THE FUTURE OF CHEMISTRY

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ABSTRACT

"Chemistry creates its own objects. This creative power, similar to that of arts, distinguishes it fundamentally from other natural sciences "; a statement attributed to Marcellin Berthelot, one of the greatest chemists known (1827-1907) captures the mission of chemistry so elegantly. Our physical environment, material culture, conceptual systems and manner of living have been changed, are being changed, and will be changed by chemical science.

Chemistry has always been the earthiest, practical and the most central of the sciences. Its earthiness, its connection to the colors, smells, and sounds of substance and of changes, stretches backward into the mists of alchemy. But its earthiness also extends into the huge, complex business enterprises of our day, in petrochemicals, pharmaceuticals, plastics, advanced materials, agriculture, biotechnology, transportation and electronics.

If steam engine drove the industrial revolution, human intellect has been the driving force behind the chemical revolution the chemical revolution has evolved through five stages. **First**, when chemists began the exploration of the synthesis of organic compounds. **Second**, when the discipline of physical chemistry was born out of a need to integrate the knowledge of the atom to the formation of molecules through chemical bonding. Physical chemistry also integrated the disciplines of organic and inorganic chemistry. The **third was** the two World Wars, which provided impetus to the growth of chemistry and chemical industry. Nitric acid, sulfuric acid, ammonia, chlorine and synthetic plastics / rubber were products of wartime efforts. This gave rise to industrial chemistry. The **fourth** was the discovery of petroleum as a feedstock for producing the basic building blocks of the chemical industry. The transformation of petroleum into chemicals was facilitated by an understanding of reactive intermediates enunciated by Frank Whitmore (1887-1947) and Christopher Ingold (1883-1970). This was the

beginning of physical organic chemistry. Vladimir Ipatieff (1867-1952) converted this knowledge into the science of heterogeneous catalysts for cracking, reforming and isomerization of petroleum hydrocarbons into olefins and aromatics. The **fifth** was the understanding that chemistry controls all biological functions and even life's processes (biochemistry, molecular biology, chemical biology). This understanding emerged from an insight into chemical bonding, conformation and stereochemistry by G.N. Lewis, (1875-1946) and Linus Pauling (1901-1994), which culminated in the discovery of chemical structure of DNA in 1953.

The rapid integration of chemistry, both, within its own sub disciplines and with other disciplines, such as, biology, computational science, material science and physics is the distinguishing hallmark of twenty first century landscape of chemistry. The boundaries between chemistry and other disciplines are becoming hazier. The key motivation for this integration is the inability of individual and stand-alone disciplines to provide answers to some of the most emergent and complex problems facing humanity, namely, energy, materials, environment, health, food and agriculture. Chemistry is also moving away progressively from the "reductionist" approach to "systems" approach in search of new solutions

What then is the future of chemistry in this century? What are the forces that are currently providing impetus to this science? How do we reorganize scientific research for future relevance? How should we reshape chemical education for tomorrows needs? This lecture will address some of these issues and attempt to provide answers.