

“The aim of science is not to open  
the door to infinite wisdom, but to  
set a limit to infinite error.”

—BERTOLT BRECHT

## COURSE DESCRIPTION

*The Search for Life in the Universe* introduces the scientific basis for the possible existence of life elsewhere in the universe. Includes origin and evolution of life on Earth and the search for evidence of life in our solar system, including Mars and Jupiter’s moon Europa. Discusses the conditions necessary for life and whether they might arise on planets around other stars.

At the end of this course you should be able to (i) describe the basic building blocks of and conditions for life as we know it; (ii) understand the origin and evolution of life on Earth; (iii) judge the prospects of finding life elsewhere in the solar system, and universe; and (iv) grasp the interdisciplinary nature of the search for life in the universe.

## READINGS

The course will—mostly—follow *Life in the Universe (4th Edition)* by **Jeffrey O. Bennett & Seth Shostak**, which you are expected to be reading along—the 3rd Edition may work, but understand there are substantial differences when compared to the newer one.

Short readings, screenings and/or listenings might be assigned periodically throughout the course, and discussed in class and/or online.

Furthermore, Dr. Jorge offers each student the possibility to read one of the following non-fiction books in detail, and respond to them for up to 4% in extra credit—written responses will be a minimum of 2,500 words driven by one or more aspects of the reading.

- *Rare Earth: Why Complex Life is Uncommon in the Universe* by Peter Ward & Donald Brownlee
- *Pale Blue Dot: A Vision of the Human Future in Space* by Carl Sagan
- *Packing for Mars* by Mary Roach
- *The Copernicus Complex: Our Cosmic Significance in a Universe of Planets and Probabilities* by Caleb Scharf
- *Goldilocks and the Water Bears: The Search for Life in the Universe* by Louisa Preston

## GRADING

### Participation—5%

In-class and online discussions, as well as attendance, and iClicker questions. All excused absences require that official documentation be provided, and should be declared prior to their occurrence, when possible, or immediately after.

### Homework—25%

At least six homework assignments will be assigned, approximately every other week, throughout the semester via Canvas—your top five scores will be

*“The difference between science and the arts is not that they are different sides of the same coin even, or even different parts of the same continuum, but rather, they are manifestations of the same thing. The arts and sciences are avatars of human creativity.”*

—MAE JEMISON

counted. Late homework will not be accepted, and there will be no make-ups for homeworks unless you provide official documentation—understand this will need to account for an extended absence since homeworks can be turned in any time once they are posted; you should not wait until the last minute.

### **Midterm Exams—20%**

Based on multiple choice and/or short answer questions, and to be taken in class on Monday, October 7, 2019; and Wednesday, November 20, 2019—unless otherwise stated. These are intended as preparation for your final exam. Thus, to relieve some midterm exam stress, your corresponding grade will give more weight to your higher grade—i.e.,  $\frac{1}{3}$ (lower grade) +  $\frac{2}{3}$ (higher grade). There will not be make-ups for midterm exams unless you provide official documentation for your absence.

### **Term Project—20%**

Individually, or on teams of up to two, write an original critical essay on any scientific topic(s) discussed in class. Alternatively, you can choose to make a meaningful creative project. You will meet with Dr. Jorge during office hours, or by appointment, to discuss the topic(s) and, if applicable, format of your project and get his approval before Halloween. Your term project is due by the beginning of class on Wednesday, December 11, 2019—unless otherwise stated.

### **Final Exam—30%**

Based on multiple choice and/or short answer questions, and to be taken on the official assigned date and location—TBD.

### **Extra Credit—Up to 8%**

Besides the extra credit reading assignment already discussed—up to 4%—students can (i) attend a nighttime observing session at Sommers-Bausch Observatory; (ii) attend a colloquium or public lecture—e.g., [LASP Public Lecture](#), [Fiske Planetarium Live Talks](#), [APS Colloquia](#), [Geology Colloquium](#), [SwRI Boulder Colloquia](#); or (iii) respond to any other opportunity Dr. Jorge may offer.

In order to get extra credit—up to 1% per event—you will need to submit photographic proof of attendance, and a 500-word original assessment of what you did, what you learned, and your general impressions. All extra credit is due a week after each event; with the exception of the extra credit reading assignment, due by the beginning of class on Friday, November 22, 2019—unless otherwise stated.

## **TEACHING ASSISTANT**

Graduate student **Justus Gibson** will be assisting with the course, and can be reached at [justus.gibson@colorado.edu](mailto:justus.gibson@colorado.edu). He will be leading review sessions before each of the exams, and will hold office hours every **Monday 9–10a** and **Friday 11a–12p**—and by appointment—at **Duane C332**. Please welcome him as an invaluable resource for your learning experience.

*“The most terrifying fact about the universe is not that it is hostile but that it is indifferent, but if we can come to terms with this indifference, then our existence as a species can have genuine meaning. However vast the darkness, we must supply our own light.”*

—STANLEY KUBRICK

## NOTES

You are responsible for knowing the policies at the University of Colorado at Boulder (see below) and making mature, enlightened decisions. Never hesitate to contact Dr. Jorge directly with any questions or concerns you may have.

### APS Cell Phone Policy

The policy of the Department of Astrophysical and Planetary Sciences is to ban any use of electronic devices (cellphones, tablets, laptops) in class except as an approved accommodation granted by Disability Services, or as explicitly authorized by the instructor.

## UNIVERSITY STATEMENTS

### Accommodation for Disabilities

If you qualify for accommodations because of a disability, please submit your accommodation letter from Disability Services to your faculty member in a timely manner so that your needs can be addressed. Disability Services determines accommodations based on documented disabilities in the academic environment. Information on requesting accommodations is located on the Disability Services website. Contact Disability Services at 303-492-8671 or [dsinfo@colorado.edu](mailto:dsinfo@colorado.edu) for further assistance. If you have a temporary medical condition or injury, see Temporary Medical Conditions under the Students tab on the Disability Services website.

### Classroom Behavior

Students and faculty each have responsibility for maintaining an appropriate learning environment. Those who fail to adhere to such behavioral standards may be subject to discipline. Professional courtesy and sensitivity are especially important with respect to individuals and topics dealing with race, color, national origin, sex, pregnancy, age, disability, creed, religion, sexual orientation, gender identity, gender expression, veteran status, political affiliation or political philosophy. Class rosters are provided to the instructor with the student's legal name. I will gladly honor your request to address you by an alternate name or gender pronoun. Please advise me of this preference early in the semester so that I may make appropriate changes to my records. For more information, see the policies on classroom behavior and the Student Code of Conduct.

### Honor Code

All students enrolled in a University of Colorado Boulder course are responsible for knowing and adhering to the Honor Code. Violations of the policy may include: plagiarism, cheating, fabrication, lying, bribery, threat, unauthorized access to academic materials, clicker fraud, submitting the same or similar work in more than one course without permission from all course instructors involved, and aiding academic dishonesty. All incidents of academic misconduct will be reported to the Honor Code ([honor@colorado.edu](mailto:honor@colorado.edu); 303-492-5550). Students who

*“Each one of you can change the world, for you are made of star stuff, and you are connected to the universe.”*

—VERA RUBIN

are found responsible for violating the academic integrity policy will be subject to nonacademic sanctions from the Honor Code as well as academic sanctions from the faculty member. Additional information regarding the Honor Code academic integrity policy can be found at the [Honor Code Office website](#).

### **Sexual Misconduct, Discrimination, Harassment and/or Related Retaliation**

The University of Colorado Boulder (CU Boulder) is committed to fostering a positive and welcoming learning, working, and living environment. CU Boulder will not tolerate acts of sexual misconduct (including sexual assault, exploitation, harassment, dating or domestic violence, and stalking), discrimination, and harassment by members of our community. Individuals who believe they have been subject to misconduct or retaliatory actions for reporting a concern should contact the Office of Institutional Equity and Compliance (OIEC) at 303-492-2127 or [cureport@colorado.edu](mailto:cureport@colorado.edu). Information about the OIEC, university policies, [anonymous reporting](#), and the campus resources can be found on the [OIEC website](#).

Please know that faculty and instructors have a responsibility to inform OIEC when made aware of incidents of sexual misconduct, discrimination, harassment and/or related retaliation, to ensure that individuals impacted receive information about options for reporting and support resources.

### **Religious Holidays**

Campus policy regarding religious observances requires that faculty make every effort to deal reasonably and fairly with all students who, because of religious obligations, have conflicts with scheduled exams, assignments or required attendance. In this class, Dr. Jorge asks you contact him as soon as possible with any conflicts.

See the [campus policy regarding religious observances](#) for full details.

## TENTATIVE COURSE SCHEDULE

Week 01 of 08/26	[START] + No class on 08/30
Week 02 of 09/02	Context for life in the Greater Universe
Week 03 of 09/09	Origin and Evolution of Stars and Planets + HW#1 due 09/13
Week 04 of 09/16	The Habitability of Earth + HW#2 Due on 09/20
Week 05 of 09/23	The Nature of Life on Earth
Week 06 of 09/30	Origins and Evolution of Life on Earth + HW#3 due 09/30
Week 07 of 10/07	ME#1 on 10/07
Week 08 of 10/14	Possibilities for Life in the Solar System + HW#4 due 10/18
Week 09 of 10/21	Mars
Week 10 of 10/28	The Outer Planets and their Moons + Fiske Planetarium
Week 11 of 11/04	The Habitable Zone + HW#5 due 11/04
Week 12 of 11/11	Extrasolar Planets + HW#6 due 11/15
Week 13 of 11/18	ME#2 on 11/20 + Reading Extra Credit Due
Week 14 of 11/25	[WINTER BREAK]
Week 15 of 12/02	The Search for Life Beyond our Solar System
Week 16 of 12/09	[THE END] + Term Project due 12/11

*“Two possibilities exist: either we are alone in the Universe or we are not. Both are equally terrifying.”*

—ARTHUR C. CLARKE