SAGE-Hindawi Access to Research
Journal of Nucleic Acids
Volume 2011, Article ID 547245, 2 pages
doi:10.4061/2011/547245

Editorial

Synthesis and Application of Functional Nucleic Acids

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Received 21 September 2011; Accepted 21 September 2011

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Both DNA and RNA can serve purposes beyond the storage and transfer of genetic information. They can display catalytic activity in a variety of chemical reactions, bind to diverse molecules, and respond to chemical stimuli. These functional nucleic acids have been thus employed in a broad spectrum of applications in biotechnology. In fact, the entire field of biotechnology has seen a complete revolution with the introduction and application of functional nucleic acids. Out of the many different types of functional nucleic acids, some of the prime contributions have been from riboswitches which have led to new ways to understand and manipulate biological processes based on molecular recognition coupled to structural rearrangements. Besides that, techniques like RNA interference which rely essentially on using small natural or synthetic functional ribonucleic acids have not only led us to a better understanding and modulation of gene regulation but also improved the rate and quality at which research progresses. Recently, functional nucleic acids have been ascribed to greater promise in nanotechnology as they have opened new avenues ranging from biosensors to computation. This special issue places the spotlight on the crossroads between nucleic acid chemistry and biology especially focusing on the design, synthesis, analysis as well as application of functional nucleic acids.

The first section of this special issue addresses synthesis, modification, characterization, and function of DNA molecules. It was demonstrated that chemical modifications of DNA molecules are promising for the design of biosensors to detect structural changes in nucleic acids and to bind proteins such as thrombin and antibodies, leading to the controlled inhibition of protein functions. Noteworthily, DNA switches regulated by light, radiation, and magnetic fields are reported. These nucleic acid switches are useful to control functions of nucleic acids by external stimuli. Moreover, biophysical studies of natural and chemically modified nucleic acids should be useful for rational design of functional nucleic acids. The utilizations of DNA in nanotechnology as building blocks for nanostructures and as template for nanoparticles are further reported.

The second section of this special issue presents functional RNA molecules which are either naturally discovered, or developed by combinatorial chemistry named *in vitro* selection or SELEX. The *in vitro* and *in cellulo* applications of such functional RNA molecules are discussed. Moreover, naturally observed and chemical modifications of RNA molecules and their functionalities are presented.

Finally, the last section comprises articles that cover the interactions between nucleic acids and proteins including oligopeptides. The influence of noncanonical DNA secondary structures and base pairs on the interaction with topoisomerases and helicases is presented. These results provide a biophysical and biochemical rationale for the design of functional DNA molecules that can regulate such protein functions. Moreover, the use of a designed peptide library for the development of a particular DNA G-quadruplex sequence is reported.

Collectively, these papers describe the present state of chemistry and biology of functional nucleic acids. Current and ongoing advances in this field will certainly propel our capacity to develop even more sophisticated functional

nucleic acids in the future. In this regard, these articles all provide a perspective into the future of this field.

Acknowledgments

The editors of this issue want to express their deep appreciation to all of the authors and reviewers for their contributions to this issue.

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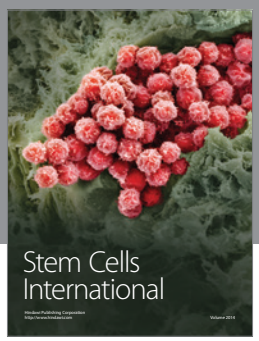

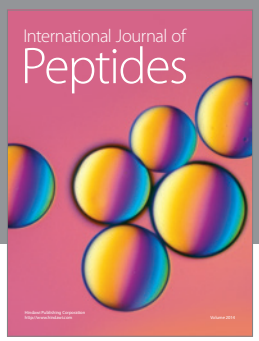

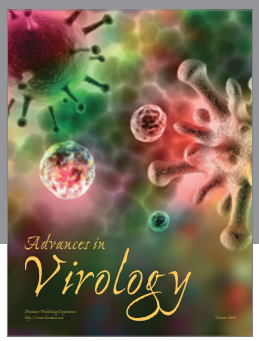

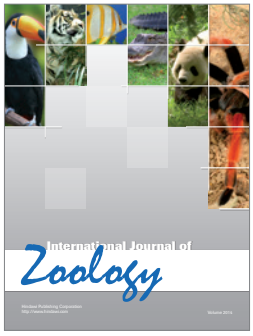

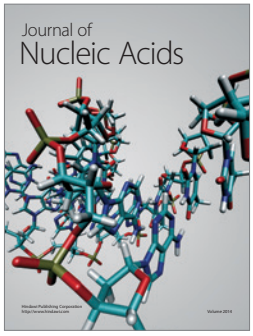

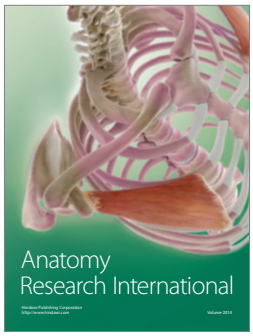

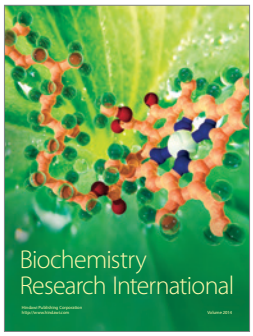

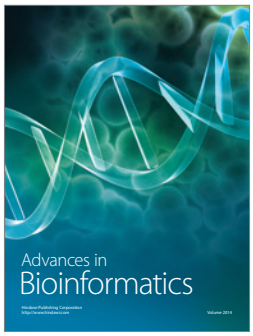

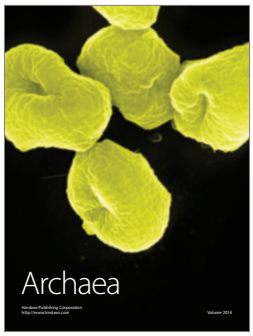

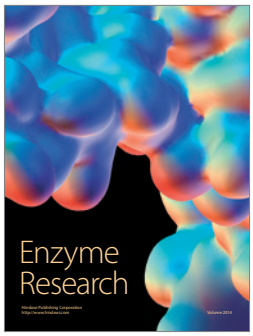

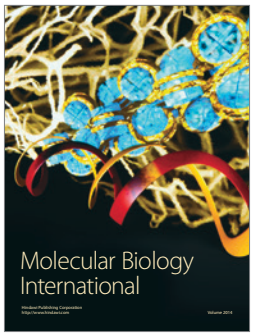

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