

## **ARE WE ALONE IN THE UNIVERSE?**

**By**

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Speculation about the existence of intelligent life elsewhere in the universe goes back to ancient times when people pondered the night-sky, drew imaginary lines between stars, and imagined these regions to be populated by gods such as Mars and Jupiter. In the nineteenth and early twentieth centuries there was intense speculation, based on telescopic observations, about the existence of intelligent life on Mars. The possibility of intelligent alien life exerts a powerful grip on the imagination which is expressed in a distinct branch of literature -- science fiction. Many films in this genre have been hugely popular, e.g. 'Close Encounters of the Third Kind', 'ET - the Extraterrestrial', etc.

No verifiable contact has ever been made with extraterrestrial intelligence nor have we any proof that such intelligence exists. Nevertheless, many scientists believe it is almost certain that intelligent life-forms have developed elsewhere in the universe. Each such intelligent civilisation would also realise that it is not unique and, if at a level of development equal to or greater than our own, would make efforts to contact civilisations elsewhere in the universe. This line of reasoning has led to organised scientific efforts in many countries to search for extraterrestrial intelligence (SETI).

In order to assess the probability of life arising elsewhere in the universe it is first necessary to understand the conventional scientific explanation of how life arose and developed on earth (alternative scenarios can also be envisaged - see previous article 'The Origin of Life - Did it Begin in a Frozen Ocean'). Living matter is composed of basic chemical building blocks, e.g. amino acids, sugars, fatty acids, etc. These compounds did not exist on Earth when the planet was formed. It is believed that the early atmosphere of the Earth was composed largely of the gases Hydrogen, Methane, Ammonia and Water Vapour. Ultraviolet light from the Sun was very strong and massive electrical storms constantly rained down into the oceans. This incubation of electricity, UV, atmospheric gases, and the ocean brought about the synthesis of the basic chemical building blocks of life. These and other chemicals formed and dissolved in the oceans to form a rich chemical soup.

Endless combinations and recombinations between chemicals occurred in the chemical soup over millions of years. New forms, particularly suited to the environmental conditions, were gradually favoured over others - chemical evolution. Eventually certain molecules arose that were capable of replicating themselves, and, later, these molecules and others organised themselves into the first living, reproducing cell. New varieties of the cell arose in time; those best suited to the environment flourished while others perished - Biological Evolution through Natural Selection. This biological evolution proceeded apace, eventually producing the myriad life-forms that presently populate the Earth, including humankind.

It is implicit in the above scientific scheme that the nature of matter and the laws of physics are such that living forms will inevitably arise, given the right chemical ingredients, environmental conditions and sufficient time. We assume that the laws of physics and the basic nature of matter are the same everywhere in the universe, but how often might these coincide with favourable environmental conditions that would allow living forms to develop?

It is only possible to approach this question on the basis of probability. Our own Milky Way

galaxy is vast (100,000 light years wide) containing hundreds of billions of stars and, presumably, many billions of planets. Beyond of our galaxy the universe presumably contains almost unimaginably large numbers of planets. If each planet in the universe is considered as a random throw of the dice, it seems very improbable that the dice has only once turned up amenable conditions for the development of intelligent life. A well-known equation for estimating the probable number of alien civilisations, the Drake Equation, estimates that our own Milky Way galaxy has about 4,000 civilisations at a stage of development capable of transmitting messages across space.

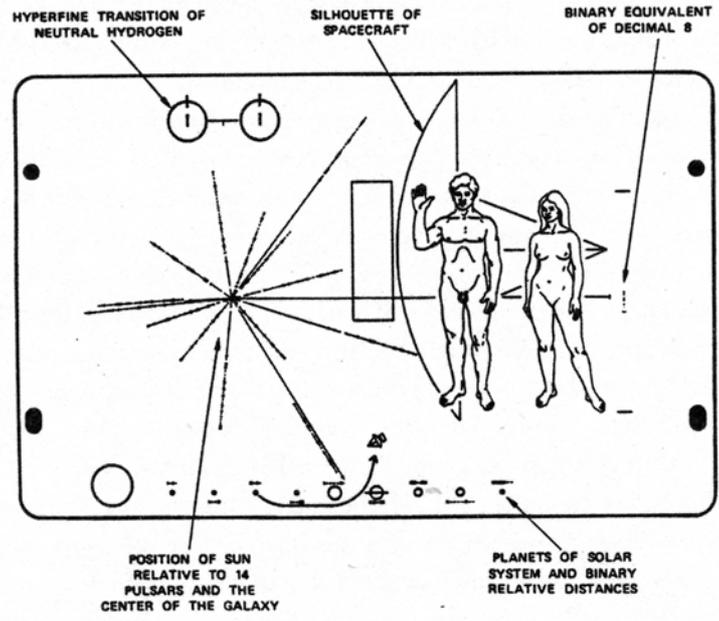
It is thought that such alien civilisations would transmit messages across the vastness of space by microwave radio transmission, which travels at the speed of light (186,000 miles per second) - the fastest velocity allowed in the Universe by the laws of physics. The SETI programmes in various countries, therefore, use massive radiotelescopes to scan the cosmos for intelligent radio messages. No intelligent messages have so far been received, but the listening process has really just started.

In addition to listening for messages, SETI scientists have also broadcast information into the cosmos about our human civilisation. The first broadcast was made in 1974 from Cornell University's giant radiotelescope transmitter in Arecibo, Puerto Rico. The message contained information that locates our sun in the galaxy and the Earth in our solar system. There was also a brief description of the human form and composition. The message was beamed at a cluster of stars 25,000 light-years away. So, in 50,000 years we may get a reply!

'Postcard' messages have also been sent into outer space. NASA's Pioneer 10 spacecraft, launched in 1972, was designed to fly by the planet Jupiter. However it was known to have enough energy to continue on and become the first object from our civilisation to leave our solar system to sail forever through space. A plaque was placed aboard the aircraft detailing various pieces of information about the Earth and humankind. It is curious to think of an alien civilisation finding the spacecraft, perhaps millions of years from now, and pondering over the message on the plaque.

Some scientists argue that SETI programmes are not justified because it is extremely unlikely that life exists anywhere except on Earth. This argument is based on very pessimistic estimations of probability. It seems most unlikely to me, and probably to a majority of scientists, that the Earth is unique, but there is much latitude for debate on this matter. However, even as you read these words, a SETI worker may be receiving the first message.

*(See illustration below.)*



*The Interstellar postcard carried on Pioneer 10*

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