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Obituary: Hermann Berg (July 16, 1923–April 17, 2010). A life for Bioelectrochemistry — from Electrochemistry to Electrobiology

Professor Hermann Berg, Dr. rer. nat. habil., passed away in the night from April 16 to 17, 2010, at the age of almost 86, in his reading and thinking chair, after an active day of probably working on the galleys of his two last manuscripts, published (post mortem) in Bioelectrochemistry, Vol. 79 (2010) 254–256 and Vol. 79 (2010) 257–260. So, his life ended in literally unbroken scientific activity, in the immediate vicinity of his cellar laboratory of his apartment, where full book shelves are distributed not only in his study room under the roof and in the living rooms, but also along the stair cases of his three-level house.

Born July 16, 1923, in the old German university town of Greifswald (near to the Baltic Sea shores), Hermann Berg finished his school time in 1942 during the war time 1939–1945 with the regular German Abitur. In 1943, he had to serve as junior artillery assistant of the German army in the Ukraina, was taken prisoner of war in Rybinsk and was subsequently taken to Moscow (1943–48). Returned to Germany in 1948, he was educated as Chemical Technician and then he studied chemistry (1949–1952) at the Technical University of Dresden, where he graduated (diploma thesis) in electrochemistry (1952). Already one year later (1953), he finished his PhD thesis during serving as Scientific Assistant in the Department of Physical Chemistry and Electrochemistry (mentored by Professor Kurt Schwabe).

At the young age of 30 years, Dr. rer. nat. Hermann Berg was chosen in 1954 as the Head of the new Department of Biophysical Chemistry of the Central Institute of Microbiology and Experimental Therapy (ZIMET) of the Academy of the (former) German Democratic Republic, Jena. He started to establish a larger multidisciplinary group. Berg's official leadership in science and teaching was successful for more than 35 years. His students and co-workers appreciated his scientific guidance as very demanding but always supporting their achievements, even beyond his official retirement in 1989.

Hermann liked to be academically nick-named as “Arminius jenensis” (Latin for the German “Hermann der Jenenser”), probably because he worked not only in the (so-called) ivory tower of an academy institute, but he also acted as an engaged lecturer in the student curricula of the Institute of Physical Chemistry at the Friedrich Schiller University (FSU) of Jena. There, in 1962, he was promoted to Dr. habil. (venia legendi). His official academic carrier was crowned in 1970, when he was established as an Ordinary Professor of the Academy of Sciences, Berlin (East). His outstanding scientific achievements and academic activities were visibly honoured in 1971 when he had been elected as a Member of the Saxonian Academy of Sciences in Leipzig.

Experimentally, Hermann Berg started his carrier with polarographic measurements on terpene derivatives (diploma thesis). He applied polarography to the kinetics chemical reactions (Doctoral thesis). From 1954 on, his group applied electrochemical methods to investigate a variety of biochemical compounds like dextrans, nucleic acids and proteins, cytostatic quinones and actinomycines. Berg's habilitation thesis on the “Polarographic reaction kinetics and catalytic mechanisms of photo-activated reduction dynamics of quinones and ketons” represented a summary of experimental data and analytical results of cell biologically relevant chemical compounds. In 1956 Hermann Berg visited the laboratory of Jaroslav Heyrovsky, Praha, who later was awarded the Nobel Prize 1959 for chemistry for founding scientific polarography.

A particular milestone in Berg's work resulted from a cooperation with H. Schweiss. The article on “Photopolarography with a flash lamp” was published in Nature 191 (1961) 1270. It gained Hermann the honour of founding photo-polarography. His subsequent activities in photochemistry and biological photodynamics culminated in establishing a couple of cytostatic compounds as important for effective treatments of mice cancer and of human psoriasis.

As early as 1980, Berg's research team documented work on direct electric field effects on cellular systems, a discipline which is nowadays called “systemic functional electroporation”. Berg's group pioneered work on electrofusion of cells and electrostimulation of cell growth by applying strong electric field pulses. Together with the results on functional electro-uptake of genetic compounds like DNA and drugs, inclusive chemotherapeutica, the work with strong electric field pulses has catalyzed medical applications such as electrochemotherapy (L.M.Mir), direct gene electrotransfer for gene therapy and electric ablations of cancerous tissue.

Besides these highly appreciated scientific activities with consequences for human clinical medicine, Hermann Berg always valued science as a general cultural activity. Quite early in his scientific

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career, Hermann Berg got actively involved in science philosophy and the history of electrochemistry. He was fascinated by the personality of Nobel laureate Wilhelm Ostwald (1853–1932) and Ostwald's colourful life for science and science philosophy. In 1996, Berg started editorial work for the book series "Ostwalds Klassiker der Exakten Wissenschaften", founded in 1889 by Ostwald and supported by the publisher Harri Deusch Verlag, Frankfurt/Main. In this series, Hermann Berg contributed historical essays on Wilhelm Ostwald and Manfred von Ardenne, and initiated a volume on relaxation kinetics by Nobel laureate Manfred Eigen.

Important for the history of bioelectrochemistry, Hermann Berg stressed Wilhelm Ostwald's appreciation for Johann Wilhelm Ritter (1776–1810). Ritter was the first who had realized that the observations of Luigi Galvani (1737–1798) on frog leg galvanism actually reflected electrochemical reactivity on the surface of the metal electrodes in contact with the biological tissue; the frog leg was just serving as an electrometer. Thus, it is Ritter who is the actual founder of scientific electrochemistry. Ritter, known for painful electrical experimentation on himself, also discovered ultraviolet radiation as a component of the sunlight and found the phenomenon of photo luminescence. Berg outlined that Ritter's experiments on plants and his scientific interpretation in terms of electrochemical processes qualify Ritter also as the founder of the discipline of bioelectrochemistry.

After his official retirement in 1989, Hermann Berg managed to get a Pension Research Contract in his former institute and named his working place "Laboratory of Bioelectrochemistry for Cancer Treatment". Here, he continued experimental work on, and coped with, the intricacies of electromagnetic field effects (EMF) in cellular systems and mice. In this field, one of the great problems is the usually low number of data reported per case, with often large error margins. Most seriously, often the independent variables are taken as the control parameters instead of evaluating characteristic system quantities. The small number of data makes it difficult to differentiate statistical significance of a small bias from insignificance because of not sufficiently emerging out of thermal motion. Hermann Berg's life ended in the midst of continuing work heading towards a resolution of these problems. It is one of Berg's great merits to have compiled the vast amount of literature on field effects in general.

The appreciation of Hermann Berg's major scientific work and historical reflections on electrochemistry would be incomplete, if it would not be emphasized that he had to operate in political difficult times of the so-called east–west conflict, visibly manifested in the iron curtain established in 1961. In these demanding times, science and social life in the east suffered from severe restrictions of travel to western countries, curbing science and teaching on all levels. It is the great science-political merit of Hermann Berg to have organized, as early as 1962, the series of the so-called twelve Jena symposia in Jena, Weimar and later in Erfurt, with international attendance, appreciated in particular by Hermann's Jena-bound co-workers. For all the attendants, from west and east, these conferences remain in lasting good memory, including Hermann's hospitable home where he was assisted by his wife Liebgard and his three children. Regularly, at the end of the symposia, the main lecturers and BES Council members were welcomed in his home and large garden. Naturally, the symposia were supported by the Bioelectrochemical Society and the scientific contributions were documented in our journal.

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