Survey of Geobiology – Special Topics (GLY 4930/6932) Syllabus
Spring 2020
Williamson Hall 218
TR 8:30 – 10:25 AM

Contact Information

Instructor: Dr. Amy Williams
Office: Williamson Hall 270
Office Hours: Tuesday 1 to 2pm
Thursday 2 to 3pm
Or by appointment Monday through Friday

Email: amywilliams1@ufl.edu
Phone: 352-273-1284
Department Mailbox: WM 241

Required Text

- Readings and materials on Canvas

Catalog Course Description

This course introduces the parallel evolution of life and the environment. Life processes are influenced by chemical and physical processes in the atmosphere, hydrosphere, cryosphere and the solid earth. In turn, life can influence chemical and physical processes on our planet. This course explores the concept of life as a geological agent and examines the interaction between biology and the earth system during the roughly 4 billion years since life first appeared.
Prerequisites: GLY 2010 or permission of the instructor.

Course Objectives

1) Students will learn the foundations for Geobiology, including microbial diversity and metabolisms, the geochemistry of organic cells, mechanisms of microbial biomineralization and weathering, early microbial life, and biosignature detection, and apply that knowledge to interpreting the geobiologic conditions in modern and ancient environments.
2) Students will learn basic techniques for the collection and study of geobiologic samples.
3) Students will use observations and data to develop a conceptual model for how life is preserved and detected in the fossil record and how these techniques may be applied to life detection in the ancient terrestrial rock record, as well as on other worlds (using the study of astrobiology).

Grading

Grading Scheme:

	A = 94.0-100%	A- = 90.0-93.9%
B+ = 87.0-89.9%	B = 84.0-86.9%	B- = 80.0-83.9%
C+ = 77.0-79.9%	C = 74.0-76.9%	C- = 70.0-73.9%
D+ = 67.0-69.9%	D = 64.0-66.9%	D- = 60.0-63.9%
F = below 60.0%		

The final course grade will be calculated using the following system:

EXAM 1	15%
EXAM 2	15%
EXAM 3	15%
LITERATURE CRITIQUES	10%
IN CLASS ACTIVITIES	15%
HOMEWORK QUIZZES	15%
FINAL TERM PAPER	15%
	100% TOTAL

More information on grades and grading policies is here:
https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx.

Exams: Exams will cover material from lectures, homework, assigned readings, and in-class activities.

Literature Critiques: We will discuss peer-reviewed journal articles during the term. These articles will be posted on Canvas in advance of the scheduled discussion. The goal of these assignments is to increase your familiarity with the scientific literature and to begin to assess and recognize the components of a good scientific paper. The entire class will read a scientific paper and each student will write a two-page summary of the article before class. During part of designated course periods, we will discuss the paper as a class.

Each person will help lead the discussion on at least one paper during the semester AND write up a full critique that will identify the main points of the paper and discuss the strengths and weaknesses of the work. Details of the full write up are forthcoming. Each critique should be no longer than two pages, 1.5 line spacing, 1" margins, typed, 12 point Times New Roman font, and the complete citation of the paper should be at the top of the page.

Field Trip & In Class Activities: You will participate in a field trip and several in class activities with the goal of learning observational skills, learning techniques used by geobiologists, and reinforcing lecture content by applying the concepts you have learned. In class activity due dates will be listed on the activity. You will write a brief lab report on the field trip, instructions are forthcoming.

Homework: Brief, 10 question homework quizzes will be due on Canvas before the start of class on the due dates listed on the schedule. No assignments will be accepted if completed and/or submitted during class time. Late submissions are subject to the late penalty described below.

Written Term Papers: At the end of the term, students will submit an individual term paper. An annotated bibliography is due early in the semester to Canvas in which you will compile a minimum of 10 peer-reviewed, recent (post-2000) most-important publications on the topic of your paper and provide at least four sentences describing the subject and findings of each paper. A draft outline of this term paper is due mid-semester to Canvas. Details of the draft requirements are forthcoming. The final individual paper is due at the end of the semester to Canvas. **Graduate Student Term Papers** will have a longer paper length requirement and more required citations.

Lecture Schedule: The schedule for lecture topics, reading assignments, and exams is below, and also posted separately on Canvas.

Class Policies

Course communication: Necessary course materials, in addition to the required text, will be available on Canvas. You are responsible for anything sent by the instructor via email or posted on Canvas. All email communication will be sent to university email accounts; you are responsible for checking your university email account at least daily. In most cases allow 24 hours for an email response from me (and longer over weekends).

I am happy to meet during office hours if you have questions, and if those times do not work, please e-mail me to set up another time for us to meet. You are also welcome to email me with questions. *To help me distinguish your emails from those coming in from other classes, add "GLY 4930/6932" to the start of your subject line. Please use best practices in your email to me (and all faculty)—this includes signing off with your name, using full sentences, and not using text shorthand. This conveys an important sense of professionalism that is worth practicing for future jobs.*

Attendance: Students are expected to attend all lectures, labs, exams, and field trips as scheduled. Students are also advised to read each assignment prior to its discussion in class/lab. If you miss a lecture, you should get notes from a classmate. I will not provide notes or a summary of the class. There are no make-up exams except for documented medical or personal emergencies. If this situation is

applicable to you, contact me as soon as possible (amywilliams1@ufl.edu) or notify the Department Administrative Assistant (352-392-2231).

Late or Missed Assignments: *There will be no make-up assignments without either prior approval or an official documented excuse.* Late assignments will be penalized 10% if they are turned in after the due date, and 10% more for each subsequent day—no exceptions. If you turn assignments in to my mailbox, please send me an e-mail telling me as much, else I will mark it late based on when I find it. I do not go to my mailbox daily. Requirements for class attendance and make-up exams, assignments, and other work in this course are consistent with university policies that can be found at: https://catalog.ufl.edu/UGRD/academic-regulations/attendance-policies/.

Electronic Devices: Cell phones and other communication devices must be set to silent or turned off. Calls cannot be made or accepted during class, and texting is not permitted.

University Honesty Policy: UF students are bound by The Honor Pledge which states, "We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code." On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: "On my honor, I have neither given nor received unauthorized aid in doing this assignment." The Honor Code (https://www.dso.ufl.edu/sccr/process/student-conduct-honor-code/) specifies a number of behaviors that are in violation of this code and the possible sanctions. Furthermore, you are obligated to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with the instructor or TAs in this class.

Withdrawal Policy: Students may withdraw from the course with the grade of W at any time prior to and including Friday, April 10, 2020.

Students with Disabilities: Students with disabilities requesting accommodations should first register with the Disability Resource Center (352-392-8565, www.dso.ufl.edu/drc/) by providing appropriate documentation. Once registered, students will receive an accommodation letter which must be presented to the instructor when requesting accommodation. Students with disabilities should follow this procedure as early as possible in the semester.

Counseling and Wellness Center: Contact information for the Counseling and Wellness Center: http://www.counseling.ufl.edu/cwc/Default.aspx, 352-392-1575; and the University Police Department: 352-392-1111 or 9-1-1 for emergencies.

Course Evaluation: Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available at https://gatorevals.aa.ufl.edu/students/. Students will be notified when the evaluation period opens, and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via https://ufl.bluera.com/ufl/. Summaries of course evaluation results are available to students at https://gatorevals.aa.ufl.edu/public-results/.

Course Materials Bibliography

- Bennett, J. O., Shostak. S., & Jakosky, S. (2007). *Life in the Universe*. (Pearson, Ed.) (1st ed.).
- Dodd, M. S., Papineau, D., Grenne, T., Slack, J. F., Rittner, M., Pirajno, F., … Little, C. T. S. (2017). Evidence for early life in Earth's oldest hydrothermal vent precipitates. *Nature*, *543*(7643), 60–64. https://doi.org/10.1038/nature21377
- Domagal-Goldman, S. D., Wright, K. E., Adamala, K., Arina de la Rubia, L., Bond, J., Dartnell, L. R., … Wong, T. (2016). The Astrobiology Primer v2.0. *Astrobiology*, *16*(8), 561–653. https://doi.org/10.1089/ast.2015.1460
- Eigenbrode, J. L., Summons, R. E., Steele, A., Freissinet, C., Millan, M., Navarro-González, R., … Coll, P. (2018). Organic matter preserved in 3-billion-year-old mudstones at Gale crater, Mars. *Science*, *360*(6393), 1096–1101. https://doi.org/10.1126/SCIENCE.AAS9185

- Falkowski, P. G. (2016). *Life's Engines: How Microbes Made Earth Habitable*. Princeton: Princeton University Press. Konhauser, K. (2007). *Introduction to Geomicrobiology*. Blackwell Science Ltd.
- Lyons, T. W., Reinhard, C. T., & Planavsky, N. J. (2014). The rise of oxygen in Earth's early ocean and atmosphere. *Nature*, *506*(7488), 307–315. https://doi.org/10.1038/nature13068
- Killops, S., & Killops, V. (2005). *Introduction to Organic Geochemistry* (2nd ed.). Blackwell Publishing.
- Knoll, A. H., Canfield, D. E., & Konhauser, K. O. (Eds.). (2012). *Fundamentals of Geobiology*. Wiley-Blackwell.
- Konhauser, K. (2007). *Introduction to Geomicrobiology*. Blackwell Science Ltd.
- McKay, D. S., Gibson, E. K., Thomas-Keprta, K. L., Vali, H., Romanek, C. S., Clemett, S. J., … Zare, R. N. (1996). Search for past life on Mars: possible relic biogenic activity in martian meteorite ALH84001. *Science (New York, N.Y.)*, *273*(5277), 924–930. https://doi.org/10.1126/SCIENCE.273.5277.924
- Mix, L. J., Armstrong, J. C., Mandell, A. M., Mosier, A. C., Raymond, J., Raymond, S. N., … ; (2006). The Astrobiology Primer: An Outline of General Knowledge - Version 1. *Astrobiology*, *6*(5), 735–813. https://doi.org/10.1089/ast.2006.6.735
- Mojzsis, S. J., Arrhenius, G., McKeegan, K. D., Harrison, T. M., Nutman, A. P., & Friend, C. R. L. (1996). Evidence for life on Earth before 3,800 million years ago. *Nature*, *384*(6604), 55–59. https://doi.org/10.1038/384055a0
- Slonczewski, J. L., & Foster, J. W. (2009). *Microbiology: An Evolving Science*. W.W. Norton & Co.

Tentative Schedule

Week	Dates	Topic	Readings	Assignments
1	01/07	[1] Microbial Properties & Diversity	The Missing Microbes, p9-22	**Lab** Winogradsky Column I **Reading Homework** Microbiology due 1/09
	01/09	[1] Microbial Properties & Diversity	Microbiology p6-11 thru Sec 1.1, p27-36 Geochemical Cycling & Microbial Genetics	
2	01/14	[1] Microbial Properties & Diversity	Life in the Universe 1, p60-77	**Lab** How to Read a Scientific Paper **Reading Homework** Organic Geochemistry 2 due 1/16
	01/16	[2] Microbial Metabolisms	Organic Geochemistry 2, p5-23	
3	01/21	[2] Microbial Metabolisms	Intro to Geomicrobiology, p47-92 Astrobiology Primer 1.0, p793-804 (Ch. 6 Diversity of Life)	**Lab** CHONPS cycling **Reading Homework** Intro to Geomicrobiology due 1/21
	01/23	Catch up & Review		
4	01/28	**Exam #1 (on topics [1] & [2])**	Organic Geochemistry 1, p30-60	**Reading Homework** Organic Geochemistry 1 due 1/30
	01/30	[3] Organic Geochemistry		
5	02/04	[3] Organic Geochemistry		**Lab** Mass Spectrometry **Write** Paper #1 critique (Lyons 2014) due 2/06
	02/06	[3] Organic Geochemistry		
6	02/11	[4] Biomineralization	Fundamentals of Geobiology, p105-125	**Reading Homework** Fund'ls of Geobiology due 2/11
	02/13	[4] Biomineralization		
7	02/18	[4] Biomineralization		**Write** Paper #2 critique (Eigenbrode 2018) due 2/20
	02/20	[5] Microbial Weathering		
8	02/25	Catch up & Review		
	02/27	**Exam #2 (on topics [3] & [4])**		
9	03/03	*Spring Break*		
	03/05			

10	03/10	[5] Microbial Weathering	Life in the Universe 2, p114-130	**Term Paper** Annotated Bibliography due 3/10 **Lab** Carbonate Mineralization **Reading Homework** Life in the Universe 2 due 3/12
	03/12	[5] Microbial Weathering		
11	*03/17*	[6] Early Microbial Life	Astrobiology Primer 1.0, p756-765 (2D Early Earth Environments)	**Lab** Winogradsky Column II **Reading Homework** Astrobiology Primer 1 due 3/17
	03/19	[6] Early Microbial Life – Winogradsky Lab II		
12	03/24	[6] Early Microbial Life	Astrobiology Primer 2.0, p613-623 (Ch. 7)	**Write** Paper #3 critique (Mojzsis 1996) due 3/24 **Reading Homework** Astrobiology Primer 2 due 3/26
	03/26	[6] Early Microbial Life		
13	03/31	Catch up & Review		**Write** Paper #4 critique (Dodd 2017) due 3/31
	04/02	**Exam #3 (on topics [5] & [6])**		
14	04/07	[7] Biosignature Detection		**Term Paper Draft** due 4/09
	04/09	[7] Biosignature Detection		
15	04/14	[7] Biosignature Detection	Astrobiology Primer 1.0, p777-780 (4E Chemical Fossils) & p780-783 (4F Paleontology)	**Lab** Winogradsky Column III
	04/16	[8] Astrobiology		
16	04/21	[8] Astrobiology		**Write** Paper #5 critique (McKay 1996) due 4/21
	04/29	Final Exam day - **Final term papers** due at midnight to Canvas		

**** This schedule is subject to change with appropriate prior notification. ****