

# Feeding Martians

## Space biology and space agriculture – Creating the path toward sustainable Martian habitation

HOS4932-2E69 • SPRING 2018

### Format

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Online weekly lectures and supplementary web-based materials.

Lectures could also be supplemented with feeds from the Future Exploration Greenhouse in Antarctica, and with hosted conversations with other space scientists.

New lectures and activities go live every Monday at 9:00 AM

### Instructors

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**Anna-Lisa Paul**

[alp@ufl.edu](mailto:alp@ufl.edu)

Office hours by appointment after Feb 20, until then please use email

**Robert Ferl**

[robferl@ufl.edu](mailto:robferl@ufl.edu)

Office hours by appointment after Feb 20, until then please use email

### Course Overview

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A One Credit, Online course will examine the concepts and science that will be necessary to establish sustainable colonies on Mars, based on current practices and concepts of growing plants in space and exploration habitats.

The history of space biology and astrobiology will serve as a basis for delving into the current state of what we know about growing crops off Earth and the potential future state of plant production in extraterrestrial environments.

The policies and procedures of space biology science will also be discussed so as to map potential timelines for near future space exploration along the pathway to the exploration of Mars.

A portion of the class will be presented on location from the EDEN-ISS Future Exploration Greenhouse at the Neumayer III Antarctic Research Station (<http://eden-iss.net/>).

## Learning Objectives

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- Gain an appreciation for space biology research and the role of plants in space exploration
- Gain an understanding of the technology and scientific approaches used to support agriculture in spaceflight and in future planetary greenhouses
- Learn the processes behind launching spaceflight and planetary analog experiments
- Learn the basic mechanisms plants use to sense and respond to gravity, and how plants adjust to growing in space
- Learn the value of exploration research in the context of expanding terrestrial knowledge that helps agriculture on Earth

## Course Materials

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### Textbook

There is not a required textbook for this course.

### Lectures

Weekly lectures will, at a minimum, take the form of 45 – 50 minute PowerPoint presentations delivered by the instructors. In addition to the core of slides, the presentation may include video and audio materials to enhance the material being presented. Lectures will be released every Friday at 9:00 AM. You are expected to watch the lecture, and take accompanying quiz, within seven days of it going live.

### Supplementary materials

In addition to the lectures, links to supplementary reading and videos will be provided to enhance and support the lecture materials.

### Course website

This course has a comprehensive mini-site in the Canvas platform. Take time to familiarize yourself with the “Start Here”, “Syllabus”, “Course Materials”, and “Grades” tabs in the navigation menu. Digital copies of this syllabus, and other learning materials can be found there. Students log in here with their credentials: *E-Learning in Canvas*, [elearning.ufl.edu](http://elearning.ufl.edu)

### Required Technology

Students will need to have access to a personal computer to access the course material and complete assignments and quizzes.

## Lectures:

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An outline of the weekly lecture topics follows. Please note that the timing and topics of the lectures may shift as new resources (e.g. availability of guest speaker) or events (e.g. a spaceflight launch or expedition) become available through the semester.

1. Orientation to the class and to Canvas
2. Why space biology and why plants? The context of plant biology in space exploration
3. History of space biology as a science
4. Plants and gravity – how microgravity taught us how plants know where they are
5. The special and largely unknown role of plants in the Apollo era moon landings
6. Plant science and plant production in space and planetary analogs – do we know enough today to feed a team on Mars tomorrow?
7. Plants in space – SciFi concepts compared to recent real life
8. Real world example 1: Greenhouses on a polar crater (Haughton Mars Project, the Arctic)
9. Real world example 2: Greenhouses on ice sheets (EDEN-ISS Project, the Antarctic)
10. Real world example 3: Plant research on the Space Shuttle and ISS (TAGES, APEX, CARA and more)
11. Challenges and technology for growing plants in microgravity – from launch to harvest
12. Challenges and technology for sustain exploration greenhouses – from construction to calories
13. Trials and Travails – from managing water and gas exchange to pathogens and abiotic stress
14. Exploration beyond Low Earth Orbit, NASA's plans and the role of plants for the future
15. Translational science – the contribution of space research to terrestrial applications

## Policies on attendance and quizzes:

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As an online only class, there are no physical attendance requirements. However, success in the class is reliant on keeping up with the weekly lectures and quizzes. The lectures and corresponding quiz will each be available for a one week window. If a week's worth of material is missed due to a documented illness or other excused absence **that spans the entire week in question**, arrangements can be made to review the material and make up the quiz (see UF policies on what constitutes an excused absence here: <https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx>). In addition, there is latitude in the grading system to provide grace for unexpected and undocumented emergencies; students will be graded on the 12 best of 14 quizzes

## Course Grade

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### Weekly Quizzes (144 points total)

Every Monday at 9:00 AM, a quiz will become available in Canvas. Students are responsible for taking the weekly quiz to establish their grade in the course. The quizzes will consist of 6 multiple choice questions, and will be worth 12 points. There will be 14 lecture quizzes during the semester, and the twelve highest scores will be used to compute the final grade in the class. Each quiz will be timed to 30 minutes, and it can only be taken once. Students can refer to the recorded lecture, supplementary material, or any other reference material to complete the quiz. However, each student must work individually. Quizzes will be available at the same time the corresponding lecture and supplementary

material is released, and will remain open until the next lecture and quiz set is released one week later. Make up quizzes will be provided in accordance with the policy referenced above in the “Policies on attendance and quizzes” section, but please note that the excused absence must span the entire week of the lecture and quiz unit.

### Quiz Schedule

	Lecture and Quiz <b>opens</b>	Lecture and Quiz <b>closes</b>
Quiz #1	Monday, January 8, 9:00AM	Monday, January 15, 9:00AM
Quiz #2	Monday, January 15, 9:00AM	Monday, January 22, 9:00AM
Quiz #3	Monday, January 22, 9:00AM	Monday, January 29, 9:00AM
Quiz #4	Monday, January 29, 9:00AM	Monday, February 5, 9:00AM
Quiz #5	Monday, February 5, 9:00AM	Monday, February 12, 9:00AM
Quiz #6	Monday, February 12, 9:00AM	Monday, February 19, 9:00AM
Quiz #7	Monday, February 19, 9:00AM	Monday, February 26, 9:00AM
Quiz #8	Monday, February 26, 9:00AM	Monday, March 5, 9:00AM
Quiz #9	Monday, March 12, 9:00AM	Monday, March 19, 9:00AM
Quiz #10	Monday, March 19, 9:00AM	Monday, March 26, 9:00AM
Quiz #11	Monday, March 26, 9:00AM	Monday, April 2, 9:00AM
Quiz #12	Monday, April 2, 9:00AM	Monday, April 9, 9:00AM
Quiz #13	Monday, April 9, 9:00AM	Monday, April 16, 9:00AM
Quiz #14	Monday, April 16, 9:00AM	Monday, April 23, 9:00AM

### Grading Scale

A	=	95 - 100 percent
A-	=	< 95 - 90 percent
B+	=	< 90 - 87 percent
B	=	< 87 - 83 percent
B-	=	< 83 - 80 percent
C+	=	< 80 - 77 percent
C	=	< 77 - 73 percent
C-	=	< 73 - 70 percent
D+	=	< 70 - 67 percent
D	=	< 67 - 63 percent
D-	=	< 63 - 60 percent
E	=	<60 percent

Additional information on current UF grading policies for assigning grade points can be found here: [Grading policy, catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx](http://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx)

# Course Policies and Expectations

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## Written Communication

Virtually all of the communication between students and professors in this course will be through e-mail, and so this too can be part of the educational experience. Effective written communication is essential for professional success, irrespective of your final career choice. In a world where first impressions are often conveyed through an e-mail communication, learning how to communicate well in this medium can make a substantial difference in how you are perceived. All written communication should be polite, professional, and the words carefully considered. Check your spelling, use complete sentences, and also be mindful of salutations and closing remarks. The university also has a nice reference sheet here: **Email etiquette**, [www.advising.ufl.edu/docs/ProfessionalEtiquette.pdf](http://www.advising.ufl.edu/docs/ProfessionalEtiquette.pdf).

## Academic Honesty

As a student at the University of Florida, you have committed yourself to uphold the Honor Code, which includes the following pledge: “We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honesty and integrity.” You are expected to exhibit behavior consistent with this commitment to the UF academic community. Additionally, on all work submitted for credit by students, the following pledge is either required or implied:

**“On my honor, I have neither given nor received unauthorized aid in doing this assignment.”**

The university requires all members of its community to be honest in all endeavors. A fundamental principle is that the whole process of learning and pursuit of knowledge is diminished by cheating, plagiarism and other acts of academic dishonesty. In addition, every dishonest act in the academic environment affects other students adversely, from the skewing of the grading curve to giving unfair advantage for honors or for professional or graduate school admission. Therefore, the university will take severe action against dishonest students. Similarly, measures will be taken against faculty, staff and administrators who practice dishonest or demeaning behavior. Students should report any condition that facilitates dishonesty to the instructor, department chair, college dean or Student Honor Court.

It is assumed all work will be completed independently unless the assignment is defined as a group project, in writing by the instructor. This policy will be vigorously upheld at all times in this course. Additionally, all work submitted for credit by students will be analyzed with originality-checking software to detect any academic misconduct.

## 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 when appropriate.

## Technical Difficulties

If you are experiencing technical difficulties within Canvas or Mediasite you should immediately contact the UF Help Desk. This will generate a ticket number, which documents the date and time of your technical difficulty. Any requests to make-up late work due to technical difficulties must be accompanied by this ticket number (**UF Help Desk**, HUB 132, 392-4357, [iss.at.ufl.edu/help.shtml](http://iss.at.ufl.edu/help.shtml)). Please let your instructors know about any difficulties with other assigned web sites.

## Students with Disabilities

The Disability Resource Center (DRC) coordinates the needed accommodations of students with disabilities. This includes registering disabilities, recommending academic accommodations within the classroom, accessing special adaptive computer equipment, providing interpretation services and mediating faculty-student disability related issues.

If you would like to request accommodations for this course, you must first register with the DRC. The DRC will provide you with documentation that you must deliver to the instructor when requesting accommodations.

- *Disability Resource Center*, 0001 Reid Hall, 392-8565, [dso.ufl.edu/drc/](https://dso.ufl.edu/drc/)

## Campus Helping Resources

If you are experiencing crises or personal problems that interfere with your general wellbeing, I encourage you to utilize the university's counseling resources. The UF Counseling and Wellness Center provides a wealth of confidential, free counseling services to enrolled students.

- *Counseling and Wellness Center*, 3190 Radio Road, 392-1575, [www.counseling.ufl.edu](http://www.counseling.ufl.edu)
- *U Matter We Care*, [www.umatter.ufl.edu](http://www.umatter.ufl.edu)

## Diversity

The University of Florida and we place great emphasis on affirming the diversity of the student body. Student, faculty, and staff interactions with others from varied backgrounds and experiences foster a superior educational environment and nurture a healthier, more accurate understanding of how our increasingly global and multicultural society operates.

We encourage you to engage in meaningful intra- and inter-culture dialogue and support a climate that is grounded in respect and inclusion for individuals of all of races, ethnic backgrounds, genders, and sexual orientations.

## Course Evaluation Process

Student assessment of instruction is an important part of the effort to improve teaching and learning. At the end of the semester, you are expected to provide feedback on the quality of instruction in this course using a standard set of university and college criteria. Evaluations are typically open during the last two or three weeks of the semester. You will be notified of the specific times when evaluations for this course are open. These evaluations are conducted online at:

- *Course evaluations*, [evaluations.ufl.edu](https://evaluations.ufl.edu)

## Student Complaints

You can file and resolve any complaints about your experience in this course in the following site:

- *Student complaints in online courses*, [distance.ufl.edu/student-complaint-process](https://distance.ufl.edu/student-complaint-process)

## Acknowledgements

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