

Special Topics: Astrobiology

AST7939 Class 25383

Class Periods: M 8-9, 3:00-4:40 PM; W 8, 3:00-3:50 PM

Location: On-line Zoom

Academic Term: Fall 2020

Instructor:

Charles M. Telesco

Email: telesco@ufl.edu, telesco@astro.ufl.edu

Mobile Phone Number: 352.328.9264

Office Hours: Zoom, anytime by Email appointment

This course is a synchronous class, with live meetings Mondays, 3:00 - 4:40 pm, and Wednesdays, 3:00 - 3:50 pm. It carries 3 credits and entails 3 contact hours/week.

Course Description: Astrobiology examines the origin, evolution, distribution, and future of life in the Universe. It is a highly interdisciplinary field of science, drawing from all key science areas including astronomy, physics, chemistry, biology, geology, planetary science, and mathematics. As the only general prerequisite, the student is expected to be familiar with physics and mathematics at the undergraduate science-major level.

The key challenge for an introductory graduate-level astrobiology course is to not only introduce students from diverse academic backgrounds to the rich fabric of this field, but to also provide a palpable sense of what front-line astrobiology research is like. To accomplish this, we (1) use the textbook *Astrobiology: Understanding Life in the Universe* (2nd Edition), by Charles Cockell, to serve as the course backbone of concepts that underlie the field, and (2) consider more specialized readings from the broader scientific research literature to examine astrobiology research in more detail. Since this Covid-motivated distance-learning experience is new for all of us, we will change procedures as needed. Do not hesitate to make recommendations or bring issues to the instructor's attention.

Learning Objectives: By the end of this course, graduate students should have:

- Acquired a firm grounding in the disciplines comprising astrobiology;
- Established the foundation for reading fundamental literature in the field of astrobiology;
- Gained confidence in their abilities to engage in cross-disciplinary learning beyond their field of expertise.

Required Textbook and Software:

- *Astrobiology: Understanding Life in the Universe*

Charles S. Cockell

Second Edition, 2020

ISBN 9781119550358 (paperback)

ISBN 9781119550396 (epub)

ISBN 9781119550303 (adobe pdf)

- **Zoom:** This course will be delivered live by Zoom during the scheduled class times. You should have the appropriate software downloaded and tested prior to the start of classes. For assistance, visit the UF Zoom site at <https://video.ufl.edu/conferencing/zoom/>

Course Structure and Schedule:

The course textbook is *Astrobiology: Understanding Life in the Universe*, by Charles Cockell, 2nd edition. The overall structure of the course is organized around the flow of material in that textbook, which serves as a convenient organizational backbone. The course is loosely divided into five main themes, represented in Canvas as modules. The left-hand table below shows how the textbook chapters map into these main themes (= modules). The right-hand table shows the approximate weekly course schedule. You should take note of the chapters that will be discussed each week and which you should have read prior to class time. Scroll down below the Schedule for more course info.

| Approximate Flow of Course with Textbook serving as Backbone | | | |
|--|--------|----------|---|
| | | Textbook | Charles Cockell, 2nd edition |
| Theme | Module | Chapter | Astrobiology: Understanding Life in the Universe |
| Basics | 1 | 1 | Astrobiology |
| | | | LIFE AS WE KNOW IT |
| | | 2 | What is Life |
| | | 3 | Matter & Life |
| | | 4 | The Molecular Structure of Life |
| Complexity | 2 | 5 | The Cellular Structure of Life |
| | | 6 | Energy for Life |
| | | 7 | The Limits of Life |
| | | 8 | The Tree of Life |
| | | | ASTRONOMICAL CONTEXT |
| Origins | 3 | 9 | Universe, Solar System, Elements of Life |
| | | 10 | Astrochemistry: Carbon in Space |
| | | | EARTH & LIFE EVOLVING TOGETHER |
| | | 11 | The Early Earth: The First Billion Years |
| | | 12 | The Origin of Life |
| Evolution | 4 | 13 | Early Life on Earth |
| | | 14 | The Geology of a Habitable World |
| | | 15 | Co-evolution of Life & a Planet: The Rise of Oxygen |
| | | 16 | Mass Extinctions |
| | | | LIFE BEYOND EARTH: Our Solar System |
| Beyond | 5 | 17 | The Habitability of Planetary Bodies |
| | | 18 | The Astrobiology of Mars |
| | | 19 | Ocean Worlds & Icy Moons |
| | | | LIFE BEYOND EARTH: The Stars |
| | | 20 | Exoplanets & the Search for Life |
| | | 21 | The Search for Extraterrestrial Intelligence |
| | | 22 | Our Civilization |

| Course Schedule | | | | |
|-----------------|------------|-------|---------|--------------|
| Week | Class Date | Chapt | Module | |
| 1 | August | 31 | 1/2 | 1 |
| | September | 2 | 2/3 | |
| 2 | | 7 | holiday | |
| | | 9 | 3/4 | |
| 3 | | 14 | 4 | |
| | | 16 | 4 | |
| 4 | | 21 | 5 | 2 |
| | | 23 | 5 | |
| 5 | | 28 | 6 | |
| | | 30 | 6 | |
| 6 | October | 5 | 7/8 | |
| | | 7 | 9/10 | 3 |
| 7 | | 12 | Test 1 | |
| | | 14 | 11 | |
| 8 | | 19 | 11/12 | |
| | | 21 | 12 | |
| 9 | | 26 | 13 | 4 |
| | | 28 | 14 | |
| 10 | November | 2 | 14/15 | |
| | | 4 | 15 | |
| 11 | | 9 | 17 | 5 |
| | | 11 | holiday | |
| 12 | | 16 | 18 | |
| | | 18 | 18 | |
| 13 | | 23 | 18/19 | |
| | | 25 | holiday | |
| 14 | | 30 | 19 | |
| | December | 2 | 19/20 | |
| 15 | | 7 | 20 | |
| | | 9 | 20 | |
| | | 15 | Test 2 | 12:30-2:30pm |

Course Procedures:

There are three resources that will serve as the platform for each class:

1. Your textbook;
2. The PowerPoint slides developed by the instructor and based on that textbook. These are available for viewing and download in the Canvas Modules;
3. Outside reading of important or key scientific papers, which will also be made available as pdf files or as links in Canvas.

PowerPoint Slides: The PowerPoint slides are provided as a distillation of the contents of the book. Many of the figures are from the textbook, but others have been added for further clarification or to make additional points. It is recommended that you read carefully the chapter in the textbook, which will provide more detail and continuity and serve as a backdrop for consideration of other course content. Use the PowerPoint slides either in parallel with your reading or as a review when you finish the chapter.

During class, we will not go through all the PowerPoint slides. For about half of each class the instructor will present only a handful of the slides in order to focus on highlights or special areas of importance. Discussion about the slide content or related topics will take place both during and after the slides are presented. **All students are expected to have already read the material and be actively involved in the discussions.**

Primary Literature and Key Papers: You will be assigned two peer-reviewed literature articles related to astrobiology. You will write a critical review of each research article as if you were reviewing the paper for

a professional journal. You will also review and lead the discussion of an assigned key scientific paper from the literature. Papers will be posted on Canvas.

Quizzes: Approximately every other week there will be a short quiz at the beginning of the class. These will focus on material covered in the previous week's reading and class discussions.

Written Exams: There will be two written exams taking the form of short answers and essays. They will cover all aspects of the course content and will be given online using *Honorlock*.

Class Compartment: All classes will be held via a Zoom link to be provided by the instructor. Your attendance and active participation in the class are required and will be noted. To maximize engagement via Zoom, you are requested to enable your Zoom video, while muting your audio unless you are speaking or engaged in active discussion. Hopefully, you will be able to find a reasonably quiet place with minimum distractions where you can participate in class.

Grading: *You must do all the graded work in order to pass the class. Assigned work is due via the mechanism specified, at the time specified; penalties for lateness are detailed on the Course Policies page. It is your responsibility to upload the correct document to Canvas, so double check when you submit to make sure you have done so.*

#1: Online discussion and class participation (10%)

There will be an overall assessment of your participation in class discussions with particular emphasis on the three areas: (1) daily involvement during the PPT slide review, (2) primary literature review, and (3) the weekly review of key papers. While recognizing that we all have different personalities, styles, and backgrounds, the intention is to assess your engagement and familiarity with the topic, and to give you the opportunity to enhance your skills at effective scientific discourse.

#2: Primary Astrobiology Literature Analysis (2 x 10%)

You will be assigned two peer-reviewed literature articles related to astrobiology. You will be expected to write a 800-1000 word critical review of each research article as if you were reviewing the paper for a professional journal. You will be provided formatting information. You must not plagiarize or cut-and-paste from the article or websites. All documents will be evaluated with Turn-it-In through the Canvas website.

#3 Key Papers (10%)

Beginning in week 3 or 4, each student will lead the discussion of one key scientific paper. Each student will be assigned a paper and the class date. Those days will usually be on Mondays during the double class. The student will present a 15-minute summary of the paper and guide the discussion for another 10-15 minutes. A loose format and other guidelines will be provided near the beginning of the course. All students are expected to have read the assigned paper in advance of the class and be actively involved in the discussions.

#4 Quizzes (10%)

Approximately every other week there will be a short quiz at the beginning of the class. These will focus on material covered in the previous week's reading and class discussions.

#5 Written Exams (2 x 25%)

There will be two written exams taking the form of short answers and essays. They will cover all aspects of the course content and will be given online using Honorlock.

More information on UF grading policy may be found at:

- <http://gradcatalog.ufl.edu/content.php?catoid=10&navoid=2020#grades>
- <https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx>

Summary of Grade Distribution by Activity

| Activity | Percentage of Final Grade |
|---------------------|----------------------------------|
| Participation | 10% |
| Quizzes | 10% |
| Midterm Exam | 25% |
| Final Exam | 25% |
| Literature Analysis | 20% |
| Key Papers | 10% |
| Total | 100% |

Grading Scale

| Percent | Grade | Grade Points |
|----------------|--------------|---------------------|
| 90.0 - 100.0 | A | 4.00 |
| 87.0 - 89.9 | A- | 3.67 |
| 84.0 - 86.9 | B+ | 3.33 |
| 81.0 - 83.9 | B | 3.00 |
| 78.0 - 80.9 | B- | 2.67 |
| 75.0 - 79.9 | C+ | 2.33 |
| 72.0 - 74.9 | C | 2.00 |
| 69.0 - 71.9 | C- | 1.67 |
| 66.0 - 68.9 | D+ | 1.33 |
| 63.0 - 65.9 | D | 1.00 |
| 60.0 - 62.9 | D- | 0.67 |
| 0 - 59.9 | E | 0.00 |

Communications: Outside of class time, the current plan for communication from the instructor to the entire class will be via the Canvas "Announcements" page. One-on-one communications between the student and instructor will be by e-mail. Please keep in mind that only your official UF email (as provided by the UF Registrar) will be used for all email communication: no gmail or other non-UF mail services are permitted for official communications. As noted in the course description, this Covid-motivated distance-learning experience is new for all of us, and we are open to changing procedures as needed to make this a better experience. Do not hesitate to make recommendations or bring issues to the instructor's attention.

Attendance Policy, Class Expectations, and Make-Up Policy:

All classes will be held via a Zoom link to be provided by the instructor. Your attendance and active participation in the class are required and will be noted. To maximize engagement via Zoom, you are requested to enable your Zoom video, while muting your audio unless you are speaking or engaged in active discussion. Hopefully, you will be able to find a reasonably quiet place with minimum distractions where you can participate in class. Also note the following:

- Excused absences must be consistent with university policies in the Graduate Catalog: (<http://gradcatalog.ufl.edu/content.php?catoid=10&navoid=2020#attendance>) and require appropriate documentation.
- Additional information can be found here: <https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx>

Contact Hours: "Contact Hours" refers to the hours per week in which students are in contact with the instructor, excluding office hours or other voluntary contact. The number of contact hours in this course equals the number of credits the course offers.

Workload: As a Carnegie I, research-intensive university, UF is required by federal law to assign at least 2 hours of work outside of class for every contact hour. Work done in these hours may include

reading/viewing assigned material and doing explicitly assigned individual or group work, as well as reviewing notes from class, synthesizing information in advance of exams or papers, and other self-determined study tasks.

Students Requiring Accommodations: Students with disabilities who experience learning barriers and would like to request academic accommodations should connect with the disability Resource Center by visiting <https://disability.ufl.edu/students/get-started/>. It is important for students to share their accommodation letter with their instructor and discuss their access needs, as early as possible in the semester.

Course Evaluation: Students are expected to provide feedback on the quality of instruction in this course by completing online evaluations at <https://gatorevals.aa.ufl.edu/>. Evaluations are typically open during the last two or three weeks of the semester, but students will be given specific times when they are open. Summary results of these assessments are available to students at <https://gatorevals.aa.ufl.edu/>.

University Honesty Policy: UF students are bound by The Honor Pledge which states, “We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code.”

On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: “On my honor, I have neither given nor received unauthorized aid in doing this assignment.”

The Honor Code specifies (see: <https://www.dso.ufl.edu/sccr/process/student-conduct-honor-code/>) a number of behaviors that are in violation of this code and the possible sanctions. Furthermore, you are obligated to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with the instructor in this class.

Software Use: All faculty, staff, and students of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate. We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity.

Student Privacy: There are federal laws protecting your privacy with regards to grades earned in courses and on individual assignments. For more information, please see: <http://registrar.ufl.edu/catalog0910/policies/regulationferpa.html>

Campus Resources:

Health and Wellness

U Matter, We Care:

If you or a friend is in distress, please contact umatter@ufl.edu or 352 392-1575 so that a team member can reach out to the student.

Counseling and Wellness Center: <http://www.counseling.ufl.edu/cwc>, and 392-1575; and the University Police Department: 392-1111 or 9-1-1 for emergencies.

Sexual Assault Recovery Services (SARS)

Student Health Care Center, 392-1161.

University Police Department at 392-1111 (or 9-1-1 for emergencies), or <http://www.police.ufl.edu/>.

Academic Resources

E-learning technical support, 352-392-4357 (select option 2) or e-mail to Learning-support@ufl.edu.
<https://lss.at.ufl.edu/help.shtml>.

Career Resource Center, Reitz Union, 392-1601. Career assistance and counseling.
<https://www.crc.ufl.edu/>.

Library Support, <http://cms.uflib.ufl.edu/ask>. Various ways to receive assistance with respect to using the libraries or finding resources.

Teaching Center, Broward Hall, 392-2010 or 392-6420. General study skills and tutoring.
<https://teachingcenter.ufl.edu/>.

Writing Studio, 302 Tigert Hall, 846-1138. Help brainstorming, formatting, and writing papers.
<https://writing.ufl.edu/writing-studio/>.

Student Complaints Campus: https://www.dso.ufl.edu/documents/UF_Complaints_policy.pdf.

On-Line Students Complaints: <http://www.distance.ufl.edu/student-complaint-process>.