Editorial

Special Issue on 'General Lessons from Philosophy of Chemistry' on the Occasion of the 20th Anniversary of HYLE

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The 20th anniversary of HYLE has been an occasion for me to regroup the Editorial Board of the journal, which, with the exception of Giuseppe Del Re, who unfortunately passed away in 2009, had not been changed almost from the beginning. Over the past two decades, philosophy of chemistry has seen the emergence of many new research fields, regional activities across the world and, of course, a new generation, but also the decline of activities of other countries and individuals. The editorial board of an international journal of a vibrant discipline needs to reflect and honor all those developments, perhaps much more flexibly than that has been done in the past.

A warm welcome to the new members of the Editorial Board: Hasok Chang, Joseph E. Earley, Robin F. Hendry, Mi Gyung Kim, Ursula Klein, Olimpia Lombardi, Guillermo Restrepo, Carsten Reinhardt, and Tami I. Spector. They replace members who have served on the Board almost from the beginning and whom I would like to thank for their support and work: Martin Carrier, Peter Janich, Michael Heidelberger, Paul Hoyningen-Huene, Vladimír Karpenko, and Hans Lenk.

Before I introduce the papers of our anniversary issue, I would like to reflect on the past 20 years and point out some of the challenges and obstacles that both the field and the journal had to overcome, which may be of general interest.

It is worth recalling that before the launch of HYLE, the first ever journal worldwide devoted to the philosophy of chemistry, it was extremely difficult to publish a paper on philosophy of chemistry in so-called philosophy of science journals. Their editorial teams considered it at best a contribution to a minor subfield of philosophy of physics. (That tradition is still alive in extraordinarily conservative organizations when they mistakenly subsume chemistry under the label of 'physical sciences'.)[1] If the paper did not meet the taste of the philosophers of physics and contribute to one of their de-

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bates in the form of a 'case study', it hardly had a chance to be accepted. Reductionism in its most naive and unquestioned form was the hidden agenda of an editorial practice, and a political strategy to defend a territory in publishing, lecturing, and recruiting university staff.

The hegemony affected not only the philosophy of chemistry but that of any discipline other than theoretical physics, and it helped promote extremely narrow views in the disguise of 'general philosophy of science'. Because their favorite discipline posed hardly more than two philosophical issues – the logical analysis of scientific sentences and the choice between two competing theories – logic as well as formal epistemology and methodology became their central topics, later enriched by the metaphysics of elementary particles. Ignoring the rich diversities of both scientific disciplines and philosophical subdisciplines, repelling any innovation from the outside, mainstream philosophy of science turned into an esoteric field which received scorn and scoff even from famous theoretical physicists, such as Steven Weinberg (1994).

The stronger the impact of science on societies, on their intellectual, moral, and technological foundations, the more is its philosophical understanding of societal importance. It was therefore overdue to help philosophy of science getting out of its dead end, liberate it from its esotericism, open its mind to the full diversity of research fields, practices, and problems, and direct it towards issues that are important to both contemporary scientists and the general society. Philosophy of biology had already taken a lead in that regard in the 1970s before philosophy of chemistry emerged in the 1990s. In the meantime all major disciplines have formed their own circles of distinct philosophical reflections, such that it is fair to speak now of the 'philosophies of the sciences' (Allhoff 2010) rather than using the mistaken singular. The future experts in the yet to be developed general philosophy of science can no longer treat just a handful of theories with one or two approaches from logic, and then boldly claim that such very particular views would be of general interest. Instead they must be knowledgeable in the full spectrum of scientific disciplines and their diverse research practices and have a command of all fields of philosophy, including ethics, aesthetics, and political philosophy, as well as of technology and the history of science. The present issue on 'General Lessons' is only a small contribution to such future work.

HYLE started in 1995 as the Bulletin of the German Working Group for Philosophy and Chemistry (GWGPC), which was founded in 1993, with a small print run distributed for free and sponsored by the University of Karlsruhe (now called KIT). At that time philosophy of chemistry had gained a strong momentum in Germany by two further initiatives. On the one hand, Peter Janich and Nikos Psarros organized a series of symposia on the philosophy of chemistry at the University of Marburg in 1993, 1994, and 1996, in

addition to the series of conferences organized by the GWGPC in 1993, 1994, and 1995, both of which grew international. On the other, the German chemical industry, as an effort to improve its public image, generously sponsored a program 'Chemistry and the Humanities' with conferences in 1991, 1993, 1995, and 1997, which attracted both established national philosophers and chemists, and with PhD scholarships and printing grants for young scholars working in the field. With eight national conferences between 1991 and 1995, out of which six published conference proceedings emerged, the scholarly environment in Germany was then particularly apt for launching a journal devoted to philosophy of chemistry. It simply had to be done.

The early years were indeed groundbreaking work that had to overcome many obstacles and meet unexpected challenges. Note that the launch was still before the rise of the Internet for most of us. By painstaking bibliographic searches in many languages, by asking friends who know friends who know friends, by time-consuming snail-mails around the world, and by accidental meetings at international conferences, a loose international network only slowly emerged. It turned out that some other small national groups had recently been formed, particularly in the Netherlands, Italy, Poland, and the UK, apart from several solitary scholars in many countries, as I had been myself before when, after a double graduation in chemistry and philosophy, I had worked on my PhD dissertation in the philosophy of chemistry.

To illustrate the communication troubles of the old days, I may share the story of how I made first contact with Steve Weininger in 1993. In an unpublished manuscript Roald Hoffmann had sent to me, I found a reference to an unpublished manuscript on the semiotics of chemistry written by Stephen J. Weininger, Worcester. Thus, I immediately wrote a letter to the University of Worcester, UK, asking Steve for the manuscript. When I received it about four months later, I learned that he was actually based at the Worcester Polytechnic Institute in the US, to which my letter was forwarded. However, he happened to be then on sabbatical at a UK university, to which his home institution forwarded the letter. Yet, he could send me the paper only after his return to the US, such that my letter crossed the Atlantic ocean three times. The communication within Europe was not much better. A snail-mail from Germany to Italy or Spain took two or three weeks, if it arrived at all. To Guiseppe Del Re in Italy and Jaap van Brakel in Belgium, who were both external referees of my habilitation, we had to send my thesis twice because the first mails simply got lost.

When the philosophy department of my university was eventually connected to the still rudimentary Internet in 1996, I set up a website of the journal on the same day. It was crystal clear that the Internet was a unique opportunity to build a 'critical mass' in a small field by connecting a scattered international community of scholars with one another, almost as if they were

neighbors. In 1997, the Bulletin turned into an international journal with a distinguished Editorial Board and a first issue of invited papers all written in English.

During the first decade, the majority of scholars, particularly among European philosophers of the established generation, did not welcome the Internet. Lack of computer skills and curiosity, conservative attitudes towards any new technology, skepticism about the quality of anything available for free, an aesthetic affinity to printed and bound paper, or whatever excuse for ignoring novel developments let them stay in the dark. To deal with these human follies, HYLE continued to appear in print up to 2006 in the form of annual volumes which collected the issues that had previously appeared electronically during the year. That required tremendous efforts, however. Because open access was indispensable, indeed the very idea of the scholarly use of the Internet, no commercial publisher would then have done the work. Therefore, we registered an own publishing company, let the copies be produced by a printer and shipped them from Germany to the Philosophy Documentation Center in the US, who did the international distribution and subscription service. Since 2007, when the Internet had gradually become accepted by the majority of philosophers – largely through the retirement of the old generation – HYLE has been published online only and, despite many offers from distinguished publishing houses after the journal was included in the Science Citation Index Expanded, open access. To illustrate the early difficulties of electronic publishing (see also Schummer 2008): of the first generation of philosophy e-journals worldwide only two have survived: HYLE and *Techné*, which in 2010 stopped open access, strangely enough, on the demand of its scholarly society.

The Internet enabled a form of internationality that the humanities were not prepared for. What had been taken for granted since many decades in the sciences, did hardly exist there in the early 1990s, apart from post-colonial networks. A journal that was distinctively devoted to internationality and aimed at engaging scholars from both the sciences and the humanities did not only face problems of interdisciplinarity (see below) but also severe language barriers. For instance, the average German or French philosophy professor had then written and read about as many publications in a foreign language as the average American or British philosophy professor has done so nowadays. Because artificial languages such as Esperanto could unfortunately never prevail, and because at least the scientists had some command of it, we decided in favor of English as the *lingua franca* of philosophy of chemistry, being well aware of the risks of cultural bias and the unjust benefit for native English speakers that many just took for granted. Others had to learn a foreign language at a level sophisticated enough to express new philosophical ideas. Moreover, they typically suffered from local disregard of their work, which

affected the career opportunities of young scholars. For instance, when Italian, French, Spanish, or German authors published a paper in English, that was hardly read and acknowledged by the humanities colleagues from their home countries, particularly not by the 'honorable' department chair who typically lacked both basic language and Internet skills. It was about the same as if today a British scholar publishes a paper in Spanish and wonders why his local colleagues ignore it.

The challenge of internationality is particularly strong in philosophy, beyond the language barrier. There are at least as many understandings of what philosophy is, and what the criteria are to judge the quality of philosophical work, as there are cultures. Each has its own historical heroes who once posed questions that have ever since been considered central to their philosophy, who developed styles of reasoning and argumentation that became models for the following generations within that culture. Much of philosophy is still about defending such cultural identities by doing endless commentating and commendatory work on their heroes, and frequently there are many such identities or schools within one culture who bitterly fight each other. Fortunately, our field has the advantage of being related to a science, about which cultural differences are comparatively small. Nevertheless, cultural bias remains a big problem for every truly international journal in the humanities, such that it is good practice to let a paper being reviewed by one referee from the same culture (or school) as the author.

The biggest problem has ever since been interdisciplinarity, however. There are perhaps no other two disciplines that are more alien to one another than chemistry and philosophy. While the lack of interest in chemistry by philosophers (of science) is largely because of their one-sided focus on theoretical physics and their extremely conservative attitude, which dismisses any issue that had not already been raised by their heros of the past, the other side of the alienation is not so clear. Any historical explanation will have to deal with puzzling facts. Recall, for instance, that the term 'philosopher' was for many centuries widely used to denote an alchemist, as it is nowadays still done in 'the philosopher's stone', and similarly in French (*la pierre philosophale*), Spanish (*piedra filosofal*), Russian (Философский камень), Latin (*lapis philosophorum*), Arab, and many other old and modern languages. HYLE's series of 'Short Biographies of Philosophizing Chemists' illustrates that many historical chemists were actually interested and engaged in contemporary philosophical debates still in the early 20th century. Did the obsession with theoretical physics by 20th-century philosophers of science alienate chemists from philosophy? Or do most chemists still associate philosophy with alchemy or with reckless speculation and metaphysics, which the discipline had worked hard to overcome in the late 18th century? Whatever

the historical reasons are, there was great uncertainty on either side about what philosophical issue of chemistry are.

To provide some orientation, we have organized many thematic issues, each with a Call for Papers that included a long list of problems for further research. We started with 'Models in Chemistry' (5-2, 6-1, 6-2), in order to direct the epistemological and methodological attention towards the pluralist and pragmatist practice of theoretical reasoning in chemistry, largely unknown in mathematical physics – strangely enough, many philosophers of science still believe a scientific model is a semantic interpretation of the mathematical formalism of a theory. The next special issue, on 'Ethics of Chemistry' (7-2, 8-1), was to make clear that philosophers of chemistry cannot simply imitate logicians. Because chemistry, unlike mathematics, has long raised strong ethical concerns, and because ethics is after all a branch of philosophy: who else than philosophers of chemistry should address the issues?

To complete the classical value triad (the true, the good, the beautiful), the third special issue was devoted to 'Aesthetics and Visualization in Chemistry' (9-1, 9-2), co-edited with Tami Spector. Because chemical research practices have long employed various forms of visualization, which in turn have an impact on the research through aesthetic values, the topic perfectly enlarged the classical spectrum of philosophy of science by exploring new terrain. In addition, we started an international Call for Artworks, asking artists worldwide to present their visual ideas about chemistry. An international jury consisting both of artists and chemists selected, in a kind of double blind review and with surprising agreement, the winners, who, thanks to a generous support by BASF, received an award. The selected artists were included in our virtual art exhibition on 'Chemistry in Art', designed by artists Ulrich Mattes and published both on the Internet and on CD as an inset of Volume 9.

Even though science in general and chemistry in particular have a strong impact on society through technology, the received philosophy of science almost completely ignored its existence. The fourth topical issue, on 'Nanotech Challenges' (10-2, 11-1), was a joined project with *Techné*, the journal of the International Society for Philosophy and Technology, and Davis Baird as its editor then. We both saw the urgent need to bridge the gap, mutually engage our readerships and authors with one another, and direct their attention towards an up-to-date topic. A later special issue, on 'Bionanotechnology' (15-1, 16-1), edited by Bernadette Bensaude-Vincent, further elaborated on that and explored the recently reinforced relationship between chemistry and biology in fields such as synthetic biology.

For the conservative philosopher of science, the largest stretch was certainly our special issue on 'The Public Image of Chemistry' (12-1, 12-2, 13-1), co-edited with Bernadette Bensaude-Vincent and Brigitte van Tiggelen,

and prepared in cooperation with the IUHPS Commission of the History of Modern Chemistry. More so than the previous issues, it brought philosophers and historians of chemistry together. While chemists are usually interested in improving their public image, the issue was actually on understanding it, both what it is composed of and how it has been developed. Because our image of chemistry shapes any reasoning of it, including philosophical ideas and publications, its understanding is a prerequisite for our field, a metaphilosophy if you want.

The thus far latest special issue, co-edited with Guillermo Restrepo, explored the relationship between 'Chemistry and Mathematics' (18-1, 19-1), to which leading scholars from the mathematical chemistry community as well as philosophers and historians of chemistry contributed. For philosophers of theoretical physics, the relationship between physic and mathematics is usually taken for granted, unquestioned, and unproblematic because their field historically grew out of applied mathematics. However, in the experimental sciences like chemistry, an epistemological hiatus separates them from mathematics. The current efforts of mathematical chemists thus tell us much about the epistemology of chemistry and the severe problems of interdisciplinarity.

From the very beginning, HYLE was not just a common scholarly journal. A new field requires more and different organizational and informational work than an established one. The Internet provided the necessary tools for that task in a unprecedented manner. Apart from the conventional publications of articles, book reviews, conference reports, and the 'short biographies', we had regularly updated conference announcements, an expanding list of university courses worldwide in philosophy of chemistry as well as a comprehensive bibliographic section that used an innovative database technology provided by FreeFind, who also managed our site search, long before Google became the dominant player. In addition to a regularly updated bibliography on the philosophy of chemistry, many other bibliographies on special topics of the history of chemistry were integrated that can be searched either individually or combined, including in total more than 7,000 titles.

On the occasion of HYLE's 20th anniverary, I have frequently been asked several questions: Would I do it again? Yes, of course. – Would I do something differently? Probably not, if the historical conditions were the same. – Was it fun? Not always, of course. However, I mostly enjoyed developing together with colleagues the topical issues, in order to help philosophy of science getting out of its obscurantism, make it relevant by applying philosophy in its full range to issues that matter in contemporary science, and reconnect it with the other humanities. Had I contributed to the present anniversary issue on 'General Lessons from Philosophy of Chemistry' with an

own paper, that would be my first message, as one might already have guessed from the Call for Papers.

The papers of our anniversary issue, mostly invited on that occasion, almost in unison call for philosophical attention to scientific practice, the ontology of chemical objects, the history of chemistry, and the relationship of chemistry to its neighboring disciplines beyond the trodden path of the reductionism debate, albeit with different accentuations.

Fashionable as it is, the term 'scientific practice' first of all works as an antidote against the imaginations of the received armchair philosophy of science, an appeal to look closer at what scientists actually do, with the appropriate attitude of being willing to face complexity and to learn philosophical lessons from scientists. In chemistry, that includes the understanding of how chemists produce, define, and distinguish between chemical substances and the multitude of intricate cases (Jaap van Brakel); how their experimental methods of analysis and synthesis determine what chemical species are (Mi Gyung Kim); how they operate both in the laboratory and at the desk using a wealth of implicit knowledge (Pierre Laszlo); and how they employ philosophical ideas in their model building and theoretical reflections (Bernadette Bensaude-Vincent, Jean-Pierre Llored).

Inescapably ontological issues come to the fore: the categories required to describe the material world as well as the overwhelming artifact character of chemical substances (Jaap van Brakel); the historical contingency of chemical species upon the experimental methods employed (Mi Gyung Kim); the relational ontology of chemistry (Jaap van Brakel, Rom Harré, Bernadette Bensaude-Vincent); and the complex part-whole relationships that reappear in quantum chemistry (Jean-Pierre Llored, Rom Harré).

Because 'chemistry' is neither a timeless idea nor a momentary snapshot but a historically grown body of knowledge, practices, methods, and values, knowing its history is a prerequisite for philosophers. That may include looking closer at the work and the philosophical views of historical chemists (Bernadette Bensaude-Vincent, Jean-Pierre Llored); developing philosophical tools for the understanding of historical changes of the implicit metaphysical assumptions of chemists (Rom Harré); or even historizing the interplay between experimental methods and chemical species concepts to develop a combined historical epistemology and ontology (Mi Gyung Kim). Because also chemical phenomena are not timeless, one may even write a cosmic history of the evolving complexity of chemical phenomena, as the highly innovative paper by Lukasz Lamza does.

Largely repeating arguments that had already been exchanged by theoretical physicists in the 1920s and 1930s, philosophers of physics have been fascinated with quantum mechanics for almost a century, although it is questionable if many of them have ever solved a Schrödinger equation of a simple

molecular system, which every chemistry student must do. Quantum chemists, like Guy Woolley and Hans Primas, have long abolished the naive reductionist dreams of the early days, such that it is obsolete to repeat their arguments in philosophy of chemistry, unless one wishes to imitate the customs of philosophy of physics. What is more important, however, is studying the conceptual and methodological relationships between chemistry and other disciplines that are established by interdisciplinary work. Jaap van Brakel develops a scheme for such interdiscourse relationships between chemistry and physics, while Jean-Pierre Llored investigates the interdiscourse of chemistry and quantum mechanics in quantum chemistry regarding their use of the ontological part/whole distinction. Pierre Laszlo reminds us that, while philosophers of chemistry so much focus on physics, chemistry's research relationship to biology has been the dominant one over many decades. Finally Lukasz Lamza provides a fresh look at the relationships between the disciplines by studying chemical, biological, and physical phenomena diachronically rather than synchronically.

There would be more to add to the list of philosophy of chemistry topics from which general lessons can be drawn. I would, for instance, highlight the methodological pluralism of chemistry and its pragmatic use of models, that require revising several classical issues of the received philosophy of science (Chang 2012, Schummer 2015). Moreover, I particularly miss ethics. It seems that the model of the logician, the philosopher of mathematics, is still influential in letting philosophers of chemistry neglect the practical philosophy of science. Thus, I shall not stop pushing ethics of science as belonging to philosophy of science, as long as it is not taken for granted in the same way in that ethics is considered a branch of philosophy.

Note

[1] See, for instance, the 'Program Structure' of the 2015 *Congress on Logic, Methodology, and Philosophy of Science* (http://clmps.helsinki.fi/programstruc.php). The mistaken use of 'physical sciences' plays with the double meaning of the term: Before the advent of modern physics, it meant all the natural sciences (from Greek *physiké*, natural), since then it has referred to the branches of modern physics only, excluding, of course, the chemical sciences. Yet, it is questionable that the mistake here is only because of ignorance.

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