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OBITUARY

A Tribute to Max L. Deinzer (June 19, 1937-May 20, 2013)

Max L. Deinzer and I became acquainted in the late 1970s and became close colleagues in 1984 when I accepted a faculty position at Oregon State University (OSU) to codirect and expand the mass spectrometry laboratory he had built there in the preceding decade. My close association with Max, his students, and his postdoctoral fellows since that time gave me a unique opportunity to witness and admire his scholarship until his retirement in 2003. Max, Emeritus Professor of Chemistry, died at the age of 75 years on 20 May 2013 at his home in Corvallis, Oregon. He is survived by his wife Machelle Kennedy, three children Nick, Karen, and Eric, and two grandchildren Tabitha and Oliver. Behind these stark facts lies the story of a wonderful man, an esteemed scientist, and a respected mentor. It is my privilege to relate some of the salient pieces of Max's story to this society.

Max grew up on a farm near Dunnvale, New Jersey, and in his early life acquired a life-long passion for classical music and chemistry. In 1960 at age 23, he received a B.S. in Chemistry from Rutgers University, purchased a Vespa motor scooter, and intrepidly rode it from New Brunswick, New Jersey, to Monterey, California. By 1963, he had earned a M.S. in Organic Chemistry from the University of Arizona, and 6 years later, graduated from the University of Oregon with a Ph.D. in physical organic chemistry. While in graduate school, Max took to climbing in the Oregon cascades with his fellow classmates and, in doing so, added the outdoors and backpacking to his life-passions. Following his graduation, Max entered the professional world of chemistry as a research chemist at duPont de Nemours and Company in Wilmington, Delaware. After 2 years, he moved to Cincinnati, Ohio, where he took up a position as research chemist in the Water Supply Programs Division of the Environmental Protection Agency.

In 1973, Max accepted an appointment as a senior research associate in the Department of Agricultural Chemistry at OSU to direct the Analytical Chemistry Core Unit within the Environmental Health Sciences Center (EHSC). However, Max had more in mind than directing a service laboratory; he envisioned an analytical facility not only for analyses of pesticides but of organic and bioorganic compounds in general. Thus, in his first year, he succeeded in persuading the EHSC, the Department of Agricultural Chemistry, and the Department of Chemistry to establish the first shared resource for mass spectrometry of organic chemicals at OSU. Max focused initially on quantifying 2,3,7,8-TCDD residues in fish and

sediment samples taken from Oregon's Willamette River in a statewide effort to assess the impact of dioxin discharges from paper mills on fish in the river, and on determining the levels of pyrrolizidine alkaloids from tansy ragwort in agricultural products.

In 1977, Max was promoted to Associate Professor with tenure, and soon after began to investigate the chemistry of sesquiterpenes in hops as part of a larger program aimed at improving the breeding of hops in the Northwest, a field of study in which he would remain active in one aspect or another until his retirement. By the early 1980s, Max and his associate Val E. Peacock had determined that the floral aroma/taste of beers brewed with Cascade hop varieties grown in the northwestern United States could be attributed primarily to linalool, geraniol, and geranyl isobutyrate, three oxidation products of humulene that they found to be at much higher levels in Cascade hops than in most other varieties. The findings from this research guided collaborative efforts by the Hop Research Council, Oregon Hop Commission, Hop Producers in Oregon and Washington, and various beer

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producers to improve the quality of hops grown in the northwestern United States, the success of which has contributed much over the long term to the Northwest's economy.

During the 1982–1983 academic year, Max took sabbatical leave with Al Burlingame's group at the National Mass Spectrometry Center at the University of California, San Francisco, to study the alkylation of nucleosides and nucleotides by dehydroretronecine and to characterize the formation of positive and negative ions of chloro- and nitrophenylglucuronides using liquid-secondary-ion mass spectrometry. Shortly upon returning to OSU, Max was able to purchase a Kratos MS-50 RF high-resolution mass spectrometer with EI/CI and FAB ionization sources. In conjunction with this acquisition, Max orchestrated the creation of a tenure-track faculty position in the Department of Agricultural Chemistry for an instrumental mass spectrometrist. I was recruited to fill this position and, in 1984, took up co-directorship of the EHSC's Mass Spectrometry Core Unit with Max. Outside the laboratory in those days, Max entertained himself by singing bass with a vocal ensemble and driving around Corvallis with open windows and classical music blaring out of his car radio.

In the mid-1980s, Max began using negative chemical ionization (NCI) to investigate polychlorinated dibenzofurans and dibenzodioxins and, by the end of 1980s, to work with his associate James A. (Jim) Laramée on the design of a resonance electron capture (REC) ionization source that would utilize an electron monochromator, a device introduced in the 1960s for generating a beam of nearly monoenergetic low-energy electrons, for selectively ionizing electrophilic molecules. In 1994, Max and Jim were awarded a U.S. patent for a "Method and apparatus for mass analysis using slow monochromatic electrons," which could be coupled to nearly any commercial mass spectrometer in existence at the time and was about three orders of magnitude more sensitive and substantially smaller in size, weight, and energy consumption than NCI sources.

In 1989, Max was appointed Guest Professor by the Fakultät für Chemie at the Universität Konstanz, Konstanz, Germany. By this time, Max was heavily involved in mass spectrometric studies of glycosylation patterns on interleukin-3, disulfide bridges in human recombinant macrophage colony stimulating factor, glycosylation of atrial muscarinic receptors, heterogeneity of *Lumbricus terrestris* hemoglobin subunits, hop pectin polysaccharides, adduction of reactive intermediates of xenobiotics to proteins, and sequencing of soluble malting barley proteins. Between 1993 and 1994, he developed an interest in the then emerging ESI MS approaches to monitoring hydrogen/deuterium exchange in proteins. Over the course of the next decade, he, his laboratory associates, and his faculty collaborators contributed both valuable data on the process of oxidative renaturation of recombinant human macrophage colony stimulating factor β and new methodology for studying protein dynamics and analyzing the thermodynamics of protein unfolding.

In 1997, as a result of departmental reorganization at OSU, Max transferred his professorship to the Department of Chemistry. By this point, Max's ongoing investigations of the constituents of hops and beers had led to the isolation, identification, quantification, and semi-synthetic preparation of a number of flavonoids from hop-oil known to retard the proliferation of breast and ovarian cancer cells in vitro. The publications that resulted from this research during the last decade of Max's career, collectively cited more than 1250 times, spawned research that continues to flourish in the College of Pharmacy and the Linus Pauling Institute at OSU and, generally, in laboratories world-wide.

In 2001, Max and I received an NIH grant to construct and evaluate a GC, REC, orthogonal time-of-flight mass spectrometer designed around Max's patented REC ionization source. The instrument that came out of this project, the only one in the world capable of simultaneously recording resonance electron energies and masses of all the transient negative ions produced in a given REC reaction, continues to this day to be used to investigate organophosphates, sulfonamides, [2,2]paracyclophanes, vinyl chloride, chloroacetaldehyde, polyhaloethenes, amino acids, peptides, and polynuclear aromatic hydrocarbons.

Max's intensive investigations of environmentally, toxicologically, and biologically significant organics, coupled with his development of novel instrumentation and methodologies with which to carry out those investigations, reflect a combination of theoretical and experimental acumen not often found in an individual scientist. The more than 100 peer-reviewed publications, innumerable presentations at scientific meetings, and many invited lectures resulting from his research reflect the contributions he made to physical, organic, and analytical chemistry, biophysics, and biochemistry, environmental chemistry, and molecular toxicology. The students, postdoctoral fellows, and colleagues (among whom I am fortunate to count myself) who have benefited from Max's intellect, imagination, rigorous scientific and ethical standards, teaching, humbleness, and geniality must too be counted as part of his academic legacy.

Shortly before his retirement in 2003, Max and his wife Machelle had purchased a cabin in the vicinity of Sisters, which lies in Central Oregon at the eastern foot of the Cascade Mountain Range, so they could be closer to the outdoors that Max so revered. Shortly after retirement, Max resumed playing the oboe with a quartet in Eugene. With Max's passing, our society has lost an exemplary scientist, respected colleague, valued mentor, and dear friend.

An endowment fund has been established in Max's name to provide scholarships to chemistry students at Oregon State University. For those wishing to donate to this fund, please contact Brian Pecor at the OSU Foundation on (541) 737-5514.

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