

PERSPECTIVES IN CHEMISTRY: TOWARDS ADAPTIVE CHEMISTRY

Lehn, J.-M.

8 allée Gaspard Monge, 67000 Strasbourg

ISIS, Strasbourg University

France

lehn@unistra.fr

Supramolecular chemistry is intrinsically a *dynamic chemistry* in view of the lability of the interactions connecting the molecular components of a supramolecular entity and the resulting ability of supramolecular species to exchange their components. Similarly, molecular chemistry becomes a dynamic covalent chemistry (DCC) on introduction into the molecular entity of covalent bonds that may form and break reversibly, so as to allow a continuous change in constitution by reorganization and exchange of building blocks. Taken together, these features define a *Constitutional Dynamic Chemistry* (CDC) covering both the molecular and supramolecular levels.

CDC introduces a paradigm shift with respect to constitutionally static chemistry. It 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*.

CDC generates networks of dynamically interconverting constituents, *constitutional dynamic networks*, presenting *agonistic* and *antagonistic* relationships between their constituents that may respond to perturbations by physical stimuli or to chemical effectors. It applies in chemistry as well as in materials science.

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

1. Lehn, J.-M., *Supramolecular Chemistry: Concepts and Perspectives*, VCH, **1995**.
2. Lehn, J.-M., *Chem. Eur. J.*, **1999**, 5, 2455-2463.
3. Lehn, J.-M., *Proc. Natl. Acad. Sci. USA*, **2002**, 99, 4763-4768.
4. Lehn, J.-M., *Chem. Soc. Rev.*, **2007**, 36, 151-160
5. Lehn, J.-M., Chapter 1, in *Constitutional Dynamic Chemistry*, ed. M. Barboiu, *Topics Curr. Chem*, **2012**, 322, 1-32.
6. Lehn, J.-M., *Angew. Chem. Int. Ed.*, **2013**, 52, 2836-2850.
7. Lehn, J.-M., *Angew. Chem. Int. Ed.*, **2015**, 54, 3276-3289.