Course Syllabus

Biogeochemistry and Env. Health (ENVS 385)

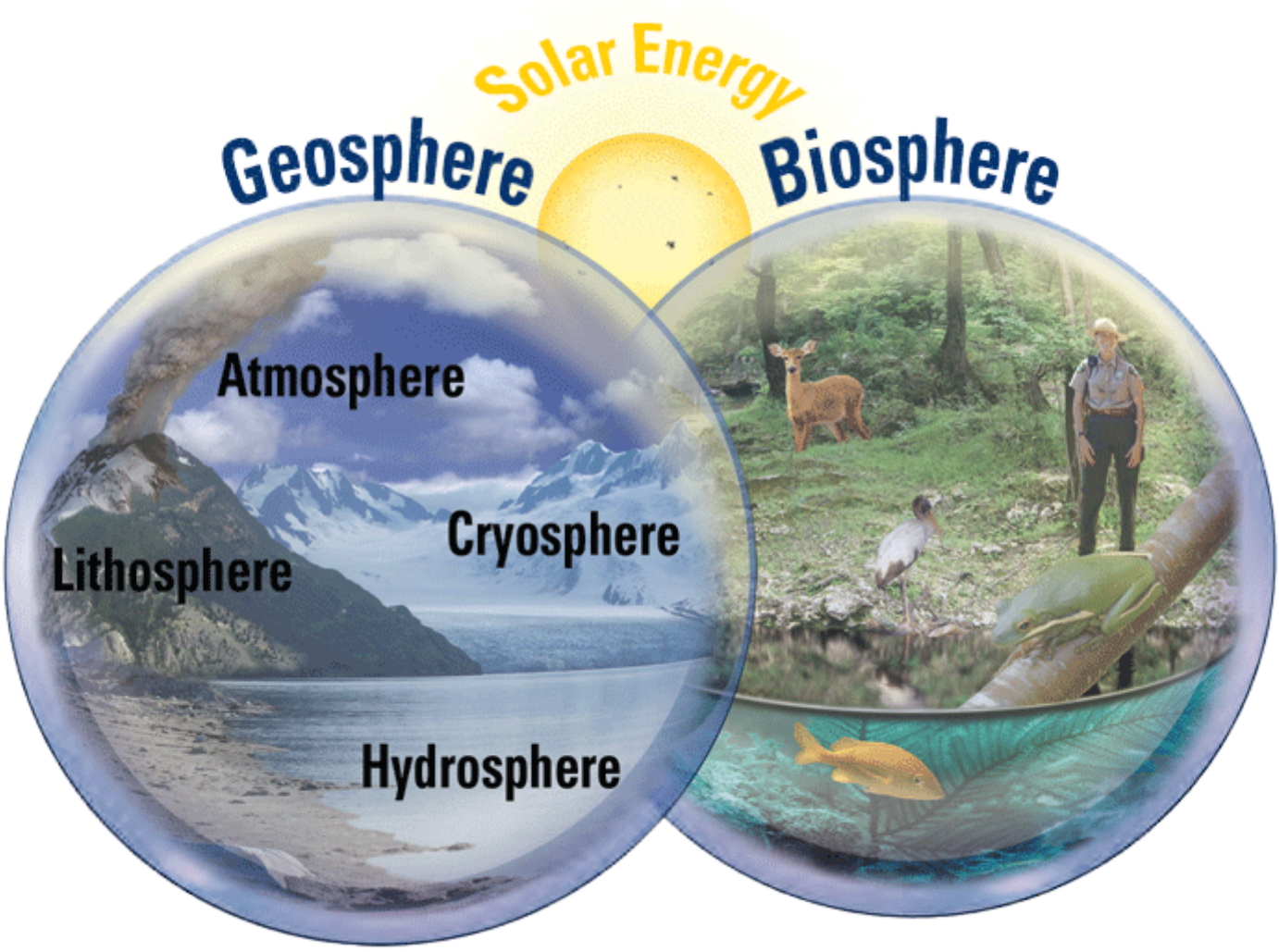

Image Credit: USGS

Course Overview

Biogeochemistry is the application of multiple disciplines (including biology, geology, and chemistry) to study nutrient and elemental cycling through both the living and non-living parts (or spheres) of the environment (atmosphere, biosphere, and geosphere). This course will broadly focus on the interplay of biology, geology, and chemistry and what impact that has on the environment, food production, global carbon (and nutrient) cycles, health, and policy.

Learning Objectives

Throughout this semester, we will learn about the chemical environment in which we live and about how

Throughout this semester, we will learn about the chemical environment in which we live and about how our planet works as an integrated chemical system in which biota/life, especially microbial life, is a major player.

By the end of the semester, students should be able to:

1. Review general chemistry concepts in term of biogeochemistry

2. Understand the basic function of the water, carbon, nitrogen, phosphorus, sulfur, and trace/heavy metal cycles

3. Understand the connections that link the major biogeochemical cycles

4. Examine environmental problems caused by human perturbations of the major biogeocheical cycles

5. Examine the link between biogeochemical cycles and health issues

Contact Information

You can find contact information of your instructor, time, venue, and office hour below. This class will meet in person two days/week.

Instructor: Debjani Sihi (email: **debjani.sihi@emory.edu (mailto:debjani.sihi@emory.edu)**)

When: Tue and Thu, 2:30-3:45 pm

Where: Emerson Chemistry Bldg. E102

Office hour: Wed 3-4 pm (E528, Mathematics and Science Center, 5th Floor) or by appointment via email (Alternative: Meet over zoom)

Textbook (paper or electronic)

All reading materials will be made available either via course reserves or by open-source materials such as media, podcast, etc. You are not required to purchase any textbook for this class. One copy of almost all of the resources (book chapter, article, etc) used in this course are also available in the Emory library (either in the form of hardcover or electronic book/article).

Software

We plan to use a cool visual programing tool, Stella (**NO CODING** for this class), to get some hands on experience and conceptualize different biogeochemical cycles across different parts of the ecosystems. There is an online limited version available for free (**https://iseesystems.com/store/products/stella-**

There is an online limited version available for free (**https://iseesystems.com/store/products/stella-online.aspx (https://iseesystems.com/store/products/stella-online.aspx)**). But the single end-user "semester student license" (RECOMMENDED) comes with more features at $59 (**https://www.iseesystems.com/store/education.aspx (https://www.iseesystems.com/store/education.aspx)**).

Course Structure

The course outline is found below. The weekly schedule is consistent throughout the semester. New material, such as lecture slides, videos, reading materials will be posted before the class. I will be available for office hours on Wednesdays from 3 pm to 4 pm. You can also take appointment via email as needed. We will meet as a class in-person on Tuesdays and Thursdays from 2:30 am to 3:45 pm. There will be approximately weekly homework (assignment, quiz, or discussion board participation) activities. **Homework of a particular week will be due by the Wednesday (11:59 pm) of the following week. Late submissions will receive a 10% reduction in score. However, you will receive 5 "Pandemic Reliefs" for late submissions.** You need to inform the instructor with a brief justification while requesting pandemic relief. There will be **NO EXAM** for this class. I do not want you all to memorize everything. Rather, I want you to INTERNALIZE the content we will cover throughout the semester. To compensate for the exam, you will need to work on a group project, which you will present (and submit a report) toward the end of the semester. We will also have bi-weekly group presentations (on Tue class). Your group will present in every other week. Time limit for group presentation is 15 mins (followed by 5 mins of Q&A). Presenters are expected to present the article that is being shared in the Library Course Reserve with a tag "Week # (Group Presentation)". The article will be based on the materials covered during the previous week. Peer-grading on group presentations will be done by the observing group members on a particular day (rubrics for peer-grading will be provided). Peer-grading (and also instructor-grading) on the group presentation will be based on the grasp on the material, thoughtful interpretation of the findings in the article, and constructive criticisms (if appropriate).

Your success in this course will be determined not only by how you showcase learning the content but also by your participation with the instructor and your classmates during the class, discussion boards, presentations, and group projects. Your engagement in these activities will support your development of knowledge in this course and is expected to be at the same extraordinary level with which you complete individual tasks. The anticipated time commitment is as follows:

In-person class sessions (3 hours/week);

Reading materials (3-4 hours/week);

Assignment, Quiz, Discussion, and Presentation (3-4 hours/week);

Variable time commitments for office hours and studying.

Note: This is an undergraduate and graduate course that will meet simultaneously. Graduate students

will be expected to complete more advanced assignments.

Grading Structure

Attendance and participation in the class: 10%

Discussion board activities: 10%

Quizzes: 20%

Assignments: 20%

Group Projects: 20%

Instructor Grading on Class Presentations: 10%

Peer Grading on Class Presentations: 10%

Your final course letter grade will be based on your total course grade on Canvas. Rubrics for Letter Grades are as follows:

A (92 or higher%); A- (89-91%); B+ (86-88%); B (83-85%); B- (80-82%); C+ (77-79%); C (73-76%); C- (70-72%); D+ (66-69%); D (60-65%); F (59% or lower)

Academic Honesty

All Quizzes and Assignments will be open-book. However, the Honor Code is in effect throughout the semester. By taking this course, you affirm that it is a violation of the code to cheat on quiz/assignment, to plagiarize, to deviate from the teacher's instructions about collaboration on work that is submitted for grades, to give false information to a faculty member, and to undertake any other form of academic misconduct. You also affirm that if you witness others violating the code you have a duty to report them to the honor council.

http://catalog.college.emory.edu/academic/policies-regulations/honor-code.htmlLinks to an external site. (http://catalog.college.emory.edu/academic/policies-regulations/honor-code.html)

Course Philosophy

Biogeochemistry is an interdisciplinary systems science whose application area includes all five Earth's spheres: biosphere, pedosphere, hydrosphere, atmosphere, and lithosphere. This makes for a unique (and exciting!) scientific challenge. Broadly, the study of biogeochemistry considers biotic controls on the

(and exciting!) scientific challenge. Broadly, the study of biogeochemistry considers biotic controls on the chemistry of the environment, or with the geochemical control of the structure and function of ecosystems. Cycles are considered, either of individual elements or of specific classes of natural or anthropogenic compounds in ecosystems. The course will cover the biogeochemical cycles of Earth: water, carbon, oxygen, hydrogen, nitrogen, phosphorus, sulfur, and trace/heavy metals, and how they are connected. The biogeochemical cycling of elements is a cornerstone of ecosystem function and structure. We will study biogeochemical cycles in a variety of systems. The cycles will be examined in terms of terrestrial (land), aquatic (wetland, estuary, ocean), and atmospheric perspectives. General chemistry concepts such as equilibrium, free energy, electrochemistry, redox chemistry, and stoichiometry will be used to understand the energetics of the elemental cycles. Connections between biogeochemical cycles and environmental (climate change, air pollution, eutrophication) and health (contaminant exposure) problems will be emphasized. Particular emphasis will be given to coupled interactions of element cycles from the molecular to global scales to elucidate the mechanisms driving patterns in biogeochemical cycles through space and time in both natural and artificial ecosystems.

Weekly Schedule

Week/Time	**Topic**
Week1 (Aug25-Aug29)	Biogeochemistry: Introduction & Overview
Week2 (Aug30-Sep5)	Biogeochemical Processes & Reactions, Origin
Week3 (Sep6-Sep12)	Earth’s Sphere: Lithosphere & Atmosphere
Week4 (Sep13-Sep19)	Earth’s Sphere: Biosphere/Ecosphere & Hydrosphere
Week5 (Sep20-Sep26)	Carbon Cycle in Terrestrial Ecosystems
Week6 (Sep27-Oct3)	Biogeochemical cycles in Terrestrial Ecosystems
Week7 (Oct4-Oct10)	Biogeochemical cycles in Aquatic (Wetland, Inland Water, Estuary, & Ocean) Ecosystems
Week8 (Oct11-Oct17)	Global Water Cycle
Week9 (Oct18-Oct24)	Global Carbon & Oxygen Cycles
Week10 (Oct25-Oct31)	Global Nitrogen, Phosphorus, and Sulfur Cycles

Week11 (Nov1-Nov7)	Global Cycles of Trace/Heavy Metals
Week12 (Nov8-Nov14)	Global Cycles of Trace/Heavy Metals Contd.
Week13 (Nov15-Nov21)	Interconnected Cycles
Week14 (Nov22-Nov28)	Biogeochemistry & Grand Challenges in Environmental Sciences
Week15 (Nov29-Dec5)	Biogeochemistry & Grand Challenges in Environmental Sciences
Week16 (Dec6-Dec7)	Group Projects: Final Presentation & Report

Teaching and Learning During Pandemic

Some of you may need to be off campus for some portion of the semester. I want our classroom community to thrive no matter the classroom delivery method or your individual methods of participating in class. I cannot guarantee an identical experience for students who cannot be physically in the classroom or an experience that is identical to pre-pandemic semesters, but my goal is to treat all students equitably and to ensure grading is clear, consistent, and fair for all of you.

As always, communication is important. I commit to responding to emails within 48 hours of receipt, and my intention to respond faster than that most of the time. I will likely be slower on weekends. Likewise, if your situation changes regarding health, housing, or in any other regard with respect to your ability to participate in the class, please contact the appropriate Emory student support organization first and then me as soon as feasible. It is easier for me to address your needs if I know about them as soon as they arise. This does not mean I can successfully respond to every request for consideration, but I emphasize that my goal is to treat you all equitably and do what I can to help you succeed in this course.

Attendance Policy

This semester due to the pandemic, some students might be sick or will need to go into isolation or quarantine. If you are sick, understand that I will be flexible about attendance. Please make sure to email me so that we can discuss your individual circumstances. For students in quarantine who are well, I will provide ways that you can keep up with your schoolwork. Please also contact me via email if you are in quarantine.

Classroom Safety

Everybody must keep their face mask on at all times when they are indoors on campus, and this includes in our classroom. Your face mask must cover your nose, mouth, and chin, and should fit snugly. Due to the necessity of keeping your PPE on, eating and drinking is forbidden in the classroom. Please read this **Emory advice about quality and fit of mask (https://hr.emory.edu/eu/working-covid-19/face-coverings/using-face-coverings.html)** .

Health Considerations

At the very first sign of not feeling well, *stay at home* and reach out for a health consultation. Please consult the **campus FAQ (http://www.emory.edu/coronavirus/emory/faq/index.html#anchor-health)** for how to get the health consultation. As you know, Emory does contact tracing if someone has been diagnosed with COVID-19. A close contact is defined as someone you spend more than 15 minutes with, at a distance less than 6 feet, not wearing facial coverings. This typically means your roommates, for example. However, your classmates are *not* close contacts as long as we are following the personal protective equipment protocols in the classroom: wearing facial coverings, staying six feet apart.

Accessibility and Accommodation

As the instructor of this course I endeavor to provide an inclusive learning environment. I want every student to succeed. The Department of Accessibility Services (DAS) works with students who have disabilities to provide reasonable accommodations. It is your responsibility to request accommodations. In order to receive consideration for reasonable accommodations, you must **register with the DAS (http://accessibility.emory.edu/students/)** . Accommodations cannot be retroactively applied so you need to contact DAS as early as possible and contact me as early as possible in the semester to discuss the plan for implementation of your accommodations.

For additional information about accessibility and accommodations, please contact the Department of Accessibility Services at (404) 727-9877 or **accessibility@emory.edu (mailto:accessibility@emory.edu)** .

Student Resources for Stress Management and Mental Health

As a student, you may also find that personal and academic stressors in your life, including those related to remote study, COVID-19, economic instability, and/or racial injustice, are creating barriers to learning this semester. Supporting Student Well-being during a global pandemic is important for an instructor.

Feel free to reach out to your instructor if you suffer from any health issues including mental health (or emotional) issues. **(http://college.emory.edu/oue/current-students/student-support/index.html)** If you are struggling with concentration, motivation, or emotional concerns that feel overwhelming and are

struggling with concentration, motivation, or emotional concerns that feel overwhelming and are impacting your daily functioning, please know that there are university resources available to support you.

More information on these resources is available here:

- **Counseling & Psychological Services (http://counseling.emory.edu/)**
- **Office of Spiritual & Religious Life (http://www.religiouslife.emory.edu/)**
- **Student Case Management and Interventions Services (http://success.emory.edu/)**
- **Student Health Services Psychiatry (http://studenthealth.emory.edu/services/psychiatry.html)**
- **Support During A Crisis: A Guide for Faculty & Staff (http://campuslife.emory.edu/support/crisis.html)**
- **Emory Anytime Student Health Services (http://campuslife.emory.edu/anytimehealth.html)**
- **Emory Student Telehealth - 24/7 Medical & Mental Health Support (https://timely.md/faq/emory/)**

Additionally, resources are available to Emory undergraduates that enriching their educational experience and support their academic progress. For a list of programs and appointment instructions, visit **http://college.emory.edu/oue/current-students/student-support/index.html (http://college.emory.edu/oue/current-students/student-support/index.html)**

Students are also encouraged to look at professional resources available from CFDE in support of their academic endeavors. Visit the following link for more information:

https://cfde.emory.edu/resources/teaching-pedagogy/student-support/supporting-student-well-being-2021.html (https://cfde.emory.edu/resources/teaching-pedagogy/student-support/supporting-student-well-being-2021.html)

Course Summary:

Date	Details	Due
	Week 1 Discussion (https://canvas.emory.edu/courses/90058/assignments/524091)	due by 11:59pm
Wed Sep 1, 2021	**Introductory Survey (https://canvas.emory.edu/courses/90058/assignments/524092)**	due by 11:59pm
	Week 1 Assignment (https://canvas.emory.edu/courses/90058/assignments/524402)	due by 11:59pm
Wed Sep 8, 2021	**Week 2 Assignment (https://canvas.emory.edu/courses/90058/assignments/536401)**	due by 11:59pm

Date	Details	Due
Wed Sep 15, 2021	Week 3 Assignment (https://canvas.emory.edu/courses/90058/assignments/539170)	due by 11:59pm
	Week 3 Quiz (https://canvas.emory.edu/courses/90058/assignments/538405)	due by 11:59pm
Wed Sep 22, 2021	1 Month Check-in (https://canvas.emory.edu/courses/90058/assignments/541231)	due by 11:59pm
	Week 4 Assignment (https://canvas.emory.edu/courses/90058/assignments/541216)	due by 11:59pm
	Week 4 Discussion (https://canvas.emory.edu/courses/90058/assignments/542338)	due by 11:59pm
	Week 4 Quiz (https://canvas.emory.edu/courses/90058/assignments/541219)	due by 11:59pm
Wed Sep 29, 2021	Week 5 Assignment (https://canvas.emory.edu/courses/90058/assignments/543131)	due by 11:59pm
Wed Oct 6, 2021	Week 6 Assignment (https://canvas.emory.edu/courses/90058/assignments/545164)	due by 11:59pm
Wed Oct 20, 2021	Week 7 Quiz (https://canvas.emory.edu/courses/90058/assignments/547209)	due by 11:59pm
	Week 8 Quiz (https://canvas.emory.edu/courses/90058/assignments/548637)	due by 11:59pm
Wed Oct 27, 2021	Mid-term check-in (https://canvas.emory.edu/courses/90058/assignments/550350)	due by 11:59pm
	Week 9 Assignment (https://canvas.emory.edu/courses/90058/assignments/550358)	due by 11:59pm
Wed Nov 3, 2021	Week 10 Assignment (https://canvas.emory.edu/courses/90058/assignments/551696)	due by 11:59pm
Wed Nov 10, 2021	Week 11 Quiz (https://canvas.emory.edu/courses/90058/assignments/554157)	due by 11:59pm

Date	Details	Due
Wed Nov 17, 2021	**Week 12 Quiz** (https://canvas.emory.edu/courses/90058/assignments/556377)	due by 11:59pm
	Week 2 Discussion (https://canvas.emory.edu/courses/90058/assignments/542323)	
	Week 3 Discussion (https://canvas.emory.edu/courses/90058/assignments/542328)	