Leonardo Bich
Biological Organization
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The most fruitful way to grasp the value of Leonardo Bich's book in the context of the contemporary philosophy of biology is to focus on its *function*. Published as part of the Cambridge Elements in the *Philosophy of Biology, Biological Organization* is intended to provide a systematic introduction to a specific and relatively recently developed perspective in theoretical biology, the so-called "organizational framework". Bich has been a key voice in the discussion of the epistemological and theoretical concerns related to biological organization (Bich 2012) since the main concepts of this perspective were introduced, such as "closure of constraint" (Bich & Mossio 2011) and "organizational closure" (Bich 2016). This publication serves as a handbook for researchers in the philosophy of biology interested in exploring a recent, refined, and original development within a well-known set of perspectives on living systems as self-organizing and self-maintaining entities, inspired by Kant (1997).

The book is organized into eight sections, following genealogical development. It begins with the theoretical context in which the notion of biological organization has been refined (sections 2-3). Bich then discusses the core concepts of this perspective (sections 4-5) and tries to show how these specific concepts can be applied to various issues in the philosophy of biology and science (sections 6-8). Conversely, the introductory section addresses the typical question regarding the features that characterize living beings specifically. At first glance, organisms exhibit fragility in their components. Even so, their never-stopping activity ensures flexibility and resilience, especially in environments where they must cope with frequently changing conditions. Indeed, organisms maintain themselves alive not just by replacing their parts: they continuously change to face internal physiological states and external environmental conditions, exhibiting self-regulation be-

yond self-production. According to Bich, these features of biological systems could be consistently explained through the "philosophical and theoretical framework" at the core of this volume, i.e., referring to a kind of internal *organization* (p. 3).

The second section focuses on traditional distinctive uses of "biological organization" in the philosophy of biology. By tracing the genealogy of the notion, Bich shows that they share a common reference to the structure of relations between the parts of a given system as patterns of causal connectivity, on whose basis one can introduce a partition of entities into classes. However, among these handlings, the relations' pertinence and the partition's specific operations are disparate, leading Bich to outline three conceptions grounded in two research traditions of the twentieth century, Cybernetics and General Systems Theory. On the one hand, organization in terms of "organizational motifs" focuses on isomorphisms between specific instances of patterns of organization, abstracting mathematical models, and then applying them to detailed cases in different systems. On the contrary, appealing to "organizing or design principles" emphasizes general properties exhibited by a certain class of organized systems without referring to concrete mechanisms in specific contexts.

In the next section, Bich introduces the third notion of organization inspired by both traditions, labeled "organizational framework". He surveys various authors who attempted to abstract the common minimal pattern of connectivity within living wholes, thereby distinguishing systems capable of persistence as living organisms. Considering organisms' specific features, these approaches use "organization" to identify the characteristic circular way in which production and transformation processes are connected – namely self-production or "*autopoiesis*" (Varela et al. 1974) –, i.e., realizing an "organizational closure" in interplay with the "thermodynamic openness". According to Bich, these initial insights were abstract and liberal, not worrying about how circular causal relations are realized. Subsequently, organizational approaches have been referring to the notion of "constraint" to indicate the canalization of a process towards otherwise improbable outcomes, by specifying the conditions of existence of harnessed processes. Bich defines "organizational closure" through the concept of "closure of constraints": constraints are organized in a manner that realizes a circular causal regime, contributing

to the ongoing maintenance of each other within this system and collectively to the maintenance of the system.

The fourth section adds self-regulation to the description of biological systems. The notion of "closure of constraints" is "still too narrow" (p. 23) to account for the continuous modulating and coordinating of the activities of constraints. To account for this variability and integration in biological systems, Bich appeals to control constraints that are sensitive to the system's internal state or its environment. They operate on the activities of other constraints to realize closure when and how the organism needs them and to face changing environments.

Once the foundational concepts are outlined, Bich turns to their applications in biology. This framework is applied to naturalize biological teleology (§5.1) and functions (§5.2), connecting these notions to self-determination. The naturalization of teleology relies on the relationship between conditions of existence and the activity of an organism: the goal is the maintenance of these conditions, i.e., the very causal influence of the set of constraints. Regulatory control enriches this minimal notion of this organizational teleology, "treating a living organism not only as being teleological but also as operating teleologically" (p. 38). Regarding functionality, the idea is the following: if the system realizes the closure of constraints and there are differential contributions to maintenance within the system, then the system can harbor biological functions. Regardless of being a living organism, every biological system that realizes this type of organization would be said to exhibit teleology and functions.

The last three sections of the volume examine how this general paradigm discloses possible insight into several philosophical issues related to biological phenomena. The initial topics are the origins of life (§6.1), revealing the conditions that have led to the emergence of prebiotic organizations, and biological communication (§6.2). This framework appears useful for operationalizing and naturalizing biological communication, offering experimental tools and criteria for demarcation. The seventh section aims to show the compatibility between the organizational framework and the position that is known as "new mechanism", based on a common reference to an organization. The latter emphasizes how the components of a mechanism interact in such a way that their organized activities give rise to a biological phenomenon. According to Bich, the former supplies instruments to select rel-

evant phenomena and identify components situating processes in self-maintaining organizations. Conversely, it could benefit from uncovering different actual realizations of biological phenomena.

In the concluding section, Bich discusses two challenging implementations in biology. Both deal with the relationship between the organization and organismal limits, showing that the realization of closure does not automatically overlap with the latter. On one side, a somewhat functional integration in symbiotic relationships leads us to establish boundaries outside one organism. Even so, it does not imply denying that the organisms involved realize closure. It would be possible to describe nested integrated causal regimes. On the other hand, the environment poses similar issues. The organizational framework could be useful in interpreting the relationships between organisms and their surroundings. It could emphasize the system's regulatory capabilities and look at an ecosystem as having specific functions that specifically contribute to its maintenance.

Does *Biological Organization* fulfill its function of introducing the reader to the debate? This Element has been the most systematic introduction to organizational approaches since their emergence in scientific and philosophical discussions. Bich offers a clear and comprehensive view of how various authors have developed key organizational concepts, highlighting the problems these approaches consider critical. The treatise's openness to expansions of the organizational interpretation to other organismal and biological phenomena, rather than merely self-maintenance, shows the largely undeveloped opportunities of the approach. This book rightly stands out as an excellent preliminary instrument for rethinking our understanding of living, which is still overly dominated by evolutionary and gene-centric reductionism. However, it does not fully capitalize on its potential, since it does not provide sufficient contextualization of the approaches in the debate and an objective foundation of the notion of constraint.

One aspect unexplored is a precise defense of the "organization" in the current debates against rival paradigms. Bich focuses more on defending a *specific notion* of organization against other conceptions, rather than placing the organizational framework within a broader philosophical context. In the third section, he claims that OA provides an alternative to mainstream evolutionary and molecular biology (pp. 13-14). Nevertheless, he does not reserve enough space to compare the two perspectives on living,

without situating "organization" among other paramount biological concepts and showing differential epistemic opportunities. This introductory volume seems to have missed an opportunity. The reader would have benefited from general contextualization and a defense of the approach against other models.

At the same time, Bich highlights the framework's usefulness for the new mechanism, particularly in characterizing biological phenomena as *explananda* due to their relevance (p. 53). According to him, the notion of function provides criteria for selecting biological activities to be explained. Functions and constraints emerge from the background of disparate biological activities, setting them in an organization. However, there are critical issues with organizational functions (Garson 2017, Corti 2023) related to the possibility of objectively and observer-independently identifying relevant constraints (Cusimano & Sterner 2020). Bich offers one of the clearest expositions of organizational concepts in the literature, enriched with numerous concrete examples. Nevertheless, the objectivity of describing an item as a constraint bearing a function remains unquestioned as though it were self-evident. Especially considering the aim to distinguish living systems, a stronger foundation for the objectivity of these concepts is still needed, presenting an intriguing and urgent area for further organizational consideration.

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Useful link

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