

Are We Alone in the Universe? Planets, Exoplanets and the Origin of Life

Spring 2014
622 Space Sciences
MW 2:55-4:10

Instructor: Daniel Tamayo
Office: 514 Space Sciences
E-mail: dtamayo_*AT*_astro.cornell.edu
Phone: 255-6420
Office Hours: M 4:15-5:15
W 1:30-2:30
Held in Space Sciences Room 514
Grading: Letter Grade Only, 3 credits
Required Texts: They Say/I Say, by G. Graff and C. Birkenstein
The Transition to College Writing by K. Hjortshoj
How to Find a Habitable Planet by J. Kasting

I. Introduction

Is there alien life beyond our planet, or is the universe an unfathomably vast, yet sterile, expanse? By a stroke of cosmic coincidence, we happen to be alive as humanity poises itself to settle this question after centuries of (mostly) philosophical debate.

In this course we will explore and follow the fascinating and ever-evolving new field of astrobiology. Among other topics, our journey will lead us through the formation of planets out of swirling astrophysical disks, cataclysmic mass extinctions, exotic biochemistry on the ocean floor, our dramatic explorations of our solar system, and the ingenious detections of the first planets around other stars.

II. Course Aims and Objectives

Primary Aims

Hopefully, given your registration in this course, you find the question and topics above intriguing, like I do. But let's face it—it is unlikely that the *knowledge* you gain in this class on stellar types and the carbonate silicate cycle will help you in the real world. Therefore, while I want to engage you with the content, we will focus on developing skills that will transfer to whatever study and career path you choose.

Our primary aims will be to develop your ability to think and read critically, and to effectively express yourself in both argumentative and expository writing. The grade distribution is designed to reflect these course priorities, and we will dedicate class time specifically toward sharpening these skills.

Specifically, by the time you finish this course, you will:

- Think critically. This involves questioning and analyzing assumptions, considering a models' consequences, and brainstorming ways in which to falsify hypotheses. This is the scientific method. It is not the one-dimensional, sequential list you have probably seen before, but a process to engage in.
- Read critically. Most of us take the articles and statistics we read in magazines and online at face value. Yet many issues are more nuanced than presented, and arguments are often biased or misleading. In this course you will sharpen your ability to identify unwritten assumptions and to evaluate a position's strength and reliability.
- Write effectively. In particular, you will:
 - purposefully consider your goals for each new piece of writing
 - target writing pieces to their intended audience
 - write in a manner that engages your readers
 - express your ideas accurately, yet succinctly
 - be a better reviser, on the sentence, paragraph, and document levels
 - be proficient in identifying and assessing underlying assumptions and biases
 - incorporate opposing viewpoints to strengthen your own arguments

Secondary Aims

This class also has ambitions beyond its role as a first-year writing seminar. In this course:

- You will apply and synthesize core principles in planetary science (spanning astronomy, geology, biology and chemistry!) to their varied expressions across solar system bodies and exoplanets.
- You will explore and critically evaluate the strengths, limitations and reliability of the scientific method. In practice, it is not the one-dimensional, rigid sequence of steps you might have previously learned; it is often a much more amorphous and creative iterative process, perpetually entangled with the social factors affecting its practitioners. Can we therefore trust science?
- You will gain a perspective of humanity's place in the cosmos, and develop a grander view of the processes that shape and allow for our existence. I want you to leave this course wanting to learn more and itching to tell others!

III. Expectations:

Of you:

- Be engaged in your own education. This means arriving to class on time, being an active participant, and doing the readings.
- Set time aside for this class. A 3-credit course expects you to spend 6-9 hours per week *outside* of class time on the course.
- Be respectful of others, both with your words and actions. This extends to the use of electronics (see full policy below).

Of me:

- Communicate openly. I will strive to directly discuss and argue for the logistical, teaching, and content choices I make for this course. Expectations for the course and specific assignments will be clearly articulated.
- Be prepared and on time for classes
- Respond to feedback. Education is not a one-way street. I will ask for your feedback at several points in the course, respond to it in class, and adapt the course as necessary.

IV. Grades:

The summary of the grade breakdown is as follows:

- **Papers** **80%**
- **Online Journal** **10%**
- **Portfolio** **10%**

Online Journal (10%)

After each class, there will be a reflection question posted on the blackboard site. You are to write a response to each prompt of at least 150 words. These are meant to motivate your own personal thinking, and can have a large effect on what you get out of this class. Some of the reflections will be designed to help you start thinking about the papers you will write for the course. For reference, the two paragraphs in this section constitute about 180 words.

Journal entries are to be submitted through the blackboard discussion board by 11:59 pm EST on the night before the following class. As long as it is clear that you put some thought into the question you will be given full credit. You can miss up to 3 entries without penalty. This is meant to be for emergencies, so don't skip the first three—you will lose points when you have a real reason that's preventing you from doing the journal! Access each journal entry under the Discussions link on the left

panel when you select Astro 1110 on blackboard.

Portfolio (10%)

Please bring a 3-ring binder to class on Monday. Many class periods we will do an in-class activity, and these should go into your binder, as well as all your papers and drafts. That way you will have all the course material in one place for easy reference, as well as a writing portfolio. You might come across opportunities that ask you for such a portfolio. For example, the Knight institute gives out prizes for outstanding portfolios!

I will grade your portfolio at the end of the semester for completeness. In-class activities are designed (not surprisingly!) to be done in class, and therefore cannot be made up. You can miss up to 3 items in your portfolio without penalty (activities, drafts etc.), and once again, this is meant for emergencies!

V. Paper Formatting

All papers submitted must adhere to the following guidelines. Papers that do not will lose a third of a grade per guideline not adhered to.

- 12 pt font
- double spaced
- Times New Roman
- 1 or 1.25 inch margins
- all paper lengths exclude references and images/figures
- papers must be submitted through turnitin on blackboard by 2:45 p.m. the day it is due.
- you can access each paper assignment under the Course Info tab on the left panel when you select Astro 1110 on blackboard
- for formats accepted, see http://turnitin.com/en_us/training/student-training/submitting-a-paper

VI. Policies

Electronics

Cell Phones, Laptops and other electronics are not allowed in this course. My experience, as surely you can corroborate, is that while some people in class do take productive notes on their laptop, almost every laptop will also have Facebook or some other sort of social media open. If you were the only person in this class, I would be happy to let you make your own educational decision on this matter; unfortunately, your choices can be very distracting for those around you.

Accommodations for students with disabilities

In compliance with the Cornell University policy and equal access laws, I am

available to discuss appropriate academic accommodations that may be required for student with disabilities. Requests for academic accommodations are to be made during the first three weeks of the semester, except for unusual circumstances, so arrangements can be made. I encourage you to register with Student Disability Services to verify your eligibility for appropriate accommodations.

Academic Integrity

I take academic integrity issues very seriously, and will forcefully deal with any infractions. Not only does this constitute grounds for failing the course, it creates a permanent entry in your academic record.

Plagiarism will not be tolerated in any form. You are responsible for properly citing any information that you did not come up with yourself. Please see Chapter 8 of the Transition to College Writing for guidelines on citation, as well as Cornell's guide to academic integrity at <http://cuinfo.cornell.edu/Academic/AIC.html>

Late Policy

Assignments will be marked down 10% for each day it is handed in late. **An exception to this is for assignments that will be reviewed by your peers. In this case late assignments will be given a grade of zero, as they will not be of use for the peer review.**

But it turns out that I'm a pretty reasonable person, and I have certainly also had emergencies and pileups of work, where having a one day extension on an assignment would have been an enormous help. So if something comes up, **e-mail me at least 24 hours before the deadline**, and we can make alternate arrangements. But don't try to exploit this! I am only reasonable as long as you are.

Public Domain

Our goal in this course is to improve everyone's writing. Therefore, any of your writing may be read and shared by all members of the class. Please come to me if you think this might be an issue.

VI. The Knight Institute Writing Walk-In Service

The Writing Walk-In Service (WWIS) provides support for individuals at any stage of the writing process. It is a free resource available to everyone on campus - faculty, staff, graduate and undergraduate students - for nearly any kind of writing project: applications, presentations, lab reports, essays, papers, and more. Tutors (trained undergraduate and graduate students) serve as responsive listeners and readers who can address questions about the writing process or about particular pieces of writing. They can also consider questions of confidence, critical reading, analytic thought, and imagination. Many writing tutors also have experience working with non-native speakers of English.

The WWIS operates out of several campus locations. During the academic year, the WWIS is open Sunday through Thursday from 3:30 – 5:30pm and from 7:00 – 10:00pm. Writers can schedule appointments or drop in at a convenient time. For more information or to schedule an appointment: <http://www.arts.cornell.edu/writing>

VII. Course Schedule

The following schedule is meant to be flexible. I want to be able to adapt to the pace of the class, follow discussions where they may lead us, and steer the content toward your interests. Nevertheless, these are the topics I intend to cover, along with approximate due dates for our various assignments. I will update this schedule as the semester progresses, and enter the assigned readings a week ahead of time.

I am happy to uphold university regulations pertaining to the observation of religious holidays. Please come talk to me ahead of time if you foresee a conflict.

Date	Topics
1/22	The Drake Equation. How long do advanced civilizations last? Readings: Read Chap 2 JK + Chap 3 in KH
1/27, 1/29	From the Big Bang to planets Readings: 1/27 Finish Chap 2 in JK 1/29 Chap 3 in JK & Chap 4 in KH 1/29 Essay #1 due: How long do advanced civilizations last?
2/3, 2/5	The revision process. The greenhouse effect, climate feedbacks and the silicate carbonate cycle Readings: 2/3 Chap 5 in JK 2/5 Chap 6 in JK & Chap 6 in KH Essay #2 due: The greenhouse effect for middle-schoolers
2/10, 2/12	Habitable zones around stars. How to craft an argument Readings: 2/10 p. 183-191 in KH on plagiarism 2/12 Articles posted on blackboard Essay #2 revisions due
No Class 2/17 (Feb Break)	Finding Another Earth How to plan and organize an essay Readings:

Class 2/19	2/19: Chaps 1,2,4 (They're short!) in They Say, I say Optional: Chap 11 in JK 2/21 Essay #3 due: The case for anthropomorphic climate change
2/24, 2/26	The discovery of planets around other stars. The astrometric method and radial velocity method. 2/28 Essay #4 due: Global warming rebuttal due
3/3, 3/5	Observational Biases. The Kepler revolution. Readings: 3/3 Chap 12 in JK 3/5 Krulwich article, 'Is our solar system typical?'
3/10, 3/12	What do we know about exoplanets? Are habitable planets rare in the galaxy? Readings: 3/12 Life on Mars: The Allan Hills Story 3/14 Essay #5 rough draft due: Is our Solar System Typical?
3/17, 3/19	What is life? Searching for the oldest microfossils. Molecular evidence for life. Writing powerful paragraphs and engaging the audience. Readings: 3/17 Earth's Oldest Fossils 1-on-1 meetings with me 3/21 Peer Revisions due
3/24, 3/26	Life's molecular building blocks. Where did life begin? Essay #5 final draft due
No class 3/31 or 4/2 Spring Break	
4/7, 4/9	DNA & Proteins. The chicken and the egg. Essay #6 rough draft due
4/14, 4/16	Is intelligent life a common outcome of evolution? The rise of humans and mass extinctions 1-on-1 meetings with me

4/21, 4/23	Searching for life in the Solar System. Looking beyond: Spectroscopy and future missions Essay #6 final draft due
4/28, 4/30	Buffer
5/5, 5/7	What would it mean to discover alien life? Is it all worth it? Essay #7 due: Is life common in the galaxy?