

study on the bioassay as an biochemical instrument, while being full of historical details, essentially presented an interesting antireductionist argument that I would reformulate in the following manner. Insofar as biochemical properties are operationally defined by means of bioassays, and thus necessarily depend on concepts of biological functionality, they cannot be reduced to chemical properties alone as long as the concepts of biological functionality are not redefined in terms of chemical properties.

Overall, the workshop took place in a very stimulating atmosphere, supplemented by Peter Morris's circumspect care of all the participants' needs. Given the previous lack of interest in the topic, a great deal of work of gathering historical material was necessary and much is still to be done. The way in which the material was placed in topics of general interest, *i.e.* the mutual relation between instrumentation and various scientific and non-scientific fields, should be continued and further enlarged. Having been both a philosophical participant and 'observer', I may suggest that philosophy of technology and philosophy of chemistry should even be more considered as complementing and inspiring future historical research. As to the former, clarification and diversification of concepts such as 'instruments' or 'tools' in terms of purposes inside and outside of science might be helpful to systematize the material and to draw more precise conclusions. As to the latter, I am pleased to say that there is now a growing number of philosophers of chemistry who are interested in instrumentation and could further enrich the discussion.

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*Wilhelm Ostwald at the Crossroads of*  
*Chemistry, Philosophy, and Media*  
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When Ostwald received the Nobel Prize of chemistry for his work on catalysis in 1909, he had already retired 3 years ago, at the age of 53, from his chair of physical chemistry at the University of Leipzig. How did this most influential co-founder of the new physical chemistry spend his remaining 26 years at his private estate near Leipzig, after having educated some 100 later professors of physical chemistry worldwide; and why did he finish his successful university career at all?

Nicely located at the University of Leipzig, an international workshop organized by philosopher of chemistry Nikos Psarros and historian of chemistry Britta Görs, shed new light on widely unknown facets of a great chemist. To start with the final discussion, the number of papers (16) did not suffice to cover all his manifold activities. Besides Ostwald the physical, analytical, and technical chemists, the founder and editor of chemistry journals and book series, the tireless chemistry textbook writer and historian of chemistry, there was also Ostwald the quick-witted philosopher, the ardent reformer and leader of various international movements, the enthusiastic popularizer of science, as well as the painter and poet who tried to apply the aesthetic theories on which he had been working so hard during his final 20 years.

Did all these activities spring up from his chemistry? Not directly. It rather emerged from philosophical reflections on chemistry. Ostwald himself was quick in elaborating his views towards an abundant and complex philosophy of nature that incorporated even sociology, psychology, ethics, and aesthetics. Though he received harsh criticism from many of his scientific colleagues, his philosophy was throughout scientific, an all-embracing scientific world view, largely based on three principles: an ex-

perimentalist epistemology; the metaphysical priority of energy over matter; and the strongest belief in societal progress by means of science, technology, and social organization. Since for Ostwald progress meant working against the consequences of the 2<sup>nd</sup> law of thermodynamics, his general demand became: "Do not waste energy – ennoble it!" As a direct consequence, he retired in order to engage in pressing organizational matters, *i.e.* in more efficient 'energy flows and transformations' for societal progress, such as educational reforms and international information and documentation management, or standardization of 'media', such as of paper format, an international artificial language, and even money. Moreover, Ostwald considered both war and traditional religion as 'unscientific' waste of energy, to the effect that he became a leading figure in both the World Peace Movement and the Monist League, the latter being an atheistic, science-based quasi-religion.

Fortunately, there was ample time for discussion during the workshop, for with each paper presenting a new puzzling facet of Ostwald his personality became more and more difficult to comprehend. As a working hypothesis, Anders Lundgreen (Uppsala University) suggested Ostwald's deeply rooted pursuit of unity and harmony, ranging from his earlier attempts at unifying chemistry and physics to his final theoretical and experimental work on color theory and aesthetics. On the other hand, many papers revealed strong ambiguities, even contradictions within Ostwald's views, such as between modernism and anti-modernism, internationalism and nationalism, anti-metaphysics and metaphysics *etc.* There was agreement that Ostwald, the restless writer who first used a phonograph as dictaphone in order to save time and energy, took up many ideas from others and changed his topic and mind too frequently to allow a consistent reading of his entire work. While this has given rise to many misunderstandings since, he nonetheless became probably

the intellectually most influential chemist of the 20<sup>th</sup> century.

Besides his autobiography and the memoir of his daughter Grete, there is only an early Russian biography of Ostwald worth mentioning (by Rodnyi & Solowjew, 1969; trans. into German 1977). Recent attempts of the Ostwald archive to edit his 10,000 letters as well as the proceedings of this workshop will make the long overdue new biography both more easy and more difficult to write.

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