

From Supramolecular Chemistry to Constitutional Dynamic Chemistry

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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 constituents. The same holds for molecular chemistry when the molecular entity contains covalent bonds that may form and break reversibly, so as to allow a continuous change in constitution by reorganization and exchange of building blocks. These features define a *Constitutional Dynamic Chemistry* (CDC) on both the molecular and supramolecular levels.

On the molecular level, CDC is expressed in *dynamic combinatorial chemistry* (DCC) a recently introduced approach that uses self-assembly processes to generate libraries of chemical compounds. In contrast to classical combinatorial chemistry which is based on vast collections of prefabricated molecules, DCC implements dynamic libraries via the continuous interconversion between the library constituents by recombination of their building blocks. Spontaneous assembly/deassembly of the building blocks through reversible chemical reactions virtually encompasses all possible combinations, and allows the establishment of adaptive processes owing to the dynamic interchange of the library constituents. Several implementations of this approach in biological systems as well as in materials science will be described.

The merging of the features: - information and programmability, - dynamics and reversibility, - constitution and structural diversity, points towards the emergence of *adaptive and evolutive chemistry*.

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