

An Upper Level Astrobiology Course with Discussion Sections

Dave Theison

*Department of Astronomy, University of Maryland, College Park, MD
20 742, U.S.A.*

Abstract. ASTR 380, Life in the Universe, has been offered here every semester since the mid-seventies. One of four upper level, special topic classes for junior and senior non-science students, the enrollment in ASTR 380 always reached the maximum of 80 students per section. A few years ago, as a result of a change in University requirements, the enrollment dropped to 20-30 students per section. Taking advantage of this situation and keenly aware of student interest in examining certain aspects of the course content more closely, I decided to teach the course with an additional hour per week devoted to a discussion section. While ASTR 380 is the only one of the four upper level classes to have a discussion section, students have enthusiastically seized the opportunity to discuss specific areas of astrobiology.

1. Course Description

For thousands of years, human beings have wondered about the origin of life on Earth and have considered the possibility that distant worlds may be teeming with other kinds of living creatures. ASTR 380 is an introductory, non-mathematical course that describes recent developments in biology, geology and astronomy that provide tentative answers to the questions of the origin of life on Earth and the cosmic distribution of other intelligent species. Methods of detecting or communicating with such extraterrestrial intelligences, from direct physical contact to the interstellar radio techniques of broadcasting and eavesdropping, are considered. Finally, current knowledge is used to evaluate the evidence behind present accounts of UFO visits and claims of past visits by ancient astronauts.

2. Course Objectives

1. To describe in broad terms the evolution of the Universe, and to discuss the consequences of this evolution for the origin of life and the development of intelligent beings.
2. To investigate the prospects for extraterrestrial life and the possible existence of intelligent extraterrestrials at other locations in the observable universe.

3. To examine and analyze the current speculation about communication or contact with intelligent extraterrestrials.

3. Course Data Sheet

Course	ASTR 380: LIFE IN THE UNIVERSE
Texts	<i>The Search for Life in the Universe</i> (3rd Edition) by Donald Goldsmith & Tobias Owen; <i>Sharing the Universe: Perspectives on Extraterrestrial Life</i> by Seth Shostak; <i>Captured by Aliens: The Search for Life and Truth in a Very Large Universe</i> by Joel Achenbach
Format	Three hours of lecture, one hour of discussion
Audience	Juniors and seniors
Enrollment	20 - 30/semester
Topics	Creation of the Universe and simple elements; galaxies; interstellar medium; stellar lifetimes and the evolution of elements; origin of the Solar System & Earth; origin & evolution of life on Earth; life in the Solar System; cosmic distribution of ETI; interstellar travel; communication with ETI; first contact
Assessment	Mid-Term & Final Exam; Course Journal; Homework Assignments and Discussion Exercises/Worksheets; Reader Dialogue Sheets for <i>Captured by Aliens: The Search for Life and Truth in a Very Large Universe</i> by Joel Achenbach; Answers to Student Study Guide Questions for <i>2001: A Space Odyssey</i>

4. Discussion Sections and Topics

Each discussion section has a worksheet completed by students in small groups (3-4 students) or by each individual student. The former are done during the first twenty minutes of the discussion period, while the latter are completed before class. In both cases, a class-wide discussion is initiated using the student worksheets as a guide. In general, discussion exercises have no one "right" answer, but instead are open-ended and designed to engage student interest, encourage student exploration and elicit student conversations. The following list describes the fifteen topics used during the last three years. (In a normal semester at least ten exercises are done.)

4.1. The Aliens You Grew up with (Icebreaker)

Students select their favorite fictional alien from a movie or television program, explain why this alien appeals to them, and describe how this alien is different from humans in appearance and behavior. For an introductory discussion exercise, this can lead to some thoughtful discussion.

4.2. Contact Optimist or Uniqueness Advocate?

Before being exposed to course content students are asked to describe i) their opinion about ETL and ETI and ii) the reasons for their opinion.

4.3. Mystery of the Great Silence by David Brin (small group work)

An article from *First Contact*, edited by Ben Bovin and Byron Preiss, introduces students to the Drake Equation identifies contact optimists and uniqueness advocates, and describes eight broad categories of explanations for the Great Silence.

4.4. ETI: Hopes and Fears (small group work)

An eight page handout uses quotes from scientists and science fiction writers to introduce students to the wide ranging ideas about ETL and ETI.

4.5. Contact: the Search for Extraterrestrial Intelligence (Video)

One of the best SETI videos describes the entire field in 48 minutes and concludes with a thoughtful discussion of the philosophical consequences of SETI.

4.6. The Listeners by James E. Gunn

The “seed” story and first chapter of Gunn’s 1972 novel *The Listeners*, described by Carl Sagan as “one of the very best fictional portrayals of contact with extraterrestrial intelligence ever written”, demonstrates what it might be like to work on a SETI listening project.

4.7. Sex in Zero-Gee (video)

O.K., this is shameless, but it was done after countless student requests! This is a video of my infamous talk discussing “sex” on sf pulp magazine covers, the generation of artificial gravity in space colonies, physiological changes in the human body in a low gravity environment, and how zero-gee may influence various human interactions, including s-e-x.

4.8. What Makes a Planet Habitable?

Exercise assessing planets (and some moons) in our Solar System as candidates for life. Based on Activity 3 from the Educator Resource Guide *Life on Earth... and Elsewhere?* published by the NASA Astrobiology Institute and TERC’s Astrobiology Curriculum Project.

4.9. What Can Life Tolerate?

Exercise designed to introduce students to extremophiles and the astonishing range of conditions life can tolerate here on the Earth. Based on Activity 4 from the Educator Resource Guide *Life on Earth... and Elsewhere?* published by the NASA Astrobiology Institute and TERC’s Astrobiology Curriculum Project.

4.10. The Sentinel by Arthur C. Clarke

The “seed” story for Arthur C. Clarke’s 2001: *A Space Odyssey* introduces students to the idea of galactic colonization and to the possibility (only sf, so far!) of extra terrestrial artifacts in the Solar System.

4.11. UFOs vs. Flying Saucers (small group work)

Students discuss various aspects of the UFO/Flying Saucer controversy such as what hard evidence would convince them of the existence of such craft, the natural phenomena often reported as UFO's etc.

4.12. The Special Theory of Relativity and Interstellar Voyaging

Students examine how time dilation may make travel throughout the Galaxy possible in a single individual's lifetime, discuss the practicalities of engaging in interstellar travel, and briefly review the design plans of various starships.

4.13. How Large Can "L" Be? (small group work)

Students are asked to consider the events and societal factors that will influence the value of "L" (the lifetime of a technological civilization) in the Drake Equation.

4.14. Interstellar Messages (small group work)

Students create a list of the pieces of information they believe should be included in our interstellar messages.

4.15. First Contact! (small group work)

Students speculate about the consequences of three scenarios (radio contact, up-close and personal visitations, and no other intelligent life) in this exercise.

5. Additional Course Assignments

Students are required to complete a course journal consisting of three parts.

1. The Mars Room Quiz, see online at <http://www.astro.umd.edu/education/marsroom/Quiz/index.html>.
2. Reader Dialogue Sheets: a separate paper on these is available on request.
3. Student Study Guide Questions to *2001: A Space Odyssey*, see online at <http://www.astro.umd.edu/theison/2001/2001studyguide.html>.