STEPS TOWARDS COMPLEX MATTER
From Supramolecular Chemistry Towards Adaptive Chemistry

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Short Bio

Jean-Marie Lehn, born in France, was awarded the 1987 Nobel Prize in Chemistry alongside Charles J. Pedersen and Donald J. Cram for his pioneering work on molecular recognition. His research led to the creation of supramolecular chemistry, a field studying associations between molecules held together by non-covalent forces. Lehn later expanded this into the study of self-organization and adaptive chemistry, focusing on dynamic networks and complex systems. He earned his PhD from the University of Strasbourg in 1963 and worked with Robert Burns Woodward at Harvard on the total synthesis of vitamin B12, witnessing the birth of the Woodward–Hoffmann rules. In 1966 he established his own laboratory in Strasbourg and later became Professor at both the Louis Pasteur University and the Collège de France. He is currently a professor at USIAS. Among his numerous honors are the Humboldt Prize, the Royal Society's Davy Medal, and the French Legion of Honour.

Abstract

Supramolecular chemistry is intrinsically a *dynamic chemistry* in view of the lability of the interactions connecting the molecular components of a supramolecular species and the resulting ability to exchange components. The same holds for molecular chemistry when the molecular entity contains covalent bonds that may form and break reversibly. These features allow for a continuous change in constitution by reorganization and exchange of building blocks and define a *Constitutional Dynamic Chemistry* (CDC) covering both the molecular and supramolecular levels.

CDC takes advantage of dynamic diversity to allow variation and selection and operates on dynamic constitutional diversity in response to either internal or external factors to achieve *adaptation*.

It generates networks of dynamically interconverting constituents, *constitutional dynamic networks*, that may respond to perturbations by physical stimuli or to chemical effectors. Of special interest is the case where the driving force is an *increase in organization/order*.

The implementation of these concepts points to the emergence of *adaptive* and *evolutive chemistry,* towards *systems of increasing complexity.*