

## MSC 417/BIL 315

### Marine Biota and Biogeochemical Cycles

**Instructor** Dennis A. Hansell, Professor of Chemical Oceanography  
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**Office Hours** In Ungar #210A for 30 minutes prior to the class meeting time or by appt at my RSMAS office (SLAB#224)

**Day/Time:** Tuesday/Thursday 3:30-4:45 p.m.

#### ***Course Description from the University of Miami course catalog***

The distribution of dissolved and particulate materials in the sea is not uniform in time or space. Variability in these reflects the diverse biological sources, transformations, and sinks of chemical constituents (e.g., nutrients, organic matter, gases) in the sea. This course focuses on the role of marine organisms in marine biogeochemical cycling, with particular emphasis on marine carbon and the nutrients. We visualize and query the ocean system using publicly available global ocean data sets and the application *Ocean Data View*. The material is presented as a capstone to your training in marine sciences, bringing together the physical, chemical and biological dynamics of the ocean as a single system.

**Prerequisite:** MSC 215 or permission of instructor

Instruction Level: This is an upper division undergraduate course for Biology, Geology and/or Ocean Science majors. The course is designed to introduce the principles of marine biogeochemistry, with emphasis on the cycling of the major elements and the responsible organisms. A basic understanding of the ocean system is necessary; that understanding comes having completed lower division MSC courses, such as chemical and physical oceanography; we include those foundational topics in this course.

#### **Book**

A text book is not required, but a laptop is necessary to complete assignments.

Recommended reference books:

*Ocean Biogeochemical Dynamics*. Sarmiento & Gruber, 2006, Princeton University Press, The figures and book errata are available at <http://www.up.ethz.ch/people/ngruber/textbook>.

*Introduction to Marine Biogeochemistry*. Susan M. Libes, 2009, Academic Press.

### **Course Notes:**

1. Powerpoint copies of the lectures will be available on “Blackboard” a few hours before each lecture. Once up, they will be kept there for the duration of the course.
2. Exams: There will be 4 exams, each worth 20% of grade (totaling 80%). These will be short essay exams that will test your understanding of the concepts and ocean processes presented. The exam material will be based on lecture material, homework problems, and ocean data manipulation and interpretation.
3. Homework problems (10% of grade): Problems will be assigned when we first begin covering a topic, with the problems sets due 1 week from the assignment date. Late submissions of homework assignments will not be given full credit.
4. A 10-15 minute Powerpoint presentation (10% of grade) will be required of each student in the last days of class. The biogeochemistry topic will be chosen by the student in consultation with the professor by November 5.
5. Grading is done on a curve; the final grades will include A’s, B’s, C’s, and lower if necessary. The key to a high grade is a high cumulative point total. Attendance and participation (your questions and discussion) will be recognized should your course grade be in the gray area.
6. Religious holidays/conflicts with test dates: If you have conflicts, notice from the student should be given to the instructor no later than the end of the first three meeting days of the course.
7. Attendance policy: I expect students to attend every class meeting in order to learn the material and be prepared for evaluation of their knowledge. Having more than 2 unexcused absences precludes earning an “A” in the course. Excused absences that I will try to accommodate include: personal illness, death or critical illness in the family, participation in university-sponsored activities, jury and military duties.

**Guiding Quote:** “Doubt is the essence of science” (Bertrand Russell); in other words, do not believe everything you are told.

### **Course Schedule**

#### Week 1

- Aug 25 – Introduction to course
- Aug 27 – Ocean Physical System; surface circulation

#### Week 2

- Sep 1 – Ocean Physical System; surface circulation
- Sep 3 – Ocean Data View (ODV)

#### Week 3

- Sep 8 – Ocean Data View (ODV)

- Sep 10 – Ocean Physical System; deep circulation
- Week 4
- Sep 15 – Ocean Physical System; deep circulation
- Sep 17 – First Examination (Physical system and *ODV* skills test; bring your notes on how to use *ODV*)
- Week 5
- Sep 22 – Review Exam; start Organic Matter Production
- Sep 24 – Organic Matter Production
- Week 6
- Sep 29 – Oxygen in Upper Ocean
- Oct 1 – Upper Ocean Nitrogen Cycle (New, Regenerated and Export Production)
- Week 7
- Oct 6 – Particulate Organic Matter (POM) Export
- Oct 8 – FALL RECESS (no class meeting)
- Week 8
- Oct 13 – Second Examination
- Oct 15 – Review Exam; start Dissolved Organic Matter (DOM)
- Week 9
- Oct 20 – DOM
- Oct 22 – Deep Ocean Remineralization & Oxygen
- Week 10
- Oct 27 – Colored Dissolved Organic Matter (CDOM)
- Oct 29 – Deep N Cycle (N<sub>2</sub> fixation & Denitrification)
- Week 11
- Nov 3 – Deep N Cycle (N<sub>2</sub> fixation & Denitrification)
- Nov 5 – Trace Element Biogeochemistry (also, inform instructor on plans for presentations)
- Week 12
- Nov 10 – Silicon Cycle
- Nov 12 – Sediment Biogeochemistry
- Week 13
- Nov 17 – Third exam
- Nov 19 – Review exam; Inorganic Carbon
- Week 14
- Nov 24 – Thanksgiving Break
- Nov 26 – Thanksgiving Break
- Week 15
- Dec 1 – Calcium Carbonate
- Dec 3 – Presentations
- Week 16
- Dec 8 – Presentations
- Week 16
- Dec 15 – Final Comprehensive Exam (2:00-4:30 PM)