UNIVERSITY OF ARIZONA GENERAL EDUCATION SYLLABUS

PTYS/GEOS/ASTR 214: Life in the Cosmos

Building Connections | Quantitative Reasoning & World Cultures/Societies

Kuiper 308, T/Th 11:00 AM -- 12:15 PM

Description of Course

Life in the Cosmos 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.

Course Prerequisites or Co-requisites

Life in the Cosmos has no formal prerequisites. However, University of Arizona high school competency requirements will be assumed. In particular, we will assume that students understand algebra and geometry.

Instructor and Contact Information

Instructor: Prof. Veronica Bray (she/her)
E-mail: vjbray@arizona.edu
Office Hours Location: (Zoom) https://arizona.zoom.us/j/89936585025
Office hours: 2-3pm Thursdays

Teaching Assistant: Claire Cook (she/her)
E-mail: clairec@arizona.edu
Office Hours Location: Kuiper library, room 409
Office hours: 10-11am Thursdays

Teaching Assistant: Sawsan Wehbi (she/her)
E-mail: sawsanwehbi@arizona.edu
Office Hours Location: Sonnett building room 111
Office hours: 12:30 – 1:30pm Tuesdays

Course web page: https://d2l.arizona.edu/d2l/home/1551472

Course Format and Teaching Methods

Life in the Universe is an in-person, lecture-driven, three credit hour course. Students also engage in discussions during lectures, a midterm exam, and a final group project. Lectures incorporate interactive polls as well as a once-weekly, open-book quiz to check student comprehension.

Course Objectives

- 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

- 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, videos, 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, active attendance is 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.

- The UA's policy concerning Class Attendance and Participation is available at: https://catalog.arizona.edu/policy/courses-credit/courses/class-attendance-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 pre-approved by the UA Dean of Students (or Dean Designee) will be honored. See: https://deanofstudents.arizona.edu/policies/attendance-policies-and-practices.
- To request a disability-related accommodation to this attendance policy, please contact the Disability Resource Center at (520) 621-3268 or disability@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.

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

Course-wide communications will be via D2L announcements and associated emails to official UA addresses. Students are welcome to email the instructor with any/all course-related questions or comments and should expect a response within about one working day. If an email response is later, please email again to give a "bump" to the email chain.

Required Texts or Readings

The suggested textbook, which is freely available to all enrolled students through the course D2L site, is:

Catling, D.C. (2013) *Astrobiology: A Very Short Introduction*, Oxford U. Press
https://academic-oup-com.ezproxy4.library.arizona.edu/book/497

This book helps bolster the information given in lectures. Course notes will hold the most up-to-date information, superseding some numbers and facts within this book.

Required or Special Materials

- Access to a networked computing device (phone, tablet, laptop) is required in-lecture to participate in in-class activities for participation credit.
- Access to a computing device (e.g., calculator, computer) is required outside of lecture to complete assignments.
- Students are recommended to take written notes on paper. Paper and online lecture notes may be used on the in-class quizzes.

Please contact the instructor if access to a computing device is a barrier to your participation in the class. Note that computing devices may be checked out from the UA library (https://lib.arizona.edu/borrow/tech).

Use of TopHat for Some Participation Credit

We will be using Top Hat (www.tophat.com) for some class quizzes. For instructions on how to download the Top Hat app, refer to Top Hat's Getting Started Guide (opens in new tab). Please note, you cannot create an account through the mobile application. For more information, please see https://help.intech.arizona.edu/article/706-syllabus-guidelines-for-top-hat.

Technical problems with TopHat MUST be reported ***at the time in class***, or else no allowance will be given for a missed quiz.

Grading Scale and Policies

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

Item	**Maximum Points**
ePortfolio Signature Assignment	30
Sci-Fi Book/Film group contracts	2
Peer reviews	3
Sci-Fi Book/Film Essay	10
Sci-Fi Book/Film Presentation	15
Homework	30
Participation	20
In-Class Quizzes	20
Total	100

Letter grades then follow:

A: $\geq$ 90 pts
B: $\geq$ 80 pts and $<$ 90 pts
C: $\geq$ 70 pts and $<$ 80 pts
D: $\geq$ 60 pts and $<$ 70 pts
F: $<$ 60 pts

All assignments must be submitted by the stated due date for full credit. Homework submitted up to one week late will be marked up to 50% points. Later homework will not be graded.

Assignments/Assessment Items

Participation (20%): This course includes discussion of cultural and scientific subjects, some at the forefront of their disciplines. As such, some material presented in the course is theoretical and is up for discussion. Participation through the answering of questions, discussion, and the asking of questions in class is a portion of the final grade (20%). Each student is expected to participate in these ways at least 5 times over the semester (4 points each). Each time, the name of that student will be recorded and entered into the grade book. For those whom speaking up in class is not a possibility, attendance at office hours also constitutes participation (4 points each time).

In-Class Quizzes (20%): Open-note multiple-choice quizzes will be administered via D2L after every 2 lectures (13 quizzes total). Each quiz has a maximum possible score of 2 points. The three lowest quiz scores will be dropped. Quiz points are totaled over the semester to a *maximum of 20 total points.* Technical problems with D2L MUST be reported ***at the time, in class***, or else no allowance will be given for a missed quiz.

Homework (30%): Students will be assigned 4 homework assignments over the course of the semester, each worth 10 points. Students will have two weeks to complete each homework assignment, affording multiple opportunities to attend office hours to get homework help. The lowest homework grade will be dropped.

Sci-Fi Book/movie Project (30%): The Signature Assignment for this course is a presentation that provides a cultural and scientific analysis (including a quantitative analysis) of the astrobiological topics encountered in a selected book/movie. Working in small groups (4-5 students), students will select a sci-fi book or movie to analyze over the course of the semester. Your analysis will encompass both the scientific concepts depicted in the book/movie, as well as its cultural aspects. Selected books/movies must include at least one of the following science themes: (1) Origins of life on Earth or elsewhere, (2) Exploration or terraforming of other worlds, or (3) Discovery of, and communication with, alien life. The cultural analysis section must connect any of the science themes to any of: (1) diverse cultural views on life's origins on Earth, (2) diverse cultural views on the presence of life beyond Earth, (3) diverse cultural views on exploration or multi-national efforts in space exploration, and (4) historical analysis on the cultural impacts of major new discoveries or exploration.

Group Formation and Book/Movie Choice (2 points): Group work can be challenging but is also an important skill to learn for use throughout our lives. The instructor will partition the class into groups of 4-5 students to jointly analyze a sci-fi book or movie over the second half of the semester. In their first meeting, the group will discuss how to productively collaborate and their expectations for each other, which they will document in a "contract" (D2L Quiz set-up)**. This D2L submission will include** justification of the appropriateness of the selected book and should include the planned roles for each member of the team (e.g., one person writes the plot summary, one person works on the quantitative analysis, etc.)

Essay-Form (10 points): The intended content of your poster/video presentation should be collected and presented in the form of an essay, midway through the poster/video design process. This draft is formally graded for content, but will also provide feedback that should be incorporated for the final presentation. The essay will include a short abstract summarizing the findings of the group, a plot summary for their chosen book/movie, a qualitative scientific analysis section, a quantitative analysis section, and a cultural analysis section. The realism of the book/movie in each of these areas should be assessed. Figures/pictures should be included, and references cited. The contribution of each group member will be recorded.

Peer reviews (3 points): 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. The first assessment is a simple yes/no answer in D2L, for 1 point. The second peer review will occur at the time of poster/video submission and is more detailed (2 points). The individual grades for the project are weighted based on the peer reviews (i.e. if you do nothing, you get nothing).

Final Poster/Video Presentation (15 points): Each group has the option to create a poster or an edited video as their final product with their e-portfolio. A poster template will be provided for those choosing this option, and utilizes Power Point. The poster will be presented in front of the class on the lecture hall front screen with a "lightning talk" – a 5 minute summary of the group's film/book analysis. If the group chooses to produce a video, they can do so with the help of the Astrobiology Center's AV equipment. A presentation will be given in class by the Astrobiology Center to assist. The video is to be 5 minutes long. The videos and lightning talks should be roughly divided into one minute for each item: Plot summary, cultural analysis, science analysis, a quantitative assessment, and conclusions concerning the film realism.

Extra Credit: There are NO extra credit assignments planned. Bonus points are available in some homework and quizzes.

Incomplete (I) or Withdrawal (W):

Requests for incomplete (I) or withdrawal (W) must be made in accordance with University policy, which is available at https://catalog.arizona.edu/policy/courses-credit/grading/grading-system.

Dispute of Grade Policy

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

Writing Requirement

All Tier One and Tier Two General Education Courses are writing intensive (https://ge.arizona.edu/gened-tiers/tiers-course-guidelines). In this course, the writing requirement will be fulfilled through the Sci-Fi book/movie cultural and scientific analysis essay, which then forms the basis of your video/poster presentation.

Final Examination or Project

There is no final examination for Life in the Cosmos. The Poster/Video presentation will take the place of a "final".

Honors Credit

As this is a GenEd course it is available for Honors credit. Honors contract information is available at frankehonors.arizona.edu/academics/honors-contracts. If you have ideas for an honors contract, please see the instructor during office hours or over email.

Scheduled Topics/Activities (Subject to change)

The course is separated into two main parts: 1) Life as we know it – a history of the solar system, the Earth and life on Earth. This is learning of facts, with learning through homework assignments and quizzes. 2) The search for life elsewhere – a discussion of habitable places other than Earth, how we find them and how to get there.

Date	Item Due
2/18	Homework 1 Due
3/4	Homework 2 Due
3/25	Homework 3 Due
4/8	Homework 4 Due
4/17	Sci-Fi Book/Film analysis essay due
4/29	Sci-Fi Book/Film analysis presentations uploaded

Provisional Lecture Plan

Week	Dates	Topic
1	1/16	The Drake Equation – An Intro to Astrobiology
2	1/21	What is Life?
2	1/23	Life Needs Energy (Quiz 1)
3	1/28	Life Needs Water
3	1/30	Life Needs Carbon (Quiz 2)
4	2/4	Making Planets (Homework 1 set – Life Needs, Essay Practice)
4	2/6 - Wehbi	Biological molecules (Quiz 3)
5	2/11 - Wehbi	Extremophiles
5	2/13 - Wehbi	Early life on Earth (Quiz 4)
6	2/18 - Cook	Mars Water/Life (Homework 2 Set – Extremophiles, Graphing)
6	2/20 - Cook	Outer Solar System (Quiz 5)
7	2/25 - Cook	More solar system life
7	2/27	From Ocean to Land (Quiz 6)
8	3/4	Luck vs Evolution (Homework 3 set – Life Times, Creative writing)
8	3/6	Group Project outline and group formation (Quiz 7)
9	3/8 – 3/16	Spring Break
9	3/8 – 3/16	Spring Break
10	3/18	Exoplanets
10	3/20	Exoplanets (Quiz 8)
11	3/25	Exo-Atmospheres (Homework 4 set – Exoplanet Habitability, Maths)
11	3/27	Habitable Zones (Quiz 9)
12	4/1	Terraforming
12	4/3	Ethics and planetary protection
13	4/8	Space Travel and Comms
13	4/10	Group Time (Quiz 11)
14	4/15	Group Time
14	4/17	Group Time (Quiz 12)
15	4/22	Drake Equation & Fermi Paradox
15	4/24	Group Time (Quiz 13)
16	4/29	Group Project Time
16	5/1	In Class Poster/Video Presentations – Groups 1 to 12
17	5/6	In Class Poster/Video Presentations – Groups 13 to 24
17	5/8	Reading Day – No Class
18	5/13	NO FINAL. In Class Poster/Video Presentations – As Necessary

Use of Generative AI

In this course, generative artificial intelligence/large-language-models/tools, such as ChatGPT, Dall-e, Bard, Bing, may be used for research purposes with appropriate acknowledgment and citation, but not to generate written text for submission. In other words, you may use generative AI tools to help you do research for assignments, but you may not use them to help you to write the text you will submit for grading (e.g, for the Cultural Analysis essay). This is because writing text is an integrative learning exercise which solidifies your understanding of course material. Editing LLM text does not produce the same degree of learning. If you are in doubt as to whether you are using generative AI tools appropriately in this course, I encourage you to discuss your situation with your teaching team.

Be aware that many AI companies collect information; do not enter confidential information as part of a prompt. LLMs may make up or 'hallucinate' information. These tools may reflect misconceptions and biases of the data on which they were trained and the human-written prompts used to steer them. You are responsible for checking facts, finding reliable sources for, and making a careful, critical examination of any work that you submit.

If you use generative AI to help you with your research, you must cite both it and the underlying secondary sources. You are responsible for verifying the accuracy of the generative AI source (they often report erroneous information). Please use the following guidelines for citing generative AI: https://style.mla.org/citing-generative-ai/.

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 will 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.

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.

Notification of Objectionable Materials

This course will include discussion of evolution, climate change, and colonization.

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/student-rights-responsibilities/academic-integrity.

The University Libraries have some excellent tips for avoiding plagiarism, available at https://lib.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.

Nondiscrimination and Anti-harassment Policy

The University of Arizona is committed to creating and maintaining an environment free of discrimination. In support of this commitment, the University prohibits discrimination, including harassment and retaliation, based on a protected classification, including race, color, religion, sex, national origin, age, disability, veteran status, sexual orientation, gender identity, or genetic information. For more information, including how to report a concern, please 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

Campus Health
http://www.health.arizona.edu/
Campus Health provides quality medical and mental health care services through virtual and in-person care.
Phone: 520-621-9202

Counseling and Psych Services (CAPS)
https://health.arizona.edu/counseling-psych-services
CAPS provides mental health care, including short-term counseling services.
Phone: 520-621-3334

The Dean of Students Office's Student Assistance Program
https://deanofstudents.arizona.edu/support/student-assistance
Student Assistance helps students manage crises, life traumas, and other barriers that impede success. The staff addresses the needs of students who experience issues related to social adjustment, academic challenges, psychological health, physical health, victimization, and relationship issues, through a variety of interventions, referrals, and follow up services.
Email: DOS-deanofstudents@arizona.edu
Phone: 520-621-7057

Survivor Advocacy Program
https://survivoradvocacy.arizona.edu/
The Survivor Advocacy Program provides confidential support and advocacy services to student survivors of sexual and gender-based violence. The Program can also advise students about relevant non-UA resources available within the local community for support.
Email: survivoradvocacy@arizona.edu
Phone: 520-621-5767

Campus Pantry

Any student who has difficulty affording groceries or accessing sufficient food to eat every day, or who lacks a safe and stable place to live and believes this may affect their performance in the course, is urged to contact the Dean of Students for support. In addition, the University of Arizona Campus Pantry is open for students to receive supplemental groceries at no cost. Please see their website at: *campuspantry.arizona.edu* for open times.

Preferred Name & Pronoun

This course affirms people of all gender expressions and gender identities. If you prefer to be called a different name than what is on the class roster, please let me know. Feel free to correct instructors on your preferred gender pronoun. If you wish to change your preferred name or pronoun in the UAccess system, please use the following guidelines:

Preferred name: University of Arizona students may choose to identify themselves within the University community using a preferred first name that differs from their official/legal name. A student's preferred name will appear instead of the person's official/legal first name in select University-related systems and documents, provided that the name is not being used for the purpose of misrepresentation. Students are able to update their preferred names in UAccess.

Pronouns: Students may designate pronouns they use to identify themselves. Instructors and staff are encouraged to use pronouns for people that they use for themselves as a sign of respect and inclusion. Students are able to update and edit their pronouns in UAccess.

More information on updating your preferred name and pronouns is available on the Office of the Registrar site at https://registrar.arizona.edu/records-enrollment/personal-information/updating-personal-information.

Safety on Campus and in the Classroom

For a list of emergency procedures for all types of incidents, please visit the website of the Critical Incident Response Team (CIRT): https://cirt.arizona.edu/case-emergency/overview

Also watch the video available at https://arizona.sabacloud.com/Saba/Web_spf/NA7P1PRD161/common/learningeventdetail/crtfy0000000000003560

Confidentiality of Student Records

Student records are kept confidential as per FERPA policy.

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.