Professor Dr. phil. Dr. h. c. mult. G. V. Schulz 1905–1999

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On October 4, 2005 we celebrate the 100th anniversary of the birth of Günter Victor Schulz. He was born in Lodz (which was then part of the Russian Empire) and moved to Berlin in 1914. He did his undergraduate studies (''Vordiplom'') in Chemistry at Freiburg and Munich, Heinrich Wieland and Gustaf Mie being among his teachers. By then, he had already developed a strong interest in the philosophical foundations of natural sciences. For his graduate studies he moved to Berlin, where he worked on the thermodynamics of solvation equilibria in colloidal solutions of proteins with Herbert Freundlich at the Kaiser Wilhelm Institute of Physical Chemistry and Electrochemistry. He obtained his Ph. D. degree in 1932 and the institute director, Fritz Haber, was his examiner in physical chemistry.

G. V. Schulz chose his field of research, the physical chemistry of macromolecules, after joining Staudinger's group in Freiburg in 1933, when macromolecular science was still in its infancy. His precise experimental and theoretical work contributed significantly to the breakthrough of the concept of macromolecules and to expanding macromolecular chemistry into polymer science as we know it today. His interest moved from natural to synthetic polymers, in particular to the correlation between the mechanisms of polyreactions and the molecular parameters of the macromolecules formed. Excellent examples of his contribution to the characterization of macromolecular compounds are his basic investigations on osmometry and the determination of polydispersity by fractionation. His studies on the kinetics of polymerization gave an insight in the ''genesis'' of macromolecules. In 1936 he discovered that the polymerization of styrene was a radical chain reaction, and he analyzed the elementary steps and calculated the resulting molecular weight distribution. P. J. Flory found that the same distribution was obtained in polycondensation and this is now well known as the Schulz-Flory distribution. Later, Schulz would tell his students that ''the molecular weight distribution is the logbook of the polymerization''. He also maintained an interest in natural polymers like cellulose and their degradation, collaborating with Elfriede Husemann, who would later become the first director of the Institute of Macromolecular Chemistry in Freiburg. The inspiring atmosphere in Staudinger's institute also attracted Werner Kern, who later became director of the Institute of Organic Chemistry in Mainz.

In 1936, G. V. Schulz received his ''Habilitation'' degree for ''the complete field of chemistry'' for his work on the determination of molecular weights by osmometry. In 1942,

he accepted the position of ''Extraordinarius'' (Associate Professor) at the University of Rostock. In spite of events during the war and the partial destruction of the institute, he started work on absolute methods for the determination of molecular weights and molecular dimensions, in particular, studies on sedimentation velocity in the ultracentrifuge and light scattering. The end of World War II and difficult times post-war interrupted his experimental work, but stimulated his theoretical studies on the statistical thermodynamics of macromolecular systems and the conditions for the biosynthesis of macromolecules.

In 1946, he was appointed Full Professor and director of the Institute of Physical Chemistry at the Johannes Gutenberg University in Mainz. This 500 year old university, after being closed for 150 years, had just been founded again and was domiciled in a partially devastated army camp on the outskirts of a city that had been 75% destroyed. Despite the hopeless situation in terms of rooms and instrumentation, Schulz was able to inspire and motivate young researchers to join the field of polymer science and to build up this institute from scratch. Hans-Joachim Cantow and Günter Meyerhoff were among these early students. Risking his life, he had been able to organize a truck to transport his ultracentrifuge and light scattering apparatus to the West during the last days of the war. With the help of Werner Kern, director of the Institute of Organic Chemistry, and by attracting the polymer physicist Herbert

Arthur Stuart to a second chair in his institute, he made Mainz one of the leading centers in polymer science in Germany and worldwide, establishing the first Collaborative Research Center (Sonderforschungsbereich 41) for Polymer Science in Germany. This was funded by the Deutsche Forschungsgemeinschaft from 1969 for a record period of 18 years. The collaboration between synthesis, physical chemistry and physics is now recognized as a leading principle in polymer science. Many of his more than 60 students found leading positions in industry, 13 of them becoming professors.

The research conducted in Mainz covered a large variety of topics, among them the kinetics of polymerization at high conversion, transfer reactions and their importance for branched polymers and new methods for the determination of molecular weight distributions and the size and shape of macromolecules and their properties in solution, including the determination of the molecular weight distribution by transmission electron microscopy. He also worked on the solution properties of biopolymers, in particular cellulose, and on the kinetics of their enzymatic and biological synthesis. In the late 1950s, Michael Szwarc, having discovered that the anionic polymerization of styrene is a living process, sent polymer samples to Mainz to have the molecular weight distribution determined. G. Meyerhoff found polydispersity indices of 1.2 to 1.6, significantly larger than those calculated by Flory. This motivated G. V. Schulz to study the kinetics and mechanisms of anionic polymerization, introducing a flow-tube reactor to follow very fast processes with sub-second half-lives. These fundamental studies – performed in friendly competition with Szwarc's group in Syracuse – led to the postulation of a ''multi-state'' mechanism, involving a dynamic equilibrium between three different species: contact and solvent-separated ion pairs as well as free anions. Theoretical calculations on the effect of these equilibria on the molecular weight distribution would later become the basis for understanding the new living processes involving dynamic equilibria with inactive (''dormant'') species, such as cationic polymerization, group transfer polymerization and ''living'' radical polymerization. In addition to his many scientific interests, he was also very interested in philosophy and founded the ''Colloquium on Philosophy and Natural Sciences'' at the university.

G. V. Schulz led a happily married life with his wife Erika, who passed away in 1967, and only one of their three children survived him. In 1974, shortly after retirement and during a visit to one of his former co-workers in Argentina, he suffered another tragic blow, a terrible car accident, which sent him to hospital and resulted in a year of rehabilitation. This left his right hand side paralyzed and resulted in a massive interruption to his scientific work. With the help of his second wife, Helma, and with incredible energy, he recovered enough to return to university as an emeritus where he continued his work with a small group of post-docs and Alexander von Humboldt fellows. His last paper was published in 1988, at the age of 83. A complete list of his almost 300 publications can be found in *Macromol. Chem. Phys.* **201**, 163 (2000), the last one being his memoirs. These were printed as a private edition in two parts, 1995 and 2000.

Numerous awards were received by G. V. Schulz. Among them (together with Werner Kern) were the first Hermann Staudinger Award of the German Chemical Society and three *Doctor honoris causa* degrees of the Universities of Uppsala, Freiburg and La Plata. His colleagues, collaborators and students remember him as an inspiring leader who made his decisions by convincing, not by dictating. Although he was very demanding, his students felt that he created an environment that gave them all the freedom to solve a scientific problem in their own independent way.

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