ESM 202 Environmental Biogeochemistry

Arturo A. Keller  
Bren Hall 3420  
arturokeller@ucsb.edu  
OH: open door policy/email appt.

Lectures: In Bren 1414 9:30 to 10:45 am Tuesday and Thursday

The goal of this course is to provide you with a scientific basis to understand:
- Major disturbances to cycling of elements in the environment
- Pollution and its implications
- A range of approaches to understand and develop solutions to these problems
- How this is relevant in your daily life as well as for your career

LECTURES

Week 1  Why is biogeochemistry relevant for solving environmental problems?  
Understanding water quality: Part I

Week 2  Understanding water quality: Part II  
Eutrophication and P cycle

Week 3  N Cycle – sources, processes and effects  
Understanding Air quality

Week 4  Sulfur cycle – sources, processes and effects  
Acid mine drainage

Week 5  Carbon cycle dynamics (major drivers of emissions)  
Terrestrial and oceanic carbon processes

Week 6  Wetland biogeochemistry  
MIDTERM (in class)

Week 7  Trace elements – sources, processes and effects  
Life-cycle assessment & biogeochemistry

Week 8  Lead and mercury  
Emerging organic pollutants

Week 9  Micro and nano pollutants  
Ecotoxicology

Week 10  Modeling Biogeochemistry to Inform Policy Decisions  
Synthesis and interactions

March 16  FINAL EXAM  (8-11 am, in class)
DISCUSSIONS
TAs: Qian Gao (Bren Hall 2326)
    Violaine Desgens-Martin (Bren Hall 2422)

Week  Topics

1  Chemistry boot camp
   (Or what I really need to know to make the most of this course)
2  Water quality concepts
3  N & P biogeochemistry
4  Air quality concepts & Sulfur cycle
5  Carbon cycle
6  Review for midterm
7  Trace elements
8  Emerging pollutants
9  Open topic
10 Review for final

GRADING
- Assignments: 3 x 15% each (#1 Due Week 4, #2 Due Week 8, #3 Due Week 10, on Fridays)
  - The assignments are INDIVIDUAL, and be careful when using information from a published source to express it in your own words after you analyze it
- Weekly short quizzes, to motivate you to keep up with the course.
  - There is no downside to the quizzes: if you do them, you can improve your final grade, but if you don't get them correct it will have no negative impact on your final grade.
  - We will post them every Thursday and you are expected to complete them by the following Monday evening.
  - If you can answer them without even looking at your notes, you are doing great. If you need to look at your notes, that is good. If you are stumped even after looking at your notes, then it is time to bring the questions to the Discussion Section or Office Hours.
- Midterm: 20%
- Final: 35%

Homework #1  1/11 to 1/21
Homework #2  1/20 to 2/4
Midterm      2/10
Homework #3  2/14 to 3/7
Final         3/15
## Reading Materials

Textbook: Biogeochemistry: An Analysis of Global Change (3rd Edition), by Schlesinger and Bernhardt

<table>
<thead>
<tr>
<th>Week</th>
<th>Readings</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Chapters 1 and 8 &amp; Article on Water Quality</td>
</tr>
<tr>
<td>2</td>
<td>Chapters 6 and 12</td>
</tr>
<tr>
<td>3</td>
<td>Chapter 3 &amp; Article on Air Quality</td>
</tr>
<tr>
<td>4</td>
<td>Chapter 13</td>
</tr>
<tr>
<td>5</td>
<td>Chapters 5, 9 and 11</td>
</tr>
<tr>
<td>6</td>
<td>Chapter 7</td>
</tr>
<tr>
<td>7</td>
<td>Article on Trace Elements</td>
</tr>
<tr>
<td>8</td>
<td>Article on Emerging Contaminants</td>
</tr>
<tr>
<td>9</td>
<td>Article on Ecotoxicology</td>
</tr>
<tr>
<td>10</td>
<td>Chapter 14</td>
</tr>
</tbody>
</table>

Articles will be posted to the course website in Gauchospace. Homework assignments will be posted in Gauchospace.