

Review of: "Thermodynamics, Infodynamics and Emergence"

Moritz Kriegleder¹

¹ Universität Vienna

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The article lays out the foundations of thermodynamics, information, and emergence in a complex review spanning physics, chemistry, biology, psychology, and sociology. Since it has such an interdisciplinary scope, it is sometimes difficult to differentiate between where the authors ideas come from, and which provide novel insights. For example, the idea of using Free Energy in an information-theoretic way to describe living processes has been used extensively by Schrödinger, Bohr, Delbrück, and Friston. Especially the latter provides a mathematically more rigorous framework, which could be beneficial for the authors work:

Friston, Karl. 2013. "Life as We Know It." *Journal of The Royal Society Interface* 10 (86): 20130475.

<https://doi.org/10.1098/rsif.2013.0475>.

Ramstead, Maxwell James Désormeau, Paul Benjamin Badcock, and Karl John Friston. 2018. "Answering Schrödinger's Question: A Free-Energy Formulation." *Physics of Life Reviews* 24 (March): 1–16.

<https://doi.org/10.1016/j.plrev.2017.09.001>.

While spanning so many disciplines, the article does not give any philosophical perspectives on the use of information in biology, which is clearly more layered than presented here. A useful resource could be:

Domondon, Andrew T. 2006. "Bringing Physics to Bear on the Phenomenon of Life: The Divergent Positions of Bohr, Delbrück, and Schrödinger." *Studies in History and Philosophy of Science Part C: Studies in History and Philosophy of Biological and Biomedical Sciences* 37 (3): 433–58. <https://doi.org/10.1016/j.shpsc.2006.06.014>.

The writing style is very approachable and the bridges between different disciplines using information, complexity, and emergence stimulating for following thoughts. The main concepts such as entropy and emergence could be defined more strictly since their ambiguities sometimes make the argument very vague. An example is the use of Free energy of in the description of biological reproduction and the role of love, which is mentioned without any references or in-depth discussion. Therefore, it comes of more as speculation than testable hypothesis. Discussing different qualities of emergence and which one applies in the specific examples introduced by the author would give the article more philosophical depth. A thorough analysis of emergence can be found in:

Humphreys, Paul. 2016. *Emergence: A Philosophical Account*. Oxford, New York: Oxford University Press.

In general, the article would benefit from cutting more of the general explanations of standard concepts in

thermodynamics and focusing on the novel contributions of the authors research. Further expanding on the explanatory power of infodynamics as proposed by the author would make this a valuable contribution in the current debate of complexity in living systems.