

PREFACE

Multifaceted roles that RNAs play in the cell constantly impose a technical challenge to those who study their functions and structures. RNAs, like other biological systems are in nanoscopic scale. Meanwhile, the remarkable progress in technologies in microfabrication has enabled manufacturing and assembling materials in nanometer scales as well as manipulating nano-objects. This advance has allowed the application of nanotechnology to manipulate or analyze directly individual biomolecules. RNAs are not exception. The power of nanotechnology has now been exploited in analyzes of RNA molecules.

This volume is devoted to pioneering works that represent integration of nanotechnology to RNA research. Application of nanotechnology pushes single molecule analysis of RNA one step forward. Nanophotonic structures called zero-mode waveguides (ZMWs) can reduce the volume necessary for an observation by more than three orders of magnitude relative to confocal fluorescence microscopy (down to the zeptoliter range) and allows single molecule observation at biologically relevant conditions (Chapter 1). Valuable biophysical properties can be characterized by applying mechanical forces to individual RNA molecules or using nanopores (Chapters 2 and 3). RNA can also be used as an element to form nanomaterials by conjugating to nanoparticles (Chapter 4). DNA, RNA itself or RNA with RNA binding protein can also form nanostructures and these nucleic-acid nanostructures can then be used as a support to exhibit biomolecules in a controlled geometry (Chapters 5 and 6).

I would like to express my sincere gratitude to the authors for their tremendous contribution. I would like to thank Dr. Michael Conn, Chief Editor of the Progress in Molecular Biology and Translational Science series for his initiative to have this volume in the series. I am grateful to Mary Ann Zimmerman, Senior Acquisition Editor, Helene Kabes, Senior Editorial Project Manager and Magesh Kumar Mahalingam, Project Manager at Elsevier for their continuous support. I hope that the readers of this volume will find its content useful and give them opportunities to think about how to incorporate these emerging new technologies into their own research.

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