Preface

© Higher Education Press and Springer-Verlag Berlin Heidelberg 2016

Nucleic acids in living cells store genetic information, conduct self-replication, templated RNA transcription and protein translation, and regulate signal transduction pathways and information flow. They can bind ligands with high specificity, and even catalyze chemical reactions. Nucleic acids are ubiquitous and found in every domain of life, including viruses and viroids, the smallest infectious pathogens containing nucleic acids. Nucleic acids impact all aspects of living organisms; they are the only molecules capable of information storage and sequence-based molecular recognition, and the only molecules in the cell subject to repair. Molecular recognition of nucleic acids is important in diagnostics, therapeutics, health and medical research, agriculture, environmental science, even national security in human health and food production. Base pairing of nucleic acids plays essential roles in molecular recognition, information storage, and damage repair. Since base mis-pairing can cause nucleic acid off-target effects, mutations and diseases, enhanced base pairing can facilitate molecular recognition, thereby leading to highly accurate diagnosis and precision medicine.

In addition to base-pairing, non-base-pairing recognition identified in both natural (much of protein binding via non-base-specific interactions) and artificial systems (such as aptamers) is extremely important as well, playing more and more important roles in diagnosis and therapeutic treatment of diseases, such as cancer early diagnosis and treatment. Therefore, structure and function understanding of nucleic acids at both the chemical and biological levels is critical to human health and medicine. The importance of this can only increase in the coming decades. Nucleic acids are going to have significant impact on many aspects of chemistry, biology, medicine, agriculture, environment science, and indeed all the life sciences.

These research and review articles have been selected in the main from the Nucleic Acid conference series held in 2015–2016. To promote a vision for the future of functional nucleic acids, Zhen Huang and his colleagues have organized the series: “The International Conference on Nucleic Acid-Protein Chemical and Structural Biology for Novel Drug Discovery”. This was begun by Zhen Huang in 2010. The inaugural conference was hosted by Peking University in 2011. The 2nd, 3rd, 4th and 5th conferences were hosted by Tsinghua University in 2012, Georgia State University in 2013, and Sichuan University in 2014 and 2015, respectively. This conference series has covered both fundamental and applied research, including RNA and DNA chemical biology, nucleic acid molecular recognition, structural and functional biology. This conference series also covers nucleic acid polymerization, nucleic acid damage and repair, RNA and DNA catalysis, the structural biology of nucleic acid-protein, and ribosome biology. Furthermore, the series includes molecular evolution, in vitro/in vivo selection and applications of nucleic acid modifications, gene silencing, nucleic acid-based diagnostics and therapeutics, nucleic acid synthesis and drug discovery, and the scientific and technological challenges in nucleic acid research areas.

Here, we would like to thank the authors to their excellent contributions. We are grateful to the Higher Education Press for providing financial support to the 2015 conference. Finally we thank Dr. Xiaowen Zhu, the Managing Editor of *Frontiers of Chemical Science and Engineering* for helping to organize this special issue.

Guest Editors

Zhen Huang

Department of Chemistry

Department of Biology

Georgia State University, Georgia 30303, USA

Email: huang@gsu.edu

David M.J. Lilley

School of Life Sciences

University of Dundee, Dundee DD1 5EH, United Kingdom

Email: d.m.j.lilley@dundee.ac.uk