Biogeosciences Discussions

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Reply on RC4

Karo Michaelian

Community comment on "Comment on K. Michaelian and A. Simeonov (2015) "Fundamental molecules of life are pigments which arose and co-evolved as a response to the thermodynamic imperative of dissipating the prevailing solar spectrum"" by Lars Olof Björn, Biogeosciences Discuss., https://doi.org/10.5194/bg-2021-135-CC3, 2021

We welcome and appreciate scientifically sound and sufficiently elaborated challenges to our proposition concerning photon dissipation and the origin and evolution of life. However, emotional comments based on "feelings" without elaboration, such as, "K. Michaelian and A. Simeonov (2015) is flawed…", "The response by Michaelian is unsatisfactory in my view…" , "I do not believe MS2015, and doubt that it has much value…", do not contribute to the scientific discussion.

The teleological concern that Martin continues to bring up is a red herring. We have already made clear that the concept of a telos is completely unnecessary once life and evolution are accepted to be under the dictates of the 2nd law of thermodynamics. Martin's vigorous defense of hydrothermal vent scenarios of the origin of life is also misplaced since it is by no means a generally accepted scenario, not the least because very few fundamental molecules have ever been produced under ideal laboratory simulations of hydrothermal vents. Indeed, Stanley Miller emphatically argued until the end of his life that hydrothermal vents were regions of molecular destruction, not molecular creation. Martin's latest reference to Battley et al.'s (Pure Appl. Chem., Vol. 81, No. 10, pp. 1843–1855, 2009) analysis of the *entropy* of a random collection of molecules compared to the same collection within a living being but "in a state of suspended animation" is pointless exercise since life is a process, not a particular static arrangement of molecules in suspended animation. The reduction in entropy due to the formation of the molecules, and that due to the dynamics of the processes of life, must also be included for a meaningful comparison of entropies (Battley et al. should have been aware that Schrödinger certainly understood this). However, we don't have to be concerned with that here (other than to perhaps inform Battley et al. of their oversight), what we are interested in is the *entropy production*, not the *entropy*. A particular static arrangement of biomolecules has zero entropy production; it is a dead organism, or a dead ecosystem. Living systems are very much concerned with positive entropy production and, as we suggest, have been generally increasing the entropy production of Earth in its solar environment since the origin of life.

We would not oppose the publication of Björn's Comment as long as, in the interest of a fair and open scientific debate, Björn and defenders do not oppose the publication of our Reply.

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