

Conference Report

SYMPOSIUM ON THE PHILOSOPHY
OF CHEMISTRY, UNIVERSIDAD DE
LOS ANDES, BOGOTA, COLOMBIA,
21-23 JULY 2009

Sponsored by the Universidad de los Andes, this symposium was organized by Professors José L. Villaveces from the Universidad de los Andes (Colombia) and Guillermo Restrepo from the Universidad de Pamplona (Colombia). The meeting took place 21-23 July 2009 in Bogota (Colombia) at the campus of the Universidad de los Andes with the participation, as international guests, of Eric Scerri and Joachim Schummer, editors of the journals *Foundations of Chemistry* and *HYLE*, respectively.

Although there are two international scientific journals devoted to philosophy of chemistry, the Latin American presence in both is still incipient. Moreover, the International Society for the Philosophy of Chemistry yearly organizes a symposium, but this event is not always accessible to scholars from distant corners of the globe, particularly because of the high cost of travel and conference attendance. These were the reasons to organize this first Symposium on the Philosophy of Chemistry in Latin America with the first aim of bringing together worldwide leaders in the Philosophy of Chemistry to discuss the most recent advances in the area and the frontier themes to be studied in the future. The second aim of this event was to spread Latin American results in philosophy of chemistry and to facilitate the scientific discussion between all the participants.

After the welcome words by Wolfram Baumann (Head of the Chemistry Department, Universidad de los Andes) and José L. Villaveces (Vice-rector for Research, Universidad de los Andes),

eight papers were presented and two panel discussions took place. The speakers came from Colombia, Germany, and USA; the conference language was English.

Joachim Schummer (University of Karlsruhe, Germany) offered a broad perspective on the philosophy of chemistry, considering four main points: the nature of chemistry and philosophical differences regarding this question; the reducibility of chemistry to physics; the epistemological limits of chemical knowledge; and the ethical relevance of chemistry. He argued that differences in philosophy of chemistry arise from ontological and epistemological priorities; that chemistry demands concepts, theories and methods completely different from those in physics; that there is an unavoidable element of incompleteness in chemical knowledge; and that chemical synthesis creates special ethical responsibilities for chemistry practitioners.

Eugenio J. Llanos (Scio Corporation, Colombia) considered the problem of defining the concepts of chemical reaction and pure substance on solid grounds. He showed how the formalism of axiomatic thermodynamics can be used as a frame for settling the matter of defining these problematic concepts, both avoiding circularity in the simultaneous definition of the two concepts and the use of seemingly arbitrary, operative standards.

Eric Scerri (University of California at Los Angeles, USA) spoke about recent developments on the concept of chemical element. Starting from Panneth's influential 1931 paper, he elaborated on the debate developed over Panneth's distinction between two different aspects of the term 'element' – namely, an element as a simple substance as op-

posed to an element as a basic substance. He then argued that we actually need to consider three different senses of element: basic substance, simple substance, and combined substance, the first being an abstract entity underlying the other two. Finally, he presented a structural realist position and developed the notion of the periodic table as a structure.

Wilmer O. Leal (Universidad de Pamplona, Colombia) elaborated on the idea that chemical properties are relational, *i.e.* that they arise from the interaction among chemicals. In so doing, he showed results from the application of network theory and set-point topology to the study of chemical elements, based upon the analysis of binary compounds. Among the most important results, it was found that traditional chemical groups such as alkali and alkaline earth metals as well as halogens and noble gases are quite robust groups, *i.e.* the elements belonging to each group are more similar to elements of its group than to elements of other groups. Some metals and nonmetals were found to be part of the topological boundary of semimetals.

Andrés Bernal (Universidad Nacional de Colombia) argued for the absence of corpuscularian elements at the core of chemical theory, supporting his argument from a historical point of view on several key passages of Lavoisier's *Traité élémentaire de chimie*. Along the way, he defended the idea that at the core of chemistry we find an intrinsically relational theory of matter. Furthermore, he proposed that the concept of relation as it appears in chemistry is characterized by an emphasis on highly selective relations which, due to epistemological concerns, leads to the adoption of internal relation metaphysics.

Guillermo Restrepo (Universidad de Pamplona, Colombia) showed that mathematical chemistry and philosophy of chemistry, apparently two different fields, have similar fundamental questions. Some of those questions are:

What is chemistry? Which are its foundations? How is chemistry related to *e.g.* physics, biology, and mathematics? And how do other sciences influence chemistry? He concluded that in spite of having common tasks, mathematical chemists and philosophers of chemistry are not in touch with each other, like the two sides of a coin. He ended his lecture with the suggestion to change this mode of work and to try to interact in a more efficient fashion by attending meetings and reading materials from each other field in order to change the 'coin' into a 'Möbius strip', a strip that only apparently has two sides but actually has just one.

Edgar Vargas (Universidad de los Andes, Colombia) traced the origins of the natural philosophy of alchemy to principles of the cultures of shamanism and craftsmanship. He pointed out that dualistic and frequently sexual metaphors underlay the practice of metallurgy, and linked these images to the substantialist theories of the elements that appeared in ancient Greece and which were later adopted by alchemy.

José L. Villaveces (Universidad de los Andes, Colombia) posed the question: What is a chemical structure? Taking as an example the case of benzene, he showed that the currently accepted hexagon for benzene came from symmetrical properties of substituted benzenes. Thus, the 'hexagon' arose in an ontogenetic process from symmetrical properties of a set of substances. Afterwards, he defined chemical structure as a set of relations showing local symmetries. Villaveces also pointed out the need to study the properties of the substances and the carriers of these properties, *i.e.* chemical formulae which become the words of a language. He ended his lecture by drawing attention on the importance of studying such a language.

There were two panel discussions, the first of which dealt with the question: Why philosophy of chemistry? When treating this topic, it turned out that

fundamental chemical concepts such as 'pure substance', 'chemical element', 'chemical reaction', 'chemical properties' and 'chemical structure' lack a formal definition. Although different approaches to each of these concepts were considered without final agreement, it was clear that it is utterly important to understand them for a better understanding and practice of chemistry. Another point discussed was the completeness of chemical knowledge. In this respect it was argued that each new substance increases the knowledge gap because many new reactivities have to be tested. It was also mentioned the importance of using mathematics in chemistry to shed light on the understanding of chemistry itself, including classification techniques, network theory, and graph theory among other branches of discrete mathematics. Finally, stressing the relationship between chemistry and the 'outer world' (the society), the importance of dealing with other philosophical questions like those of ethics of chemistry was put forward. In general, the more evident the importance of chemistry to the society is, the easier it is to ponder on philosophical questions regarding chemistry.

The second panel discussion was on trends in philosophy of chemistry. This discussion gathered several of the issues raised by the previous lectures, which depict current trends in philosophy of chemistry. One of the most discussed issues was the relationship between the disciplines. The main suggestion was to move from the Comtean hierarchical classification of sciences, where issues like the reduction of one science to another are addressed, to interdisciplinary sciences. Several contributions were about chemistry education. There was agreement that chemistry is frequently taught as if it were a part of physics. Because of that, philosophical aspects of chemistry are left to philosophers of physics – an undesirable situation that let students disregard the unique philosophical characteristics of the chemi-

cal approach. Another point was the importance of a mediator in interdisciplinary research who could be a philosopher. Furthermore, there was agreement on the need to improve the image of the philosophy of chemistry among both the chemical and the philosophical communities, insofar as the first has a certain 'philosophobia' and the second a 'chemophobia'. It was pointed out the importance of a study on the image of the Philosophy of Chemistry among the chemical community in order to address problems of its popularization in this scientific group.

It was a pleasure to have young scientists attending the meeting and even lecturing, which can be regarded as a good sign for the continuity of these events and of the topics discussed during the symposium. Attendances came from different fields, namely from chemistry, philosophy, biology, and biophysics, a diversity that was important and fruitful for the ensuing discussions. According to the international guests (Schummer and Scerri) the meeting was not just the invitation to the editors of the two journals devoted to the philosophy of chemistry but a clear illustration of how Schummer's and Scerri's ideas can be interlinked to yield new ideas and also to pose new questions. It is the aim of the organizers to continue with this kind of meetings in South America and they expect to have, in future events, more participants from other South American countries.

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