



Editorial

Renegotiating Disciplinary Fields in the Life Sciences

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The general problem around which this Special Issue revolves is that the way in which science is organized into specialties can have negative consequences on the progress of knowledge. Specifically, research priorities in biology and the circumscription of core concepts, both in biology and in the philosophy of biology, are very sensitive to the articulation of the Life Sciences in specialties.

The problems deriving from an inadequately critical attitude towards this issue affect biology as a whole due to the widespread lack of critical attitude, both in defending traditional disciplinary areas and in promoting new, or newly characterized and newly named, areas of research, often with an aggressive strategy.

In a well-documented and incisive article entitled 'Inclusion and Exclusion in the History of Developmental Biology', Nick Hopwood [1] demonstrates how the articulation of a science in specialties impinges on decisions on what the important problems are and how these must be addressed. This conditioning has a social dimension, as the division of a science into specialized disciplines very strongly affects the identity of a scientific community, and consequently the strategies of academic affirmation, and the criteria for the allocation of funds and the organization of undergraduate degree programs (see also [2,3]).

As soon as we become aware of the issue, action becomes possible. To use Hopwood's words [1] (p. 1), 'Disciplines are made, not found.' Quite a few disciplines, indeed, are simply defined on the basis of inclusion or exclusion criteria. This is more frequent in the case of ancient disciplines and those of an applied nature, e.g., in the domains of medicine and agriculture. There is nothing to blame, from an operational point of view, if individual researchers or institutions (including scientific societies and their journals) address sets of biological phenomena that only have in common the fact of dealing with the diseases of humans or domestic animals (human or veterinary pathology), or with crop plants, or aquatic animals relevant to fisheries. A very different thing, however, is to consider these disciplines as areas suitable for the development of general concepts, or theories, with regard to the living.

In the course of time, new disciplines emerge, generally characterized by a distinct set of problems or by a common technique, but often energetically pursuing less scientific targets such as the personal affirmation of a scholar or the creation of a new lobby aiming at success in the competition for funding and academic positions [1,4,5]. This must be seriously addressed if we wish to identify an organization of the biological disciplines that is able to stimulate and support the conceptual refreshment of the sciences.

To date, insufficient attention has been paid to the new perspectives that show up every time the boundaries between two or more disciplines are questioned or newly determined, often facilitating, in this way, the emergence of new questions, new research directions, and, in any case, helping to refresh notions and terms, including general and fundamental ones, which interest the philosopher no less than the biologist, such as individual, generation, development, reproduction, and evolution.

A collective effort is needed to move forward in this direction, which I hope the essays forming this Special Issue will contribute to. None of us are claiming to write a new biology, or a new philosophy of biology. Our pages, however, express an effort towards a vision of the living world that is both integrated and flexible in the identification of problems, concepts and their mutual relations.

Inevitably, it is difficult for each of us to avoid privileging the biological discipline to which we have devoted a lifetime of research. Even a scholar of the stature of Ernst Mayr, one of the most prestigious figures in evolutionary biology of the last century, insisted that there could not be a biology as a unitary science before the acceptance of an evolutionary vision of the living [6]—a questionable statement that neglects the importance of the cellular theory, as formulated by Schwann [7] ca. 20 years before the *Origin* [8]: ‘it may be asserted, *that there is one universal principle of development for the elementary parts of organisms, however different, and that this principle is the formation of cells. [. . .]* The development of the proposition, that there exists one general principle for the formation of all organic productions, and that this principle is the formation of cells, as well as the conclusions which may be drawn from this proposition, may be comprised under the term cell-theory.’ ([9]; pp. 165–166; italics as in the original). The insistence on the role of evolutionary theory as a unifying principle of biology also overshadows another great merit of Charles Darwin, naturalist extraordinaire, who developed his works, including the *Origin*, on a documentary basis, without taxonomic restrictions.

This Species Issue includes five contributions. In their diversity, both the topics addressed and the approaches adopted to address them, these articles will hopefully stimulate further exploration towards an improved articulation of the Life Sciences at the service of both science and philosophy.

My main intended message in ‘Disciplinary Fields in the Life Sciences: Evolving Divides and Anchor Concepts’ is that advances in both biology and the philosophy of biology will benefit from a degree of flexibility in the way in which problems’ agendas [10] are organized around (and through) concepts: this may require adopting unconventional perspectives and arguably, as suggested by other articles in this collection, a degree of pluralism too.

Indeed, Igor Pavlinov defends in his essay, a ‘Multiplicity of Research Programs in the Biological Systematics: A Case for Scientific Pluralism’. Moving from a general philosophical position dominated by ideas of contemporary conceptualism and evolutionary epistemology, Pavlinov defends taxonomic pluralism. Biological diversity explored by biological systematics is a complex yet organized natural phenomenon that can be partitioned into several aspects, defined naturally with reference to various causal factors. These aspects are studied by research programs based on specific taxonomic theories. According to Pavlinov, each taxonomic theory is characterized by a unique combination of interrelated ontological and epistemological premises, which are most adequate to address one aspect of biological diversity. Phenetic, rational, numerical, typological, biosystematic, biomorphic, phylogenetic, and evo-devo research programs in systematics are recognized. From a scientific pluralism perspective, all of these research programs are of the same scientific significance, as possible parts of a generalized faceted classification.

The main message of Chris Fields and Michael Levin’s paper titled ‘How Do Living Systems Create Meaning?’ is that the fundamental goal of Life Sciences is to understand how living systems create meaning. The authors discuss this question at multiple scales, from molecular interaction networks to the biosphere. Their focus is on identifying and understanding the roles of the reference frames that systems use, at each scale, to interpret their inputs. This involves understanding attention, memory, and the representation of *self* at multiple scales. From the perspective of disciplinary boundaries, Fields and Levin try to dissolve the one between biology and cognitive science.

In ‘Evo-Devo: An Ongoing Revolution?’, Salvatore Ivan Amato discusses the epistemological status of Evo-Devo as a theory. Evo-Devo has been considered as a new paradigm, a new research program or a revolutionary science within biology, but the variety of stances within this field makes it difficult to establish whether we are facing a new evolutionary synthesis. What is desirable is an adequate problematization of development, which can help clarify the relationship with both evolution and inheritance and take it one step further in the search for the identity of Evo-Devo.

Rolf Rutishauser revises ‘The Past and Future of Continuum Plant Morphology’ from a process-thinking perspective that allows to perceive and interpret growing plants as developmental continua, as process combinations rather than as assemblages of structural units (“organs”) such as roots, stems, leaves, and flowers. This philosophical perspective was already favored by Agnes Arber

(e.g., in her book on *The Natural Philosophy of Plant Form* [11]), and by Rolf Sattler, who first proposed his continuum approach in plant morphology exactly 50 years ago. This dynamic approach, known as continuum plant morphology, allows developmental geneticists and evolutionary biologists to move towards a more holistic understanding of multicellular plants in time and space.

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