Wilhelm Simon – An Appreciation

A teacher affects eternity; he can never tell where his influence stops (Henry Adams: The Education of Henry Adams)

Wilhelm Simon was born on September 26th, 1929 in Fahrwangen, Switzerland, and he died on November 17th, 1992. He studied chemistry at the Swiss Federal Institute of Technology in Zurich where he received his diploma in 1953 at the age of 24 and three years later his doctorate in the Laboratory for Organic Chemistry. In 1961 he was “Privatdocent”, in 1965 professor, then full professor for “Special Organic Chemistry” in 1972. It is in 1985 that his group was designated as “Laboratory for Analytical Chemistry”, a novelty in the history of the Federal Institute of Zurich. The group was always incorporated within the famous “Laboratory of Organic Chemistry” but Wilhelm Simon was now entitled Professor for Analytical Chemistry. He was proud of this title considering it as an endorsement of his efforts for the recognition of analytical chemistry as a key science in modern world’s struggle for a clean environment.

It may be strange that, at a school where Treadwell and Schwarzenbach made their essential contributions to analytical chemistry, there was no chair devoted to this discipline. Indeed, this demonstrates the strong forces of traditional thinking. In fact, in the 19th century analytical chemistry had been considered naturally related to inorganic chemistry. An independent chair was created only at a few universities, but Willy Simon succeeded in convincing his colleagues by his scientific achievements that the creation of an independent chair was justified and certainly profitable for the whole chemistry department. Let us also pay homage to his colleagues of the Laboratory of Organic Chemistry. Indeed, it was not the first time that the head and/or the members of this Laboratory played an important role in the creation of a new group or a new chair outside of their speciality.

The first article of Willy Simon appeared in 1954, entitled “Microtitration of Organic Compounds: A Semi-Automatic Apparatus for Microtitration” [1]. Among the coauthors, Edgar Heilbronner was the supervisor of his doctoral thesis; my own contribution to this paper was the method of evaluation of the measured data – today it would be called chemometrics. For the next few years acid-base equilibria remained the preoccupation of Willy Simon: automation of measuring devices, miniaturization of apparatus, relationships between acidity and molecular structure. With time his curiosity turned towards the essential element of his measuring system, the electrode. In fact the relevance of his results depended on the proton specificity of this response of the glass electrode and he undertook a study to develop low resistance glasses [2]. This first project of his scientific carrier was concluded by the publication of dissociation constants in three volumes, “Dissociation Constants Measured in the Binary Solvent Methylcellosolve/Water” [3].

Already in this first period of his career Willy Simon began to explore other domains of analytical chemistry. Studies on preparative and analytical gas chromatography were reported. Then he received an important grant from the Swiss National Foundation for the...
development of an automated C,H,N-elemental analyzer. After some unsuccessful efforts, where he wanted to explore too innovative procedures, an apparatus was developed based on the traditional combustion technique, but carried out in helium with analysis of evolved gases by a thermal conductivity detector [4]. The analyzer became a successful commercial product and this has been one of the few cases in history that the Foundation insisted on reimbursement in order to tax the research group for an initial failure. Another research topic was concluded with a successful commercial apparatus – the determination of the molar mass by vapor osmosmetry [5].

Parallel to research Willy Simon began to develop a curriculum for analysts. In the sixties his activities were characterized by an interaction of research and education. Within the analytical curriculum several techniques were presented. He applied the best method to learn a new technique i.e. to acquire expertise by planning and performing a small project in the domain in question. There we see several studies in NMR-spectroscopy, microcalorimetry and some exercises on hyphenated analytical techniques. For example, a ferromagnetic metal can be heated by a high frequency device to a temperature well defined by its Curie point. This was the basis of the Curie-point pyrolyser where pyrolysis products were then analyzed by gas chromatography [5].

The beginning of the second, and undoubtedly most important period of his work is signalled in 1966 where he reported “In vitro Properties of Macrotetrolides in Membranes as a Basis for Selective, Cation-Specific Electrode Systems” [6]. Not much later appeared the report on the potassium-selective valinomycin-based electrode which is used ever since in clinical praxis. The principle of this electrode and subsequent cation specific devices is to incorporate an organic ligand in a poly(vinyl chloride) membrane together with appropriate plasticizers. Cation specificity of the ligand implies specificity of the response of the electrode constructed with such a PVC-membrane.

Following the ideas of the Zurich school the organic ligand is thought to “carry” the cation in question across the membrane. In the following years and more studies were reported about the synthesis of “carriers” and specific electrodes were developed for alkaline and alkaline earth metal cations, then for ammonium, cadmium, uranyl and so forth. Size reduction of the measuring and the reference electrodes allowed study of single cells. Clinical applications were reported and the electrodes were produced on a commercial basis. Simon’s views on the basic phenomenon of the generation of the potential across the electrodes were not shared by another recognized specialist in the domain, Ernő Pungor, in Budapest. However, this divergence between Simon and Pungor did not inhibit a friendship. A lively exchange of ideas developed between the two research groups. They organized common seminars and projects, and finally produced common publications [8]. It is interesting to note that though neither scientist seems to have convinced the other, nevertheless, their friendship was established based on mutual respect of opinion.

Simon benefited from the close proximity the world’s best organic chemistry community in Zurich. More than 1000 ionophores were prepared and studied. The chemistry of Jean-Marie Lehn is closely related to carrier chemistry and connection was also established with the Strasbourg group [9] to explore the application of carriers for relatively big organic cations. Ab initio calculations were made for the deeper understanding of structural features of the cation/host complex and the choice of the ligand [10]. Electrodes were found for biorganic cations, then for anions. The specific electrodes were applied to biological fluids, mainly to serum and urine, then also to whole blood. They can be applied also for in vivo controls and experiments. The Ion Specific Electrodes (ISE) were applied as detectors for liquid chromatography [11], for capillary electrophoreses and so forth. From this rich period let us only mention the series of papers on optodes where the response of the ion specificity of the membrane is converted by the use of incorporated indicators to color changes.

The few papers cited here are only examples to illustrate some events in the course of the life of Willy Simon. An appreciation of the ensemble of his 440 papers is the affair of a specialist more competent in electro-analytical chemistry than I am. They cover a wide spectrum of topics in nearly every subject of analytical chemistry. His original research reports reflect both a deep insight into the problems treated and a meticulous attention to detail.

This successful scientist was a devoted and resourceful teacher and educator. He put in place and developed an undergraduate curriculum to form chemists with specialization in analysis. In his highly respected research laboratory he trained more than 100 doctoral students. Some of them are now appreciated in industrial and governmental laboratories, others we meet in academic positions. He was a demanding boss but always open to dialogue. He celebrated his 60th anniversary in the large circle of grateful former students as reported by his closest co-workers [12].

He was member of some 20 national and international learned societies, some 30 scientific committees, advisory boards and editorial boards of scientific journals. He was firmly engaged in issues especially touching chemical education and he was an appreciated interlocutor of the “Schweizerische Gesellschaft für Chemische Industrie” where he was the chairman of the group treating problems of the rising generation.

His achievements have brought him many honours. Amongst others he was made Doctor honoris causa of the Technical University of Budapest (1988), Honorary Professor of Shanghai University (1991); he was named honorary member of the Hungarian Academy of Science (1979) and the Japan Society for Analytical Chemistry (1986); he was recipient of the “Werner