
Preface

Nanotechnology is slowly and steadily entering more and more aspects of our life. It is becoming a base for developing new materials as well as a base for developing novel methods of computing. As natural computing is concerned with information processing taking place in or inspired by nature, the ideas coming from basic interactions between atoms and molecules naturally become part of these novel ways of computing.

While nanotechnology and nanoengineering have flourished in recent years, the roots of DNA nanotechnology go back to the pioneering work of Nadrian (Ned) C. Seeman in the 1980s. Many of the original designs and constructions of nanoscale structures from DNA developed in Ned's lab provided a completely new way of looking at this molecule of life. Starting with the synthesis of the first immobile Holliday junction, now referred to as J1, through the double and triple cross-over molecules, Ned has shown that DNA is a powerful and versatile molecule which is ideal for building complex structures at the nanometer scale.

Through the years, Ned has used some of the basic DNA motif structures as 'tinkertoy' or 'lego' units to build a cube, two-dimensional arrays, and various three-dimensional structures, such as Borromean rings, nanomechanical devices, nano-walkers (robots), etc. All of them were designed and demonstrated originally in Ned's lab, but then all these ideas and designs were followed up by many other researchers around the world.

Adleman's seminal paper from 1994 provided a proof of principle that computing at a molecular level, with DNA, is possible. This led to a real explosion of research on molecular computing, and very quickly Ned's ideas concerning the design and construction of nanoscale structures from DNA had a profound influence on the development of both the theoretical and the experimental foundations of this research area.

Ned is a scientist and a chemist in the first place. Although Ned can be considered the founder of the DNA nanoengineering field, he has always considered himself as a chemist who is interested in basic science. Therefore, he is still very interested in the basic physical properties of DNA and enzymes

that interact with nucleic acids. Ned has been continuously funded by NIH for almost 30 years and is still providing valuable insights into the DNA and RNA biophysical and topological properties as well as the mechanism of homologous recombination between two chromosomal DNAs.

Ned's enormous influence extends also to service to the scientific community. Here one has to mention that Ned is the founding president of the International Society for Nanoscale Science, Computation and Engineering (ISNSCE). The respect that Ned enjoys is also manifested through various honors and awards that he has received — among others the Feynman Prize in Nanotechnology and the Tulip Award in DNA Computing.

Besides science, Ned is very much interested in the world around him, e.g., in art. Amazingly, some of this interest has also influenced his scientific work: by studying the work of Escher he got some specific ideas for constructions of DNA-based nanostructures! Ned is an excellent lecturer and has given talks around the world, thereby instigating significant interest and research in DNA nanotechnology and computing.

With this volume, which presents many aspects of research in basic science, application, theory and computing with DNA molecules, we celebrate a scientist who has been a source of inspiration to many researchers all over the world, and to us a mentor, a scientific collaborator, and a dear friend.

December 2005

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<http://www.springer.com/978-3-540-30295-7>

Nanotechnology: Science and Computation

Chen, J.; Jonoska, N.; Rozenberg, G. (Eds.)

2006, XI, 393 p., Hardcover

ISBN: 978-3-540-30295-7