

Earth 351 - Forming a Habitable Planet

Earth & Planetary Sciences
Spring Quarter 2016

M, W 3:00-4:20 PM
Tech F285

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Class Website: <http://lunar.earth.northwestern.edu/courses/351/>

Assigned readings, journal articles and handouts will be posted on this website.

Description:

We will investigate whether intelligent life is rare or common in the universe, exploring the conditions under which the formation and evolution of a planet allow it to develop and support intelligent life. Using our solar system and Earth as our only definite example of a planet supporting life, we will consider global geophysical and geochemical processes critical in developing our planet such that sentient beings evolved. The prospects for life elsewhere within our solar system and beyond will be discussed. The rapidly expanding database of exoplanets - those around other stars - identified, and specifically the discoveries by NASA's ongoing Kepler mission will be analyzed. Proposed NASA Discovery missions will be a feature of the course.

Readings:

Ward, P. D. & D. Brownlee, *Rare Earth: Why Complex Life is Rare in the Universe*, Springer, 2004, paperback, ISBN 0387952896.

Langmuir, C. H. and W. Broecker, *How to Build a Habitable Planet*, Princeton Univ. Press, 2012. ISBN 9780691140063

(Reading assignments: RE# denotes chapters for *Rare Earth* and HP for *Habitable Planet*)

Both books on Reserve in the Main Library, as Mudd SEL not available for reserve.

Grades: 50% Homework; 10% Class Discussion; 30% Team Presentation; 10% Team Report
Course grades will be assigned on the basis of problem sets, class discussion exercises and participation as well as an independent team project presenting a mission proposed for NASA's Discovery program. This will be presented in class. A final paper will summarize the mission science goals with full documentation and citations. Opportunity will be given for revision.

Homework numerical answers require units and appropriate numbers of significant digits. All work must be shown.

Students may discuss homework with others, but are expected to work and do their write-ups independently: You cannot look at another student's work or show them yours.

Class Attendance: It's important to keep up, so attending class is required. In-class discussion questions cannot be made up. Homework is due a week after being handed out, at the beginning of class. No credit will be given for late work without prior approval from an instructor.

Make-ups ONLY allowed through advance arrangement with the WCAS of Studies.

Note: No portable electronic devices, including laptop computers, may be used during class.

Earth 351 - Spring Quarter 2016 - Schedule

Date	Topics	Text, Homework
Mar 29	Fermi Question; Drake Equation: "Where is everybody?"	RE1,2; HP21; PS1
Mar 30	Our solar system; Definition of habitable zone	
Apr 4	Nucleosynthesis; Formation of the Solar System	RE3; HP3,5; PS2
Apr 6	Evolution of the Solar System	
Apr 11	The Moon	RE4,5; HP13; PS3
Apr 13	Guest Lecture, Kepler Mission, Dr. Jason Steffen	
Apr 18	Impacts: Comets and Asteroids; Earth's Water	RE6,7; HP9,16; PS4
Apr 20	Early Earth; Origin of Life	
Apr 25	Mass extinctions and extra-terrestrial theories for the events Moon Mission Team -	RE8; HP14; PS5
Apr 27	Volatiles and Organics in the Solar System Venus Mission Team -	RE9; HP10; PS6
May 2	Mars; Outer satellites NEO Mission Team -	RE10,11; HP12; PS7
May 4	The Moon ### Apollo Lunar Rocks ### Mars Mission Team -	
May 9	Importance of terrestrial plate tectonics Asteroid Mission Team -	RE12,13; PS8
May 11	Depiction of Extra-Terrestrial Life Io Mission Team - Enceladus Mission Team -	
May 16	Exoplanets KBO Mission Team -	PS9
May 18	Discovery Mission Selection	
May 23	SETI, the Search for Extra Terrestrial Intelligence	
May 25	Course summary; Drake Equation Revisited	
May 30	Memorial Day, No Class	
June 1 - 4	Wed - Sat WCAS Reading Period	

(Assignments: RE# denotes chapters to read in *Rare Earth*; HP# for *Habitable Planet*;
PS# refer to Problem Set #, due at beginning of class a week later)

May 25, Final Class, Final Science Paper Due

First paper draft due a week after presentation; drafts can be repeatedly submitted for comments, allowing for further revision in response.