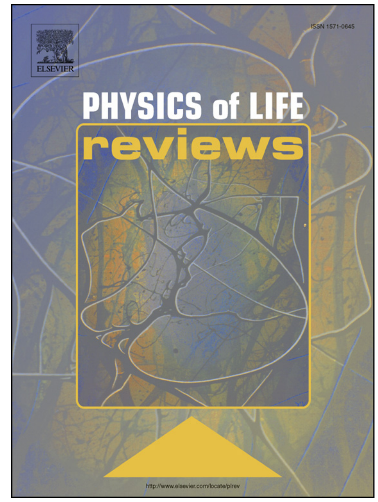

Entropy production guides energy budget

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Entropy Production Guides Energy Budget. Comment on "Physics of metabolic organization" by Marko Jusup et al

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The paper [1] is very important and useful for everyone involved in mathematic modeling of biological processes. There is no point in mentioning here all the advantages of the publication because they can be found in the primary source itself. In this comment, I would like to briefly refer to the critical points that authors and readers may find useful for further consideration and development of the Dynamic Energy Budget (DEB) theory.

The title selected for the publication is inaccurate and gives the readers a wrong idea. In fact, the paper represents a more or less detailed description of only one modeling method (DEB model) involving a number of classical energetic concepts from thermodynamics. So, "Physics of Metabolic Organization" as a title fails to reflect the contents of the treatise. It does not address the current state of metabolic organization in biology neither from the viewpoint of experimental facts (for instance, the recent interesting result [2]) nor from the perspective of modern theoretical foundations (as will be mentioned below). Moreover, there are also other well-known models (e.g., MTE [3]) in the field of mathematic modeling of biological and ecological energetic processes. The critical comparison of different existing models which has been previously undertaken in the papers [4,5] is crucial for developing and popularizing a DEB model. However, co-authors of the model neglect this fact and mention only MTE in the study at hand.

There is another important point which is presently barely noticed with regard to DEB modeling: analysis of the modeling accuracy and the interval to which prediction results can be extrapolated. This issue is extremely important as one must take into account both a (typically) relatively low accuracy of the experimental data used for obtaining parameters of a model and errors of direct and indirect calculations based on the model's equations. Additionally, it is also necessary to analyze the stability and unicity of a solution to a DEB model holding, in the general case, non-linear differential equations. If a model is intended only for systematization and interpolation of sufficiently accurate experimental data given in the literature (in this case, the model's parameters can always be corrected through repeated comparisons), then the recommendations mentioned herein may be ignored. However, if a DEB model is designed to make predictions for objects that lack sufficient experimental investigation, then the above theoretical analysis shall be mandatory.

The authors of the paper [1] in their description of the DEB model and applications thereof emphasize its universal and powerful nature (the same can also