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Preface

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Biomolecular computing has emerged as an interdisciplinary field that draws together molecular biology, chemistry, computer science and mathematics. Scientists in this area share an interest in practical and theoretical issues relevant to the development of programmed biomolecular systems, including the construction of programmed self-assembling structures and the development of molecular computational networks. Much of the current work focuses on DNA/RNA nanotechnology where fundamental tools, both experimental and analytical, are already widely available.

The main venue for presentation of results in this area is the annual International Conference on DNA Computing and Molecular Programming, along with the sister conference on Foundations of Nanoscience. The conference began in 1995 right after the landmark work by L. Adleman, who solved an instance of the Hamiltonian path problem by DNA molecules and opened the door to this new field. Since then, the meeting has been a forum where scientists with different backgrounds, yet sharing a common interest in biomolecular computing, meet and present their latest results.

This special issue contains a selection of 5 papers presented at DNA 17: the 17th International Conference on DNA Computing and Molecular Programming, held during September 19–23, 2011 in Pasadena, California, USA. The papers are representative of the breadth of topics of the conference: from theory, to device design, to experimental results.

The paper "Computing maximal Kleene closures that are embeddable in a given subword-closed language" by Stavros Konstantinidis and Nicolae Santean, considers the problem of algorithmically producing DNA sequences of a certain length that respect sets of design constrains specified as subsequences of the full sequence.

The paper "Graph-theoretic formalization of hybridization in DNA sticker complexes" by Robert Brijder, Joris J.M. Gillis and Jan Van den Bussche, is inspired by the possibility of using DNA complexes to represent both databases and their data retrieval operations, and focuses on characterizing the termination and complexity of such computations.

The paper "Improved DNA-Sticker Arithmetic" by Mark G. Arnold, improves on previous proposals of how to perform arithmetic computation with strands of DNA. A new algorithm for integer addition is presented, which through logarithmic encoding extends to multiplication and division.

The paper "One-Dimensional Staged Self-Assembly" by Erik D. Demaine, Sarah Eisenstat, Mashhood Ishaque, and Andrew Winslow, studies the self-assembly of one-dimensional structures out of staged combinations of elementary tiles; this is made non-trivial by requiring a specified linear sequence of tiles in the final assembly.

The paper "Cooperative Linear Cargo Transport with Molecular Spiders" by Oleg Semenov, Mark J. Olah, and Darko Stefanovic, provides analysis and experimental results for a class of molecular devices that can move on a substrate, where the substrate is in this case single-stranded DNA.

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