Undergraduate Studies 303 - Extraterrestrial Life (Scalo)
Syllabus

This syllabus is somewhat incomplete in details, but will filled in with a subsequent version, probably by the next lecture period. None of the essential material, concerning instructor, textbooks, grading, etc, will be changed. The subsequent version will fill in the office hours, dates of exams, topics of each week's lectures, … and will always be available at the course web site (when that site is ready, probably Friday)

Classroom and time: Welch 3.502, MWF 9-10

Professor: John Scalo
Office: R.L. Moore 15.204 (Dean Keaton and Speedway)
Phone: 478-2748 (home; best place to call me, any time 9am to 9pm); office number is 471-6446.
Email: scalo@astro.as.utexas.edu or parrot@astro.as.utexas.edu
Office hours: **XX**

Meetings at times besides office hours can usually be easily arranged. I also urge you to feel free to call me at my home or office, or to talk to me after class (in the foyer just outside the classroom--I have free time after most of our classes); for short questions there is usually no need for you to walk all the way to my office, and I welcome phone calls at home.

Teaching Assistants: There are four teaching assistants, each in charge of three discussion sections.

63985, 64010, 64025: Jacob Hummel, R.L. Moore 16.340, 471-4475, jhummel@astro.as.utexas.edu.
64000, 64005, 64040: Athena Stacy, R. L. Moore 16.212, 471-8443, minerva@astro.as.utexas.edu
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Office hours: Will probably be on the next edition of this syllabus.

Class Website: link to it through http://www.as.utexas.edu/astronomy/education/courses.html
Or directly at XX.
The class website will contain the syllabus, an outline of most class lectures, extra reading in the form of articles that may be assigned (you can read them online or print them); a link to eGradebook, where you can check your exam scores; and a simple way for me to distribute handouts or make slight revisions to the reading assignments (see "Announcement" at the web site). I urge you to check the website often.
[It is possible I will switch this to Blackboard; I will let you know as soon as I do.]

Required books: ***Extraterrestrial Life, 5th Edition***, by Evans
Contact by Carl Sagan.

The novel *Contact* will be used only for the last section of the course, so you should begin reading it around Spring break. In part this book is meant to give you an alternate view of that subject matter (detection of extraterrestrial signals). The picture presented in that book is technically fairly accurate, but of course is over two decades old. In discussion sections you will discuss ways in which it has changed, or ways in which the book's speculative possibilities have not yet been realized. Watch the movie if you like, but it contains no content of relevance here, so in no way is it a substitute.

These books have not yet arrived at the Coop. While we wait, I will place copies on reserve at PCL, and a scan of the first reading assignments online at the class web site. (Note: The Evans book is not available at any online bookseller as far as I know, new or used, so don't waste your time searching like I did. This textbook is a low-cost edition that is printed as needed by Pearson Publishing.)

Supplementary reading: I suggest you do *not* purchase or otherwise obtain materials for this course from another book, since there are a large number of books that appear to be about the same subject, but almost invariably are popularizations that are not useful and will even be confusing. You will encounter additional material from the assignment to monitor an astrobiology web site, which will also add some visual content to each part of the course. So subscribe to www.astrobionet.com.

Assignments and grading: Your grade will be based on five exams (70%), a research paper (15.4%), a short report on a visit to a UT resource (to be explained later, 5%), discussion class participation, including attendance (5%), and an oral presentation to be given in discussion section (5%). A long list of potential topics for the research paper will be given separately. There will be a sufficient variety that everyone should be able to find something of interest.

Exams: All exams will consist of about 20-40 multiple choice questions, and will be weighted equally, *except* that your lowest exam score will only receive a weight of ½ compared to the others. So you have to take all the exams, but if you have an off day (or week, etc.) it won't hurt your final grade *too* much. Because the textbook contains no end-of-chapter questions, a sample of potential questions will be sent to you before each exam. I will try to prepare you for the nature of the exam questions by occasionally giving sample questions during lectures, by trying to point out the types of information that I expect you to understand or remember, and giving examples on review sheets.
Exam dates will be given in the next edition. Exams are given during a lecture period (MWF 9-10).
There will be no comprehensive final.

In case of medical or other non-academic emergencies or situations, contact me as early as possible—it will usually be possible for you to take an exam a day or so early or late, but not more.

We will try to get exam grades available to you through the UT eGradebook system. Often we can get these to you within a day of the exam.

The material in this course will be *almost* entirely non-mathematical, concentrating on a number of key ideas that can be understood without math, although they do require a solid conceptual grasp of the subjects, and *a degree of comfort using graphs as an important quantitative tool*. You will be required to become familiar with a lot of elementary but diverse material from astronomy, chemistry, and a bit of geology and cell biology. This material requires no background, nor gives any advantage to those who do have some background—it is really at an elementary level. A positive way to view the variety of topics is as a primer for courses you have yet to take. The mathematical level is somewhat higher in your textbook, where several key points are made clear by a simple calculation. I will let you know which, if any, formulas I expect you to understand, but very few exam questions will require manipulation of equations or numbers.

Homework: Besides the assignments, there will be homework questions assigned. The homework in this class will be ungraded until your exam, where you will see some or all of the homework assignments as multiple choice questions. Usually once per week (or so) I will send out class email containing one or more questions relating to the topic we are covering. You should try to answer these (for yourself, not to me or to the TA) within a day or two of receipt of the email. Most of these questions will be basic and fairly easy, and serve the purpose of having you keep up with the reading and lectures (lagging on these is the most common cause of grade decline); some will involve searching the internet concerning developments too recent to be covered in your text. An example is the possibility that an Earth-like planet will be discovered in within the present semester, since there are currently space-borne planet detection missions that didn't exist at the time your textbook was written. Whether you have done your homework and how well will be found by corresponding questions that will appear on the exams. Some of these will serve as topics for the discussion sections.

Another continuing assignment will be to subscribe to and look at the astrobiology "news" reports at www.astrobionet.com. In part, this assignment is intended to offer a visual overview of the topics we cover, since your textbook is affordable primarily because it contains few illustrations. You will also find this site a way to become familiar with the kinds of questions relevant for our class early in the semester. Familiarity like this is important for understanding the material. I will include 1-2 questions on these "news stories" on each exam.

Final letter grades: Your final grade will be computed as follows:

5 exams with lowest weighted ½, at 100 points each, gives 450 points possible for a perfect exam score.
The research paper, worth 15.4%, contributes 100 points (now you see why 15.4 instead of a round number).
Each of the 5% assignments is worth 33.3 points each, for a total of 100 points.

The total number of points possible is then 650 points. Letter grades will be assigned as follows.

A: 565 points and higher (>87%)
B: 500-564 (77 to 86.9%)
C: 436-499 (67 to 76.9%)
D: 360-435 (57 to 66.9%)
F: less than 360 points.

Notes: 1. I am not assigning plus or minus letter grades. 2. There is no extra credit possible, so don't ask.

Special requests: If you have *any* special request of *any* sort (excluding those not allowed, like lowering the grade cutoff), please put the request in writing, preferably by email, or call me on the phone. Please state clearly and explicitly your request and why it is reasonable. Include a phone number so that I can contact you about your request.

Obviously (I hope) this procedure does not apply to minor requests such as "Could you write a little larger on the board?" etc. Any suggestions for improvement of the class as we proceed will be greatly appreciated, either in person, by phone, or by email.

Attendance: Although I will not take attendance records, you should keep in mind that the exams are based heavily on the lecture material (as well as the textbook and any other readings), and that the "notes" that I will make available to you are only outlines or abstracts of my lectures. The biggest single danger in this course is that you fall far enough behind, either through lack of reading or spotty attendance, that you cannot really understand the material being covered. In addition, I often try to give examples of future exam questions during lecture. I therefore urge you to attend all classes, and ask questions if you don't understand something. In contrast, attendance *will* count toward your participation grade in the discussion section.

Dropping the course: (see http://registrar.utexas.edu/calendars/08-09/index.html and *General Information*, ch.4, for details of required approvals, and the timetable for various kinds of adds/drops.)

Incompletes: An incomplete (X) will only be considered in extreme cases, for students who cannot complete the required course work for reasons other than lack of diligence (illness or other imperative nonacademic reasons), but only if the student has a passing grade on the work completed.

Cheating: Academic dishonesty will result in failure of the course and a report to the Dean of Students, who will decide on further action. Because of the large size of this class and the temptations involved, it will be important to keep your eyes from wandering and to guard your own exam. Students near the rear of class should try to sit one seat apart. Also, bring your UT ID card with you to exams and be prepared to show this card if asked.

Student observing opportunities: (call 471-5007 or see http://outreach.as.utexas.edu/public/viewing.html for Monday updates; information below is tentative)

Students interested in observing the night sky through small telescopes have several opportunities. **1**. The Painter Hall Observatory has UT Student/Staff Night on Fridays and Public Night is on Saturdays. These sessions are free and open to all ages; no reservations are required. **2**. The Astronomy Department sponsors weekly "Star Parties" on the 18th floor observing deck of R. L. Moore Hall on Wednesdays. This is free and open to the public. Call phone number or see url listed above for current times. This is not an assignment for the class, and is only here for your information.

UGS 303-Course Description

Signature Course: The "Signature Course" is a fairly new requirement at UT, and this is my first attempt to teach one of them. To paraphrase the description given by the University: Signature courses are restricted to first-year students, and consist of a large-group lecture and a smaller discussion class, focusing on a contemporary issue. These courses are designed to introduce undergraduates to scholarly analysis from an interdisciplinary perspective, and include an introduction to University resources, such as research facilities, museums, and attendance at University lectures or performances as assigned.

Topics*:* The course covers a wide range of topics, drawing on astronomy, physics, chemistry, biology, cognitive science, and more. The table of contents of the text gives a good idea of the subjects covered in the class. A more detailed summary is given below.

Brief description (please read in detail, later)

Whether or not we are alone in the universe is a question that has a long speculative history, but has more recently become a scientific field of research, the subject of this course. We want to know whether our world, and the life it supports, is a fluke, or whether our Galaxy could be teeming with planets inhabited by complex organisms, and what sort of scientific approach can even address such questions.

We will discuss possibilities for Earth-like worlds, the living state, complex organisms, forms of intelligence in our Galaxy, as well as the potential for communication with extraterrestrial civilizations. Those five possibilities form the topics of the five major sections of this course.

We also discuss current research projects aimed at detecting extraterrestrial worlds and their potential inhabitants using biosignatures, intentional signals, and, perhaps someday, direct visitation of other star systems—in other words star travel.

These topics sound like a lot of fun, but don't let that fool you. In order to take a serious approach to the subject at hand, we need to avoid opinions, speculations, or preconceptions, but do need elements from many fields of research. The course tries to communicate, and examine, an interdisciplinary scientific worldview that combines elements of astronomy, physics, chemistry, biology, cognition, and more, and asks whether such a view can explain or predict the complexity of phenomena, using the living state ("life"), and the cognitive state ("intelligence") as the primary targets. We basically are trying to find if there is a reasonable approach to give us some indication whether these features of our planet are likely to be features of planets orbiting other stars.

The current inability of any worldview to provide concrete, or even partial, answers to most of our questions provides a useful basis for questioning whether we should expect advanced extraterrestrial civilizations, if they exist, to be anything like us. It also allows us to question whether assertions of knowledge in other fields, or in other courses, or anywhere, have any solid basis.

Current issues that are addressed include: Ongoing attempts to create synthetic life and its implications; the imminent discovery of an Earth-like planet (perhaps during this semester!); planetary change, with a focus on rapid climate evolution; the nature and varieties of intelligence; whether there exist real motivations for preservation of diversity of genomes, languages, cultures; the mysterious nature of our existence in a seemingly random world; the limits to predictability of anything; and the stability and collapse of technological societies.

Such a wild variety of topics requires some discipline to avoid simple opinions or speculations, a willingness to try out new ideas, and the development of an interdisciplinary perspective on knowledge, what might be called a flexible mind. I hope it will also be fun.

UGS 303: SCHEDULE OF TOPICS, READINGS, AND EXAM DATES

The course is divided into five sections, with an exam after each section. The exam dates will be provided on a separate handout (soon!). The general plan is: An exam about every three weeks. The exception is Part III, for which we should only need two weeks.

The lectures will mostly follow the sequence of topics in your textbook, indicated by a chapter number in parentheses. In some cases we will not read the textbook section completely, in others the lectures will cover significant supplementary material.

I. Planets and Habitability

Course overview (Evans, Ch1). Drake equation as an organizing tool.
Origin of elements, stars (2, 3A-C). Interstellar molecules.
Origin of planets; observations of protoplanetary disks (3D)
Exoplanet detection*
Habitable planets (3F)*

.....Our first exam will occur here (date to be filled in) .....

II. Transition to the living state by chemical evolution (Evans 4)

Nature of life (4A). Why carbon? Why water?
Origin of the monomers (4B); Miller-Urey experiment, exogenous delivery, …
Rise of the polymers (4C); the problem with DNA; the even larger problem with RNA; importance of early encapsulation and mineral surfaces.
Rise of the foldamers; the origin of functionality. Why water?
Scenarios for the transition to life (4D). Lipid world, metabolism first,…
RNA world* (more detail than textbook)
Alternative biochemistries (4E) and exotic life forms (4F)

……Second exam here (XXX)……

III. Life in the Solar System; Biosignatures (Evans 5)

Some astronomical background: The planets.
Possibilities for life on Venus and Mars
Giant planets, moons, especially Titan.
We will spend only 4-5 lecture periods on this material, with an emphasis somewhat different than in Evans.

.....Third exam here (Thurs. Oct 23).....

IV. Development of complex life and civilizations on Earth and elsewhere.

Evolution of biological complexity on Earth. Read Evans 6A as a popularized version of the subject. The Lecture material here will be nearly independent of the textbook here.
Biological complexity on Earth: Part II.
SPRING BREAK 3/17, 3/19 → Start reading ***Contact*.**
→Paper topics due
Cultural evolution and technological civilizations (7A)
Lifetime of a technological civilization (Evans 7C, D)

……Fourth exam here (XXX)……

V. Modes of contact

Drake equation (8)
→Research papers due
Universality of intelligence? (6B, supplemented).
Strategies for extraterrestrial communication or signal detection (9A-D, E)
Contact (*Contact*)
→Paper rewrite due
Possibilities for interstellar travel (10A, B).
Possibilities of past visitations and related phenomena (10C)

..... Fifth (last) exam here, on last class day (XXX)……

There is no comprehensive final