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In references *Topics in Current Chemistry* is abbreviated Top Curr Chem and is cited as a journal.

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ISBN 978-3-540-78394-7

ISBN 978-3-540-78395-4 (eBook)

DOI 10.1007/978-3-540-78395-4

Topics in Current Chemistry ISSN 0340-1022

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Cover design: WMXDesign GmbH, Heidelberg

Typesetting and Production: le-tex publishing services oHG, Leipzig

Printed on acid-free paper

9 8 7 6 5 4 3 2 1 0

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To Cristiana and Emma

Preface

The invention of scanning tunneling microscopy (STM) in 1981 [1] and later atomic force microscopy (AFM) in 1986 [2] facilitated breakthroughs in various disciplines of science such as chemistry, physics and biology, and truly boosted the development of nanoscience and nanotechnology.

These two techniques made it possible to achieve a detailed understanding of chemical and biological systems as well as phenomena across multiple length scales, and in particular down to the sub-nanometer scale. In fact STM and AFM are not simply microscopy tools, but they are also extremely useful techniques to chemist and biochemists. For example AFM and STM offer synthetic chemists the chance to observe the molecules they have synthesized, how they move and dance on a surface, how they recognize and communicate with each other, thus making it possible to cast new light onto the molecular interactions [3]. Alongside their capability of generating artistic three-dimensional pictures with nanoscale resolution, they also allowed the study of molecular based architectures beyond imaging, providing quantitative insight into various physico-chemical properties [4]. For instance, by manipulating molecules individually it is possible to bestow information onto their mechanical properties and to perform constructions on the nanoscale. In the last few years the application of AFM and STM to study molecular systems in various environments (e.g., liquid, gas, vacuum) is paving the way towards the unraveling of complex characteristics and phenomena of nanostructured (bio)systems.

In this volume we have selected a few of the most relevant examples of AFM and STM based experiments on (bio)molecular based systems, which offer not only a close look into the nanoworld but also provide quantitative insight into various properties of molecular and polymeric systems, and ultimately highlight some technologically relevant applications.

I was delighted and felt privileged to work with an outstanding group of contributing authors: I truly thank them for all their efforts. I am also grateful to Dr. Marion Hertel and Birgit Kollmar-Thoni for their invitation to edit this volume and for their assistance.

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