D.L. (Ed.). 2008. Microbial Ecology of the Oceans. 2nd Ed. Wiley-Blackwell, Hoboken, NJ, USA.
Rheinheimer, G. 1980. Aquatic Microbiology. 2nd ed. John Wiley & Sons, London, UK.
Paul, J.H. (Ed.). 2001. Marine Microbiology. Academic Press, San Diego, CA.

Fermented Food

Hutkins, R.W. 2006. Microbiology and Technology of Fermented Foods. IFT Press-Blackwell Publishing, Ames, Iowa, USA.