In Memoriam: Earl Muetterties

When Earl Muetterties died on January 12, 1984, the loss to our world was acute. His family and friends felt most deeply the departure of a loved one and a warm personal friend. And the world of science marked with sorrow the passing of an unusual man. For Earl Muetterties was not just a scientist with substantial achievements in one field of our enterprise, but a unique creator of molecules and integrator of ideas, a person whose interests spanned all of chemistry and who changed the patterns in which we think about our science. By bridging in his own career the industrial and academic worlds as well, he also provided us with a salutary example of how these two parts of the chemical world do and must interact.

At Du Pont, Muetterties synthesized most of the polyhedral borane anions in the $B_nH_n^{2-}$ series and explored the great derivative chemistry of these molecules. These are interesting compounds in their own right, but they also were and are important in the general evolution of modern inorganic chemistry. Thinking about their stability led others to the development of simple computational methods for nonplanar molecules and, later, to important systematizations of the electronic and geometrical structures of polyhedral transition metal clusters.

Earl Muetterties pioneered the application of NMR spectroscopy to the elucidation of the dynamics of intramolecular rearrangements and reactions. The specific applications that he and his able co-workers made to phosphoranes, boron hydrides, and transition metal complexes were pioneering studies, but I think more important was the firm notion that Muetterties implanted in the collective mind of the chemical community of the time scale of different molecular transformations and of the appropriateness of using different physical methods characteristic of different time or energy regimes. He also left us with a sense of the wide range of molecular motions, a better feeling for the meaning of conformation and isomerism, and an appreciation of the beautiful stereochemical complexity of then unfamiliar coordination geometries such as five-, seven-, or eight-coordination.

It is interesting that it was only after leaving the supportive industrial environment of Du Pont for Cornell that Muetterties began to work on problems of catalysis. His was a many-sided approach—it included the study of many important homogeneous organometallic reactions such as the reduction of coordinated arenes, the study of interconversion of different bonding modes of π complexes, the use of low-valent phosphite complexes, and the reactivity of clusters, especially those containing carbide atoms. Finally, at Berkeley, he undertook a concerted effort to bring homogeneous solution chemistry and surface physics together by studying the details of bond breaking and deformation of molecules adsorbed on clean surfaces.

What is unique and so typical of Muetterties in all his work is the wide range of chemical and physical techniques that he could and did bring to bear on these problems, and the fact that in each area that he entered the ideological impact of his work strongly affected the community of chemistry. Let me be a bit more specific. Transition metal cluster chemistry was in flower before Earl's contributions, and others have shown us in more detail than he did how molecules break and re-form on, for instance, trinuclear clusters. But that molecules should or might do so, that a cluster might provide reaction channels different from those of a mononuclear complex, that we should worry about the possibility of cluster decomposition in its reactivity, and that we should think carefully of the ways in which a cluster does or does not approach a surface—these questions, the way that we think about clusters—all of these were influenced in a fundamental way by Muetterties. He and his co-workers did it by working out a crucial case here, by a pedagogically effective presentation there, by writing comprehensive and perceptive reviews. His legacy is a web of ideas, patterns, and understandings that permeates modern inorganic chemistry. This great experimentalist made us *think* about molecules and their transformations in different and effective ways.

Roald Hoffmann