

**BIOLOGY 438**  
**ECOLOGY OF PROKARYOTES**  
**September – December 2011**  
**COURSE OUTLINE**

**LECTURER:**

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Office hours Monday 10:00-12:00

**LECTURES**

Room: CORNETT A125

Monday, Thursday 8:30-9:50

**COURSE DESCRIPTION**

An introduction to the ecology of the prokaryotes (bacteria and archaea). 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 or 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) Appreciate 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. 8  | Introduction                                               |                             |
| M    | Sept. 12 | The physical environment: Terrestrial, Marine, and Extreme | Brock 1 to 6                |
| Th   | Sept. 15 | Diversity and evolution of prokaryotes (general)           | Brock 2,14, BM 2A           |
| M    | Sept. 19 | Prokaryotes populations, communities and ecosystems        | Brock 23                    |
| Th   | Sept. 22 | Prokaryotes populations, communities and ecosystems        |                             |
| M    | Sept. 26 | SHORT TEST                                                 |                             |
| Th   | Sept. 29 | Methods and scales in prokaryote ecology                   | Brock 22                    |
| M    | Oct. 3   | Carbon cycle: Photosynthesis                               | Brock 20 I, 24              |
| Th   | Oct. 6   | Carbon cycle: Respiration                                  | Brock 21                    |
| M    | Oct. 10  | No CLASS (Thanksgiving)                                    |                             |
| Th   | Oct. 13  | Carbon cycle: Fermentation                                 | Brock 21                    |
| M    | Oct. 17  | Carbon cycle: Methane oxidation                            | Brock 21                    |
| Th   | Oct. 20  | Carbon cycle: Methanogenesis                               | Brock 21                    |
| M    | Oct. 24  | MID TERM EXAM                                              |                             |
| Th   | Oct. 27  | Nitrogen cycle: Nitrogen fixation                          | Brock 20, 24                |
| M    | Oct. 31  | Nitrogen cycle: Assimilation/mineralization, Nitrification | Brock 20, 24                |
| Th   | Nov. 3   | Nitrogen cycle: Denitrification                            | Brock 21                    |
| M    | Nov. 7   | Localization of prokaryotes in nature: Soil and Sediment   | Brock 23, FKB 4,5           |
| Th   | Nov. 14  | Localization of prokaryotes in nature: Aquatic Systems     | Brock 23, FKB 6             |
| M    | Nov. 17  | NO CLASS (Remembrance Day)                                 |                             |
| Th   | Nov. 21  | Localization of prokaryotes in nature: Extreme Environment | Brock 23, FKB 8             |
| M    | Nov. 24  | Biogeochemical cycling and the origin of life              | Brock 14, FKB 10            |
| Th   | Nov. 28  | Diversity and evolution of prokaryotes (Archaea)           | Brock 17, BM 1              |
| M    | Dec. 1   | Diversity and evolution of prokaryotes (Bacteria)          | Brock 15, 16<br>BM2B, 2C, 3 |

Brock: Madigan, M., J.M. Martinko, P.V. Dunlap, D.P. Clark. 2009.

BM: Bergey's Manual. 2001-2009.

FKB: Fenchel, T., King, G.M., & Blackburn, T.H. 1998.

## EVALUATION

1. Short test 20%
  2. Mid-term: 30%
  3. Final: 40%
  4. Assignments :10%
- 1) Critical presentation of a scientific article. 2 page summary and critique of a published article.  
(DEADLINE November 3)

IMPORTANT: any delays in submitting assignments will be penalized (5% per day).

### Grading scheme

A+ (90-100%), A (85-89.9%), A- (80-84.9%), B+ (75-79.9%), B (70-74.9%), B- (65-69.9%), C+ (60-64.9%), C (55-59.9%), D (50-54.9%), F (<50%, after final)

**NO CLASSES ON OCTOBER 10 AND NOVEMBER 10 BECAUSE OF  
THANKSGIVING AND READING BREAK.**

**THE DEPARTMENT OF BIOLOGY DOES NOT OFFER SUPPLEMENTAL FINAL EXAMS.**

**ABSENCE TO THE EXAMS FOR HEALTH PROBLEM WILL 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

### Required Coursepack

Roy, Réal. 2011. BIOL438 / BIOL538. Course reading.

### Recommended textbook

Madigan, M., J.M. Martinko, P.V. Dunlap, D.P. Clark. 2009. Brock Biology of Microorganisms. 12<sup>th</sup> ed. Pearson-Benjamin Cummings, San Francisco, CA, USA.

### General textbooks

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

Schlegel, H.G. 1997. General Microbiology. 7<sup>th</sup> 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). 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**

Rheinheimer, G. 1980. Aquatic Microbiology. 2<sup>nd</sup> ed. John Wiley & Sons, London, UK.

Paul, J.H. (Ed.). 2001. Marine Microbiology. Academic Press, San Diego, CA.