

## PROFESSOR HANS PAULSEN

Hans Paulsen, to whom this Special Issue of *Carbohydrate Research* is dedicated, was born on May 20, 1922 in Altona which later became a part of Hamburg, Germany. After finishing his school education in 1939, he could not start his intended study of chemistry at the University of Hamburg because of the outbreak of World War II. Labour service, then military service, a very serious illness, and the extensive war damage to the infrastructure in Germany delayed the start of regular study until 1948, at the age of 26.

He received the first qualifying degree, the *Hauptdiplom* (cf. M.Sc.), in 1953, and, after only two more years, he was promoted to the *Dr. rer. nat.* (cf. Ph.D.) at Hamburg in the research group headed by Professor Kurt Heyns. In 1962, Hans Paulsen received his *Habilitation* (cf. D.Sc.) from the Faculty of Mathematics and Natural Sciences of the University of Hamburg with a thesis entitled "Monosaccharide mit Stickstoff im Ring".

Surveying this early phase of Hans Paulsen's academic career does not really reflect the considerable problems and obstacles that he encountered. In fact, his educational training as well as the later scientific work had to be performed in temporary buildings with equipment not nearly adequate for today's minimum requirements.

After 1953, Hans Paulsen became a *Wissenschaftlicher Assistent* (scientific assistant) in the research group of Kurt Heyns, who involved him increasingly in the planning, organisation and construction of the new chemistry centre of the University of Hamburg. The move into the new buildings followed in 1962 and only then were appropriate working conditions provided. From 1962–1968, Hans Paulsen was a *Privatdozent*, and in 1968 he was named Professor of the University. In 1971, he received a "Call" to the University of Kiel which he declined in favour of the newly founded position of Professor for the Chemistry of Natural Products at the University of Hamburg. This position he held from 1972 until his *Emeritierung* (retirement) in 1987.

Hans Paulsen's scientific work centred around carbohydrate chemistry. Initially, it was considerably influenced by his academic teacher Kurt Heyns and this is reflected by many joint publications during more than 20 years. Their first paper in 1953 on the catalytic oxidation of *myo*-inositol was followed by a series of studies of the configurational and conformational selectivities in platinum-catalysed oxidations<sup>1</sup>. For a number of years, these findings remained somewhat in the background because of the selective oxidation of partially blocked carbohydrate derivatives by metal oxides and other processes. However, in recent years, their application has become more significant in connection with syntheses of oligosaccharides containing glycuronic acid residues.

A corresponding development may be noted with Hans Paulsen's first independently established research topic "Carbohydrates Having Nitrogen in the Hemiacetal Ring"<sup>2</sup>. In the early sixties, mainly the chemical aspects of this class of compounds were studied, but nowadays derivatives of this type are of considerable interest because they are extremely potent inhibitors of glycosidases. Later, the spectrum of studies of nitrogen-containing monosaccharides was extended to hydrazino and azido derivatives. Another topic involving mechanistically oriented studies of acyloxonium rearrangements in carbohydrate chemistry was started<sup>3</sup>. Among these studies are such prominent and almost "classical" results as the preparative rearrangement of D-glucose into D-idose and the cyclic rearrangement of a cyclopentane pentol.

Early in his career, Hans Paulsen realised the particular value of n.m.r. spectroscopy for structure evaluations in the field of carbohydrate chemistry. In fact, the first paper dates back to 1965. Subsequently, n.m.r. spectroscopy in Hamburg was developed progressively until today it has become the central analytical technique in carbohydrate chemistry. A series of studies of the conformations first of monosaccharides and later of oligosaccharides contributed to our present understanding of the anomeric and exo-anomeric effects<sup>4</sup>, as well as of other aspects (in particular, dynamic aspects). Such methods as chiroptical structure elucidations as well as X-ray structure analyses were also incorporated effectively into these studies.

In the early 1970's, several other topics were initiated, including phosphorus-containing carbohydrates and branched carbohydrates with functionalised side-chains<sup>5</sup>. Improved syntheses for several branched-chain sugars, *e.g.*, L-streptose and D-hamamelose, were described. However, by the mid-1970's, in spite of a new approach to problems in the field of cyclitol chemistry, the main effort in Hans Paulsen's scientific work had shifted from mono- to oligo-saccharides<sup>6</sup>. Initially, the amino glycoside antibiotics were studied, but this quickly led to more general studies in the field of oligosaccharide synthesis. Following the introduction of the azido group as a non-participating neighbouring group, the synthesis of  $\alpha$ -linked 2-amino-2-deoxy oligosaccharides was significantly improved. Subsequently, the determinants of blood-group substances A, B, and H were synthesised. In the glycolipid area, the oligosaccharides of the Forssman antigen, the P-antigen, and the gangliosides G<sub>M1</sub> and G<sub>M2</sub> were synthesised. Furthermore, the special problem of linking carbohydrate chains to serine, as in O-glycoproteins, was successfully approached. An octasaccharide derivative, which is part of a complex N-glycoprotein, and several repeating units of bacterial polysaccharides were prepared.

In recent years, the synthetic studies of Hans Paulsen's group became more closely oriented towards biologically relevant target molecules. This trend accords with public demand, but he also recognised it to be a powerful stimulant for the development of carbohydrate chemistry.

The scientific work of Hans Paulsen, documented in nearly 400 publications, has met with approbation at both the national and international level. Appointed

by the Gesellschaft Deutscher Chemiker (German Chemical Society), he is active as the national representative on the International Steering Committee for Carbohydrate Chemistry. As early as 1975, Hans Paulsen and F. W. Lichtenthaler were appointed by the Deutsche Forschungsgemeinschaft (German Research Council) to document the state of carbohydrate chemistry within the Federal Republic of Germany relative to foreign achievements. In 1980 the Gesellschaft Deutscher Chemiker granted him the Emil Fischer Medal, in 1983 the Royal Society of Chemistry honoured him with the Haworth Memorial Medal, and in 1985 he received the Claude S. Hudson Award of the American Chemical Society.

Hans Paulsen is co-editor of *Liebigs Annalen der Chemie* and is a member of the board of *Angewandte Chemie*. He is also a member of the advisory boards of *Carbohydrate Research*, *Tetrahedron*, *Tetrahedron Letters*, *Glycoconjugate Journal*, and *Advances in Carbohydrate Chemistry and Biochemistry*. Furthermore, he serves as a member of the IUPAC nomenclature commission for carbohydrate chemistry. For a number of years, Hans Paulsen was one of the five main referees of the Deutsche Forschungsgemeinschaft for all German research applications in the field of organic chemistry. His opinion and advice are of interest and importance, both at the national and international level.

It would be difficult to count the invitations to scientific events which have enabled Hans Paulsen to present his scientific achievements worldwide. This travel is unquestionably of fundamental importance for him and makes possible the personal contacts that he considers to be essential for the international scientific community.

These impressively numerous and very extrovert scientific activities over several decades contrast somewhat with Hans Paulsen's personal manner which is characterised by modesty and reserve. Similarly, one cannot imagine that he would utter any loud sounds when dealing with members of his research group. However, his special and personal care for every co-worker has helped to establish the close and friendly community that is evident to the many visitors to his group in Hamburg.

Hans Paulsen lives a remarkably secluded private life in Hamburg. His interests become evident when he returns from travelling and one hears him comment on the cultural and historic monuments of foreign countries, the creators of which he respects more than those of many modern achievements. His personal characteristics are completed by his special interest in the collection of old arts and crafts, and by his fondness for classical music.

Since Autumn 1987, Hans Paulsen has been released from his administrative and teaching responsibilities at the University of Hamburg. However, his scientific working capacity remains unchanged and, as former co-workers and younger colleagues for many years, we know that his interest in science will not diminish. We join with his past and present students, his associates, and his many friends in wishing him a fruitful continuation of his scientific work and in conveying best personal regards.

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