COMMITTEE I
Unity of Science: Organization and
Change in Complex Systems

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COMMENTS ON THE ORIGIN OF LIFE

by

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DISCUSSION PAPER

on

Bulent Atalay's

THE ORIGIN OF LIFE

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The problem of life and the relation of living to non-living matter is probably as fundamental to human nature and as old as thought itself. While the progress of knowledge has expanded our horizon, understanding of the real nature of life still appears to elude us. We know that biological evolution has occurred on Earth, and we have a fair idea of the means by which it is achieved. But there is nothing in the established laws of physics to warrant that matter and energy could, or need, flower into life. We also know for a fact that mind and consciousness exist (cogito ergo sum), but we do not know much beyond the external means by which they manifest themselves about their relationship to physical realities.

In physico-chemical terms, however, it is well known that organic molecules are made up of perfectly ordinary matter. It seems that there exists no organic compound that could not be synthesized in a laboratory, though some syntheses may be too complicated to be successfully carried out in practice. Therefore, the peculiarity of life is not to be sought in the materials it uses, as these are derived directly or indirectly from the inorganic surroundings. What distinguishes living from non-living matter is organization. The operative term is the system, design or pattern, not merely the component parts.

The above remarks make it obvious (to the point of banality) that a huge tome would not suffice to discuss the problem of life in any detail. The best one may hope to achieve in a short paper is a discussion of one important point, as is done in the paper under discussion. A living organism is a system, which has many individual components, whose description requires an unmanageable amount of detailed information. Nevertheless, one may try to

build a model to mimick the rules governing the evolution and development of the system. While such a model may have no quantitative justification, it may well prove instructive and give very useful insight.

The main part of the paper addresses the problem of the emergence of organized self-replicating molecular systems and in particular, the unresolved problem of polymerization, namely, the assembly of the molecules, which comprise life, into extremely complicated structures: living organisms. Two models are discussed: a descriptive model by A.G. Cairns-Smith, and a mathematical model by F. Dyson. These offer scenarios, which point toward how, within the framework of physico-chemical processes, life may have originated. However, as aptly pointed out by Professor Atalay, demonstrating the possibility of a process is not the same as showing its probability, and certainly not its inevitability. So we are still in the dark, although we do see some glimmer of light.

I would like to pose two questions:

1. What about time? It does not appear that the models considered take time into consideration. Does indeed Earth exist long enough for the processes sugested by these models to take place with any reasonable probability?
2. There is no mention of quantum mechanics in the paper, although, since we are dealing with submicroscopic particles, quantum mechanics should presumably be the proper physical theory to deal with them. In view of the measurement problem of quantum mechanics and the difficulty of how to formulate the acquisition of information, is it indeed reasonable to suppose that biology is ultimately a branch of physics, in the sense in which chemistry is now known to be, in principle, a branch of physics?