



Israeli Society for Astrobiology and the Study of the Origin of Life (ILSOL)

Abstracts for presentations given in the 17th annual meeting of the society that took place on Sunday, 21 December 2003.

- **Extending the Concept of Kinetic Stability: Toward a Paradigm for Life**, Addy Pross (BGU)

A physico-chemical framework for bridging between animate and inanimate matter that builds on the concept of kinetic stability, is proposed. Its essential idea is that for transformations in the world of replicative chemistry, selection is kinetic, whereas in the parallel world of regular chemistry, selection is thermodynamic. Our kinetic approach leads us to conclude that all living systems represent a kinetic state of matter, as opposed to the traditional thermodynamic states associated with inanimate matter.

- **Lipidia Simulation System**, Barak Naveh, Moshe Sipper (BGU), Doron Lancet (WIS) and Barak Shenhav (WIS)

Lipidia is a new simulation system that is related to the "Lipid World" scenario for the origin of life. Lipidia allows for conducting experiments with a population of assemblies containing lipid-like molecules on a two dimensional grid. The dynamics of the assemblies is modeled using the Graded Autocatalysis Replication Domain (GARD) model. New experiments using a finite environment model with GARD were conducted with Lipidia. The experiments show that more self-replicating assembly species appear when using a model of finite environment than when using a model of infinite environment. In many species the number of individuals increases as well.

- **The Arrow of Evolution: Absorption of Excess Solar Energy**, Malcolm Schrader (HUJ)

Natural selection is described as resistant to reduction to chemistry and physics, due to conflict with the principle of the second law of thermodynamics. By contrast, conversion of solar energy to chemical free energy and finally negative entropy provides a reasonable hypothesis for the driving "force" of long-range evolution. This thermodynamic treatment deals with initial and final states which, for the case of long range evolution, is taken from an initial phenotype to a final phenotype. The genetics are treated as mechanisms and therefore not needed for the thermodynamic comparisons of initial to final states. This action of solar energy as the driving "force" of evolution can, but need not necessarily be, considered a continuation of the role of the sun in fueling the original conversion of inanimate matter to the high-free energy steady-state of the living process.

- **Reflections of a Geologist on the Origin of Life Following Yuval Neeman's book "Order Out of Randomness"**, Arie Issar (BGU)

According to Yuval Neeman the components needed for the process of evolution are in the first place a process, which creates random changes in the organism and secondly selective criteria, which select the "positive" changes, namely that which have the chance to survive. Self organization and order is created while surrounding entropy rises. The dissipative (non equilibrium state) and source of energy which feeds it is gravity. Regarding the question "Why just three space and one time dimension"? Neeman's answer is: Because when a new universe is created, it contains 11 dimensions, some of which collapse. Only when the collapse leaves exactly 3 spatial and one time dimension This universe has a chance to exist and develop forming atoms stars and humans. The questions poised by Issar to this conceptual model are:

1. What activates the mechanism, which creates random changes?
2. Why random changes?
3. Why survival?
4. Why progressive evolution?
5. Why while we regard gravity as a field of force supplying energy we do not treat entropy as such?
6. Can the bio-world and especially humanity be described only on space-time dimensions? What about information?

The conceptual model suggested by Issar to answer these questions is the following:

Two forces are ingrained in nature a function of the Big Bang. One is a result of the expansion of the universe it pulls all structures by random changes=mutations to minimum complexity = maximum entropy = maximum symmetry. The other force, which is a result of the contraction, observed as wrinkles in cosmic background radiation, is gravity (when measured only on space-time dimensions). It causes the formation of matter and Galaxies and works perpetually in the opposite direction to entropy pulling towards more complex structures i.e. progressive evolution (survival is a temporary steady state). All evolution of complex systems (matter, life, societies, science) is within the framework of space-time-information dimension, which have 11 degrees of freedom ("dimensions") 6 space (xyz forward & backward) 1 time (present to future) 4 information (+,-, if-then, synthesis & analysis). Conclusion: Appearance of life and the evolution of organisms towards more complex and intelligent forms, is inevitable once we take into consideration the universal nega-entropy arrow and the space-time-information lattice of dimensions.

- **Astrobiology and the Origin of Life: Questions, Assumptions and Speculations - Moderator's opening** , Noah Brosch (TAU)

In the context of the Astrobiology discussion panel I presented a number of issues connected with panspermia. I described the basic requirements of panspermia, namely ejection and escape from a planet harboring life, transport through interplanetary or interstellar space and survival, and accretion or seeding on another planet. I showed that a number of intriguing publications seem to encourage a positive answer to the question "did panspermia happen". These are (a) a calculation by Melosh (1988 Nature 332, 687) that shows the possibility of ejecting large fractions of a planet's crust as a consequence of a major impact, (b) claims that million-year old micro-organisms can be revived (Vreeland et al 2000, Nature 407, 897), and (c) another paper by Melosh (2003, Astrobiology 3(1), 207) that shows the low likelihood of interstellar panspermia. The latter is based on the low accretion (seeding) probability because of the high incoming velocity of the interstellar meteors. If a way would be found to slow these down after ejection from a solar system, e.g. through an interaction with the interstellar matter or magnetic fields, then interstellar panspermia could become possible.

- **An Introduction to Astrobiology**, Joseph Gale (HUJ)

Astrobiology is a multidisciplinary field that unites those interested in the factors that allowed the

appearance and affected the evolution of life on Earth and those searching for life, perhaps intelligent life, elsewhere in the universe. Relevant research comes from astronomy, geology and biology. The search for extraterrestrial life is informed and deeply biased by knowledge of life on earth. This bias may prove to be incorrect, but is our first working hypothesis. Astrobiology, as applicable to the particular case of planet Earth, is reviewed. It is proposed that ILSOL widens its scope to take part in and to benefit from the international interest in Astrobiology an interest that although recently receiving much attention, can be traced back to the ancient Greeks.

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