Malcolm H. Chisholm (1945–2015)

Expert in metal–metal multiple bonding

Malcolm H. Chisholm, Distinguished Professor of Mathematical and Physical Sciences at The Ohio State University, died on November 20, 2015. Chisholm was born in 1945 in Bombay (now Mumbai) India, and was raised and educated in England. He graduated with high honors in chemistry from Queen Mary College, University of London in 1966, and he remained there to work with Donald C. Bradley for a PhD in inorganic chemistry (completed in 1969). Following a post-doctoral fellowship with Howard Clark at the University of Western Ontario (1969–1972), he accepted his first academic position at Princeton University (1972–1978), followed by 22 years at Indiana University Bloomington (1978–2000), and 15 years at The Ohio State University in Columbus (2000–2015).

Chisholm's research covered many topics, but he is probably best known for his pioneering work on the chemistry of metal–metal multiple bonds, the molecular and electronic structure and bonding of transition-metal compounds, and the exploration of excited states of complexes with metal–metal quadruple bonds. His multifaceted research bore his unmistakable stamp of an appreciation for the interplay of synthesis, structure, and properties coupled with a never-ending joy of discovery.

For nearly three decades at Princeton and Indiana, Chisholm worked to elucidate the coordination chemistry, electronic structure, and classes of chemical reactivity displayed by staggered, "ethane-like" M_2X_6 complexes **1** (for a Review by Chisholm, see *Angew. Chem. Int. Ed. Engl.* **1986**, *25*, 21). When the central metal ion is molybdenum or tungsten, these compounds can be described as d^3–d^3 dimers with a $\sigma^2\pi^4$ electronic configuration and a metal–metal triple bond, in analogy with the triple bond in acetylene. Chisholm viewed the M–M multiple bonds as "inorganic functional groups" and his chemical-reactivity studies were focused on chemical transformations about the central M_2 dinuclear core. These included ligand substitution, and oxidative addition and reductive elimination reactions. Depending on the steric and electronic nature of the ligands, substitution reactions could result in larger M_4 or M_6 clusters, or generate highly reactive species towards unsaturated small molecules such as acetylenes, alkyl nitriles, CO and CO_2. These reactions would convert the M_2 center between quadruple, triple, double, and single bonds, or result in metal–metal bond cleavage. Single and double bonds could be accessed through oxidative addition to the triple bond, and reductive elimination gave eight-electron quadruply bonded compounds.

In 2000, he moved to The Ohio State University where, in addition to synthesis and structure, he also explored tuning the electronic structure of dinuclear centers to produce interesting properties of materials. He began to link dinuclear centers together with ligands of different coupling capabilities (**2**) to give fascinating spectroscopic properties based on the ability of the electrons in the dimetal unit to delocalize. At Ohio State, he coupled his synthetic acumen with electronic structure theory and ultrafast spectroscopy to study the electronic interactions between dinuclear centers in coupled systems as well as in polymers and liquid crystals. During this period, he discovered new charge-transfer excited states and developed a new understanding of the intervalence charge transfer in dinuclear units.

Chisholm also extended his work to applications in the areas of catalysts for the generation of biodegradable polymers such as polylactides, new metalloorganic polymers that form liquid crystals, and in new materials for use in photovoltaic cells.

He is the author of more than 650 publications, and received numerous honors. Among the most notable were his election as Fellow of the Royal Society in the UK, to the US National Academy of Sciences, and to the Deutsche Akademie der Naturforscher Leopoldina. He was the recipient of numerous prizes, including the American Chemical Society Award for Inorganic Chemistry, the Davy Medal of the Royal Society, and the Nyholm Prize of the Royal Society of Chemistry.

Chisholm was a remarkable mentor and teacher and was respected for his generosity and graciousness. He was an exceedingly influential and supportive father, husband, friend, and colleague for all who knew him. For his students, postdocs, and colleagues, he was a remarkable role model. He had a wonderful sense of humor, and he cared deeply and genuinely about everyone around him. This extended well beyond his immediate students and colleagues, but also to their families. He was happiest when he could celebrate the successes of his family and his students. He will be sorely missed.

David L. Clark
Los Alamos National Laboratory
Bruce E. Bursten
Worcester Polytechnic Institute

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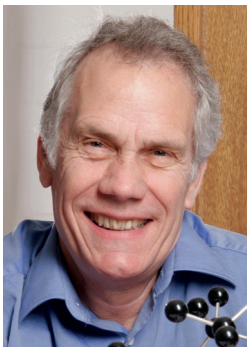

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