PTYS/GEOS/ASTR 214 | Life in the Cosmos

Building Connections | Quantitative Reasoning & World Cultures/Societies

Kuiper 308 | T/Th 9:30—10:45

Description of Course

This course explores key questions in astrobiology and planetary science about the origin and evolution of life on Earth and the possibility that such phenomena have arisen elsewhere in the Universe. We examine what it means for a planet to be alive at scales ranging from cellular processes up to global impacts of biological activity. We consider space-exploration activities to search for life within the Solar System, throughout our Galaxy, and beyond from various cultural perspectives.

Instructor and Contact Information

Instructor: Prof. Tyler Robinson | Kuiper 417 | tdrobin@arizona.edu

Office Hours: T/Th 11:00—12:00, by appointment, and/or "open door"

Teaching Assistant: Laura Seifert | Office | lseifert@arizona.edu

Teaching Assistant: Zoë Wilbur | Office | zewilbur@arizona.edu

Web: https://d2l.arizona.edu/d2l/home/1243307

Course Format and Teaching Methods

Course content will be delivered through a combination of lectures, in-class small-group discussions, online discussions, in-class assessments, and small-group assignments.

Course Objectives

During this course students will:

- Identify and interrelate the wide variety of disciplines that address the fundamental questions:
  - Where did we come from?
  - What is the meaning of life?
  - Are we alone in the universe?
- Communicate and justify how interdisciplinary approaches contribute to understanding the origin and history of life on Earth.
- Use core values, concepts, theories, and quantitative methods from planetary science and biology to identify promising targets in the search for extraterrestrial life.
- Examine the role and importance of astrobiology from various perspectives.
- Engage in critical and conceptual thinking about the impact of discovering life on another planet.

Expected Learning Outcomes

Students will demonstrate:

- The ability to utilize multiple perspectives and make meaningful connections across disciplines and social positions, think conceptually and critically, and solve problems.
- Competency in working with numerical information by critically analyzing quantitative information, generating ideas that are supported by quantitative evidence, assessing the relevance of data and its associated implications in a variety of contexts, and communicating those ideas and/or associated interpretations using various formats (graphs, data tables, illustrations, video presentations, or written reflections).
- Understanding of the values, practices, and/or cultural products of at least one non-US culture/society with an astrobiology or space exploration program; relate how these values, practices and/or cultural products have shaped their space exploration activities; and reflect on how the student's own background has influenced their perceptions of other societies and their sense of place in the global community.

Absence and Class Participation Policy

Participating in the course and attending lectures and other course events are vital to the learning process. As such, attendance and in-class participation are incorporated into a student's grade. However, students can have several absences and still achieve a perfect participation score, thereby minimizing the stress of missing a lecture. *To request a disability-related accommodation to this attendance policy, please contact the Disability Resource Center at (520) 621-3268 or drc-info@email.arizona.edu.* If you are experiencing unexpected barriers to your success in your courses, the Dean of Students Office is a central support resource for all students and may be helpful. The Dean of Students Office is located in the Robert L. Nugent Building, room 100, or call 520-621-7057.

The UA's policy concerning Class Attendance, Participation, and Administrative Drops is available at https://catalog.arizona.edu/policy/class-attendance-and-participation.

The UA policy regarding absences for any sincerely held religious belief, observance or practice will be accommodated where reasonable: http://policy.arizona.edu/human-resources/religious-accommodation-policy.

Absences preapproved by the UA Dean of Students (or dean's designee) will be honored. See http://policy.arizona.edu/employmenthuman-resources/attendance.

Makeup Policy for Students Who Register Late

Students who register after the first-class meeting may make up missed assignments within one week of joining the class.

Course Communications

All course-wide communications will occur through both D2L and email. The instructor can be reached via email or through an in-person visit to office hours. Students should not expect the instructor to respond via email or D2L outside of normal business hours.

Required Texts or Readings

Catling, D.C. (2013) *Astrobiology: A Very Short Introduction*, Oxford U. Press

Assignments and Examinations: Schedule/Due Dates

Short, low-impact **quizzes occur in-class every Thursday**. This course has **no exams**.

Major assignments are scaffolded and centered on a science fiction novel read within an instructor-assigned small group. Each small group has the freedom to select their preferred novel, although a key theme (or themes) in the book must include one (or more) of: (1) Origins, (2) Exploration, and (3) Discovery. These themes within the novel will be used to make connections to: (1) diverse cultural views on life's origins, (2) diverse cultural views on exploration or multi-national efforts in space exploration, and (3) historical analysis on the cultural impacts of major new discoveries.

Small groups submit a one-page **Sci-Fi Book Justification** to argue for how their selected novel addresses any of Origins, Exploration, and/or Discovery. The justification should also briefly describe connections to the cultural aspects listed in the previous paragraph. Feedback will be provided on writing and ideas, although full credit will be awarded to any submission that meets the length requirement.

In anticipation of producing a scientific analysis of their group-read science fiction book, small groups will submit a **Sci-Fi Book Poster Draft** for feedback. This is an opportunity to practice design and to provide an initial discussion of science-focused themes in the book. As with the Justification assignment, feedback will be provided on writing and ideas, and full credit will be awarded to any submission that meets the poster requirement.

At the end of the semester, small groups will submit their **Sci-Fi Book Cultural Analysis** and **Sci-Fi Book Scientific Analysis Poster**. The Cultural Analysis Signature Assignment must be between four and five pages (single spaced) and must coherently connect relevant themes of Origins, Exploration, and Discovery to the cultural concepts listed above. This is a research-focused project where small groups must make cultural connections and cite relevant sources, independent of materials directly covered in class. The Sci-Fi Book Scientific Analysis Poster may contain no more than 500 words, must be visually appealing, must contain at least one novel, group-designed graphic (e.g., a depiction of a world or alien, a graphic detailing the layout and function of a starship or habitat), and should contain at least one quantitative comparison (e.g., comparison of atmospheric make-up on an alien world to Earth, analysis of a timeline underlying the creation of interstellar travel).

Item	Due Date
Sci-Fi Book Justification	Feb 03 (Week 4)
Sci-Fi Book Poster Draft	Apr 07 (Week 13)
Sci-Fi Book Cultural Analysis	May 03 (Week 17)
Sci-Fi Book Scientific Analysis	May 03 (Week 17)

Potential science fiction books in the three key themes are:

Origins: *Frankenstein* (Mary Shelley)
Exploration: *Red Mars* (Kim Stanley Robinson)
Discovery: *Contact* (Carl Sagan)

Writing Requirement

In this course, students (working in small groups) will produce two writing-intensive products: a cultural analysis Signature Assignment and a scientific analysis Signature Assignment. Both assignments have an opportunity for feedback and revision prior to their final submission.

Final Examination

This course has **no final examination**.

Grading Scale and Policies

Grades are assigned based on accumulated points throughout the semester. Course items and associated points are:

Item	Maximum Points
Participation	50
In-Class Quizzes	10
Peer Grades	5
Sci-Fi Book Justification (*group*)	5
Sci-Fi Book Poster Draft (*group*)	5
Sci-Fi Book Cultural Analysis (*group*)	15
Sci-Fi Book Scientific Analysis Poster (*group*)	10
Total	100

Letter grades then follow:

A: ≥ 90 pts
B: ≥ 80 pts and < 90 pts
C: ≥ 70 pts and < 80 pts
D: ≥ 60 pts and < 70 pts
F: < 60 pts

Participation: Students will have many avenues to achieve success in participation; attendance, in-class questions/answers, on-line discussion, and visits to office hours all award a student with participation points. Attendance at a twice-weekly lecture earns a point, asking a question or responding to a prompt in lecture earns a point, participating in a weekly on-line discussion with a thoughtful, paragraph-long entry or relevant shared article earns a point, and a weekly visit to office hours to chat about course content yields a point. Participation points are awarded up to a *maximum of 50 total points*. The total number of available points are then:

Participation Item	Available Points
Attendance (daily)	28
In-class Question or Answer (daily)	28
On-line Discussion (weekly)	17
Office Hours Visit (weekly)	17
Total	90

In-Class Quizzes: Brief, low-impact quizzes will be administered every Thursday in all 15 weeks of the semester. Each quiz has a maximum possible score of one point. Quiz points are totaled over the semester to a *maximum of 10 total points*.

Peer Grades: Group work can be challenging but is also an important skill to learn for use throughout our lives. To best enable the strong functioning of small-groups, group members will evaluate one another at the middle and end of the semester. Each assessment is worth 2.5 points and the end-semester average group-assigned grade for each student is used to weight their grade

for all group-submitted items.

Sci-Fi Book Justification: Working in small groups, students will select a science fiction book to read and analyze over the course of the semester. A one-page justification of the appropriateness of the selected book (submitted as a group) is worth five points. This is an opportunity to receive feedback on ideas, especially with regards to how material in the group-read book connects to cultural themes in Origins, Exploration, and Discovery.

Poster Draft: One Signature Assignment for this course is a poster that provides a scientific analysis (that is quantitative, where feasible) of the astrobiological topics encountered in the group-read science fiction book. Midway through the poster design process, small groups will submit a poster draft for feedback. This draft is not formally graded and its submission awards five points.

Sci-Fi Book Cultural Analysis: As described above, another Signature Assignment for this course centers on the cultural analysis of the group-read science fiction book. Selected books must include at least one of the following themes: (1) Origins, (2) Exploration, and (3) Discovery. The cultural analysis assignment then connects any of these book themes to any of: (1) diverse cultural views on life's origins, (2) diverse cultural views on exploration or multi-national efforts in space exploration, and (3) historical analysis on the cultural impacts of major new discoveries. A total of 15 points is available for this assignment.

Sci-Fi Book Scientific Analysis Poster: As described above, small groups will submit a Signature Assignment in the form of a stylistic poster that provides a scientific analysis of the astrobiological themes present in the group-read science fiction book. A total of 10 points is available for this assignment.

Extra Credit: Show your creative side! Students can be awarded up to a total of five (5) additional points for any form of artistic creation inspired by the theme: "life in *our* Universe." Write a poem about water on Mars, decorate a cake that depicts an origin story from another culture, paint a watercolor piece about the tree of life—it all counts! Points will be awarded based on roughly-perceived efforts, broadly following: short poem (1 pt); poem or short story or sketch (2 pt); small decorated baked goods (3 pt); longer-format story or large decorated baked good (4 pt) musical piece or animation or play or video (5 pt). Pieces may be shared with the larger class, with permission. Students may ask the instructor in advance for the anticipated number of points for a proposed artistic piece.

Class-wide extra credit will also be given for completing the end-of-semester course evaluations. If 50% of all students submit responses, the entire class receives one (1) point of extra credit. If 80% of all students submit responses, then the class-wide extra credit will be increased to two (2) total points.

Requests for Incomplete (I) or Withdrawal (W): Requests must be made in accordance with University policies, which are available at http://catalog.arizona.edu/policy/grades-and-grading-system#incomplete and http://catalog.arizona.edu/policy/grades-and-grading-system#Withdrawal, respectively.

Dispute of Grade Policy: Grade disputes must be brought to the attention of the instructor within one week of return.

Honors Credit

Honors credit is available, either through enrollment in Section 002 of PTYS/GEOS/ASTR 214 (if available) or through fulfillment of an Honors contract.

Scheduled Topics/Activities

Week	Dates	Topic
1	Jan 12	Course Introduction
2	Jan 17 – Jan 19	What is Astrobiology? Small Groups (Read: p.1–13)
3	Jan 24 – Jan 26	From Big Bang to Stars (Read: p. 14–22)
4	Jan 31 – Feb 02	Planets: Formation and Habitable Environments (Read: p. 22–27)
5	Feb 07 – Feb 09	A History of Earth and Life: Part I (Read: p. 28–43)
6	Feb 14 – Feb 16	A History of Earth and Life: Part II (Read: p. 44–62)
7	Feb 21 – Feb 23	Origin and Structure of Life: Part I (Read: p. 63–75)
8	Feb 28 – Mar 02	Origin and Structure of Life: Part II (Read: p. 75–81)
9	Mar 07 – Mar 09	Spring Break (No Class)
10	Mar 14 – Mar 16	Habitability & Life in the Solar System: Part I (Read: p. 82–88)
11	Mar 21 – Mar 23	Habitability & Life in the Solar System: Part II (Read: p. 99–109)
12	Mar 28 – Mar 30	Human Space Exploration; Interstellar Travel (Read: p. 120–123)
13	Apr 04 – Apr 06	Fermi Paradox; SETI; Rare Earth (Read: p. 123–129)
14	Apr 11 – Apr 13	Habitability Outside the Solar System (Read: p. 110–119)
15	Apr 18 – Apr 20	Life on Mars: Past, Present, Future Prospects (Read: p. 88–99)
16	Apr 25 – Apr 27	Final Project Group Work (No Class)
17	May 02	In-Class Final Project Assistance

Classroom Behavior Policy

To foster a positive learning environment, students and instructors have a shared responsibility. We want a safe, welcoming, and inclusive environment where all of us feel comfortable with each other and where we can challenge ourselves to succeed. To that end, our focus is on the tasks at hand and not on extraneous activities (e.g., texting, chatting, reading a newspaper, making phone calls, web surfing, etc.).

Students are asked to refrain from disruptive conversations with people sitting around them during lecture. Students observed engaging in disruptive activity may be asked to cease this behavior. Those who continue to disrupt the class will be asked to leave lecture or discussion and may be reported to the Dean of Students.

Some learning styles are best served by using personal electronics, such as laptops and iPads. These devices can be distracting to other learners. Therefore, students who prefer to use electronic devices for note-taking during lecture should seat themselves to the side of the classroom.

Threatening Behavior Policy

The UA Threatening Behavior by Students Policy prohibits threats of physical harm to any member of the University community, including to oneself. See: http://policy.arizona.edu/education-and-student-affairs/threatening-behavior-students.

Accessibility and Accommodations

At the University of Arizona, we strive to make learning experiences as accessible as possible. If you anticipate or experience barriers based on disability or pregnancy, please contact the Disability Resource Center (520-621-3268, https://drc.arizona.edu/) to establish reasonable accommodations.

Code of Academic Integrity

Students are encouraged to share intellectual views and discuss freely the principles and applications of course materials. However, graded work/exercises must be the product of independent effort unless otherwise instructed. Students are expected to adhere to the UA Code of Academic Integrity as described in the UA General Catalog. See https://deanofstudents.arizona.edu/policies/code-academic-integrity.

The University Libraries have some excellent tips for avoiding plagiarism, available at http://new.library.arizona.edu/research/citing/plagiarism.

Selling class notes and/or other course materials to other students or to a third party for resale is not permitted without the instructor's express written consent. Violations to this and other course rules are subject to the Code of Academic Integrity and may result in course sanctions. Additionally, students who use D2L or UA e-mail to sell or buy these copyrighted materials are subject to Code of Conduct Violations for misuse of student e-mail addresses. This conduct may also constitute copyright infringement.

UA Nondiscrimination and Anti-harassment Policy

The University is committed to creating and maintaining an environment free of discrimination; see http://policy.arizona.edu/human-resources/nondiscrimination-and-anti- harassment-policy.

Our classroom is a place where everyone is encouraged to express well-formed opinions and their reasons for those opinions. We also want to create a tolerant and open environment where such opinions can be expressed without resorting to bullying or discrimination of others.

Additional Resources for Students

UA Academic policies and procedures are available at http://catalog.arizona.edu/policies.

Student Assistance and Advocacy information is available at https://deanofstudents.arizona.edu/support/student-assistance.

Confidentiality of Student Records

http://www.registrar.arizona.edu/personal-information/family-educational-rights-and-privacy- act-1974-ferpa?topic=ferpa

COVID Considerations

Students and instructors with COVID-like symptoms should not attend lecture unless a negative COVID test has been received. The participation points system in this course is designed to allow students to miss lectures (and quizzes) while not negatively impacting their grade. Should the primary instructor test positive for COVID, lecture will be temporarily delivered through Zoom and the lecture hall will be set up for viewing this presentation.

Subject to Change Statement

Information contained in the course syllabus, other than the grade and absence policy, may be subject to change with advance notice, as deemed appropriate by the instructor.