Geo 371C/388G Global Biogeochemical Cycles
Fall 2009

Instructor: Dr. Timothy Shanahan, tshanahan@jsg.utexas.edu 232-7051
Office: EPS 3.126
Office hours: M, W 12:30-1:30
Class: MWF, 9-9:50, JGB 3.222

Goals:

This course will examine the chemistry of the surface of the Earth with a focus of biogeochemical processes and their interactions with the global climate system. Our planet is essentially a closed system in which chemical cycles of many elements are both driven by biological and geological processes and determine the distribution and nature of life on Earth. We will study the chemistry of the atmosphere, soils, rivers and oceans, and examine how these systems are connected via the global nitrogen, phosphorus and carbon cycles. We will especially focus on the carbon cycle and assess the effects humans have had on cycling of this crucial element.

Prerequisites: Introductory Chemistry, Biology, Geology. Intended for upper level undergraduates and introductory graduate students

Course expectations:

The class will be conducted in a lecture- discussion format. You are expected to do the reading and participate in class

Required reading:

Biogeochemistry: An analysis of global change (Schlesinger; Academic Press, 1997).

A number of other readings, listed by week in the syllabus, are posted on the course's Blackboard site.

I won't be teaching directly from the textbook or other readings, so please don't worry about every detail covered in the assigned readings if that topic isn't covered in lecture. Instead, I suggest that you use the readings to better understand the material we cover in lecture and in the paper discussions – this is what I will test you on!

Grading:

1- Exams. You will take two exams during the term. The final exam will be comprehensive; it will test your understanding of the material covered during the entire semester.

2- Attendance/Participation. Attendance is mandatory and, along with participation in classroom exercises and discussions, will constitute a significant portion of your course grade. All excused absences must be reported to me in advance and can be made up by arrangement with me. Unexcused absences will be handled on an individual case basis.

3- Paper discussion/presentations. Giving presentations and leading discussions is an important skill. It also helps to foster class discussion. For this reason each of you will be required to lead discussions of 1-2 scientific papers during the course of the semester. This will entail a 10-15 min presentation of the paper (including a powerpoint presentation), followed by a 10-20 minute discussion.

4-Term papers: Only required for graduate students. Term papers are due on the last day that classes meet (before dead day). They should take the form of a short, 5 page NSF style research proposal (length not including references) on a topic of your choice relating to biogeochemical cycles. The goal of this is for you to use this opportunity to investigate a project related (but not identical to) your thesis/dissertation research.

Grading (undergraduates):
Participation: 15%
Presentation: 25%
Midterm exam: 30%
Final exam: 30%

Grading (graduates):
Participation: 15%
Presentations: 25%
Midterm exam: 20%
Final exam: 20%
Final paper: 20%

Exams:
Midterm: Wed Oct 14, 9 am
Final: take home, due Dec 12 in my office at 5pm

A note to students with disabilities: students with disabilities may request appropriate academic accommodations from the Division of Diversity and Community Engagement, Services for Students with Disabilities, 471-6259.

date	***Topic***
	Introductions-background
26-Aug	Introduction-
28-Aug	Earth system
31-Aug	Chem rev 1: carbonate chemistry
2-Sep	Chem rev 2: redox reactions and metabolism
4-Sep	Origins - the elements/planets/atmosphere
7-Sep	Labor day
	The Atmosphere
9-Sep	Origin of the atmosphere
11-Sep	atmospheric chemistry/structure
14-Sep	atmospheric chemistry- key reactions
16-Sep	aerosols
	Terrestrial environment
18-Sep	Lithosphere I minerals and weathering reactions
21-Sep	Lithosphere III - Pedogenesis and soil formation

23-Sep	DISCUSSION 1 - the rock cycle
25-Sep	soil nutrient cycling I (stoichiometry)
28-Sep	soil nutrient cycling II (nutrient limitation)
30-Sep	soil nutrient cycling III (nutrient limitation)
2-Oct	Net primary productivity/carbon cycle
5-Oct	terrestrial carbon storage I - nutrients
7-Oct	terrestrial carbon storage II - temperature
9-Oct	DISCUSSION 2 soils - anthropogenic influences
12-Oct	Bennett - microbial biogeochem
14-Oct	MIDTERM
	Freshwater
16-Oct	Biogeochemistry of fresh waters - lakes/rivers
19-Oct	Biogeochemistry of fresh waters - lakes/rivers
21-Oct	Biogeochemistry of coastal zone - estuaries
23-Oct	DISCUSSION 3- anthrpogenic impacts
	Ocean
26-Oct	Ocean intro: structure, dynamics, general chemistry
28-Oct	chemical composition of the ocean
30-Oct	Carbonate chemistry
2-Nov	Organic matter production
4-Nov	Organic matter export/biological pump
6-Nov	Ocean nitrogen cycle
9-Nov	ocean phosphorous cycle
11-Nov	ocean silica cycle
13-Nov	Role of trace elements in nutrient cycles
16-Nov	DISCUSSION 4-Anthro impacts - ocean acidification
18-Nov	DISCUSSION 5-Anthro impacts - ocean fertilization
	Cycles
20-Nov	Biogeochemical cycling on glacial-interglacial timescales
23-Nov	Breecker - revisiting the carbon cycle
25-Nov	no class
27-Nov	thanksgiving
30-Nov	The nitrogen and phosphorous cycle
2-Dec	The sulfur cycle
4-Dec	Biogeochemical cycles and the future
7-Dec	Dead day
9-Dec	Dead day
12-Dec	FINAL