Editorial Introduction: Bridging the Philosophies of Biology and Chemistry

Joachim Schummer

Whether philosophy of chemistry will eventually survive and grow, essentially depends on if it establishes itself as an academic field at universities with own chairs devoted to that field. That can happen either if it meets essential teaching needs, such as in ethics of chemistry, or if it develops entirely new insights on science that are of general importance, or both. Being a gathering place or refuge for second-class philosophy of physics, still surfing the century-old, but gradually dying, quantum-mechanics wave, will not suffice in the long run. Neither will be the discussion on whether physical theories can explain certain chemical phenomena, which is, of course, not a matter for philosophers to decide, but for chemists. The current pandemic is both a call and a chance to wake up and have a broader look at both chemistry and philosophy in order to identify what matters to both fields at the interface.

This journal has tried to identify, describe, and foster a broad range of fields and topics, many of which are still waiting to be dealt with by future philosophers of chemistry, through its numerous special issues for more than two decades. In particular, its Calls for Papers have described dozens of topics that are still unaddressed, including those for the special issues on modeling, ethics, aesthetics and visualization, nanotechnolgy, public image, mathematization, ethical case studies, and eventually our call to bridge the gap between the philosophies of biology and chemistry. The underlying idea has not only been to point to important issues of the philosophy of chemistry, but also to dissolve the ossification of the received philosophy of science, dominated by physicists who have strangely reproduced and entrenched themselves for many generations in philosophy departments.

Whereas philosophy of biology emerged in the 1970s as a field independent of the philosophy of science/physics, with much support from biology departments, philosophy of chemistry emerged a decade later and much slower with near to no support from chemistry departments. Even at a surface level there are many scientific commonalities between chemistry and biology, such as the focus on classification (of chemical and biological species, respectively), the plurality of models for explanation and prediction

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(rather than the longing for a Theory of Everything), and a similar and overlapping laboratory practice, as well as a molecular theory that makes it at times even difficult to distinguish between biochemistry and molecular biology on conceptual rather than on socio-historical grounds. Moreover, it even becomes a matter of taste if certain strands of, say, synthetic biology, belong to biology rather than to chemistry. Against the background of the actual scientific practice, the generations-old attempts by physicists to build a wondrously direct bridge from physics to biology, which completely omits chemistry, appears as one of the great mysteries of mainstream 'philosophy of science'.

The present special issue on 'Bridging the Philosophies of Biology and Chemistry' has emerged from a conference of the same title, originally planned by Jean-Pierre Llored, Michel Morange, and myself, and which eventually took place at the University Paris, France, 25-27 June 2019. When Michel unfortunately dropped out for health reasons, Quentin Hiernaux and Cécilia Bognon-Kuss joined the organization team. The present collection is only a very small selection of the papers from that conference, providing just an outlook of what is possible in the future, and what was sketched in our Call for Papers.

Historical approaches between biology and chemistry, if not literal coincidences or overlap of research, are so numerous that there is ample material for historical case studies. An early example from the late 17th century, long before the disciplinary distinction, is G.W. Leibniz' concept of organism, which Miguel Escribano Cabeza explores here, based on primary sources, to illustrate a convergence between, in our terms, chemical and biological concepts. In contrast, Ute Deichmann analyzes a period in which chemistry and biology, as independent disciplines, generated first what came as close as possible, in the middle of the 20th-century molecular biology, when the helical structure of DNA was elucidated, but then went into opposite directions, exemplified by the different theories by Francis Crick and Linus Pauling.

Since then, biomolecules, especially polynucleotides and proteins, have been at the crossroads of biology and chemistry. Against the age-old distinction between process philosophy and substance philosophy Stephan Guttinger bridges a very important gap between the process-ontology of living beings and that of bio-molecules, by focusing on the laboratory practices that turn processes into temporarily stable states. Grant Fisher elaborates in his paper on stem cells as a prospective means for toxicological studies of chemicals, a substitute for animal and human experiments, to point out the manifold obstacles, both epistemological and ethical, that would continue from previous debates on stem cell research.

Massimiliano Simons finds in current, chemistry-driven synthetic biology a move towards a universal biology that seeks to understand all possible liv-

ing beings, rather than an inventory of currently available forms of life. That corresponds to the knowing-through-making paradigm of synthetic chemistry, which Joachim Schummer shows to have been at work for long in both chemistry and biology in order to initiate an overdue comparative epistemology of the sciences.

I close this editorial not without pointing to a volume, *Ethics of Chemistry: From Poison Gas to Climate Engineering*, just published by World Scientific Publishing, and which draws on previous papers of *HYLE* that were composed to provide, at long last, educational material for teaching ethics to chemistry students. As Roald Hoffmann comments: "This book is the one chemistry has been waiting for – a readable and instructive guide to thinking through the ethical consequences of chemical action."

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Editor of HYLE, editor@hyle.org