COMMITTEE VI
The Universe and Its Origin:
From Ancient Myth to Present Reality
and Fantasy

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REFLECTIONS ON LIFE AND INTELLIGENCE

by

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DISCUSSION PAPER

on

Seth Shostak's

THE SEARCH FOR EXTRATERRESTRIAL LIFE

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Dr. Shostak clearly demonstrates that there are many Earth-like planets in the universe. His argument is a reasonable one as far as astronomical considerations are concerned. And I heartily agree with him. I cannot go easily with him, however, when he states that the Earth-like planets develop life and ultimately intelligent one. The planets whose number he calculates are Earth-like only in terms of astronomy, planetology, and possibly geology but not in terms of biology and sociology. With all that professional care he exercised in figuring out the number of the Earth-like planets in the Milky Way, how could Dr. Shostak be so unassuming that he omits every consideration about life and intelligence? Matters of life and intelligence, I believe, are the most critical and yet unknown factors that determine the chances of the success of the search for extraterrestrial life: they are questions concerning the origins of life and intelligence, their nature, and their duration.

A contact with an extraterrestrial life, no matter such an encounter is the beginning of a doom or a happiness for us, must change the course of man's history in a profound way. It comes, then, with a mixed feeling of a relief and a disappointment that the planetary exploration of the past two decades made it almost certain that the life on this planet is the only living form in the Solar System.

After failing to find another life in the Solar System, we must not only continue the search for extraterrestrials as Dr.

Shostek proposes but also, with greater effort, reflect upon what life and its nature really are. I admit that our view on what life is cannot be free from a terrestrial bias, because the terrestrial life is the only one known to us and we ourselves are a part of it. Still, it may be possible and worth the effort to draw something general from only one instance. We should pay an extra attention to the process that made life per se and especially an intelligent being a reality on the Earth.

Mars may be an example of an Earth-like planet that failed to foster an intelligent life. Despite the existence of liquid water in a large quantity in its past, Mars today appears a dead planet: no living forms seem to be present on it. Further studies on the history of Mars may give us an insight into the nature of chemical and early biological evolution taken place there. Jupiter and its moons may be other nearby places in which a study of chemical evolution would have much to offer to us. Besides these, there still are many other places in the Solar System where a clue to our understanding of what life is might be hidden.

Geological records of the Earth indicate that life has existed very early on this planet. Possible traces of life were found in 3.8 billion-year-old Isua Precambrian rocks, the oldest sedimentary rock yet known. Microsfossils found in 3.5 billion-year-old Pilbara Supergroup appear very much like modern cyanobacteria and bacteria. Although there still is an argument that these may not be a true trace of once living organisms, the weight of evidence appears to

suggest that life has been present on the Earth for about 3.5 billion years. This leaves less than one billion years from the formation of the Earth's crust and oceans to the origin of life on the Earth.

A biologist would be amazed when he learns that the life originated so quickly and yet took more than 3 billion years to evolve into what we see today on the Earth. His surprise must have resulted from the fact that, on one hand, the molecular mechanism which makes biological evolution possible is, at least partially, understood; it seems a neat, quick system to let an organism to adapt itself to ever changing environments. On the other hand, a process of chemical evolution that eventually resulted in a form of life on the Earth remains virtually unknown in spite of the three decades of experimental work specifically aimed at elucidating the process. Therefore, it would seem more fitting if the chemical evolution toward the origin of life took much longer time than the later boilogical evolution. However, what apprently happened on the Earth was just the opposite. The biologist's astonishment may be an indication that we are yet to learn many about the nature of chemical evolution. Professor Sermonti states that life is an impossibility even on the Earth. Though I understand his sentiment, I believe that it is too early to make such a statement, considering our yet inadequate knowledge about evolution of matters.

In fact, the early emergence of life on the Earth found in geological records and the vexing problem we face in

understanding the process of chemical evolution must together show that some critical ingredients may be missing in our current thinking on the genesis of life. There also exist many puzzling events in the course of biological evolution which glaringly show that our understanding of the processes of biological evolution is critically inadequate. Among many, I would point out two.

For more than 2 billion years since the emergence of life, only living form on the Earth was prokaryotes. Fossil records show that the first eukaryotic cell appeared on the Earth about 1.4 billion years ago. Furthermore, 700 million more years had passed before the biological burst that ended the Precambrian period and began the Phanerozoic eon. How necessary were these long periods for the later outcome of biological evolution? I really do not know.

Man and chimpanzee separated from each other about 5 million years ago, and yet our ancestors had been only another animal just like other apes until the end of the last glacier period that took place about 10 thousand years ago. At that time, man started agriculture and stock farming. They apparently enabled him to establish a culture and eventually to build a scientific and technological edifice that makes him call himself proudly an intelligent being. Biologically speaking, however, man today is just like the one before the end of the glacier period. Then, what made the two men appear so differently? By what reason did man begin to behave differently 10 thousand years ago from what he used to before?

Admittedly, archeological records show that a gradual

process of hominization had been taking place after the human-ape split and before the advent of agriculture and stock farming. It is also true that a similarly gradual change occurred during the Precambrian period that might have had made life on the Earth ready for the biological proliferation in the Phanerozoic eon. The questions I would like to ask are: was the proliferation the only outcome of the preceding evolution, and was every millennium of time elapsed before the proliferation really necessary?

When I look over the history of life on the Earth, it appears to me that what we see today on the Earth is only one of many possible outcomes. There may be no fixed destiny for chemical and biological evolution. A complex cycling of bioelements on an Earth-like planet may or may not come to be called life. If it does, the life certainly alter its surroundings because of its very nature, and the changed environments in turn let it modify itself. Furthermore, geophysical and geochemical forces would continually alter the environments in no relation to living activities. The process of evolution may be something like a tinkering as Jacob once called it and no one knows what happens next.

Even if the presence of intelligent Homo sapiens today is an inevitable result of biological evolution on the Earth, an accidental event in man's history might have yielded a totally different human society. Without the Western civilization that dominates today's world, human society would have been quite different. Whether we could avoid the fiery exchange of nuclear

arms between the powers will of course impose a grave significance upon the fate of human society. And I hesitate to support Dr. Shostek's apparent notion that the invading Spaniards of the 16th century were more intelligent than the conquereds. Spaniards were merely superior in their desire to dominate other civilizations.

Dr. Shostek might be correct in assuming that there are millions of earths in the Milky Way which are so like the Earth that intertwined cyclings of elements may be allowed to develop into a complex one enough to be called life. Even so, there are numerous number of uncertainties which must be clarified before presuming that, on every such an earth, there is an intelligent life which is capable of and interested in a search for another form of life in a distant world. Rather, our present understanding of evolutionary processes lets us tend toward the belief that the probability of an intelligent life on an Earth-like planet could be infinitesimal as Professor Sermonti notes.

I would not subscribe to Dr. Shostek's suggestion that there may exist a living form whose desire to conquer other worlds is so strong that it is willing to wholly replace itself with a set of machines specifically tailored for the invasion, because the past biological evolution on the Earth seems to show that, for each individual living being, the primary purpose of its existence must be the continuation of its likes. It seems much more likely to me that the interest of an intelligent being in the communication with aliens in other worlds wanes quickly

because of many plausible causes. The master machines made by an intelligent being to replace their creator and to invade other planets may belong only to a man's fantasy.

Nevertheless, it is still possible that, just like what is happening on this planet, an intelligence that enabled its possessor to continue his existence makes him interested, however momentarily, in a search for another intelligent living form in another world and let him send a message, because biological evolution that necessitated the intelligence elsewhere might also nurture curiosity.

Chances of finding an intelligent alien by means of radio are yet uncertain and could be virtually null. Professor Sermonti appears also in favor of this conclusion. So, it may not be wise to do an all-out effort to search for extraterrestrial intelligence at present; however, I believe that the enormous impact the success of the search would carry and the yet undeniable possibility of its success warrant the endeavor to continue at a reasonable level. It should be an integrated part of a larger effort for man to study the question of evolution of matters.

Finally, I would like to note an incidental benefit derived from the search. Professor Sermonti notes that the conquest of the skies (and the universe) is a byproduct of a military enterprise and is supprted only because of a defense strategy. Although it was and is certainly true, it may not yet tell the whole story. With so much nuclear arms enough to end the whole

human civilization, the curiosity and the probably inborn aggressiveness of man better be directed to something other than a military. In that sense, the search will make man aware of his responsibility for the rest of living organisms on the Earth and at the same time make him better recognize the oneness of all terrestrial living forms including himself. In today's world where sectionalisms of every possible kind are found, a sincere effort to find an extraterrestrial life and philosophical reflections that come along with it are uniquely of value.

BIBLIOGRAPHY

Folsome, Clair E. The Origin of Life: A Warm Little Pond. San Francisco and London: W.H. Freeman and Company, 1979.

Jacob, François. "Evolution and Tinkering," Science, **196** (1977), p.1161.

Mizutani, Hiroshi and Wada, Eitaro. "Material Cycling and Organic Evolution," Origins of Life, **12** (1982), p.369.

Mizutani, Hiroshi. "What is Life? -changing view of man on life," in Tetsuji Sato, ed., Towards the 21st Century - Life, Cells, and Genes. Tokyo: Kogyo Chosakai Pub. Co., 1985, p.265.

Morowitz, Harold J. Energy Flow in Biology: Biological Organization as a Problem in Thermal Physics. New York and London: Academic Press, 1968.