Scientific controversies and a touch of mysticism

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The Fifth Miracle:
The Search for the Origins of Life
By Paul Davies
The Penguin Group, 1998

In his most recent publication *The Fifth Miracle: The Search for the Origin of Life*, Paul Davies provides an intelligent and well-written popular account of the scientific controversies concerning the origins of life. He has brought together the astonishing wealth of research--from the discovery of strange one-cell life forms to the insights of geologists and astronomers into the formation of the Earth and the solar system--which is providing the basis for new theories and a richer understanding of this complex and difficult scientific problem.

The book traces the scientific debate from its origins in the evolutionary theories of Charles Darwin to the fossil evidence of early life, laboratory attempts to simulate the conditions for the formation of life, and arguments over the probable evolution of the genetic code and proteins. Davies cites evidence for the existence of organic matter in space and considers the possibilities of life elsewhere in the universe.

One of the most intriguing aspects of *The Fifth Miracle* is its exposition of a radical new theory developed to overcome the limitations of some of the ideas first put forward by Charles Darwin in 1871. Darwin proposed that life originated in "some warm little pond, with all sorts of ammonia and phosphoric salts, light, heat, electricity, etc". In doing so he assumed, along with the geologists of his day, that the Earth was relatively stable when life was forming and subject to the same gradual processes as today. But it is now clear from geological evidence that the early history of the Earth was extremely violent.

The most turbulent period was from 4 to 3.8 billion years ago when the Earth was bombarded by a hail of meteorites. Norman Sleep of Stanford University has modeled the impact of planetesimals--objects as large as 500 kilometres across which were very common in the early Solar System. He found that a huge amount of rock would have been vapourised, lifting the surface temperatures to 3,000 C, turning the oceans into gas and driving off any atmosphere. Such conditions would have been catastrophic for any living things on the land surfaces or in the water. Sleep estimated that the Earth would have taken 2,000 years to restabilise after each collision.

Davies poses the question: how did life establish itself under such inhospitable conditions? One solution may be provided by a number of unusual microorganisms discovered in places previously thought to be not conducive to life. Black smokers--volcanic cracks in deep ocean locations--are teeming with living organisms that can tolerate temperatures as high as 110C and sulphurous fumes that are toxic to most other living things. Known as hyperthermophiles, these microbes survive by metabolising the chemicals produced from the volcanic activity. John Parkes of Bristol University claims he has evidence of organisms that can survive at 169C.

The international Ocean Drilling Program has discovered another group of organisms deep underground in drill cores from rock samples a kilometre beneath the seabed. Life seems to be particularly prolific under the seabed as opposed to under land. Parkes has discovered that population density actually rises from one billion per cubic centimeter just below the surface, to 10 million per cubic centimeter in deeper rock strata. Tommy Gold from Cornell University has found evidence of biological activity seven kilometres down.

A myriad of different organisms, now classified into a new Kingdom known as the archaea, have been discovered surviving under surprising conditions, from extreme cold to very high salt concentrations and even exposure to highly corrosive chemicals such as sulphuric acid. Comparative DNA studies indicate that the archaea are the most primitive living things and most likely gave rise to the other Kingdoms such as the bacteria and the eucarya, which include plants and animals.

Davies postulates that life evolved deep underground, protected from the constant bombardment by meteorites. These organisms would have been able to evolve undisturbed by the catastrophic events on the surface. When conditions settled about 3.8 billion years ago, the subterranean organisms would have been pushed to the surface by volcanic activity and earth movements. A few of the organisms thrust onto the Earth's surface adapted to the lower temperatures and fluctuating conditions that prevailed. The next major evolutionary step was the transition to organisms that used sunlight rather than chemicals as their source of energy--the starting point for the diverse life forms that proliferate on Earth today.

The Fifth Miracle also presents a contending theory, known

as panspermia, which holds that life developed on another planet and made its way to Earth via a meteorite or comet. Davies pinpoints Mars as the most likely planet for life to have originated in our solar system. It had a far less turbulent history because its smaller gravitational pull meant fewer meteorite impacts. In addition Mars' cooler crust would have enabled microbes to survive far deeper below the surface.

The analysis of photos taken of the Martian surface reveals many geological formations, which resemble river valleys and flood plains older than 3.5 billion years. The weathering of impact craters indicates that Mars once had an atmosphere. If water and an atmosphere were present then life may have proliferated on the planet.

Moreover, a number of meteorites found on Earth are known to have come from Mars--thrown into space possibly as a result of volcanic eruptions or impacts on the Martian surface. Such meteorites would have taken about a century to reach the Earth.

Could bacteria imbedded in a meteorite have endured for so long in the extremely harsh conditions of space? A British microbiologist John Postgate has found that bacteria starved of nutrients become dormant and can survive almost indefinitely until more favorable conditions arise. Davies postulates that microbes could have survived the journey, including the deadly effects of cosmic radiation, if buried within a metre of rock.

The Fifth Miracle is an absorbing book. It presents complex scientific ideas in an accessible manner and gives an insight into the extraordinary developments being made by researchers in what is still a highly speculative scientific field. Unfortunately, however, it is marred by Davies' own underlying mystical and religious views as indicated in the book's title.

In the chapter entitled "The Message in the Machine," he constantly uses the analogy of computers and computer software for the genetic code implying that there must have been a super programmer, in other words, a God. He asks: "Might purpose be a genuine property of nature right down to the cellular or even subcellular level? There are no agreed answers to these questions, but no account of the origin of life can be complete without addressing them."

Davies is introducing a theme that has permeated much of his work, including books such as *The Mind of God*. It is the teleological argument used by the religious scholars of the Middle Ages to demonstrate the existence of God. At the beginning of the 19th century, the British theologian William Paley resurrected teleology, arguing that just as an intricate object such as a watch had been designed and created by a watchmaker so too the products of nature, such as a bird's wing or a human eye, had also been designed with a "purpose" by a creator. Darwin decisively refuted Paley in 1859, with the publication of *The Origin of Species*, which showed that the various complex adaptations of living organisms could be explained through the process of natural selection without any recourse to God.

In the final chapter entitled "A Bio-Friendly Universe?" Davies writes: "The ramifications of finding life elsewhere in the cosmos are ... profound in the extreme. They transcend mere science, and impact on such philosophical issues as whether there is a meaning to physical existence, or whether life, the universe and everything are ultimately pointless and absurd."

According to Davies, if living things are found on other planets it proves that life could not have formed simply by accident or chance but that there is a "built-in bias towards life and mind" and therefore a purpose and a God. But if science does discover in the future that life appears to be present in the universe more often than we might expect by pure chance, the task of scientists is to reveal the underlying physical mechanisms and laws. To appeal to religion is simply to relinquish the task.

Ironically Davies quotes the Roman philosopher and poet Lucretius of the 1st Century BC and dismisses his arguments. In the essentials, Lucretius, who understood that life was a product of matter, was far closer to the truth than Davies, who with the benefit of 2,000 years of scientific development beckons us into the bog of mysticism. What Lucretius wrote still rings true:

If atom stocks are inexhaustible,
Greater than power of living things to count,
If Nature's same creative power were present too
To throw the atoms into unions--exactly as united now,
Why then confess you must
That other worlds exist in other regions of the sky,
And different tribes of men, kinds of wild beasts.

See Also:
The Mind of God: Science and the search for ultimate meaning By Paul Davies
A descent into mysticism
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