

PLANETARY SCIENCES AND ASTROBIOLOGY

Course Overview

This course is loosely divided up into four sections:

- 1) Life on Earth: what life is, and its origin and evolution.
- 2) The evolution of terrestrial planets.
- 3) The habitability of icy satellites.
- 4) The habitability of exoplanets

We will see that there are arguably at least 9 bodies (other than Earth) in the solar system that could, in theory, be habitable today, albeit only by simple microbial-type life. You will have to attend the rest of the course to find out what celestial bodies these are.

Because it's necessary to range over several disciplines to appreciate planetary sciences and astrobiology (biology, geology, geochemistry, atmospheric sciences, planetary astronomy, etc.), we will have to do some groundwork in various disciplines as we go along.

You might be wondering:

So what exactly is "Astrobiology", anyway?

All biological elements apart from H were synthesized in stars. Therefore life is the "biology of stars", in a certain sense.

Oxford English Dictionary:

Astrobiology: a branch of biology concerned with the discovery or study of life on the celestial bodies. (Gr. $\alpha\sigma\tau\rho\omicron$ - = "astro-" = star, Gr. $\beta\iota\omicron$ - = "bio-" = 'life, course or way of living'.)

But this dictionary definition is not very good. Scientists doing research in astrobiology would all agree that the purpose of astrobiology is to seek answers to the questions:

*What's the history and future of life? and
Is there life elsewhere?*

In practice, astrobiology is as much concerned with the history of life on Earth as studying the possibility of life elsewhere. Thus, many astrobiologists are concerned with understanding the origin and evolution of *terrestrial* life.

Your instructor defines astrobiology as:

A branch of science concerned with the study of the origin and evolution of life on Earth and the possible variety of life elsewhere

NASA has defined astrobiology as *the study of the origins, evolution, distribution, and future of life in the universe*. Other definitions commonly used by are:

the study of life in the universe

or the study of life in a cosmic context

But there is little point in hypothesizing about life elsewhere unless we have good understanding of life on Earth. So this is our point of departure for this course.