Beilstein-Institut
Beilstein Bozen Symposium on Molecular Engineering and Control
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Preface

The Beilstein Bozen Symposia address contemporary issues in the chemical and related sciences by employing an interdisciplinary approach. Scientists from a wide range of areas – often outside chemistry – are invited to present aspects of their work for discussion with the aim of not only to advance science, but also, to enhance interdisciplinary communication.

With the increasing understanding of molecular systems it is now possible to build materials and new systems with nano-scale precision through the control of the structure of matter at the atomic and molecular level. Since the forces that dominate the macroscopic world have either less relevance or different consequences at the nano-level, we must employ different paradigms when conceiving molecular-scale machines that will build, in turn, new types of materials and machines, etc. In this respect biological systems are the best proof of concept that this kind of technology already exists. Multicomponent systems such as ribosomes can be considered as molecular-scale machines that read RNA, decode the information, generate proteins and finally assist in the folding process to ensure the generation of a correct three-dimensional configuration. This newly created entity can carry out structural functions, catalytic activities in chemical processes, and even form a constituent part of further ribosomes for the construction of new molecular machines. Inspired by biological systems, researchers are beginning to mimic nature in the design of molecules and supramolecular systems but also in the modification of nature's own factories.

A key aim is to be able to routinely design molecules or systems with desired physicochemical or physiological properties.

For example, the manipulation and control of molecules on surfaces to bring about the functionalization of the surface or of the molecules themselves is important for a wide variety of applications. Accomplishing this requires not only expertise in synthesis but also in many other techniques such as imaging, lithography and computation. Many difficulties associated with being able to simultaneously understand and control assembly, recognition, transport and motion at the molecular and systems levels remain and need to be addressed by future research.

This symposium brought together experts from different disciplines to discuss, from their own points of view, the contemporary state and future perspectives including the following aspects of molecular engineering and control, i.e. molecular control of surfaces, manipulation of metabolic pathways and engineering of proteins and nucleotides, self-organization and molecular self-assembly, imaging, diagnostics and sensors, and artificial (biological) systems.

We would like to thank particularly the authors who provided us with written versions of the papers that they presented. Special thanks go to all those involved with the preparation and organization of the symposium, to the chairmen who piloted us successfully through the sessions and to the speakers and participants for their contribution in making this symposium a success.

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