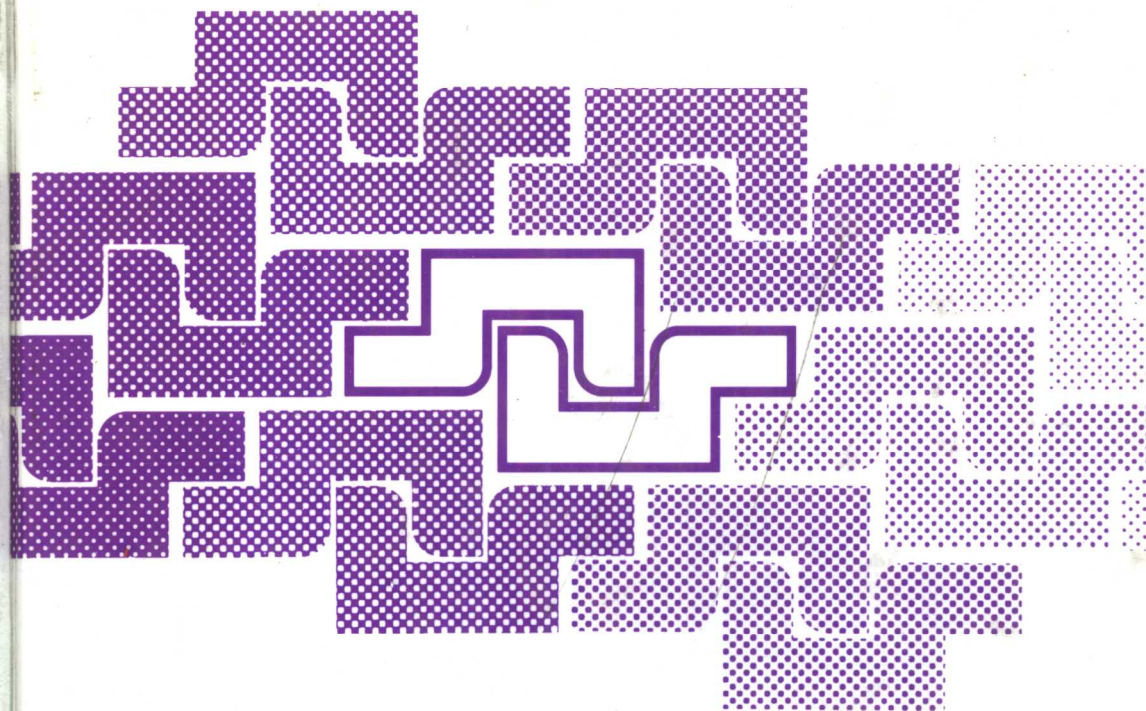




Supramolecular Science: Where It Is and Where It Is Going

Edited by

Rocco Ungaro and Enrico Dalcanale

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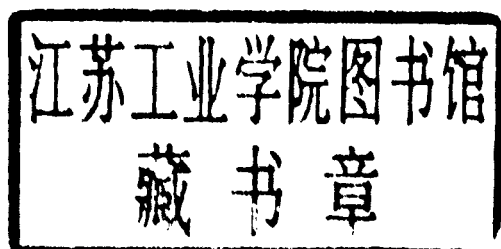
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PREFACE

The study of noncovalent interactions takes the roots in Chemistry, where it was soon recognised as an important area of research, with the 1987 Nobel prize awarded to the pioneers of Supramolecular Chemistry D.J. Cram, J.-M. Lehn and C. Pedersen. The initial studies were mainly devoted to crown ethers (Pedersen, 1967), cryptands (Lehn, 1969) and spherands (Cram, 1979) and on their interaction with ammonium and s block metal cations, which occurs with high efficiency and selectivity. Soon later, it was discovered that cavity containing compounds, such as cyclodextrins, cyclophanes and calixarenes were able to encapsulate also neutral molecules in a well defined structural arrangement and this widened the scope of Supramolecular Chemistry. The molecular recognition processes have been studied in great detail and in different experimental conditions (gas phase, organic media, water solution) leading to the disclosure of the important role played by weak interactions, such as hydrogen bonding, cation/ π , C-H/ π , *et cetera*. The success of the molecular inclusion and recognition by relatively simple hosts is also evidenced by the large use of cyclodextrins (native and semisynthetic) in pharmaceutical and food industry and by the application of molecular sensors in several fields.

The knowledge on how to master weak noncovalent interactions, which greatly benefited from theoretical and molecular modelling calculations, encouraged scientists to design more complex systems, mostly based on self-assembly, which led to the development of new materials and devices. Supramolecular conductor, semiconductor and magnetic materials have been synthesised, together with liquid crystals, sensors, wires, and grids. Supramolecular devices which are able to perform specific mechanical, photophysical, or electrochemical functions resembling logic gates, have been developed over the years. Both these topics had a profound impact also on a close discipline such as Physics.

At the same time, it has been recognised that several biological processes such as enzyme catalysis, binding to DNA, transport through membranes, cell-cell recognition, drug delivery and action, *et cetera*, are largely regulated by non-covalent interactions and this led to the penetration of supramolecular concepts inside Life Sciences.

Therefore, in the last decade Supramolecular Chemistry has developed more and more into Supramolecular Science, with a broader scope than it had at the beginning. The perception of this development led the organizers of the NATO Advanced Research Workshop entitled Supramolecular Science: where we are and where we are going, held in Lerici (La Spezia, Italy) from September 4-7, 1998, to select a large variety of topics, putting together scientists from different fields, having in common the supramolecular approach in their research.

One hundred and fourteen scientists attended the Lerici Workshop, with a large participation of young people. The beautiful setting of Villa Marigola, just in front of the "Golfo dei Poeti", helped to create a relaxed and friendly atmosphere, which greatly stimulated the exchange of information. It was a discussion oriented and forward looking meeting, with 22 lectures and seventy contributions for the poster sessions. All participants were asked to report on very new topics of their research. The following fields were covered: (i) synthetic receptors for ions, carbohydrates, peptides and small molecules; (ii) molecular recognition in chemical and biological systems, (iii) catenanes, rotaxanes, dendrimers and new materials; (iv) molecular and supramolecular devices; (v) self-assembly and nanotechnology, (vi) supramolecular catalysis, (vii) computational studies on supramolecular systems. The present volume contains most of the invited lectures presented at the Lerici NATO Workshop.

The format of the meeting was strongly encouraged by the scientific panel of NATO Special Programme on Supramolecular Chemistry. We want to thank them for having chosen the "Parma group" as the local organizers of the Workshop. A special thank to the Chairman of the NATO panel Prof. J. Fraser Stoddart and to Prof. David N. Reinhoudt, for having accepted to co-organize the meeting and for their continuous support and advice. We thank also the other members of the local organizing committee, Arturo ARDUINI, Alessandro CASNATI, Roberto CORRADINI, Andrea POCHINI, Franco UGOZZOLI and the students who enthusiastically helped to solve all the problems connected with the organization and to Ms. Paola PEDRETTI who handled all duties connected with the Workshop Secretariat in a very gentle and efficient way.

The first Advanced Research Workshop of this series was also held in Italy (Taormina, December 1991), organized by V. Balzani and L.

De Cola, to celebrate the birth of the NATO Special Programme on Supramolecular Chemistry. Since then, 23 events of this sort and one Advanced Research Institute took place within the Programme, which also provided 93 Collaborative Research Grants to scientists in at least 17 countries. The Lerici Advanced Research Workshop was the last one of the series and was also financially supported by NATO. On behalf of all scientists who benefited from the various initiatives, we want to thank the NATO Scientific Affairs Division for the generous support to the field. A special thank to the Director of the NATO Special Programme on Supramolecular Chemistry Dr. Alain Jubier for his interest and for the constant help and advice given to all organisers.

Rocco Ungaro, Enrico Dalcanale
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December 1998

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