

## PROFESSOR RAYMOND U. LEMIEUX

Raymond Urgel Lemieux, the seventh child of a pioneer homesteader, was born on June 16th, 1920, in the small prairie community of Lac La Biche, two hundred kilometres north-east of Edmonton, Alberta. Despite the economic and social privations of the period, to which the Lemieux family were no strangers, Raymond Lemieux, aided by an Alberta scholarship, studied chemistry at the University of Alberta. He graduated in 1943 and subsequently studied with Professor C. B. Purves at McGill University, where he received his Ph.D in 1946. It was at McGill that his interests in carbohydrate chemistry and stereochemistry were stimulated. A postdoctoral Fellowship with Professor M. L. Wolfrom followed, and it was in this famous carbohydrate group at the Ohio State University that he became involved in the structural elucidation of streptomycin. He also co-authored a publication which, by correlating the relative configuration of D-glyceraldehyde *via* alanine with serine, served as a milestone in stereochemistry by linking the stereochemical notation for these two important classes of molecules. Many years later Professor Lemieux used D-glucose in a related fashion to synthesize one enantiomer of  $\alpha$ -deuterioethanol. This was one of the first examples of the use of a carbohydrate to provide a specific asymmetric centre of known chirality in the synthesis of an unrelated molecule.

In 1947 Raymond Lemieux became Assistant Professor at the University of Saskatchewan, and two years later he joined the National Research Council's Prairie Regional Laboratory, also in Saskatchewan. During this period he attracted considerable public and scientific attention with the first rational synthesis of sucrose. Two reactions involving oxidative cleavage of double bonds by sodium periodate and potassium permanganate, and periodate-osmium tetroxide were also published at this time and bear his name, the Lemieux-von Rudloff and the Lemieux-Johnson reactions. Raymond Lemieux became Professor and Chairman of the Department of Chemistry at the University of Ottawa in 1954, and served as the Vice-Dean of the Faculty of Pure and Applied Science. During his tenure, he not only designed and supervised the building of a new chemistry department but, through his energy and perceptive staff appointments, established a flourishing research environment. In 1961 Professor Lemieux returned to the University of Alberta Chemistry Department, where he has continued his research to the present day. From 1966 to 1973, he was Chairman of the Division of Organic Chemistry and, aided by his influence and stature, the department grew to become one of the largest and foremost research centres for chemistry in North America.

Professor Lemieux's profound influence on organic chemistry has derived in large part from his constant interest in the basic physical characteristics of

molecules. Early appreciation of the implications of reaction mechanisms to carbohydrate chemistry [*Adv. Carbohydr. Chem.*, Vol. 9 (1954)] was clearly evidenced in the chemical synthesis of sucrose. The extensive research on the mechanism of substitution at the anomeric centre, which lay behind this success, soon led to the recognition of the anomeric effect, followed later by the reverse-anomeric effect, and perhaps most important of all the *exo*-anomeric effect. Theoretical support for these concepts followed many years after their recognition and acceptance as general, stereoelectronic effects in organic chemistry. This fundamental understanding of the chemistry of the anomeric centre paved the way for new methods of 1,2-*cis*-glycoside synthesis, a career-long interest. Indeed without these, the chemical syntheses of the human blood-group antigens could not have been seriously contemplated. Another of Professor Lemieux's important contributions to chemistry was the application, in 1957, of the "new" technique of n.m.r. spectroscopy to the determination of structure and configuration. It is interesting to note that this work was presented, prior to publication, in the Karl Folkers lectures at the University of Illinois. In attendance and much impressed was Martin Karplus, whose subsequent theoretical work strongly aided in establishing this correlation as one of organic chemistry's most potent stereochemical probes. The exploitation of n.m.r. to answer stereochemical problems subsequently became a hallmark of Professor Lemieux's publications. This aspect of his research continued through the revolution which the advent of the pulsed, Fourier-transform technique and cryomagnets have brought to the subject. Nowhere has this pre-eminence been more apparent than in his elegant studies of oligosaccharide conformation. These latter endeavors have witnessed a remarkable confluence of his diverse talents and concepts. Through his mastery of synthesis, blood-group oligosaccharides have been available for immunochemical and n.m.r. studies, the latter being facilitated by a semi-empirical computational method (HSEA) for assessing conformational preference, which embodies the concept of the *exo*-anomeric effect. The picture of oligosaccharide topography which has emerged has made possible novel interpretations of the chemistry of protein, receptor-carbohydrate, ligand interactions.

Professor Lemieux's scientific achievements have been matched by his leadership and commitment to the development in Canada of a viable, research-intensive industry, which could fulfil national goals and provide much needed employment for Canadian graduates. He has founded three companies, which have sought to apply the creativity of university-based research to these objectives.

Professor Lemieux's academic and research accomplishments have been recognized in Canada, the United States, and Europe through numerous awards and honorary degrees. He received the Claude S. Hudson Award in 1966, was elected a Fellow of the Royal Society of London in 1967, and was awarded the Haworth Memorial Medal of the Chemical Society in 1978. In Canada, he was appointed an Officer of the Order of Canada in 1968, and most recently was the first recipient of the Izaak Walton Killam Memorial Prize.

These awards and prizes speak for the continued recognition of a truly unique and outstanding scientist, to whom his students, former research associates, University colleagues, and friends offer their admiration and best wishes through the pages of this issue of *Carbohydrate Research*.

DAVID R. BUNDLE