

Astrobiology

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ABSTRACT

Astrobiology, formerly known as exobiology, is an interdisciplinary scientific field concerned with the origins, early evolution, distribution, and future of life in the universe. Astrobiology considers the question of whether extraterrestrial life exists, and if it does, how humans can detect it. Astrobiology makes use of molecular, biophysics, biochemistry, chemistry, astronomy, physical cosmology, exoplanetology and geology to investigate the possibility of life on other worlds and help recognize biospheres that might be different from that on Earth. The origin and early evolution of life is an inseparable part of the discipline of astrobiology. Astrobiology concerns itself with interpretation of existing scientific data, and although speculation is entertained to give context, astrobiology concerns itself primarily with hypotheses that fit firmly into existing scientific theories. This interdisciplinary field encompasses research on the origin of planetary systems, origins of organic compounds in space, rock-water-carbon interactions, abiogenesis on Earth, planetary habitability, research on bio signatures for life detection, and studies on the potential for life to adapt to challenges on Earth and in outer space. Biochemistry may have begun shortly after the Big Bang, 13.8 billion years ago, during a habitable epoch when the Universe was only 10–17 million years old. According to the panspermia hypothesis, microscopic life—distributed by meteoroids, asteroids and other small Solar System bodies—may exist throughout the universe

INTRODUCTION

According to research published in August 2015, very large galaxies may be more favorable to the creation and development of habitable planets than such smaller galaxies as the Milky Way. Nonetheless, Earth is the only place in the universe humans know to harbor life. Estimates of habitable zones around other stars sometimes referred to as "Goldilocks zones," along with the discovery of hundreds of extra solar planets. Current studies on the planet Mars by the Curiosity and Opportunity rovers are searching for evidence of ancient life as well as plains related to ancient rivers or lakes that may have been habitable. Current studies on the planet Mars by the Curiosity and Opportunity rovers are searching for evidence of ancient life as well as plains related to ancient rivers or lakes that may have been habitable. The search for evidence of habitability, taphonomy (related to fossils), and organic molecules on the planet Mars is now a primary NASA and ESA objective.

Even if extraterrestrial life is never discovered, the interdisciplinary nature of astrobiology, and the cosmic and evolutionary perspectives engendered by it, may still result in a range of benefits here on Earth. The term was first proposed by the Russian (Soviet) astronomer Gavriil Tikhov in 1953. Astrobiology is etymologically derived from the Greek *ἄστρον*, *astron*, "constellation, star"; *βίος*, *bios*, "life"; and *λογία*, *-logia*, study. The synonyms of astrobiology are diverse; however, the synonyms were structured in relation to the most important sciences implied in its development: astronomy and biology. A close synonym is exobiology from the Greek *ἔξω*, "external"; *Βίος*, *bios*, "life"; and *λογία*, *-logia*, study. The term exobiology was coined by molecular biologist and Nobel Prize winner Joshua Lederberg. Exobiology is considered to have a narrow scope limited to search of life external to Earth, whereas subject area of astrobiology is wider and investigates the link between life and the universe, which includes the search for extraterrestrial life, but also includes the study of life on Earth, its origin, evolution and limits. Another term used in the past is xenobiology, a word used in 1954 by science fiction writer Robert Heinlein in his work *The Star Beast*. The term xenobiology is now used in a more specialized sense, to mean "biology based on foreign chemistry", whether of extraterrestrial or terrestrial origin.

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