FRSHWTR-522 (Fall 2017)
Aquatic Organic Biogeochemistry
3 credit hours

Instructor: Laodong Guo
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Office: School of Freshwater Sciences, Room 3009

Meeting Time: Monday (1:00 -3:40 pm)
Location: 1st floor classroom, Room 1080; School of Freshwater Sciences, 600 East Greenfield Avenue, Milwaukee WI 53204

2. Course Description

Organic geochemistry is the study of the impacts and processes that organisms and once-living organisms have on the earth. This course will focus on the biogeochemical cycling of natural organic matter in aquatic environments. Dissolved organic matter is a key component in the interplay between the biosphere, hydrosphere, and geosphere. Knowledge of the source, composition and cycling processes of organic matter in terrestrial and aquatic systems is important not only for the understanding of the biogeochemistry of a variety of bioactive elements, but also for global carbon cycles and thus climate changes of human concern. Graduate and undergraduate students from freshwater sciences, biological/environmental science and geoscience will greatly benefit from this course. The course is offered to students, both within and external to the School of Freshwater Sciences, who are interested in gaining knowledge of natural organic matter and its ecological/environmental roles in aquatic systems. Prerequisite courses include basic chemistry and other core courses or permission of instructor.

Topics to be covered in this course include sources, composition, transport and cycling pathways of dissolved, colloidal and particulate organic matter, and sedimentary organic matter in aquatic systems; Fluxes of organic matter across river-lake, soil-water, sediment-water, and land-ocean interfaces; Interactions of organic matter with trace elements (metals and radionuclides) and particles/nanoparticles and their effects on bioavailability/toxicity; Applications of stable C & N isotopes, radiocarbon, and biomarkers; and case studies. Instrumentation and laboratory techniques for organic analysis and characterization will also be covered. Emphasis will be placed on the characterization of dissolved organic matter (DOM), including achromophoric DOM and fluorescent DOM, sampling and characterization of colloidal organic matter and natural nanoparticles using ultrafiltration and flow field-flow fractionation techniques.

Research component in this class include literature search, paper discussion, student presentations, and a term paper or research proposal.

3. Course Objectives

This course is designed to provide students an introduction to biogeochemical cycling of organic matter in aquatic environments. Students will gain an understanding of organic biogeochemistry,
carbon cycles, sampling and analytical methods, characterization of bulk and size-fractionated organic matter, applications of stable isotopes and radiocarbon, as well as frontier research in carbon cycles. Knowledge and skills gained from aquatic organic biogeochemistry could add a broad range of approaches to student thesis research.

**Workload**
This is a 3 credit-hour course. As such, students should expect to devote at least 6 hours of work per week to this course over a full semester. This time commitment will include:
- In-class time and labs (approximately 3 hours per week);
- Reading assignments;
- Completion of homework and/or lab assignments;
- Preparation of presentations;
- Preparation of a paper or research proposal (see below);
- Preparation for exam.

4. **Recommended Books (chapters) and Journals**

Related Journals:
- *Geochimica Coamochimica Acta*
- *Limnology and Oceanography*
- *Marine Chemistry*
- *Organic Geochemistry*
- *Biogeochemistry*
- *Journal of the Great Lakes Research*

Internet resources
- [Science Direct](http://www.sciencedirect.com/)
- [Web of science](http://apps.isiknowledge.com/)
- UWM Libraries Online Resources
- Google Scholar ([https://scholar.google.com/](https://scholar.google.com/))

5. **Course Grading**
There will be one 3-hours lecture or labs per week. Homework includes problem sets from lectures, reading assignments, paper discussion, and laboratory experiments. Students will be
required to write a term paper or research proposal on the topic of student’s interest and approved by instructor. Students will also give presentations based on assigned topics, lab data, literature research, and reading. There will be a final exam, but not mid-term exam.

**Grading (for undergraduate students)**
- Participation (10%)
- Homework and labs: (50%)
- Presentations/discussion-paper (10%)
- Term-Paper (15%)
- Final exam (15%)

**Grading (for graduate students)**
- Participation (10%)
- Homework and labs: (50%)
- Presentations/discussion-paper (10%)
- Term-Paper/Research proposal (15%)
- Final exam (15%)

**Assignment Details**

- **Homework and lab (50%):** There will be problems sets utilizing data from lectures, reading assignments, discussion-papers, and laboratory experiments. Assignments must be written in a style consistent with the major publication style in your field and turned in at the beginning of class on the assigned due date.

- **Presentations (10%):** Students will give presentations based on assigned topics, literature research, and discussion-papers/readings. **Graduate students** will present a more comprehensive and in-depth literature review and summary.

- **Term Paper/Research Proposal (15%):**
  - **Undergraduates:** Students will be required to write a term paper on the topic of the student’s interest and approved by the instructor. The paper will be based on an essay format research paper, requiring the use of the primary scientific literature.
  - **Graduate students:** Students will be required to write a mini literature review or a research proposal on a topic of the student's interest and approved by the instructor. Proposals are to be developed in the format of a National Science Foundation proposal (shorter version).

- **Final Exam (15%):** A comprehensive take home final exam will require students to demonstrate knowledge of concepts presented in class and through research literature to solve advanced problem sets.

**Deadlines and Attendance Policy**
- Students are expected to be in attendance at each class. Unexcused absences may result in deductions from class participation grade.
• All homework and papers are due at the beginning of the class on the due date. Late submissions may result in a grade deduction.
• There are no make-up exams except for extreme emergencies, which require official documentation. In such an event, contact instructor as soon as possible to discuss options. An un-excused absence will result in lost points for that exam.

**Academic Misconduct:**
All UWM students are required to adhere to University standards of student conduct especially with regard to academic honesty and plagiarism. Plagiarizing is prohibited. Cheating, plagiarism, and other misconduct will result in severe penalty, as per University of Wisconsin System Chapter 1:

**University Policies**
The Secretary of the University web site contains the university policies.
http://www4.uwm.edu/secu/SyllabusLinks.pdf

1. **Students with disabilities.** Special accommodations are provided to meet learning and testing needs in a timely manner.
http://www4.uwm.edu/sac/

2. **Religious observances.** Accommodations for absences due to religious observance.
http://www4.uwm.edu/secu/docs/other/S1.5.htm

3. **Students called to active military duty.** Accommodations for absences due to call-up of reserves to active military duty.
http://www4.uwm.edu/current_students/military_call_up.cfm

4. **Incompletes.** A notation of "incomplete" may be given in lieu of a final grade to a student who has carried a subject successfully until the end of a semester but who, because of illness or other unusual and substantiated cause beyond the student's control, has been unable to take or complete the final examination or to complete some limited amount of term work.
http://www4.uwm.edu/secu/docs/other/S31.pdf

5. **Discriminatory conduct (such as sexual harassment).** Discriminatory conduct will not be tolerated by the University. It poisons the work and learning environment of the University and threatens the careers, educational experience, and well-being of students, faculty, and staff.
http://www4.uwm.edu/secu/docs/other/S47.pdf

6. **Academic misconduct.** Cheating on exams or plagiarism are violations of the academic honor code and carry severe sanctions, including failing a course or even suspension or dismissal from the University.
http://www4.uwm.edu/osl/dean/conduct.cfm
7. Complaint procedures. Students may direct complaints to the head of the academic unit or department in which the complaint occurs. If the complaint allegedly violates a specific university policy, it may be directed to the head of the department or academic unit in which the complaint occurred or to the appropriate university office responsible for enforcing the policy. 
http://www4.uwm.edu/secu/docs/other/S49.7.htm

8. Grade appeal procedures. A student may appeal a grade on the grounds that it is based on a capricious or arbitrary decision of the course instructor. Such an appeal shall follow the established procedures adopted by the department, college, or school in which the course resides or in the case of graduate students, the Graduate School. These procedures are available in writing from the respective department chairperson or the Academic Dean of the College/School. 
http://www4.uwm.edu/secu/docs/other/S28.htm

9. Other. The final exam requirement, the final exam date requirement, etc. 
http://www4.uwm.edu/secu/docs/other/S22.htm
6. Tentative Schedule (FRSHWTR-522)

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<thead>
<tr>
<th>Week</th>
<th>Date</th>
<th>Topic</th>
<th>Note</th>
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<tbody>
<tr>
<td>1</td>
<td>Sept-05</td>
<td>Tue/no class</td>
<td>Class begin</td>
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<tr>
<td>2</td>
<td>Sept-11</td>
<td>Introduction/assignments/lab-visit</td>
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<td>Carbon cycle</td>
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<td>3</td>
<td>Sept-18</td>
<td>Dissolved organic matter</td>
<td>Reading/HW</td>
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<td>Chromophoric-DOM (CDOM and FDOM)</td>
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<td>4</td>
<td>Sept-25</td>
<td>Colloidal organic matter</td>
<td>Presentation title Due</td>
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<td>Sampling and characterization of colloids</td>
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<td>5</td>
<td>Oct-2</td>
<td>Riverine organic matter and export fluxes</td>
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<td>Organic matter in estuarine environments</td>
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<td>6</td>
<td>Oct-09</td>
<td>Lab on DOM characterization</td>
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<td>7</td>
<td>Oct-16</td>
<td>Student Presentations/discussion-papers</td>
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<td>8</td>
<td>Oct-23</td>
<td>Stable C&amp;N isotopes and applications</td>
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<td>Radiocarbon applications</td>
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<td>9</td>
<td>Oct-30</td>
<td>Soil organic matter</td>
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<td>Organic degradation</td>
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<td>10</td>
<td>Nov-06</td>
<td>Black carbon and other organic chemicals with environmental concern</td>
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<td>Sedimentation and preservation of organic matter</td>
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<td>11</td>
<td>Nov-13</td>
<td>Metal complexation with DOM</td>
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<td>Interactions with nanoparticles/Discussion papers</td>
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<td>12</td>
<td>Nov-20</td>
<td>Organic characterization-Methods</td>
<td>Thanksgiving week</td>
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<td>Lab on organic size fractionation (Ultrafiltration/FIFFF)</td>
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<td>13</td>
<td>Nov-27</td>
<td>Carbon and nutrient dynamics in the Great Lakes</td>
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<td>Case studies</td>
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<td>14</td>
<td>Dec-04</td>
<td>Term-paper presentations</td>
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<td>15</td>
<td>Dec-11</td>
<td>Reading week</td>
<td>Study day</td>
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<tr>
<td>16</td>
<td>Dec-18</td>
<td>Final Exam (take-home)</td>
<td>Term-paper due</td>
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Total contact hours: 45.