ONE HUNDRED YEARS OF CHEMICAL BONDING: THE LIFE AND TIMES OF GILBERT NEWTON LEWIS

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ABSTRACT

On 26 January 1916, a paper was submitted to the Journal of American Chemical Society by a young man of forty which changed the course of chemistry as a science. The young man was Gilbert Newton Lewis and the paper was titled "Atoms and Molecules" which appeared in volume 38, p.762, April 1916 issue of JACS. In this paper G.N. Lewis enunciated the principle of a covalent bond, formed by sharing of a pair of electrons and gave us the Lewis "dot" structure which became the foundation of all chemistry that we know today. In one stroke, Lewis's concept of a chemical bond united two branches of chemistry, viz., organic and inorganic, which were considered as two district disciplines till that time. The half a century that spanned the life of Lewis is regarded as one of the most brilliant in the history of science and his name ranks amongst the highest in the roster of those who built modern chemistry.

G.N. Lewis contribution to chemistry was expansive and ranged from chemical bonding to concepts of acids and bases, integrating thermodynamics and concept of Gibb's free energy into the language of chemistry, understanding the origin of colours in organic compounds, discovery of D2O and a study of the interaction of light with matter (fluorescence and phosphorescence). Terms such as “activity”, “fugacity", “photon”, “free-radical”, “electron-pair acceptor or donor” were all introduced into the lexicon of chemistry by G.N. Lewis. Although Lewis possessed powerful mathematical skills it was the qualitative and simple concepts and models he gave to chemistry that has become his lasting legacy.

G.N. Lewis was also a colourful personality, a dominant thought leader of his times who dared to question the prevailing logic as well as dogmas in science. This led to several “scientific conflicts” with fellow scientists, for which he paid a heavy price. Lewis was nominated to the Nobel Prize a record thirty three times, but died under mysterious circumstances in his laboratory in the afternoon of Saturday, March 23, 1946 without winning that coveted prize!

G.N. Lewis wrote in his preface to the famous book titled “Thermodynamics and the Free Energy of Chemical Substances” co-authored with Randall (1923) that “But sometimes we enter (a cathedral) that is still partly under construction; then the sound of hammers, the reek of tobacco, the trivial jests bandied by workmen, enable us to realize that great structures are but the result of giving to ordinary human effort a direction and purpose. Science has its cathedrals, built by the efforts of a few architects and many workers….. Lewis was, undoubtedly, one of the key architects of the cathedral of chemistry.

This lecture will provide a historical overview of the life and times of G.N. Lewis, the people who influenced him and those whom he influenced and how his unique insights shaped the future of chemistry. I will also illustrate how the kinks in his personality made him a rank “outsider” to the establishment and the price scientists often pay when they are fiercely independent and non-conformists; yet, some of the most revolutionary science originates from the minds of “scientific outsiders”, whereas, the “insiders” are more invested in working within the framework of existing knowledge.