Life in the Universe Lab class
Astronomy 184L — Fall 2008

http://www.physics.nau.edu/∼trilling/teaching/fall2008/lab/

Instructor: Professor David E. Trilling

Course syllabus

Meeting times:
We meet *some Fridays* in Physical Sciences (Building 19) Room 218 (or other rooms, TBD). We also meet *some additional times (not Friday afternoons)*. Please see the schedule at the end for details.

Course description:
Welcome to the *Life in the Universe* lab course. In this class, we will discuss and learn about the origin and evolution of life and the search for life in the Universe. We will carry out field trips to locations of astrobiological interest. We will also have in-class labs and on-campus, out-of-class labs, both of which will help illuminate various aspects of the study of astrobiology. All of the labs in this class will teach practical and useful skills related to scientific experimentation and observation, and more generally to logical approaches to real-world experiences. This course will help develop essential skills such as critical thinking, quantitative analysis, and scientific inquiry, and is in the liberal studies Science/Applied Science laboratory studies distribution block. I'm looking forward to our adventure together!

Course prerequisites and objectives:
Officially, you should have either already taken Astronomy 183, or be taking it this semester. With instructor approval, this requisite can be waived. The following are among the goals for this course:

From dark-sky observations, students will be able to identify and spatially visualize the cosmological setting of life on planet Earth (scientific inquiry, critical and creative thinking).

Students will exhibit mastery of first-hand evidence for past and current influx of solar system materials in the form of crater morphology and surface densities (environmental consciousness, scientific inquiry, critical and creative thinking, quantitative analysis).

Students will be able to explain how the chronology of ancient evolution is inferred from stratigraphic principles, sedimentary rock analyses, and radio-isotope age-dating (environmental consciousness, scientific inquiry, critical and creative thinking).

Students will be able to identify and/or describe extremophiles in the terrestrial environment and make inferences about their possible survival in similar solar system environments (environmental consciousness, scientific inquiry, critical and creative thinking).

Students will learn how local environments are related to the study of the origin of life both on Earth and elsewhere, and how these local sites are relevant planetary analogs (analogy, critical thinking).

Course structure and approach:
This is a lab course, so nearly everything you will do will be hands on. We will have field trips; night observing; in class labs; work you will do outside of class; and will have both writing and speaking assignments. There will also be a final exam. There's lots more about the assignments below.

Required materials:
I will distribute (either on my web page, or in hard copy) the lab assignments. There is no textbook or formal manual.

For the field trips you will need sufficient gear: sturdy walking shoes, a canteen or water bottle, a hat, sunscreen, etc. More details on this in advance of each lab. Please see me if this is a hardship.

The course web page:
The course web page is given at the very top of this syllabus. **This is very important!** This is an evolving course, and new materials will appear on the course web page before each lab.

You need to check the course web page frequently in the days leading up to each of the labs!!!

This web page is where I will post everything for this class: this includes this syllabus and the course outline; assignments, both those to be done before the labs and those to be done during and after the labs; and background and supplementary materials. I will also post important logistical information there from time to time.

Office hours (how to find me and ask questions):
My office is Physical Sciences (Building 19) room 207 (phone number: 928 523 5505; email: `David.Trilling@nau.edu`). I will have office hours on Mondays, from 3–5 pm. I am also in my office most days, so you can stop by if you would like to chat. You can also arrange a specific meeting time with me (which guarantees I will be there). If you have a regular conflict with my usual office hours, talk to me. It is certainly possible to set up another time for office hours if enough people have conflicts. However, please don't come 12:30–1:30 on

MWF, as I'll be finishing my preparations for Astronomy 183 at that time.

Grading:
There will be around ten labs in this course. (There may be only nine – we'll see how the semester goes.) Additionally, each student will be required to give two oral presentations during the semester (more information on that below). All the labs together will count for 80% of your final grade. The lab final will count for the remaining 20%.

Your final grades will be calculated this way. I will simply total your points for the semester according to the above proportions; this gives a total out of 100 points. I will then compile everyone's total grades and assign letter grades from the final, cumulative distribution, using as a guideline what I consider to be "A" work, "B" work, and so on. In this way, I let the performance of the class dictate the grade distribution. **Note:** I do not have a predetermined number or percent of A's, B's, etc. I also have no preset scale (like 90% correct is an A, 80% is a B, etc.). If everyone in the class does A work this semester, then you will all get A's – no problem. I will not assign any letter grades until after the final exam is graded. I will give you status reports along the way so you can have some idea where things stand. Also, you can ask me at any time how you are doing. I do not have any predetermined class average, mean, median, or letter grade. In previous semesters, my classes' average grades were around a B.

A note about working together (statement on plagiarism and cheating):
Science works by sharing ideas. Most (or maybe all) the lab assignments in this class will be group assignments. You and your partner(s) will write up your work together, turn in a single copy, and all partners will receive the same grade for that lab. However, some assignments may be individual assignments, and for these you may discuss with your classmates but you should do all the writing by yourself. Anything that has only your name on it should be written by you and you alone.

For these assignments where you do not work with partner(s), you should not have identical answers to anyone else in the class. If you do, you have cheated and perhaps plagiarized. This is absolutely not allowed in this class or this University, and I am very serious about this. Cheating pisses me off.

If you have any questions about what all this means, please, please come talk to me. Don't wait until I get pissed off.

Here's the official statement: This course requires professional and ethical behavior. Plagiarism, or any form of cheating, violates this principle and will not be tolerated. The University regards acts of academic dishonesty as very serious offenses. Students charged with academic dishonesty are subject to the Arizona Board of Regents Code of Conduct and Procedures established by NAU.

Other stuff:
Amanda Lapage, our TA: Amanda is a third year graduate student. She has actually even taught a version of this course before! She'll be helping to lead the field trips and teaching the on-campus labs.

Makeups: All assignments are required. There will be **no makeups**. If you have a **really** good reason for missing some graded assignment then come talk to me. You will not be punished, but each of your other assignments will increase in worth.

Student responsibilities. This class, perhaps more than any other you have taken or will take at NAU, will require you to take a lot of responsibility for yourself and your fellow students. I am thrilled to run a course like this. You will have to be responsible for advance preparations for the labs; for preparing yourself for the off-campus activities; to work on out of class assignments on your own; and, most importantly, for helping to run and teach this class and make it successful. Each lab activity is extremely participatory — not only must you be there, but you must an active participant. The field trips will be really fun! Previous field trip classes I have participated in have always been the best classes of those years, and I hope this class will be the same for you this semester.

Come talk to me: I want to hear if you are having fun in this class, or hating it; if you are learning stuff, or hopelessly confused, or just bored. I want to hear suggestions, and I want to learn your names and who you are. Hopefully you'll want to come to my office and learn about all the cool stuff we are working on and why I care about astrobiology. Don't be shy.

And now ... let's begin!

Assignments for this course

As listed on the course schedule (see next pages), there will be seven scheduled lab sessions. **Two of these are on Saturdays and two are on Sundays.** There are labs scheduled for three Friday afternoons (in October and November). You also have three ongoing lab assignments that you will do out of class; one of these has a related Friday afternoon meeting time in November.

For each of the ten lab assignments, you will work with a partner. For each lab, I want you to work with a *different* partner.

For each lab, you will turn in a written lab report. These don't need to be very long. I will give you the specific assignments for each of the labs when the time comes. The lab reports will typically be due a week after you do the lab.

In addition to these ten lab assignments, each of you will, with a partner, be required to give a brief (5–10 minutes) oral presentation on a field trip topic (see the following list). The purpose of this is for you to learn one topic more deeply, and to teach this topic to your peers. You will need to do some outside research to learn about your topic. Feel free to come talk to me if you need help with this. You will almost certainly need to make handouts for the entire class ahead of the field trip; I can help print these out if necessary.

List of topics for oral presentations

Scenic skyride (September 6)

(1) San Francisco volcanic field (history; geologic overview of Northern Arizona). What does this have to do with astrobiology?

(2) Mars Phoenix mission: Goals, techniques, instruments, results so far. What does Mt. Agassiz have to do with this?

(3) Life on the peaks (what's living there?). What does this have to do with astrobiology?

Meteor crater (September 20)

(4) Impact craters on Earth and elsewhere. What does this have to do with astrobiology?

(5) Stratigraphy of Meteor Crater.

(6) Meteorites: Delivery of interplanetary material.

Sunset Crater (September 28)

(7) Types of volcanos. Where else in the Solar System are volcanos observed?

(8) Types of lava flows. Where else in the Solar System is lava observed?

Grand Canyon (October 5)

(9) Stratigraphy/rock record of the Grand Canyon. What does this tell as about previously existing environments?

(10) Erosion and river channels/flood channels. What about erosion and channels on other planets? What is the astrobiology connection?

(11) The history of the Colorado Plateau. Why isn't every river channel a grand canyon? What is the astrobiology connection?

Course schedule

Here are my present thoughts about the schedule of the course. The hand sample/geology lab will meet in this room (Room 218 of Building 19). The location for the computer imaging labs is TBD (check the course web page). The location for the nighttime labs is TBD (check the course web page). The meeting times and places for the field trips are TBD (check the course web page).

There are a lot of logistics for this course, and things may change at times. **Did I mention that you should please check the course web page frequently?**

Course web page (check frequently!!):

`http://www.physics.nau.edu/~trilling/teaching/fall2008/lab/`

Welcome. Schedule and logistics. Intro to first labs.

First meeting ..... August 29

The Scenic Skyride (geologic overview; Mars Phoenix)

Lab 1 ..... September 6 [**Saturday**, half day]

Meteor Crater (impact craters)

Lab 2 ..... September 20 [**Saturday**, half day]

Sunset Crater (volcanism)

Lab 3 ..... September 28 [**Sunday**, half day]

Grand Canyon (volcanism; stratigraphy; erosion; fluid environments)

Lab 4 ..... October 5 [**Sunday**, all day]

Geology/hand sample lab

Lab 5 ..... October 17

Computer imaging lab I: Mars (craters, evidence for water)

Lab 6 ..... October 24

Nighttime observing I: Moons of Jupiter (out of class lab)

Lab 8, below ..... Due November 10

Computer imaging lab II: Europa (change detection)

Lab 7 ..... November 14

Sea Monkey labs

Lab 9, below ..... Oral presentations and labs due on November 21

In addition to the above labs, which have scheduled dates, there will be three ongoing lab assignments to be done outside of regular class hours, as follows.

Nighttime observing I: Moons of Jupiter

Lab 8 ..... Due November 10

Sea Monkeys

Lab 9 ..... Due November 21 (with oral presentation)

Nighttime observing II: The Earth's moon

Lab 10 ..... Due December 5

Final exam

Final exam ..... December 9, 3:00 – 5:00 pm