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Obituary: Charles Crawford Sweeley, Jr. (1930–2012)

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PHOTOS PROVIDED

Charles C. Sweeley Jr., right, of Haslett, Mich., a Williamsport native, is following in the footsteps of his father, the late Charles C. Sweeley Sr., above. The elder Sweeley composed the "Repasz Band March" while he lived here more than a century ago. Now his son, in his retirement years, has taken up a family musical tradition and composed his own march, "New Horizons," meant to be played by New Horizons Bands.

Charles (Chuck) Sweeley was born in Williamsport, Pennsylvania, and obtained his BS in Chemistry, 1952, at the University of Pennsylvania, and PhD in Chemistry, 1955 with Herbert Carter at the University of Illinois. Chuck served as a Commissioned Officer, U.S. Public Health Service, Laboratory of Natural Products, National Institutes of Health, 1955–1957 followed by a Civil Service Commission Appointment, Laboratory of Chemistry of Natural Products, National Heart Institute, 1957–1960. He began his academic career as Assistant Research Professor, Dept. of Biochemistry and Nutrition, Graduate School of Public Health, University of Pittsburgh, 1960–1963, and was promoted to Professor in 1966. He became Professor at the Dept. of Biochemistry, Michigan State University, 1968–1979, retiring in 1995. He was Visiting Professor of Biochemistry and Guggenheim Fellow at the Royal Veterinary College, Stockholm, Sweden, 1971, Assistant Dean for Research, College of Human Medicine, Michigan State University, 1973–1977, was on sabbatical leave at Massachusetts Institute of Technology in 1979, and served as Professor and Chairperson, Dept. of Biochemistry, Michigan State University, 1979–1985. He was a member of The American Chemical Society, American Society of Biological Chemists, American Association for the Advancement of Science, Society for Complex Carbohydrates (now Glycobiology), and the American Society for Mass Spectrometry. In his long career, he published mainly in the area of analytical biochemistry of carbohydrates and sphingosines. He listed his own research areas as: Chemistry of glycosphingolipids; Lysosomal enzymes of glycosphingolipid metabolism; Enzyme replacement therapy in genetic diseases of sphingolipid metabolism; Effects of tumor promoters on glycolipid metabolism; Regulation of glycolipid metabolism in normal and transformed cells in culture; and Metabolic profiling analysis of organic acids and steroids by GC-MS and Isolation and characterization of glycolipid tumor antigens.

However, Sweeley had the strongest contributions in the development of the use of gas chromatography and mass spectrometry in bioanalytical chemistry. For one example in 1970–71, with John (Jack) Holland, he made a major advance that had a strong impact on analytical chemistry when his laboratory produced the LKB9000 interfaced to a PDP8 computer. This development made it possible for the first time to monitor all ions in a gas chromatogram, search them individually in a data run (mass chromatography), and other innovations [1, 2]. Along with Bengt Samuelsson, he invented "reverse isotope dilution", the most sensitive

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GC-MS method existing for analysis of naturally occurring small molecules, used widely in analytical chemistry [3].

He continued his pioneering work in this breakthrough area for many years, pioneering methods for *mass spectral background subtraction* to increase sensitivity of GC-MS analysis, and *mass spectral library search methods* [4–6]. Previously, he had developed, with Ragnar Ryhage in Stockholm, the Accelerating Voltage Alternator, a device that could switch monitoring of multiple ions by a double focusing mass spectrometer paving the way for enhancing the powerful combination of GC and mass spectrometry.

In his signature work on carbohydrates, with William Wells, he published a series of papers in 1963–1965 on analysis of sugars by trimethylsilyl derivatization and gas chromatography which are still standard methods used today (*e.g.* by the analytical division of the Complex Carbohydrate Research Center, CCRC, U. of Georgia) [7–12].

During this time, he also pioneered analysis of sphingosine long chain bases by methanolysis and gas chromatography [13, 14]. Early on, he had invented a method for determination of the location of double bonds in fatty acids [15]. In 1967, he participated in the determination of the insect juvenile hormone structure [16]. In 1967–9, with Jack Strominger and Higashi, his laboratory determined that the lipid intermediate in peptidoglycan synthesis was a polyisoprenoid [17]. Later following up with Wm Lennarz and Strominger showing the generality of isoprenoid lipid intermediates [18, 19]. Sweeley and Holland also founded two companies, one for mass spectrometry and Meridian Instruments, for laser sorting of two dimensional tissue culture.

Sweeley's curriculum vitae is filled with methodology developed for applications of GC-MS in biology, including urinary aromatics, urinary acids, indoles, lipids, sugars, steroids, antibiotics, metabolic intermediates, glycolipids, fatty acids and other compounds. He published 186 research papers and 53 book chapters in his remarkable career, with more than 100 abstracts, presentations and seminars. He was listed as "One of 300 most quoted scientists in the world literature, Institute for Scientific Information (1961–1975)", and had numerous other honors including Merit Award, Chicago Gas Chromatography Discussion Group, 1969; Guggenheim Fellowship, 1971; Michigan State University College of Natural Science Distinguished Alumni Award (1980); Honorary Doctorate in Pharmaceutical Sciences, University of Ghent, Belgium (1982); Dreyfus Lecturer, Bucknell University, 1983; President, Society for Complex Carbohydrates, 1985; Distinguished Faculty Award, Michigan State University, 1986; Michigan Scientist of the Year, 1988; University Distinguished Professor, Michigan State University, 1990.

Chuck's hobbies included sports car rallies and driving a bright yellow Triumph TR3, a completely restored example of which he owned during his retirement years. He played the trombone in high school and college, taking after his father, who died when he was 1 year of age [18]. Chuck had one of his own compositions, the New Horizon March, performed by a band he directed in Michigan a few years ago. A youTube video captures his personality as he directs his own march (http://www.youtube.com/watch?v=nDVrLsgrH8o, http://www.youtube.com/watch?v=w8M6uPFnLz8) [20, 21].

He enjoyed both the North Carolina Seacoast and Michigan lakes, and owned a summer-house on a lake for many years.

Those of us who worked with Sweeley remember him fondly as a real gentleman of science, with a friendly and compassionate attitude, patient demeanor, especially at answering questions, even considering "dumb" questions in a positive light. This was combined with a great sense of humor. He would sit together editing a manuscript with students or postdocs, going over each sentence word by word to suggest edits for clarity. Above his office door he had a street stoplight installed by students. If Green, it was OK to approach him, if Yellow, with caution, and if Red, he was busy! His work in sphingolipids and carbohydrates led him to interact as an ambassador of glycochemistry and biochemistry with a number of prominent Japanese scientists, including Tamio Yamakawa, Yoshitaka Nagai, Kunihiko Suzuki, and others, with whom he organized international scientific meetings in Japan, Hawaii and North America. Charles Crawford Sweeley, Jr. is an unforgettable character. His passion for life, and for family and friends is a legacy equal to the scientific discoveries and understandings he bequeathed. He and his wife Marilyn (1929–2012) are survived by two children and five grandchildren.

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21. Charles Sweeley Curriculum Vitae link in Dropbox: https://www.dropbox.com/s/6ugtqrpws8nax28/1994_09_Sweeley_CV.docx