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Constitutional Dynamic Chemistry

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Preface

Constitutional Dynamic Chemistry (CDC) and its application Dynamic Combinatorial Chemistry (DCC) are new evolutional approaches to produce chemical diversity. In contrast to the classical methods, they allow for the simple generation of functional systems amplified from a mixture of inter-exchanging architectures which result from sets of building blocks interacting reversibly. Kinetic or thermodynamic resolution, self-assembly followed by covalent modification, and phase-change processes all shed light on useful strategies to control and create convergence between self-organization and constitutional functions. Such dynamic libraries have special relevance for a very diverse range of applications such as drug-, catalyst-, and material discovery. CDC implements a dynamic molecular/supramolecular reversible interface between interacting constituents, mediating the structural self-correlation of different domains of generated systems by virtue of their basic constitutional behaviors. The self-assembly of the components controlled by mastering molecular/supramolecular interactions may allow the flow of structural information from molecular level toward nanoscale dimensions. This volume of *Topics in Current Chemistry* focuses on constitutional methods for understanding and controlling such upscale propagation of structural information. These methods show potential to impose further precise order at the mesoscale and to discover new routes to obtain highly ordered ultradense arrays over macroscopic distances. During the last decade, CDC has become increasingly interesting for Dynamic Interactive Systems (DIS). Networks of continuously exchanging and reversibly reorganizing objects form the core of DIS. For example, molecules, supermolecules, polymers, biomolecules, biopolymers, nanotubes, surfaces, nanoparticles, liposomes, materials, and cells are all operating under the natural selection to allow spatial/temporal and structural/functional adaptability in response to constitutional internal or stimulant external factors. The contributions to this volume open new horizons, shortening the essential steps from molecular to functional nano-objects. These steps are sometimes too long and the research strategies should expand the fundamental understanding of complex dynamic structures and properties as it relates to creating products and manufacturing processes. Combined

dynamic strategies to produce constitutional/combinatorial systems can be effectively shared as soon merged marketable technology to benefit most research laboratories and industrial producers. The 11 chapters are structured in three groups: 1. *Evolutional Approaches to Produce Chemical Diversity and the Development of the Constitutional Dynamic Systems* (Lehn, Miller, Ramström et al., and Ladame), 2. *Constitutional Self-Assembly Toward Complex Architectures* (Pantos and Sanders, Custelcean, and Quemener et al.), and 3. *Constitutional Dynamic Chemistry Toward Dynamic Interactive Systems* (Barboiu, Mahon et al., Giussepone et al., and Stadler et al.).

I would like to thank all the authors, as well as all those who have facilitated this volume, and I hope that readers will find answers to key questions concerning basic principles and related evolutional approaches that have been used in Constitutional Dynamic Chemistry (CDC). The most revolutionary consequences may reflect the fascinating possibilities offered by selection, evolution, amplification, molecular recognition, and replication processes. This volume is not a comprehensive treatise, but is a timely objective snapshot of the CDC field from which the reader can get a broader insight into this and hopefully a future source of inspiration.

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