Kelvin Recalled

Biological Origins: Theories Evolve

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One of the favorite stories among natural scientists who study the origin of earthly life turns on a dogmatic statement once made by Lord Kelvin.

The famous 19th-century British physicist could not conceive of "living organisms arising from dead matter." The impossibility of such an event was, he said, as certain a teaching of natural science as the law of gravitation.

Yet within a few decades, Einstein had shown the theory of gravitation as Kelvin knew it to be seriously incomplete; so has it been with the theories of the rise of organic life.

Scientists at the recent annual meeting of the American Association for the Advancement of Science pointed out that Kelvin knew nothing of the vast lengths of time in which organisms have had an opportunity to arise.

Origins Examined

Chemists of his day did not know that organic material can evolve from inorganic constituents. Astronomers and geologists were ignorant of the conditions that apparently prevailed in the early days of our planet.

It is modern knowledge of these and related things that has convinced most experts that earthly life probably arose right here on this planet.

For one thing, the geological record suggests that living organisms have been around for as long as earth provided a favorable environment.

Dr. Albert E. J. Engel, of the University of California at La Jolla, told a press conference that the earth is believed to have solidified 4,500,000,000 years ago. For at least 3,000,000,000 of those years, organic life has been present.

Dr. Engel said that remains of single-cell algae had been found in African rocks dated geologically at 2,800,000,000 years old. American and Soviet findings had also turned up algal remains of roughly the same age. Dr. Engel added that he wouldn't be surprised if subsequent research will push the algal record back as far as 4,000,000,000 years.

Although algae are the only organisms that have left remains older than 600,000,000 years, they still are evidence that highly organized organic life has existed as long as the planet has had conditions we would consider livable, at least as far as one-celled organisms are concerned.

Dr. Engel said that the ocean waters, atmospheric gases, and continental type rocks have been substantially the same collection of materials for as long as one can trace back the record, that is for roughly 3,000,000,000 years. The rise of living organisms is thought to have been concurrent with that of the evolution of air, sea and land.

Theories Changed

As the story of Lord Kelvin suggests, scientists have not always thought along these lines. One of the most popular theories earlier in this century envisioned earthly life as springing from microbes that drifted in from outer space.

This theory still crops up from time to time. However, Dr. Carl Sagan of the University of California said he thinks he has shown this theory to be extremely unlikely.

The traveling microbes are called "panspermia." They are supposed to be propelled across interstellar distances by the pressure of starlight, traveling in this way from planetary system to planetary system.

Dr. Sagan said that his calculations show this would be a speedy means of transport. A "bug" from the earth would be propelled to the orbit of Mars within a few weeks and to the nearest star within a few tens of thousands of years. For the transport mechanism, the "bug" should be from 0.2 to 0.6 millionths of a meter in diameter. There are many earthly organisms in this size range, Dr. Sagan said.

Plausibility Scanned

He added that it is reasonable to expect that microbes might be ejected from a planet such as the earth from time to time. Also, a travel time of tens of thousands or even millions of years is within the life span of organisms chilled to the very low temperatures of space.

Thus, on the face of it, the theory of panspermia appears plausible. The trouble lies in radiation hazards. Dr. Sagan said that radiation from the sun would quickly kill any unprotected organism leaving the earth or approaching it. Thus he ruled out interstellar "bugs" as the originators of earthly life.

This theory had been proposed before scientists knew how readily the organic materials of life can be synthesized from inorganic matter under the conditions thought likely to have prevailed in the early days of the earth. Today, Dr. Sagan said, it is far easier to believe that organisms arose spontaneously on the earth than to try to account for them in any other way.

Complexity Immense

Nevertheless, this still is a statement of faith rather than of demonstrable scientific knowledge. Scientists have only sketchy notions of how this evolution might have occurred.

Dr. Harold C. Urey, Nobel Prize-holding chemist of the University of California at La Jolla, explained the modern outlook on this question by noting that "all of us who study the origin of life find that the more we look into it, the more we feel it is too complex to have evolved anywhere."

And yet, he added, "We all believe as an article of faith that life evolved from dead matter on this planet. It is just that its complexity is so great, it is hard for us to imagine that it did."

Pressed to explain what he meant by having "faith" in an event for which he had no substantial evidence, Dr. Urey said his faith was not in the event itself so much as in the physical laws and reasoning that pointed to its likelihood. He would abandon his faith if it ever proved to be misplaced. But that is a prospect he said he considered to be very unlikely.