
The Relevance of Irrelevance: Explanation in Systems Biology

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Abstract

Session: The explanatory role of mathematical and dynamical models in molecular and cell biology (BAETU, BRAILLARD, GROSS, ISSAD and MALATERRE)
Explanations in systems biology often rely on the tools of dynamic modeling. Here I argue that accounts of mechanistic explanation that are based on 'change-relating relationships' between the components of a mechanism and its overall behavior do not easily make sense of certain features of dynamical patterns, even though these can be accounted for in mathematical models. I suggest that when investigating the use of such models, one should distinguish between the ideas of 'causal relevance' and 'explanatory relevance.' I show that the explanatory function of mathematical models often consists in elucidating relationships of non-dependence, that is, relationships that are not change-relating. Notably, the robustness of biological systems, a property that has been of great interest to many systems biologists, is often best accounted for in this way, and not by invoking separate 'robustness mechanisms.' Drawing on examples from the scientific literature, I show that an important aspect of explaining the behavior of a biological mechanism consists in elucidating how in the systemic context components are not, or only weakly, dependent on each other.

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