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Supramolecular chemistry: Where from? Where to?

Jean-Marie Lehn*

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It is difficult to determine when the area termed "Supramolecular Chemistry" started and thus what anniversary there really is.

Where from? The term itself, which is now widely accepted and has deeply permeated chemical literature, was introduced by this author in two publications in 1978 in order to define, consolidate and generalize the areas of crown ether chemistry, host–guest chemistry and the chemistry of molecular recognition, thus allowing for the emergence of the concepts and perspectives offered. However, much earlier and before 1967, fifty years ago, entities formed by the binding together of molecules, known as molecular complexes, had already been investigated here and there, as well as macrocyclic complexes of natural (such as cation binding antibiotics) and synthetic types, until the forest was seen beyond a collection of trees. As anniversaries go, 2017 also marks the 30th anniversary of the 1987 Nobel Prize in Chemistry, which recognized the three areas of crown ether, host–guest and molecular recognition chemistries already mentioned above.

Supramolecular chemistry has been defined as "chemistry beyond the molecule" as it aims at designing and implementing functional chemical systems based on molecular components held together by noncovalent intermolecular forces. It has over the last half a century grown into a major field and has fuelled numerous developments at the interfaces with biology and physics; from basic knowledge to applications, from noncovalent interactions to drug design, and from materials and polymers to solid state engineering. It thus gave rise to the emergence and establishment of supramolecular science and technology, as a broad multidisciplinary and interdisciplinary domain providing a highly fertile ground for the creativity of scientists from all origins.

Arguably the major conceptual contribution of supramolecular chemistry to chemistry has been to extol and implement the notion of chemical information, as it operates in molecular recognition processes, being stored at the molecular level in the framework of molecules and implemented at the supramolecular level in the build-up (synthesis!) of discrete or extended assemblies of chemical objects. It forms the basis of the universal principle of self-organisation, the feature that on the wide scene is the driving force of the development of complex matter in our universe.

Where to is supramolecular chemistry then heading? Of course, many directions for future development will be found or may be extrapolated from the set of contributions collected in the present special publication. A feature of particular interest is the dynamic character of supramolecular chemistry, its ability to explore a multitude of combinations by exchange and selection of molecular components for the generation of a given supramolecular entity from a diverse collection of building blocks until the "best" constitution (thermodynamically and kinetically) is attained.

The introduction of such dynamic character into molecular chemistry and the exploration of the perspectives thus opened have given rise to an independently developing field, dynamic covalent chemistry, where the molecular entity contains covalent bonds that may form and break reversibility, so as to allow a continuous change in constitution by reorganization and exchange of building blocks. Thus, supramolecular chemistry has also been fertilizing molecular chemistry and has led to the emergence of an adaptive chemistry, which plays on constitutional diversity in dynamic chemical systems at both the molecular and supramolecular levels to allow for variation and selection in a self-organisation process to achieve adaptation.

Along the path from "Where from?" to "Where to?" supramolecular chemistry has played and is playing a major role in the development of chemistry. The breadth and depth of its scope is witnessed and illustrated by the wide range and very numerous publications, reviews and books that have sprung up in the past fifty years. The collection of papers by a select group of major players in the field gathered in the present special issue of *Chemical Society Reviews* illustrates in a most convincing way the achievements and the vitality of supramolecular chemistry.

This author has written extensively about the field, describing its core realizations, its

Institut de Science et d'Ingénierie Supramoléculaires (ISIS), University of Strasbourg, 8 Rue Gaspard Monge, Strasbourg 67000, France. E-mail: lehn@unistra.fr

underlying concepts and its wide perspectives in publications that may be found in the literature. Thus, there does not seem to be any reason to delve further into it, but the floor should rather be given to those who have contributed to the present issue.

I would finally like to congratulate and thank the editors of the present opus as well as all those who are contributing to it, to highlight the occasion of this 50^{th} (or 30^{th}) anniversary.