

Reply on RC1

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Community comment on "Comment on "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 K. Michaelian and A. Simeonov (2015)" by Lars Olof Björn, Biogeosciences Discuss., <https://doi.org/10.5194/bg-2021-135-CC1>, 2021

Michaelian and Simeonov (2015a) do not "call everything that absorbs photons a pigment". (See point 4 of the comment by Michaelian and Simeonov (2015b) on our original article for validation of the use of the word "pigment" in our paper.) We suggest that those organic molecules now known as the fundamental molecules of life (i.e. those in the 3 domains of life) that strongly absorb light within the 210-285 nm (UVC) region and have a conical intersection to rapidly dissipate the electronic excitation energy into heat (Michaelian2011;2017;2021) were originally (at the origin of life) organic pigments which were dissipatively structured from simpler and more common precursor molecules under this UVC light to perform the thermodynamic function of dissipating this light into heat.

There are numerous and conflicting theories for the origin of life. There is no inherent reason to believe that the hydrothermal vent theory is the correct theory. Our theory, of course, does not have to facilitate, or even be consistent with, any other particular theory, no matter how appealing the other theory may seem. Our theory only has to be consistent with known chemical and physical principles and laws and with the probable initial conditions, i.e. known facts about possible physical environments at the origin of life. It is not scientifically sound to label a theory "flawed" simply because it is not consistent with a favored theory!

The whole system, dissipative structure (pigment or organism) plus driving potential (the photon potential), is under the dictates of the Second Law of Thermodynamics, as is every macroscopic biotic process (including evolution), as well as is every abiotic process. There is nothing personal or particular about it, this law is intrinsic to all processes. The Second Law for the biological processes states that the entropy of the organism(s) plus that of its environment must increase. It is the Second Law that gives function-existence closure to the dissipative structure and its inseparable driving potential. It is completely unnecessary to bring philosophical concepts like *teleology* into the discussion. However, for those who still think in these terms rather than in terms of physical law, the *telos* of pigments or life (or any dissipative structure) would be to dissipate the solar photon potential (or any generalized thermodynamic potential) and it is precisely this dissipation on which the structure depends for its very existence. The teleology (if you must) is thus intrinsic (Jonas, 1966; Mossio and Bich, 2014).

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