Preface to

Angelo Marinucci, *Theoretical Principles of Relational Biology. Space, Time, Organization*, Springer, 2023, pag. Ix-xi

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A scientific turn is often a matter of a changing perspective, as a new way of looking at the same phenomena or area of knowledge from a new view point. This changing perspective may also be based on the choice of a different priority : same objects or conceptual structure but different epistemic evaluation of "what comes first". In a sense, the move from Pythagora's ontological priority of numbers to Euclid's geometry, based on axioms for "producing/tracing", says he, segments, lines, circles, parallel lines... sets different priorities : space symmetries precede numbers[1]. We all know what happened, two thousands years later, when some decided to look at the planetary systems from a different perspective, that is from the point of view of the Sun.

This book is based on an approach to life that does not look at individual organisms first, as biological objects, but gives epistemic priority to "the spaces of biological relations". An ecosystem is not seen as the result of interacting organisms, but organisms are analyzed as the result of ecosystemic relations. A tissue is not seen as a network of interacting cells, but cells are understood as components or the result of a tissue structure. What matters first is not what cells are, individually, but what they do, collectively, as a tissular network. Of course, this does not forbid to work on cells and on organisms, but always and first in a context, actually a historical context : an organism or an ecosystem are the result of a history and nothing can be understood of them without a historical perspective[2].

The book makes extensive references to physics, its history, its philosophy. As a matter of fact, the author first worked in those areas (Marinucci 2011, 2021). The references to physics allow to understand the methodological analogies and the theoretical differences. Typically, we learned from Einstein's General Relativity Theory the priority given to interactions over the abstract, "a priori" (or even absolute, Newtonian) space structure. To make it short, for GRT « the geometry of relativistic spaces is a tissue of interactions: when deforming these interactions, the tissue and its geometry change; conversely, a deformation of the geometry changes the interactions, their tissue » (Bailly, Longo, 2006). This relativistic approach to space geometry and the role of interactions is an explicit source of inspiration for the method driving the book. That is, this perspective, inspired from physics, is assumed by the author as a *method* to construct biological theories (for ontogenesis and phylogenesis), while it allows to depart radically from existing physical *theories*. The latter are grounded on invariant properties first, by which objects and their trajectories are defined in physical spaces, as geodetics in suitable "phase spaces" (spaces of pertinent observables and parameters)[3]. For the author instead, variation comes first and this in a space of changing relations, where it is impossible to fix a priori the pertinent observables and parameters. This may still allow to analyze individual organisms in an ecosystem or individual cells in a tissue, but after or only as a

1 Euclid's axioms maximize symmetries and proofs are based on rotations and translations, i.e. symmetries of the plane.

2 An organism can only be defined and analyzed as the result of a phylogenetic history (Lecointre, G., Le Guyader, H., 2001. *Classification phylogénétique du vivant*. Belin, 2006); but also the first questions a doctor must ask you concern your age and clinical history.

3 Einstein first baptized his approach "Invariantentheorie". As H. Weyl stressed: "all fundamental principles in physics are based on symmetry properties" – symmetries, as groups of transformations, are the mathematical frame for invariance preserving transformations.

component of the intended relational structure. The Tissue Organization Field Theory (Sonnenschein, Soto) is a paradigmatic example for the author.

Of course, this change of perspective has a long history. First Darwin, who proposed the two principles of heredity that allow to understand biological historicity: reproduction with variation and selection. Then the organicist perspective. The issue is to relate and enrich these two theoretical frames, by overcoming, in particular, some limits of the organicist approach, as stressed by the author. By the latter I mean a long tradition which goes back to Waddington and MacKlintock's epigenetics to Maturana and Varela's autopoiesis (Moreno A., Mossio M., *Biological Autonomy, a philosophical and theoretical enquire*, Springer, 2015), without forgetting their old philosophical antecedents: Kant and Bergson, in their diversity. And here comes a delicate issue. The autopoietic approach has been recently revised by the work by Montévil and Mossio (Montévil Mossio, 2015): the "closure of constraints" is an in depth analysis of how processes produce constraints that canalize/enable processes; this has been further extended to a "relational approach" in (Montévil Mossio, 2020). By the introduction of (characteristic) time and an opening to historicity (I insist on my preferred motto: "nothing in biology can be understood if not in the light of evolution" or, more, generally, "… in the light of time"), Montévil and Mossio first set the grounds for a link of an enriched autopoiesis to evolutionary change in novel terms. According to the author of this book, though, the stress on invariant structure of processes and constraints (their closure), though "relative and historical", does not allow to move to the radical "relational historicity" of life: in the book's epistemic view, *first* a relational space changing in time, *then* the temporary stability (historicized invariants) of closures of constraints, at the core of organisms' organization. In the author's words, the closure of constraints is viewed as a "historical empirical *a priori*" in relational spaces. The debate is open, starting from, I believe, the same anti-reductionist school of thought, yet with a further deepening of the relational perspective that may have an epistemological and scientific relevance: what comes first, conceptually? where to act first in experiments and knowledge construction? The example of the ethiology of cancer (origin, prevention and therapies), extensively mentioned in the book, is a paradigmatic case.

The book introduces several relevant new notions for biology, such as the notion of "thickness", as relating what is "possible" in a contingent context to the "real" enabled by it. An evolutionary niche enables a biological dynamics, while being changed by it; as the author stresses, enablement acts on "possibilities", as it makes "real" a possible process, a new organism for example. Thickness is a tool for the analysis of this passage on the grounds of existing organisms and phenotypes.

The book, by its extended references to physics, beautifully reinforces a strong anti-reductionist approach: it is the understanding of the rich history of physics, its theoretical audacity, such as the courage to radically change theory on the grounds of a change of scale (e.g. microphysics vs classical or relativistic theory), which helps the author to drive away from physical theories. Historicity and relationality of life are at the core of the approach, a strongly needed insight in a time where the ecosystemic relations are disrupted by a mechanistic approach to life that disrupts the historical fine tuning of species and organisms, a relational structures.