

# 3d Dna

Jung-II Jin,James Grote

**3D DNA Nanostructure** Yonggang Ke, Pengfei Wang, 2016-11-04 This detailed volume presents a comprehensive technical overview of DNA nanotechnology with an emphasis on 3D DNA nanostructure design and applications. Coverage spans from basic design principles for DNA and RNA nanostructures to their cutting-edge applications in a variety of fields, with the book divided into basic DNA and RNA nanostructure design strategies as well as applications utilizing DNA nanostructures, including but not limited to nanomedicine, bioimaging, biosensing, nanoplasmonics, nanoelectronics, nanofabrication, crystallography, biophysics, and analytical chemistry. Written for the highly successful Methods in Molecular Biology series, chapters include introductions to their respective topics, lists of the necessary materials and reagents, step-by-step, readily reproducible laboratory protocols, and tips on troubleshooting and avoiding known pitfalls. Comprehensive and authoritative, 3D DNA Nanostructure: Methods and Protocols provides the most up-to-date tutorial style overviews and technical style protocols to benefit researchers in a wide variety of areas.

**Assembly of 3D DNA Architectures** Christopher McLaughlin, 2013 DNA serves as the essential biomacromolecule responsible for encoding, transmitting and expressing genetic information in all forms of life. However, when taken out of this biological role, the unique self-assembling properties, information rich content and easy means of chemical synthesis make DNA an ideal material for solving some of the challenging problems in chemical construction at the nanometer length scale. The emerging field of supramolecular DNA assembly presents chemical solutions to DNA construction, by synthetically modifying DNA with small molecules and supramolecular motifs. This thesis specifically examines how DNA building blocks modified with synthetic organic, inorganic and polymeric molecules can be designed to efficiently assemble into well-defined 3D structures. In part 1, a modular assembly strategy is developed whereby 2D DNA triangles are efficiently prepared and connected to create the first triangular prismatic structure that can be site-specifically coordinated with transition metals. In part 2, selective introduction of sequence symmetry is utilized to both simplify design and generate an expanded set of 3D DNA geometries in a mild, facile and high yield manner. In parts 3 and 4, a 3D DNA construction method that assembles a minimum number of DNA strands in near quantitative yield, to give a scaffold with a large number of single-stranded arms, is introduced. As demonstrated in part 3, site-specific hybridization of DNA-polymer conjugates to the single-stranded arms of this 3D-DNA scaffold gives efficient access to nanostructured DNA-block copolymer cages with enhanced nuclease resistance. In part 4, it is demonstrated that unfunctionalized 3D DNA

cubes efficiently accumulate in the cytoplasm of human cervical cancer cells (HeLa) without the aid of any transfection agent. Collectively, this work develops 'DNA-economic' strategies to assemble 3D DNA structures in a facile manner and excellent yield. These assembly methods lay the foundation for fundamental assessment and future integration of 3D DNA structures as cellular probes or drug delivery tools and as a means to help solve some of the challenges facing researchers in biophysics and nanoscience. --

**Modeling the 3D Conformation of Genomes** Guido Tiana, Luca Giorgetti, 2019-01-15 This book provides a timely summary of physical modeling approaches applied to biological datasets that describe conformational properties of chromosomes in the cell nucleus. Chapters explain how to convert raw experimental data into 3D conformations, and how to use models to better understand biophysical mechanisms that control chromosome conformation. The coverage ranges from introductory chapters to modeling aspects related to polymer physics, and data-driven models for genomic domains, the entire human genome, epigenome folding, chromosome structure and dynamics, and predicting 3D genome structure.

**3D DNA Origami as Precise Building Blocks in Protocellular Systems** Saskia Gröer, 2021

DNA Nanotechnology Chunhai Fan, Yonggang Ke, 2020-09-07 The series Topics in Current Chemistry Collections presents critical reviews from the journal Topics in Current Chemistry organized in topical volumes. The scope of coverage is all areas of chemical science including the interfaces with related disciplines such as biology, medicine and materials science. The goal of each thematic volume is to give the non-specialist reader, whether in academia or industry, a comprehensive insight into an area where new research is emerging which is of interest to a larger scientific audience. Each review within the volume critically surveys one aspect of that topic and places it within the context of the volume as a whole. The most significant developments of the last 5 to 10 years are presented using selected examples to illustrate the principles discussed. The coverage is not intended to be an exhaustive summary of the field or include large quantities of data, but should rather be conceptual, concentrating on the methodological thinking that will allow the non-specialist reader to understand the information presented. Contributions also offer an outlook on potential future developments in the field. The chapter DNA-Programmed Chemical Synthesis of Polymers and Inorganic Nanomaterials is available open access under a CC BY 4.0 License via [link.springer.com](https://link.springer.com).

DNA and RNA Origami Julián Valero, 2023-05-11 This volume details diverse methodological approaches on the assembly and applications of DNA

origami assemblies. Chapters guide readers through different synthetic and computational methods, isolation and structural characterization of 2D and 3D DNA origami nanoarchitectures, nanophotonics, drug delivery, biophysics, and synthetic biology. Written in the successful Methods in Molecular Biology series format, chapters include introductions to their respective topics, lists of the necessary materials and reagents, step-by-step, readily reproducible protocols, and notes on troubleshooting and avoiding known pitfalls. Authoritative and cutting-edge, *DNA and RNA Origami: Methods and Protocols* aims to serve as a guideline describing the current state-of-the-art assembly methodologies and applications of DNA origami nanostructures.

*DNA Origami* Masayuki Endo, 2022-05-05 DNA ORIGAMI Discover the impact and multidisciplinary applications of this subfield of DNA nanotechnology DNA origami refers to the technique of assembling single-stranded DNA template molecules into target two- and three-dimensional shapes at the nanoscale. This is accomplished by annealing templates with hundreds of DNA strands and then binding them through the specific base-pairing of complementary bases. The inherent properties of these DNA molecules—molecular recognition, self-assembly, programmability, and structural predictability—has given rise to intriguing applications from drug delivery systems to uses in circuitry in plasmonic devices. The first book to examine this important subfield, *DNA Origami* brings together leading experts from all fields to explain the current state and future directions of this cutting-edge avenue of study. The book begins by providing a detailed examination of structural design and assembly systems and their applications. As DNA origami technology is growing in popularity in the disciplines of chemistry, materials science, physics, biophysics, biology, and medicine, interdisciplinary studies are classified and discussed in detail. In particular, the book focuses on DNA origami used for creating new functional materials (combining chemistry and materials science; DNA origami for single-molecule analysis and measurements (as applied in physics and biophysics); and DNA origami for biological detection, diagnosis and therapeutics (medical and biological applications). *DNA Origami* readers will also find: A complete guide for newcomers that brings together fundamental and developmental aspects of DNA origami technology Contributions by a leading team of experts that bring expert views from different angles of the structural developments and applications of DNA origami An emerging and impactful research topic that will be of interest in numerous multidisciplinary areas A helpful list of references provided at the end of each chapter to give avenues for further study Given the wide scope found in this groundbreaking work, *DNA Origami* is a perfect resource for nanotechnologists, biologists, biophysicists, chemists, materials scientists, medical scientists, and pharmaceutical researchers.

**Artificially Controllable Nanodevices Constructed by DNA Origami Technology** Yangyang Yang, 2015-12-16 In this book, the author deals mainly with two topics: (1) single-molecule visualization of switching behaviors in the DNA nanoframe system utilizing different kinds of molecular switches through the use of high-speed atomic force microscope (AFM); (2) construction of photocontrollable DNA nanostructures in programmed patterns and direct visualization of the dynamic assembling process. Here, high-speed AFM was employed to observe the dynamic movements of single molecules. Compared to a traditional single-molecule analysis method, such as fluorescence spectroscopy or electron microscopy, high-speed AFM makes possible the real-time observation of molecule behaviors. DNA nanostructures were designed and assembled as scaffolds to incorporate interested biomolecules. The observations were carried out under robust conditions without complicated pretreatment. Moreover, the photoresponsive molecules were successfully assembled into around 100 nm-sized DNA nanostructures. The assembly/disassembly of nanostructures can be regulated reversibly by photoirradiation. This book explains how DNA origami has gradually become a useful tool for the investigation of biochemical interactions in defined nanospace. It also shows the possibility of DNA nanostructures acting as nanodevices for application in biological systems, serving as a good introduction to basic DNA nanotechnology.

**Perspective of DNA Computing in Computer Science** , 2023-02-21 DNA or Deoxyribonucleic Acid computing is an emerging branch of computing that uses DNA sequence, biochemistry, and hardware for encoding genetic information in computers. Here, information is represented by using the four genetic alphabets or DNA bases, namely A (Adenine), G (Guanine), C (Cytosine), and T (Thymine), instead of the binary representation (1 and 0) used by traditional computers. This is achieved because short DNA molecules of any arbitrary sequence of A, G, C, and T can be synthesized to order. DNA computing is mainly popular for three reasons: (i) speed (ii) minimal storage requirements, and (iii) minimal power requirements. There are many applications of DNA computing in the field of computer science. Nowadays, DNA computing is widely used in cryptography for achieving a strong security technique, so that unauthorized users are unable to retrieve the original data content. In DNA-based encryption, data are encrypted by using DNA bases (A, T, G, and C) instead of 0 and 1. As four DNA bases are used in the encryption process, DNA computing supports more randomness and makes it more complex for attackers or malicious users to hack the data. DNA computing is also used for data storage because a large number of data items can be stored inside the condensed volume. One gram of DNA holds approx DNA bases or approx 700 TB. However, it takes approx 233

hard disks to store the same data on 3 TB hard disks, and the weight of all these hard disks can be approx 151 kilos. In a cloud environment, the Data Owner (DO) stores their confidential encrypted data outside of their own domain, which attracts many attackers and hackers. DNA computing can be one of the best solutions to protect the data of a cloud server. Here, the DO can use DNA bases to encrypt the data by generating a long DNA sequence. Another application of DNA computing is in Wireless Sensor Network (WSN). Many researchers are trying to improve the security of WSN by using DNA computing. Here, DNA cryptography is used along with Secure Socket Layer (SSL) that supports a secure medium to exchange information. However, recent research shows some limitations of DNA computing. One of the critical issues is that DNA cryptography does not have a strong mathematical background like other cryptographic systems. This edited book is being planned to bring forth all the information of DNA computing. Along with the research gaps in the currently available books/literature, this edited book presents many applications of DNA computing in the fields of computer science. Moreover, research challenges and future work directions in DNA computing are also provided in this edited book. This edited book gives an overall detail of DNA computing and the fundamentals of cryptography. Many applications of DNA computing in computer science fields, such as cryptography, cloud computing, big data storage, Wireless Sensor Network (WSN) security, and many more, are presented in different chapters of this edited book. Research challenges along with many future work directions in DNA computing are presented in this edited book.

Visions of DNA Nanotechnology at 40 for the Next 40 Nataša Jonoska, Erik Winfree, 2023-07-04 This open access book provides a unique and state-of-the-art view on DNA nanotechnology with an eye toward future developments. Intended as a tribute to Nadrian C. Seeman, who founded the field of DNA nanotechnology, the content is an exciting mixture of technical and non-technical material, reviews, tutorials, perspectives, new findings, and open questions. The book aims to inspire current researchers to sit back and think about the big picture, while also enticing new researchers to enter the field. Most of all, the book captures voices from a unique moment in time: 40 years after the publication of the first paper that envisioned DNA nanotechnology. From this vantage point, what are the untold stories, the unspoken concerns, the underlying fundamental issues, the overlooked opportunities, and the unifying grand challenges? What will help us see more clearly, see more creatively, or see farther? What is transpiring right now that could pave the way for the future? To address these questions, leading researchers have contributed 22 chapters, grouped into five sections: perspectives, chemistry and physics, structures, biochemical circuits, and spatial systems. This book will be an important reference point in the field of

DNA nanotechnology, both for established researchers looking to take stock of the field and its future, and for newcomers such as graduate students and researchers in other fields who are beginning to appreciate the power and applicability of its methods.

Structural DNA Nanotechnology Nadrian C. Seeman, 2016-01-07 Written by the founder of the field, this is the first text of its kind, providing a definitive introduction to structural DNA nanotechnology. Readers will learn everything there is to know about the subject from the unique perspective of the leading expert in the field. Topics covered range from origins and history, to design, experimental techniques, DNA nanomechanics devices, computing, and the uses of DNA nanotechnology in organising other materials. Clearly written, and benefiting from over 200 full colour illustrations, readers will find this an accessible and easy to follow text that is essential reading for anyone who wants to enter this rapidly growing field. Ideal for advanced undergraduate and graduate students, as well as researchers in a range of disciplines including nanotechnology, materials science, physics, biology, chemistry, computational science and engineering.

**Injectable Hydrogels for 3D Bioprinting** Insup Noh, Xiumei Wang, Sandra van Vlierberghe, 2021-07-30 Hydrogels represent one of the cornerstones in tissue engineering and regenerative medicine, due to their biocompatibility and physiologically relevant properties. These inherent characteristics mean that they can be widely exploited as bioinks in 3D bioprinting for tissue engineering applications as well as injectable gels for cell therapy and drug delivery purposes. The research in these fields is booming and this book provides the reader with a terrific introduction to the burgeoning field of injectable hydrogel design, bioprinting and tissue engineering. Edited by three leaders in the field, users of this book will learn about different classes of hydrogels, properties and synthesis strategies to produce bioinks. A section devoted to the key processing and design challenges at the hydrogel/3D bioprinting/tissue interface is also covered. The final section of the book closes with pertinent clinical applications. Tightly edited, the reader will find this book to be a coherent resource to learn from. It will appeal to those working across biomaterials science, chemical and biomedical engineering, tissue engineering and regenerative medicine.

*Materials Science of DNA* Jung-Il Jin, James Grote, 2016-04-19 The field of materials science and technology has undergone revolutionary advances due to the development of novel analytical tools, functional materials, and multidisciplinary approaches to engineering. Additionally, theoretical predictions combined with increasingly improved models and computational capabilities are making impressive contribution

*DNA Beyond Genes* Vadim V. Demidov, 2020-01-29 This is the first book portraying to a wide readership many fields of DNA in the world of materials altogether in a single volume. The book provides underlying concepts and state-of-art developments in the emerging fields of DNA electronics, structural DNA nanotechnology, DNA computing and DNA data storage, DNA machines and nanorobots. Future possibilities of innovative DNA-based technologies, such as DNA cryptography, DNA identity tags, DNA nanostructures in biosensing and nanomedicine, as well as DNA-based nanoelectronics are all covered, too. This book is valuable for university students studying engineering and technology; biotech, nanotech, and medical device R&D managers, practitioners and investors; and IP analysts who would like to extend their background in advanced DNA technologies. It is nicely illustrated, which makes it very readable, and it conveys science and principles in a lively language to appeal to a broad audience, from professionals and academics to students and lay readers. Advance Praise for *DNA Beyond Genes*: “Most students of DNA, and lay readers as well, are interested in the absolutely essential role it plays in biology. However, the properties which make DNA the carrier of genetic information also make it an extraordinary material that can be used as the backbone for a wide variety of nanoengineering applications – these range from information storage and computation to molecular machines and devices to artfully designed logos and symbols. The perfect self-recognition of DNA sequences makes it an ideal building block to synthesize more and more elaborate constructions and imaginative scientists have probably only just scratched the surface of what can eventually be created. Here for the first time in this wonderful book Vadim Demidov explores the full range of the non-biological applications of DNA.” Charles R. Cantor Professor Emeritus of Biomedical Engineering, Boston University Member of the USA National Academy of Sciences

**Structure and Conformational Dynamics of 3D DNA Origami Objects Probed Small-angle X-ray Scattering** Linda Brützel, 2017

**DNA Nanotechnology for Cell Research** Zhou Nie, 2024-02-13 DNA Nanotechnology for Cell Research Comprehensive coverage of DNA nanotechnology with a focus on its biomedical applications in disease diagnosis, gene therapy, and drug delivery Bringing together multidisciplinary aspects of chemical, material, and biological engineering, *DNA Nanotechnology for Cell Research: From Bioanalysis to Biomedicine* presents an overview of DNA nanotechnology with emphasis on a variety of different applications in cell research and engineering, covering a unique collection of DNA nanotechnology for fundamental research and engineering of living cells, mostly in cellulo and in vivo, for the first time. Broad coverage of this book ranges from pioneering concepts of DNA nanotechnology to cutting-edge reports regarding the use of DNA nanotechnology for fundamental cell science



and related biomedical engineering applications in sensing, bioimaging, cell manipulation, gene therapy, and drug delivery. The text is divided into four parts. Part I surveys the progress of functional DNA nanotechnology tools for cellular recognition. Part II illustrates the use of DNA-based biochemical sensors to monitor and image intracellular molecules and processes. Part III examines the use of DNA to regulate biological functions of individual cells. Part IV elucidates the use of DNA nanotechnology for cell-targeted medical applications. Sample topics covered in DNA Nanotechnology for Cell Research include: Selections and applications of functional nucleic acid toolkits, including DNA/RNA aptamers, DNAzymes, and riboswitches, for cellular recognition, metabolite detection, and liquid biopsy. Developing intelligent DNA nanodevices implemented in living cells for amplified cell imaging, smart intracellular sensing, and in cellulo programmable biocomputing. Harnessing dynamic DNA nanotechnology for non-genetic cell membrane engineering, receptor signaling reprogramming, and cellular behavior regulation. Construction of biocompatible nucleic acid nanostructures as precisely controlled vehicles for drug delivery, immunotherapy, and tissue engineering. Providing an up-to-date tutorial style overview along with a highly valuable in-depth perspective, DNA Nanotechnology for Cell Research is an essential resource for the entire DNA-based nanotechnology community, including analytical chemists, biochemists, materials scientists, and bioengineers.

Computational Science and Its Applications - ICCSA 2006 Osvaldo Gervasi,Vipin Kumar,C.J. Kenneth Tan,David Taniar,Antonio Laganà,Youngsong Mun,Hyunseung Choo,2006-05-11 The five-volume set LNCS 3980-3984 constitutes the refereed proceedings of the International Conference on Computational Science and Its Applications, ICCSA 2006. The volumes present a total of 664 papers organized according to the five major conference themes: computational methods, algorithms and applications high performance technical computing and networks advanced and emerging applications geometric modelling, graphics and visualization information systems and information technologies. This is Part I.

**The Chemistry of Nanostructured Materials ,**

Structural DNA Nanotechnology Nadrian C. Seeman,2015 Written by the founder of the field, this is a comprehensive and accessible introduction to structural DNA nanotechnology.

**DNA Decipher Journal Volume 10 Issue 2** Quantum Dream Inc,2020-12-21 This is DNADJ Volume 10 Issue 2 first published in December 2020. It is entitled 3D Quantum Vacuum, Origin of Life, & Bio-harmony and contains the following: (1) The Quantum Potential & the Bell Length of the 3D Quantum

Vacuum as the Parameters Generating the Avian Compass; (2) Perspectives on the Origin of Life in Exoplanets as a Phenomenon Generated by a 3D Quantum Vacuum; (3) How to Compose Beautiful Music of Light in Bio-harmony? (4) DNA & Time Reversal; and (5) Life in Venus? - What TGD says. DNA Decipher Journal (DNADJ, <http://www.dnadecipher.com>) is a publication in which biologists, physicists, mathematicians and other learned scholars publish their research results and express their views on the origin, nature and mechanism of DNA as a biological program and entity and its possible connection to a deeper reality.

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