BISC 538 (Draft)

Metals and Biology in Oceanic Regimes

2 Units

One 80 minute lecture per week

Meeting Time and Place: Mondays 1-2:20 pm (total 12 lectures in the semester, plus 3 lecture periods for student presentations and course review)

Prerequisites: Permission of Instructor

Contact Info: James Moffett, Dave Hutchins
Office Hours: By Appointment
Letter Grade
Grading Scheme: 20% Mid Term Exam; 30% Presentation; 50% term Paper.

Course Description

The class is targeted at students interested in the major biogeochemical cycles in the oceans, as well as geomicrobiology. It explores the relationship between metals in reducing regimes and microbes that utilize them for key metalloenzymes. The focus is on biological availability of key micronutrients, rather than processes like chemoautotrophy or biomineralization. However, the course focuses on the coordination and redox chemistry of metals like iron, cobalt, copper and molybdenum, so it is of general interest to geomicrobiologists and trace metal chemists. Each student will be assigned a special topic based on an important research paper published that year, covering material that is new, and potentially controversial. The paper will be used as a basis for a detailed survey of that area of research, summarized in an oral presentation followed by a 10 page term paper.
Learning Objectives:
Students will emerge from the class with a general understanding of how microbes interact with their chemical environment. The course will also strengthen interactions between students working in different lab groups who have overlapping interests in metals. In particular, the class will strengthen ties between students in biology, earth sciences and ocean sciences. The presentation and term paper will enhance skills in oral and written communication of basic research.

Statement for Students with Disabilities

Any student requesting academic accommodations based on a disability is required to register with Disability Services and Programs (DSP) each semester. A letter of verification for approved accommodations can be obtained from DSP. Please be sure the letter is delivered to me (or to TA) as early in the semester as possible. DSP is located in STU 301 and is open 8:30 a.m.–5:00 p.m., Monday through Friday. The phone number for DSP is (213) 740-0776.

Statement on Academic Integrity
USC seeks to maintain an optimal learning environment. General principles of academic honesty include the concept of respect for the intellectual property of others, the expectation that individual work will be submitted unless otherwise allowed by an instructor, and the obligations both to protect one's own academic work from misuse by others as well as to avoid using another's work as one's own. All students are expected to understand and abide by these principles. Scampus, the Student Guidebook, contains the Student Conduct Code in Section 11.00, while the recommended sanctions are located in Appendix A: http://www.usc.edu/dept/publications/SCAMPUS/gov/. Students will be referred to the Office of Student Judicial Affairs and Community Standards for further review, should there be any suspicion of academic dishonesty. The Review process can be found at: http://www.usc.edu/student-affairs/SJACS/.

Syllabus

15 Lectures including Presentations made by the students. Time allotted per presentation anticipated to be 20 minutes.

1. Overview of trace metal geochemistry in the oceans and role in major biogeochemical cycles (Moffett) August 26

2. An Introduction to metal speciation (Moffett) September 9

3. Iron redox cycling and role in ocean history (Moffett) September 16

4. Iron inputs and internal cycling: dust, hydrothermal and continental margins (Moffett) September 23

5. Copper – a key micronutrient for methanotrophy, nitrous oxide reduction and other important processes. (Moffett) September 30

6. In situ Fe experiments (Hutchins) October 7

7. Conceptual models Fe cycling. (Hutchins) October 14

8. Zinc, cadmium and cobalt and their metalloenzymes (Hutchins) October 21

9. Fe and nitrogen fixation . Hutchins October 28

10.) Fe Limitation, Biology and Biochemistry (Hutchins) November 4

11. Metals in the changing future ocean (Hutchins) November 11

12. Metals and toxicology (Moffett) November 18

13. Student Presentations and Discussion November 25

14. Student Presentations and Discussion December 2
15. Student Presentations and Discussion December 9 (if needed)

Papers due December 9

Assigned Reading List

Saito, M., Morel, F.M.M. and Sigman, D. 2003 The bioinorganic chemistry of the ancient ocean: the co-evolution of cyanobacterial metal requirements and biogeochemical cycles at the Archean/Proterozoic boundary. Inorganica Chimica Acta 356 308-318

J.J.R.F. da Silva, R.J.P. Williams, The Biological Chemistry of the Elements: The Inorganic Chemistry of Life, Oxford University Press, Oxford, 1991.

Kim, H.J. et al., 2004. Methanobactin, a Copper-Acquisition Compound from Methane-Oxidizing Bacteria. Science 30: 1612

Marine Bioinorganic Chemistry: The Role of Trace Metals in the Oceanic Cycles of Major Nutrients F. M. M. Morel, A. J. Milligan, and M. A. Saito Treatise on Geochemistry Volume 6; pp. 113–143 2003

Plus other papers cited above as the course progresses