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 survey international space-exploration activities to search for life within the Solar System, throughout our Galaxy, and beyond.

This course is in the Building Connections Curriculum Category in the University’s General Education Curriculum. It includes both World Cultures & Societies and Quantitative Reasoning attributes. It is also a Tier II Natural Science course in the previous curriculum. The course is equivalent to ASTR 202 (students may not receive credit for both courses).

Course Prerequisites or Co-requisites
None

Instructor and Contact Information
Instructor: Professor Dante Lauretta, Lunar and Planetary Laboratory, University of Arizona

Office: Kuiper Building (1629 E University Blvd) 536

Email: lauretta@arizona.edu

Office Hours: Wednesday: 9 – 10 am (in person), Thursday: 4 – 5 pm (Zoom), and by appointment (Zoom or in person): contact Dante to schedule.

Teaching Assistant: Tarunika Ramprasad, Lunar and Planetary Laboratory, University of Arizona

Office: Kuiper Building (1629 E University Blvd) 509F

Email: tarunika@arizona.edu

Office Hours: Tuesday: 3 – 4 pm and Thursday: 2 – 3 pm

Preceptor: Scott Peterson

Email:

Office Hours: Zoom?

Preceptor: Shayna Katz

Email:

Office Hours: Zoom?

Web Information: https://d2l.arizona.edu/d2l/home/1206815
Course Format and Teaching Methods
The course content will be a combination of innovative delivery from the instructor, active learning both in and out of the classroom, and collaborative team projects. Content will combine Geology, Atmospheric Science, Biology, Neuroscience, Technology, and Cultural Studies.

The course content will be presented and evaluated through a combination of:

- TED-style talks focused on Key Questions in astrobiology
- In-class discussions and activities
- Asynchronous content directed by student interest
- Semi-weekly thinking and reflection assignments
- Group projects with regular Team Reports and Individual Contribution Summaries

Details are provided in the following sections.

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 cultural perspectives.
- Engage in critical and conceptual thinking about the societal 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.

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. They will also be able to join any existing activities related to mission team formation and assignment of roles and responsibilities.
Course Communications
The instructor is available via email and by appointment. All course material will be posted on D2L. Instructor presentations, and student mission-team progress reports will be delivered in person or via Zoom when the instructor is traveling. Students are expected to work in small groups outside of class. The instructor can assist students in setting up these breakout meetings.

Required Texts or Readings
Weekly Padlet posting and commenting

Required or Special Materials
Preparation of recorded video presentations for in-class reports

Assignments and Examinations: Schedule/Due Dates
The course content will be a combination of innovative delivery from the instructor, active learning both in and out of the classroom, and collaborative team projects.

In-class discussions and activities
Students will engage with instructor-delivered content through in-class discussion and activities. These will be designed to engage students in topics using student-driven ideas, inquiries, questions, and contexts.

Asynchronous content directed by student interest
Student engagement with each question will be enhanced through asynchronous content. Each question will have multi-disciplinary ways to approach the answer. Prior to each class discussion, students will research related content in one of these areas:

- Geology
- Atmospheric Science
- Biology
- Neuroscience
- Technology
- Society/Culture

Students will post and interact with their content in a group chat (Padlet). Content can be online articles, videos, podcasts, creative work, or any source they can justify. Highlights from this content will be incorporated into the class discussions. Students will be responsible for two such posts in each of the six categories listed above (12 total) throughout the semester.

Signature Assignments
There are two signature assignments in this course. More details will be provided with each assignment.

The World Cultures & Societies Signature Assignment is an individual Reflection Journal, submitted for evaluation six times over the course of the semester. The search for life in the cosmos motivates research and inquiry across the world. Space exploration and science more generally, connect to cultural and societal values and narratives. Examination of these different approaches allows students to see both cultural biases and the common interests that drive humans to understand our origins and seek life outside planet Earth. Students will describe, from their own perspective, the benefits of confronting some of the most challenging questions facing humanity. They will
then describe, from one or multiple cultural perspectives, the values and practices that emerge from seeking answers to these questions.

The Quantitative Reasoning Signature Assignment involves the design of an astrobiology mission of exploration. This assignment has both an Individual and a Group component. For the individual component, each student will develop, articulate, and investigate their own Key Question related to the history of life on Earth or the search for life elsewhere in the Universe. Students will then team up to work together and develop a mission concept that addresses all their collective Key Questions. Each team will provide regular Mission Reports on their progress four times throughout the semester. These reports will include written, graphical, and video components.

Grading Scale and Policies

Final grades will be calculated based on:

20%: In-class Activities
20%: Asynchronous Content (Padlet)
30%: World Cultures & Societies Signature Assignment
30%: Quantitative Reasoning Signature Assignment

The grade distribution for the course is as follows:

A: $\geq 90\%$ = excellent (regular grade)
B: $80\% - <90\%$ = good (regular grade)
C: $70\% - <80\%$ = satisfactory (regular grade)
D: $60\% - <70\%$ = poor (regular grade)
E: $<60\%$ = failure (regular grade)

Instructor’s Reading Recommendations


## Schedule of Key Questions/Activities

<table>
<thead>
<tr>
<th>Date</th>
<th>Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>8/23/21</td>
<td>What is Life? What is Consciousness?</td>
</tr>
<tr>
<td>8/25/21</td>
<td>How did the Solar System form?</td>
</tr>
<tr>
<td>8/30/21</td>
<td>What is the basic unit of life?</td>
</tr>
<tr>
<td>9/1/21</td>
<td>What role do quantum effects play in life?</td>
</tr>
<tr>
<td>9/6/21</td>
<td>How did the Earth form?</td>
</tr>
<tr>
<td>9/8/21</td>
<td>What are the building blocks of life? How did they arrive on Earth?</td>
</tr>
<tr>
<td>9/13/21</td>
<td>What is the role of matter and energy in life?</td>
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<tr>
<td>9/15/21</td>
<td>Team Mission Status Report #1</td>
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<tr>
<td>9/20/21</td>
<td>What is the role of information in life?</td>
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<tr>
<td>9/22/21</td>
<td>How did life originate?</td>
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<tr>
<td>9/27/21</td>
<td>What are the range of extreme conditions for life on Earth?</td>
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<tr>
<td>9/29/21</td>
<td>Where else in the Solar System might life have originated?</td>
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<tr>
<td>10/4/21</td>
<td>How did Earth's atmosphere reach its current composition?</td>
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<tr>
<td>10/6/21</td>
<td>Where is the best place to find life outside the Solar System?</td>
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<tr>
<td>10/11/21</td>
<td>When and how did intelligence evolve?</td>
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<tr>
<td>10/13/21</td>
<td>Why is matter conscious?</td>
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<tr>
<td>10/18/21</td>
<td>Team Mission Status Report #2</td>
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<tr>
<td>10/20/21</td>
<td>Can life spread beyond a planet? Beyond a solar system?</td>
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<tr>
<td>10/25/21</td>
<td>When and how did the nervous system evolve?</td>
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<tr>
<td>10/26/21</td>
<td>How do we know there are oceans elsewhere in the Solar System?</td>
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<tr>
<td>11/1/21</td>
<td>When and how did life move to land?</td>
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<tr>
<td>11/3/21</td>
<td>What might life look like on ancient and current-day Mars?</td>
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<tr>
<td>11/8/21</td>
<td>How are plants, fungi, and animals related?</td>
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<tr>
<td>11/10/21</td>
<td>Did an asteroid kill the dinosaurs?</td>
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<tr>
<td>11/15/21</td>
<td>How did the mammals evolve?</td>
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<tr>
<td>11/17/21</td>
<td>Team Mission Status Report #3</td>
</tr>
<tr>
<td>11/22/21</td>
<td>Open session</td>
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<tr>
<td>11/24/21</td>
<td>THANKSGIVING – NO CLASS</td>
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<tr>
<td>11/29/21</td>
<td>How and why did technology evolve?</td>
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<tr>
<td>12/1/21</td>
<td>How can we detect ET technology?</td>
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<tr>
<td>12/6/21</td>
<td>Can we build synthetic life?</td>
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<tr>
<td>12/13/21</td>
<td>Team Mission Final Report (Note: 8 am start time)</td>
</tr>
</tbody>
</table>

### Legend

- **Date**: Instructor out of town, office hours by Zoom appointment only
- **Topic**: Class discussion led by Tarunika
- **Mission Status Report**
- **Holiday**: – no class
Incomplete (I) or Withdrawal (W):
Requests for incomplete (I) or withdrawal (W) must be made in accordance with University policies, which are available at [http://catalog.arizona.edu/policy/grades-and-grading-system#incomplete](http://catalog.arizona.edu/policy/grades-and-grading-system#incomplete) and [http://catalog.arizona.edu/policy/grades-and-grading-system#Withdrawal](http://catalog.arizona.edu/policy/grades-and-grading-system#Withdrawal) respectively.

Dispute of Grade Policy
Each team member will receive instructor feedback on each Mission Report and Individual Contribution Summary. Students may revise and resubmit their previous report in advance of the next deadline for reconsideration of the initial assigned grade.

Honors Credit
Students wishing to take this course for Honors Credit should enroll in one of the Honors sections.

*Jovian Satellites Observation Project* – Students enrolled in an Honors section will participate in a telescopic observing campaign of the moons of Jupiter. Students will take images of Jupiter and its moons during evening telescope observing sessions organized for this class on the UA Mall outside the Kuiper building. Images will be taken once each night over a roughly 18-day period, observing as the four largest moons orbit around Jupiter. Each image of the Jovian system through the telescope must be accompanied by a selfie of the student observer with the telescope in the background on the same night. Students will then convert their images into a time lapse animation and an accompanying explanatory video demonstrating how and why the positions of the moons change.

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.

Additional Resources for Students
UA Academic policies and procedures are available at [http://catalog.arizona.edu/policies](http://catalog.arizona.edu/policies)

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

**Counseling and Psych Services (CAPS)**
[https://health.arizona.edu/counseling-psych-services](https://health.arizona.edu/counseling-psych-services)
If you are facing physical or mental health challenges this semester, please note that Campus Health provides quality medical and mental health care, including short-term counseling services.
For medical appointments: 520-621-9202.
For After Hours care: 520-570-7898.
For the Counseling & Psych Services (CAPS) 24/7 hotline: 520-621-3334.

**The Dean of Students Office’s Student Assistance Program and Life challenges**
[http://deanofstudents.arizona.edu/student-assistance/students/student-assistance](http://deanofstudents.arizona.edu/student-assistance/students/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. If you are experiencing unexpected barriers to your success in your courses, please note the Dean of Students Office is a central support resource for all students and may be helpful.

Email: DOS-deanofstudents@email.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@email.arizona.edu
Phone: 520-621-5767

Academic Advising
If you have questions about your academic progress this semester, please reach out to your academic advisor (https://advising.arizona.edu/advisors/major). Contact the Advising Resource Center (https://advising.arizona.edu/) for all general advising questions and referral assistance. Call 520-626-8667 or email to advising@arizona.edu

COVID Mitigation Efforts
As we enter the Fall semester, the health and wellbeing of everyone in this class is the highest priority. Accordingly, we are all required to follow the university guidelines on COVID-19 mitigation. Please visit https://covid19.arizona.edu/ for the latest guidance.

Confidentiality of Student Records

University-wide Policies link
Links to the following UA policies are provided here, https://academicaffairs.arizona.edu/syllabus-policies:

- Absence and Class Participation Policies
- Threatening Behavior Policy
- Accessibility and Accommodations Policy
- Code of Academic Integrity
- Nondiscrimination and Anti-Harassment Policy
- Subject to Change Statement

Classroom attendance:
- If you feel sick or may have been in contact with someone who is infectious, stay home. Except for seeking medical care, avoid contact with others and do not travel.
- Notify your instructor(s) if you will be missing a course meeting or an assignment deadline.
- Non-attendance for any reason does not guarantee an automatic extension of due date or rescheduling of examinations/assessments.
• Please communicate and coordinate any request directly with your instructor.
• If you must miss the equivalent of more than one week of class, you should contact the Dean of Students Office DOS-deanofstudents@email.arizona.edu to share documentation about the challenges you are facing.
• Voluntary, free, and convenient COVID-19 testing is available for students on Main Campus.
• COVID-19 vaccine is available for all students at Campus Health.
• Visit the UArizona COVID-19 page for regular updates.