Darwinian model of evolution. II

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A story about self-replicating life which unintentionally became organized struggling to survive.

When we talk about life we talk about adaptations. In other words, we look at bio-systems as some nature's optimal solutions [1-4]. In particular we suppose that living matter perhaps behaves like an efficient engine concerning the transformation of usable energy.

Life is an organized system of chemical reactions. The essential feature of living things, which enabled them to evolve, is their capability to replicate. The first prebiotic chemical complexes [5, 6], that had arisen spontaneously, showing primitive metabolism and an ability to divide were the physical realization of the autocatalytic open systems model. For such aggregates of molecules the concurrent existence of competitors is not a trivial task, and that has led to organized chemical systems, or life.

Indeed, the ratio of the equilibrium concentrations of products for parallel chemical reactions depends on the Gibbs free energies of products. Dominates that product which has the lowest free energy, or, in other words, which is more thermodynamically stable [7]. But in the case of concurrent autocatalytic processes the product with the lowest free energy wins entirely, namely, it excludes the concurrent products, perhaps due to positive feedback which destabilizes the whole system. That means that when equilibrium is reached the concentration of a reagent is minimal and the concentration of the remaining product is maximal. Extending these relations to open systems, which existence depends on the exchange of chemical compounds with their environment, we naturally come to the notion of efficiency: the remaining self-replicator has to use resources in the most efficient way.

We assume that the precursors of modern types of cells most probably were heterotrophic molecular complexes [8]: they consumed chemical substances from surrounding environment and thus competed for them. Making copies of itself these different forms of prebiotic cells were able to sustain their own populations only by increasing the potential of the growth of population biomass. Les favourable competitors were forced to extinction. The exclusion principle of autocatalysis dictated the strategy for surviving – increase the efficiency of energy utilization which is derived from resources. *Efficiency can be increased if processes associated with energy transfer, for example chemical reactions, are strongly coupled* [9]. *Emergence of coupling means that a specific mechanism comes into being. That is a structure already. In the course of such a creative but unintentional evolution, based on accidental events, the organization of living matter increased and cell fabric has been formed.* As a rule the overall best possible result probably is a compromise between the energy gains due to coupled chemical reactions and the energy losses due to the maintenance cost of the organization itself.

How does life relate with technological devices created by human beings? From the fundamental point of view living organisms and man-made machines are the products of the same evolutionary plan despite the difference in the evolution rates. Both are evolving entities made of integrated parts and coupled processes were efficiency plays an important role leading toward optimal solutions.

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