

# CALL FOR PAPERS

First International Conference on

## **Bridging the Philosophies of Biology and Chemistry**

25-27 June 2019

University of Paris Diderot, France

Extended Deadline for Abstract Submission: 28 February 2019

The aim of this conference is to bring philosophers of biology and philosophers of chemistry together and to explore common grounds and topics of interest. We particularly welcome papers on (1) the philosophy of interdisciplinary fields between biology and chemistry; (2) historical case studies on the disciplinary divergence and convergence of biology and chemistry; and (3) the similarities and differences between philosophical approaches to biology and chemistry. Philosophy is broadly construed and includes epistemological, methodological, ontological, metaphysical, ethical, political, and legal issues of science.

For a detailed description of possible topics, please see below and visit the conference website <http://www.sphere.univ-paris-diderot.fr/spip.php?article2228&lang=en>

### Instructions for Abstract Submission

Submit a Word file including author name(s), affiliation, paper title, and an abstract of maximum 500 words by 28 February 2019 to Jean-Pierre Llored ([jean-pierre.llored@linacre.ox.ac.uk](mailto:jean-pierre.llored@linacre.ox.ac.uk)).

### Registration

If you are interested in participating, please register by sending an e-mail to Jean-Pierre Llored ([jean-pierre.llored@linacre.ox.ac.uk](mailto:jean-pierre.llored@linacre.ox.ac.uk)) before 30 April 2019.

### Venue

Room 454A, Building Condorcet, University Paris Diderot, 4, rue Elsa Morante, 75013 Paris, France

### Sponsors

CNRS; Laboratory SPHERE, Laboratory LIED, and Department of History and Philosophy of Science, University of Paris Diderot; Fondation de la Maison de la Chimie; Free University of Brussels; University of Lille

### Organizers

Cécilia Bognon, Quentin Hiernaux, Jean-Pierre Llored, Joachim Schummer

# Bridging the Philosophies of Biology and Chemistry

25-27 June 2019, University of Paris Diderot, France

## Description

### Background

For much of the twentieth century, philosophy of science had almost exclusively been focused on physics and mathematics. Other scientific disciplines were considered only in case studies that should support ideas of so-called general philosophy of science, which was largely a debate on the progress of physics, and especially of theoretical physics, across the conceptual shifts from classical mechanics to relativity theory and quantum mechanics.

Dissatisfied with that one-sided focus on physics, scientists, historians of science, and philosophers, usually with a background in another discipline, developed philosophical approaches to other sciences in the late 20th century. Philosophy of biology emerged in the 1970s, philosophy of chemistry in the early 1990s, and many others would follow soon. Nowadays almost all larger scientific disciplines have their own philosophies, which are largely disconnected from each other.<sup>1</sup> They each explore conceptual, epistemological, methodological, ontological, metaphysical, ethical, aesthetic, etc. issues of their particular discipline. This situation was foreseen by Bachelard who once stated that “[e]ach interesting problem, each experiment, or even each equation required a philosophical reflection of its own”.<sup>2</sup> Apart from the common involvement in philosophies of new interdisciplinary fields, such as nanotechnology and bio-nanotechnology, and sometimes in the framework of ethics committee as well, the interaction between philosophers of different disciplines is much underdeveloped. As a result, philosophers belonging to one domain usually ignore a great part of the work done by their colleagues in another domain, which prevents them from studying the way those sciences influence one another, and from implementing new research cooperations, which could turn out to be of importance in order for them to scrutinize those sciences from a philosophical standpoint.

After a period of the emergence of various philosophies of sciences it appears overdue to take not only stocks but also to find new ways to connect the manifold philosophical approaches. This workshop, which is the first of its kind, aims at building bridges between the philosophies of biology and chemistry by exploring common grounds or topics of interest on both the level of philosophical approaches and the level of interdisciplinary fields between biology and chemistry.

### Intermediary/interdisciplinary fields

There are various interdisciplinary research fields bridging biology and chemistry, *e.g.* biochemistry, bioinorganic chemistry, biomimetic chemistry, geochemistry, medicinal chemistry, pharmacy, (eco)toxicology, molecular biology, chemical ecology, synthetic biology, chemical evolution (historical origin of preforms of life), supramolecular chemistry, medicine, and environmental science. Furthermore, many chemical projects and teams are now integrated into biology departments in universities all over the world and thus depend on them. In addition, methods and tools originating from ecology and biology, as for instance the life cycle analysis, are now used by green chemists who are gradually learning how to use and improve it in order to integrate eco-conceptions in chemistry. This double context, first of the emergence and stabilization of a wide range of intermediary and interdisciplinary fields entangling biology and chemistry, and second of the reorganization of the chemical research done in biology

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<sup>1</sup>Fritz Allhoff (ed.), *Philosophies of the Sciences: A Guide*, Blackwell-Wiley, 2010; Thomas Reydon & Simon Lohse (eds.): *Grundriss Wissenschaftsphilosophie. Die Philosophien der Einzelwissenschaften*, Hamburg: Meiner, 2017.

<sup>2</sup>Bachelard Gaston, *The Philosophy of No*, Trans. G. C. Waterson, New York: Orion, 1968, p. 40. [*La philosophie du non: Essai d'une philosophie du nouvel esprit scientifique*, Paris: Presses Universitaires de France, 1940.]

## *Bridging the Philosophies of Biology and Chemistry*

departments, requires new philosophical investigations at least in order to check how, and to what extent, this new coexistence changes the way biology and chemistry are currently done. Following this line of thought, philosophers could address specific issues, among them are:

- (1) Biologists have supplied mechanistic descriptions of proteins (macromolecules) as nanomachines. More recently, a statistical description of protein folding and protein transconformation has become dominant. Has a similar transformation also occurred in chemistry? More and more chemists are working on 'biological objects'. Does it mean that the boundary between biology and chemistry is presently shifting?
- (2) How do intermediary and interdisciplinary new domains or practices bridge biology and chemistry?
- (3) Which disciplinary perspectives and resources do they combine?
- (4) Do they develop new, intermediary concepts that are independent of both biology and chemistry or do they recombine existing concepts in a creative manner?
- (5) How are the different inferences drawn from chemical and biological experiments integrated into one report in order to address a specific question?
- (6) Do those interactions transform chemical and biological types of reasoning and do they transform the way the practitioners give sense to what they do, and if so in what manner?
- (7) Can those interactions be usefully described and understood by Kuhn's, Lakatos's, Popper's or any other received description of the way knowledge evolves in science? Or, by contrast, do they pave the way for a new understanding of the production, stabilization, and evolution of scientific knowledge?

### **Epistemological and methodological issues**

Another group of issues about which the workshop aims to provide insights deals with the differences and resemblances between both the types of knowledge and methods used by chemists and biologists in their specific laboratories. To do so, we will ask the following questions:

- (1) Biology and chemistry stand out among all the sciences by having developed the by far most powerful classifications, including taxonomies and the periodic table of elements. What are the commonalities and differences of these classifications and their underlying concepts of species, property, similarity, supporting theories, etc.?
- (2) Are biology and chemistry each striving for a unified and reductionist master theory, such as physics, or do they follow methodological pluralism of a variety of models tailored to certain epistemic needs and based on interdisciplinary exchanges?
- (3) Do biology and chemistry differ in their way of developing and stabilizing concepts, models, theories, nomenclatures, pictures and representations, instruments, and laboratories? Do they have different forms of experimentation, explanation, representation, and prediction? Do they differ in their use of quantitative concepts and the degree of mathematization? Following this line of questioning, a comparison between the representations (of processes and objects) in chemistry and biology would be particularly interesting.
- (4) A recent trend in biology has been to focus on 'systems' (systems biology) and to reject the previous forms of reductionism. Systemic approaches are developed in chemistry as well, as it is the case for instance in green chemistry and supramolecular chemistry. Is it possible to establish a parallel between those activities? Are 'systems' defined and understood in the same way by biologists and chemists? What is the epistemological status of such 'systems'? How is this notion related to that of 'network' in biological and chemical research programs? Are systems and networks only metaphors in chemistry and biology?

## *Bridging the Philosophies of Biology and Chemistry*

- (5) Genetic determinism has played a central role and is still exerting a strong influence on the way biology is used for understanding certain diseases. The role of genetic information is characteristic of biology. A recent approach, namely epigenetics, develops a wider scheme in which apart from genes other factors have an impact on the expression of genetic information, and thereby shape cells, tissues, and the relationships between the environment of the organism under study and the organism itself. Also chemists are talking about ‘molecular information’ in supramolecular chemistry or whenever they design what they call ‘a chemical computer’ and a ‘molecular logic’. Is it possible to compare the mutual dependence of a chemical and its surroundings in chemistry with the epigenetic approach in biology and, more broadly speaking, to draw stronger parallels between the domains of chemistry and biology in which information is of primary importance? How has the notion of information been *translated* from information theory to biology and chemistry?
- (6) What is the role of historical and teleological/functional explanations in biological and chemical research practice? How is that represented in their respective scientific self-image and philosophical understanding?
- (7) Has biology, as many have claimed, recently followed chemistry’s earlier move from an analytic to a synthetic approach (particularly in synthetic biology) based on the *verum-factum* principle (“knowing-through-making”)? Moreover, the significance of synthetic biology is heavily debated in biology. How do chemists consider this new discipline?
- (8) What particular forms of graphic/pictorial tools and sign languages have biologists and chemists developed for representing their knowledge? Do they essentially differ from each other or do they overlap and inspire each other to a certain extent?
- (9) What are the wholes/parts strategies, i.e. the way in which something is divided up in parts and in which parts are said to build up wholes, used both in chemistry and biology? Are they similar? What do those strategies tell us about the way biologists and chemists understand and describe the world? Are those forms of mereology compatible with the conclusions drawn by holistic and reductionist approaches from wholes and parts or, by contrast, could they enable philosophers to overcome the holism/reductionism dichotomy and, if so, in what manner?

### **Ontological and metaphysical issues**

- (1) How do (philosophy of) biology and chemistry conceptualize their basic entities? Do they favor an individualist, relationalist, structuralist, functionalist, or systems approach? What is the relevance of the ontological category ‘property’ for chemistry and biology? Do chemists and biologists favor manifest or dispositional properties? Do they favor substance ontology, affordances and dispositions ontology, or process ontology? Do they believe in natural kinds or in nominalism?
- (2) A relational understanding of chemicals and life is arising in many domains of chemistry and biology, including for instance in ‘integrative chemistry’ and ‘sustainable chemistry’ on the one hand, and in epigenetics, biohermeneutics, the study of plants, and geochemistry on the other. Those approaches rely on ‘the mutual dependence of a chemical or of an organism and its surroundings.’ Some philosophers<sup>3</sup> start using the concept of ‘associated milieu’, coined by the philosopher of technology Gilbert Simondon<sup>4</sup>, in order to insist on the fact that a ‘milieu’ should not be understood as something already given, but rather as that complement of the individual that is brought into being by processes of individuation. Is the ‘milieu’ in which a chemical is synthesized or introduced, or in which an organism is living

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<sup>3</sup> Llored, J.-P., “Investigating Consistencies, Inconsistencies, and the Meaning of the Ceteris Paribus Clause in Chemistry”, *Humana Mente, Journal of Philosophical Studies*, 2017, Vol. 32, 53–74.

<sup>4</sup> Simondon Gilbert, *L’individuation à la lumière des notions de forme et d’information*, Paris: Presses universitaires de France, 1964.

## *Bridging the Philosophies of Biology and Chemistry*

just a place detachable from the body under study, or, by contrast, an active element of its constitution? Do chemicals and living beings consist in a provisional unity of interactions or processes in particular ‘associated milieu’? Is the *modus operandi* of their actions upon other bodies, and through the action of other bodies upon them, the only possibility we have to clarify their ontological status? Is this milieu dependence a starting point for developing a relational approach of the concept of structure in biology and chemistry as well? Is the concept of ‘milieu’ useful to unify different domains of science?

- (3) What is the meaning of causation in (philosophy of) biology and chemistry? Is it similar to the deterministic concept of physics? Or is causation a pluralistic concept that can involve structure and function besides efficient causes?
- (4) If chemicals and living beings of different kinds depend, even partly, on the way the surrounding acts upon them or on the way they act upon what surrounds them, the phrase “all other things being equal” is difficult to apply in chemistry and biology in the case of changing individual context factors because factors mutually depending on each other change at the same time. What is the status and the meaning of the *Ceteris Paribus* clause in chemistry and biology? Do they depend on particular types of metaphysics and epistemology?
- (5) How do (philosophy of) biology and chemistry deal with physicalism, the powerful reductionist notion that all real entities and all truly scientific approaches belong to physics? Do they ignore it, develop counter-reductionist approaches, or do they have their own reductionist positions, such as biologism and chemicism?
- (6) How do (philosophy of) biology and chemistry distinguish between natural and artificial or between nature and technology? How could the study of the natural/artificial dichotomy from the standpoint of chemistry and biology enable philosophers to renew their understanding of science and technology?

### **Historical case studies on the separation and convergence of biology and chemistry**

- (1) During the 19th century, chemists, biologists, and physicians were commonly involved in various big debates (*e.g.* on vitalism, the possibility of spontaneous generation of life, the nature of fermentation, the causes of infectious diseases).<sup>5</sup> How did they manage to cross the then already existent disciplinary boundaries? Why did that tradition of cross-disciplinary big debates fade?
- (2) How did general ideas – such as evolution, emergence, imitating nature, systems approaches, and reductionism/physicalism – as well as other disciplines – such as medicine and physics – contribute to the separation/integration of biology and chemistry?
- (3) How did biochemistry and molecular biology split? Was the adoption of the information paradigm by molecular biology the essential move as many have claimed? Are recent approaches to introduce the information paradigm into (supramolecular) chemistry (“molecular recognition”) moves towards convergence?
- (4) How do chemists and biologists work together in industrial, academic, and governmental or international institutions? How do they interact with toxicologists and ecotoxicologists in institutions dedicated to chemical regulation, as it is the case for instance within ECHA (the European Chemical Agency) in the framework of REACH?
- (5) The question of the origin of life is particularly important to appreciate the potential epistemological convergences and divergences between biology and chemistry. How do

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<sup>5</sup> Joachim Schummer: “Chemical versus Biological Explanation: Interdisciplinarity and Reductionism in the 19th-Century Life Sciences”, in: Joseph E. Earley (ed.), *Chemical Explanation: Characteristics, Development, Autonomy*, New York (*Annals of the New York Academy of Science*, Vol. 988) 2003, pp. 269-281.

## *Bridging the Philosophies of Biology and Chemistry*

chemistry and biology interact for investigating the origin of life? How does this interaction change our understanding of both the emergence of life and its evolution?

- (6) What is or are the role(s) of biology and chemistry in the rise of the environmental sciences?

### **Ethical Issues**

Chemicals change the relationships we have with our body, ourselves, the other forms of life, and the Earth. In this sense, they take actively part in our life and the constitution of what we are. The way they intervene upon us and are inside us, the way they enable us to change ourselves and the world imply that they are not simply 'external objects or products', rather they constitutively shape us, which has many ethical implications. Ethical issues to be addressed include:

- (1) Biologists and chemists have both been involved together in many ethical issues of public concern, including animal experiments, genetic engineering, patenting DNA, attempts at creating artificial life, human enhancement, food safety, human health, etc. How did (philosophy of) biology and chemistry respond to public concerns?
- (2) How is ethics integrated in the philosophies of biology and chemistry? Or do both follow an ethics-free understanding of philosophy of science after the model of the philosophy of physics?
- (3) How can the philosophies of biology, ecology, and chemistry be of help for environmental ethics and for the philosophy and the anthropology of nature<sup>6</sup>?
- (4) How can the philosophies of chemistry and biology interact with moral philosophy for discussing, for instance, utilitarian approaches of technology or the ethics of care<sup>7</sup>?
- (5) What are the relationships between ethics and chemistry, and especially the kinds of ethical principles and arguments to which chemists and policy-makers have referred since the 19th century? What are the roles played by ethical principles in chemical regulations, and especially by the Precautionary Principle in the emergence of REACH?
- (6) What are the relationships between ethics and biology, and especially the kinds of ethical principles and arguments to which biotechnologies have referred so far?
- (7) Do the relational approaches developed by a growing number of chemists, biologists, and philosophers weaken the argument of the intrinsic value of life from an ontological standpoint while opening the door for a pragmatic new understanding of this argument?
- (8) How can the philosophies of chemistry and biology help investigate sustainability and biodiversity? How can they help investigate the rise of an eco-friendly turn in sciences and technology?

### **Political and juridical issues**

As disciplines, chemistry and biotechnologies are also permanent sources of new unknowns, which justifies our paying special attention to the risks they potentially raise for us, and for other forms of life. Following this line of investigation, many questions have to be addressed, as for instance:

- (1) How can the philosophies of chemistry and biology be of help to clarify the definitions of risks, hazards, substances, organisms, among many other key concepts upon which regulations, environmental policies and laws rest? How can they contribute to policy making?

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<sup>6</sup> Llored, J.-P., "How Philosophy of Nature needs Philosophy of Chemistry", *Philosophica*, 2016, Special issue "Thinking Nature Today", Vol. 47, 93–108.

<sup>7</sup> Llored, J.-P. & Sarrade, S., "Connecting the Philosophy of Chemistry, Green Chemistry, and Moral Philosophy", *Foundations of Chemistry*, 2016, Vol. 18, n° 2, 125-152.

*Bridging the Philosophies of Biology and Chemistry*

- (2) How can philosophers of chemistry and biology interact with law experts in order to improve the efficacy of regulation and to implement sustainable development?
- (3) How can philosophers of chemistry and biology interact together with political philosophers to develop new models of public debate and deliberative forms of democracy in which all stakeholders have the same right to take part in the decision-making about science and technology?
- (4) How could the epistemology of the models used in medicine and quantum chemistry, drugs design, ecology and ecotoxicology, as for instance in risk assessment using QSAR (Quantitative Structure Activity Relationships) models, play a role in the way modelling is used and understood by governments in order to make environmental and health policy decisions?
- (5) How could the philosophies of biology and chemistry promote the reconceptualization of concepts, such as emergence, discovery, and innovation, by integrating the pragmatic, socio-political, technological, and institutional conditions of chemical and biological research into the philosophical reflection about those concepts, in order to face the environmental and social issues of our time?

*Composed by Jean-Pierre Llored, Michel Morange, and Joachim Schummer*