Life in Extreme Environments
Fall 2020
Course meeting: Tuesday and Thursday 4:00 PM – 5:15 PM
Room: TBD

Instructor Information

<table>
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<tr>
<th>Solange Duhamel, Ph.D.</th>
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<td>Office: Life Sciences South Room 354</td>
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<td>Phone: (520) 621-6057</td>
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<td>Dr. Duhamel’s Office Hours</td>
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<td>Tuesdays 1:30 PM – 2:30 PM</td>
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<td>Thursdays 1:30 PM – 2:30 PM</td>
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Course Description

Extreme environments are numerous and diverse on Earth. Despite harsh environmental conditions, microbes have been found thriving from the deepest seafloors to the highest mountains, from the coldest polar regions to the hottest and most arid deserts or steaming hot springs. Microbes survival in such extreme and varied conditions allows them to play fundamental roles in global nutrient cycling. The course will encompass foundational material for the study of life in extreme environments.

In this course, we will examine microbial adaptations to their environment, how the adaptive responses affect microorganisms’ evolution and how microorganisms modify their environment. We will consider physical extremes, such as temperature, radiation, pressure, and geochemical extremes (e.g., desiccation, salinity, pH, depletion of oxygen or extreme redox potential).

We will also assess how the study of life in extreme environments can provides critical elements of answer to important questions such as: “How did life appear on our planet?”; “How microbes made Earth habitable?” and “Could life exist beyond our planet?”, and explore the impact of human activity on ecosystems. Additionally, we will explore the wide application potential of this area of research in the fields of medicine, biotechnology, chemical and pharmaceutical industry, or cosmetics.

Course Goals

Students will be introduced to a wide range of topics related to the biogeochemical foundations of life in extreme environments. Students will be also expected to develop their scientific reasoning and writing skills as well as conduct independent literature reviews and synthesize their findings.

Course Objectives and Learning Outcomes

In this course, students will:
- Read current literature on life in extreme environments
- Engage in critical discussion of current literature
• Lead a discussion on a current research paper
• Synthesize their findings into a Term Project

By participating in this course, students will be able to:
• Improve fundamental understanding of life in extreme environments
• Find and identify important research papers
• Critically evaluate research papers
• Discuss current research on life in extreme environments
• Develop skills related to critical thinking

Registration and Prerequisites

MCB181R (or equivalent), completion of 1st semester organic chemistry and at least one upper division Molecular Biology, Biochemistry, Microbiology, or Astrobiology course (unless explicit instructor permission is received).

Course Format and Workload

Participation in weekly discussions is a critical portion of your grade (see grading policies below). Failure to participate in a week’s discussion will result in a score of “zero” for discussion that week. Exceptions will be made conflicts due to University-authorized commitments (pre-approved by the UA Dean of Students), or holidays observed by organized religion with which you are affiliated provided the instructor is contacted before the discussion is missed and proper documentation is provided.

There will be no Final Examination. However, there will be an extensive (semester-long) Term Project that will involve reading one additional book chapter or peer-reviewed article per week and submitting a one paragraph summary of what the paper was about, what you found most interesting, and specifying an additional paper that you will read next. This process will be repeated every week for approximately ten weeks, with reports due on Tuesdays 7AM. The final report will be a synthesis of each of these reports and the themes that were explored. The final report will be two pages long, plus references. Additional expectations for the final report will be posted on D2L. The first weekly report is due on Tuesday, September 1st, and every Tuesday thereafter (unless otherwise noted). The final report will be due on or before November 23rd. There will also be an accompanying ten-minute in-class presentation held on December 1st and 3rd.

Grading Policy

<table>
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<th>Category</th>
<th>Percentage</th>
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<tr>
<td>Homework Assignments:</td>
<td>20%</td>
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<tr>
<td>Weekly reports:</td>
<td>20%</td>
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<tr>
<td>Discussions:</td>
<td>20%</td>
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<tr>
<td>Term Project (final report):</td>
<td>20%</td>
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<tr>
<td>Term Project Oral Presentation:</td>
<td>20%</td>
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Grades will be assigned as follows:  
A ≥90%  
B ≥75 and <90%  
C ≥60 and <75%
D ≥50 and <60%
E <50%

Final grades will not be scaled; however, students may receive up to a 5% bonus toward the final grade based on their in-class attendance and participation.

Incompletes (I) are only given at the instructor’s discretion in the specific case of a student who is passing the course and has missed a portion of the assigned work.

Absence Policy
1. The UA policy concerning Class Attendance, Participation, and Administrative Drops is available at: http://catalog.arizona.edu/policy/class-attendance-participation-and-administrative-drop
2. 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.
3. Absences pre-approved by the UA Dean of Students (or Dean Designee) will be honored. See: https://deanofstudents.arizona.edu/absences

Participating in the course and attending lectures and other course events are vital to the learning process. As such, attendance is required at all lectures and discussion section meetings. If you miss class for any reason, please contact the instructor so we can discuss any barriers you have to attending class. Assignments due on the due date and time specified under the Schedule of Topics section below (or before). If an assignment is due, you are responsible for turning it in, even if you are absent from class. Late work will generally not be accepted. However, if it is accepted, a penalty of 25% will be applied to the assignment’s score for each day that the assignment late (i.e., if your score on the homework assignment would have been 85%, but it was handed in a day late, you will receive a score of 60%). For exams, if you have reason to believe you will be absent from class please let the instructor know in advance.

Expectation for Academic Honesty

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: http://deanofstudents.arizona.edu/academic-integrity/students/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.
The instructor reserves the right to utilize electronic means to help prevent plagiarism. Students agree that by taking this course, all assignments are subject to submission for textual similarity review to turnitin.com. Assignments submitted to turnitin.com will be included as source documents into turnitin.com’s restricted access database solely for the purpose of detecting plagiarism in such documents.

Classroom Behavior

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.). The use of cell phones and computers for activities outside of coursework is prohibited during class. Non-class activities are also prohibited (includes things like playing cards, playing with your dog, quilting, building a model airplane, 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.

Attendance is required from all students at all lectures, and while in class, students are expected to conduct themselves in a considerate manner. Late arrivals and early departures are disruptive and not permitted. Students must disable cell phones for the duration of the class and refrain from answering calls (please take any emergency calls outside and explain them later). Students that persistently disrupt the class may be removed through the administrative drop procedure. Video recording in the classroom is not permitted without prior approval. No food or drink (except water) is permitted in this room and please clear up your seating area after use.

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.

UA Nondiscrimination and Anti-Harassment

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.
Changes

The information contained in this course syllabus, other than the grade and absence policies, may be subject to change with reasonable advance notice, as deemed appropriate by the instructor.

Required or Special Materials:

Students are expected to have access to Microsoft Word and Excel (or equivalent) to complete homework assignments.

Schedule of Topics

We will endeavor to follow this class schedule as closely as possible throughout the term:

**Week 1**  
*Introduction to Life in Extreme Environments*  
Tuesday, August 25: Syllabus review and introduction to the Term Project  
Thursday, August 27

*Reading:* Reading Selections will be Posted on D2L  
*Homework 1 issued:* Due Thursday on September 10

**Week 2**  
*Life in extreme habitats and what it means to be an extremophile*  
Tuesday, September 1 Paper 1 Summary Due  
Thursday, September 3:

*Reading:* Reading Selections will be Posted on D2L

**Week 3**  
*Introduction to Planetary Sciences and Exobiology*  
Tuesday, September 8: (Invited speaker) Paper 2 Summary Due  
Thursday, September 10 (Invited speaker) Homework 1 Due

*Reading:* Reading Selections will be Posted on D2L  
*Homework 2 issued:* Due on Thursday, October 1

**Week 4**  
*Life under low temperature*  
Tuesday, September 15: Paper 3 Summary Due  
Thursday, September 17

*Reading:* Reading Selections will be Posted on D2L

**Week 5**  
*Life under high temperature*  
Tuesday, September 22: Paper 4 Summary Due  
Thursday, September 24

*Reading:* Reading Selections will be Posted on D2L
Week 6  
**Life without water**  
Tuesday, September 29: Paper 5 Summary Due  
Thursday, October 1: Homework 2 Due  

*Reading:* Reading Selections will be Posted on D2L  
*Homework 3 issued:* Due on Thursday, October 22

Week 7  
**Life under high salinity**  
Tuesday, October 6: *Term Paper Draft Due*  
Thursday, October 8  

*Reading:* Reading Selections will be Posted on D2L

Week 8  
**Life under high and low pH**  
Tuesday, October 13: Paper 6 Summary Due  
Thursday, October 15  

*Reading:* Reading Selections will be Posted on D2L

Week 9  
**Applications to the Study of the Origin of Life**  
Tuesday, October 20: (Invited speaker) Paper 7 Summary Due  
Thursday, October 22: (Invited speaker) Homework 3 Due  

*Reading:* Reading Selections will be Posted on D2L  
*Homework 4 issued:* Due on Thursday, November 12

Week 10  
**Life Under High Pressure and the Deep Biosphere**  
Tuesday, October 27: Paper 8 Summary Due  
Thursday, October 29  

*Reading:* Reading Selections will be Posted on D2L

Week 11  
**Organic Solvent Tolerant Microorganisms and Radiation Resistant Organisms**  
Tuesday, November 3: Paper 9 Summary Due  
Thursday, November 5  

*Reading:* Reading Selections will be Posted on D2L

Week 12  
**Microorganisms in Oligotrophic Environments**  
Tuesday, November 10: Paper 10 Summary Due  
Thursday, November 12: Homework 4 Due  

*Reading:* Reading Selections will be Posted on D2L
**Week 13**  
*Applications to Astrobiology*  
Tuesday, November 17: No Paper Summary Due  
Thursday, November 19:  

*Reading:* Reading Selections will be Posted on D2L

**Week 14**  
*Other Applications*  
Tuesday, November 24: Term Paper Return  
Thursday, November: no class - Thanksgiving *No Lecture*

*No Reading Assignments*

**Week 15**  
*Term Project Presentations*  
Tuesday, December 1: Term Project Presentations I  
Thursday, December 3: Term Project Presentations II

*No Reading Assignments*

**Week 16**  
*Conclusions and Perspectives*  
Tuesday, December 8: Discuss Term Papers and Term Project Presentations

*No Reading Assignments*