

# Review of: "Thermodynamics, Infodynamics and Emergence"

Mario Martinelli<sup>1</sup>

<sup>1</sup> Polytechnic Institute of Milan

**Potential competing interests:** No potential competing interests to declare.

I admit that I don't know the QEIOS magazine, which I still thank for inviting me to write a review for the paper:

*"Thermodynamics, infodynamics and Emergence, by Klaus Jaffe"*

The first lines of the Abstract of the paper summarize well the centrality of the theme: *"Emergence, information and energy are fundamental properties of nature. We know that it takes free energy to acquire information, and it takes information to increase free energy."*

This theme has always interested the scientific community (physicists and others) but the theme continues to be "elusive". In the long list of contributions that the Author carries out (page 7/21) I think it was perhaps appropriate to mention E.T Jaynes [1, 2] which has conducted the most systematic effort to attack the problem and who underlines the centrality of the *"partition function"* as a basic entity that allows to connect thermodynamics and information theory (for those interested, this centrality is also taken up in a modest contribution of mine [3]).

Similarly, since the title also speaks of an emergency, perhaps it was also appropriate to mention the fundamental contribution of P.A Ortega and D.A Braun [4] who masterfully dealt with the theme of "decision" and its impact on free energy .

The paper remains a good introduction to the relationship between thermodynamics and information and, in underlining the ambiguity present in the two terms of the relationship, it gives a glimpse of its complexity.

[1] Janes ET, Information theory and statistical mechanics, Phys. Rev. 106, 620 (1957)

[2] Janes ET, Note on unique decipherability, Trans. IRE Inf. Theory 5, 98 (1959)

[3] Martinelli M, Entropy, Carnot cycle and Information theory, Entropy, 21, 3 (2019)

[4] Ortega PA and Braun DA, Thermodynamics as a theory of decision making with information processing costs, Proc. R. Soc. A, 469, 20120683 (2013)