

Towards theoretical formalisms

Olaf Breidbach · Jürgen Jost · Peter Stadler

Published online: 24 March 2007
© Springer-Verlag 2007

With the present issue, Theory in Biosciences has a new publisher. We are glad for the long period in which the Keynesian publishers took care of this journal. Our endeavour started 10 years ago when the former Gustav Fischer Press launched Theory in Biosciences as a new approach towards reviewing and commenting recent and future developments in biology. When Elsevier swallowed Gustav Fischer press, the crew remained in Jena and, thus, our journal could be continued more or less according to its former tradition. Yet, it became clear to us that for a more profound and substantial discussion in theoretical biology, we needed to encourage both the formal and the conceptual treatment of deeper and perhaps more complicated ideas in biology. For that purpose, Jürgen Jost and Peter Stadler joined the journal as editors. Also, the editorial board was enlarged, and several new editors accepted to join and supported us. We should thank all our collaborators for their support and advice during all these years.

With Springer as our new publisher, Theory in Biosciences changed its appearance, so as to give a clearer

impression about our intentions. The main purpose of the journal is to support the formal and mathematical treatment of structural and evolutionary biology in its broadest sense. The main objective of our journal was and will be the analysis of the evolution of structures, of dynamical systems in biology and of the interplay between neural dynamics and cognitive processes. We believe that those subjects are at the very heart of recent discussions in the biosciences. For instance, the evo-devo community starts to include ecological thinking. In turn, ecology has become aware that the established theories are insufficient for understanding evolution at greater scales. The discussion about microevolution and speciation is still going on. The question of the methodological framework of comparative phylogenetic analysis is not solved. Likewise, we need new concepts for describing patterns and morphologies. The relation between genes as discrete, conceptual entities and the underlying biochemical reactions acquires new aspects in the light of modern omics data. All this shows us that theoretical biology should not be restricted to technical aspects, but has the need to encourage integration of various perspectives. We also need to integrate the terminologies, and often also the concepts, of different communities that are grappling with the same problems in their own way. On the other hand, we need to incorporate different perspectives to handle such problems as evolution on the species level and to describe developmental morphologies. Structural biology, for example, cannot simply be defined by pointing at static attribute configurations provided by molecular analysis or classical morphology. Structures are to be seen as the outcome of a complicated interaction of various biochemical pathways against a background of particular adaptations in a complex fitness landscape and of preserved structures. It is quite hard to describe what such

O. Breidbach (✉)
Institut für Geschichte der Medizin,
Naturwissenschaft und Technik, Ernst-Haeckel-Haus,
Friedrich-Schiller-Universität Jena,
Berggasse 7, 07745 Jena, Germany
e-mail: Olaf.Breidbach@uni-jena.de

J. Jost
MPI für Mathematik in den Naturwissenschaften,
Inselstrasse 22, 04103 Leipzig, Germany

P. Stadler
Institut für Informatik, Universität Leipzig,
Härtelstrasse 16-18, 04107 Leipzig, Germany

an outcome really is in terms of such interacting reactions. In this context, we should also ask whether the idea of a web of interactions already pre-selects certain formalisms and modelling strategies.

As becomes evident through such examples, we are still at the beginning, looking for terminologies, models, formalisms and a redefinition of former problems. This—in our view—is theoretical biology, at this moment at least. There is no established mainstream of theoretical formalisms. There are certain side branches in discussions that are already well established and might provide consistent terminologies. There is no overall solution present, however, and perhaps one should not even expect that such a solution exists and will be found. In any case, we need to follow and perhaps connect several such established side branches, including historical comments or philosophical statements.

In our view, the description of evolution and the development of quantitative tools for such a description are a central question of contemporary biology. With our journal, we hope to stimulate contributions that either enlighten certain aspects of such a process, provide interesting examples to understand the broad range of putative

reactions in evolution or eventually describe how we have dealt with such problems so far and what we have not seen.

Accordingly, also in its new format, *Theory in Biosciences* will be interested in documenting a broad range of approaches towards theoretical biology, testing various formalisms, stimulating discussions about modelling strategies and the effectiveness of certain models, describing case studies and addressing questions for the history of sciences and bio-philosophy. Beyond testing our formalisms, we also need to specify the terms we use to describe evolution and to clarify the conceptual background of the various theoretical approaches.

We are glad that Springer as a whole and its Biology Department in particular has expressed its interest to support us in that aim. This allows us to continue and move on with our idea of a forum for theoretical biology. We have to thank the editorial board that was and is willing to support our approaches towards theoretical biology, and we are dependent on our readers and contributors for filling our aim of promoting the discussion in theoretical biology with substance.

Jena and Leipzig, February 2007