



Small Wonders, **Endless Frontiers**

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A Review of the National Nanotechnology Initiative

NATIONAL RESEARCH COUNCIL

Small Wonders Endless Frontiers A Review Of The National Nanotechnology Initiative

National Academy of Engineering



Small Wonders Endless Frontiers A Review Of The National Nanotechnology Initiative:

Small Wonders, Endless Frontiers National Research Council, Division on Engineering and Physical Sciences, Committee for the Review of the National Nanotechnology Initiative, 2002-10-10 Nanoscale science and technology often referred to as nanoscience or nanotechnology are science and engineering enabled by our relatively new ability to manipulate and characterize matter at the level of single atoms and small groups of atoms This capability is the result of many developments in the last two decades of the 20th century including inventions of scientific instruments like the scanning tunneling microscope Using such tools scientists and engineers have begun controlling the structure and properties of materials and systems at the scale of 10^{-9} meters or $1/100,000$ the width of a human hair Scientists and engineers anticipate that nanoscale work will enable the development of materials and systems with dramatic new properties relevant to virtually every sector of the economy such as medicine telecommunications and computers and to areas of national interest such as homeland security Indeed early products based on nanoscale technology have already found their way into the marketplace and into defense applications In 1996 as the tremendous scientific and economic potential of nanoscale science and technology was beginning to be recognized a federal interagency working group formed to consider creation of a national nanotechnology initiative NNI As a result of this effort around 1 billion has been directed toward NNI research since the start of FY 2001 At the request of officials in the White House National Economic Council and agencies that are participating in NNI the National Research Council NRC agreed to review the NNI The Committee for the Review of the National Nanotechnology Initiative was formed by the NRC and asked to consider topics such as the current research portfolio of the NNI the suitability of federal investments and interagency coordination efforts in this area *Nanotechnology Research Directions for Societal Needs in 2020* Mihail C. Roco, Chad A. Mirkin, Mark C. Hersam, 2011-06-17 This volume presents a comprehensive perspective on the global scientific technological and societal impact of nanotechnology since 2000 and explores the opportunities and research directions in the next decade to 2020 The vision for the future of nanotechnology presented here draws on scientific insights from U S experts in the field examinations of lessons learned and international perspectives shared by participants from 35 countries in a series of high level workshops organized by Mike Roco of the National Science Foundation NSF along with a team of American co hosts that includes Chad Mirkin Mark Hersam Evelyn Hu and several other eminent U S scientists The study performed in support of the U S National Nanotechnology Initiative NNI aims to redefine the R D goals for nanoscale science and engineering integration and to establish nanotechnology as a general purpose technology in the next decade It intends to provide decision makers in academia industry and government with a nanotechnology community perspective of productive and responsible paths forward for nanotechnology R D

Nanotalk Rosalyn W. Berne, 2005-08-31 No one really knows where nanotechnology is leading what its pursuit will mean and how it may affect human and other forms of life Nevertheless its research and development are moving briskly into that

unknown Nanotalk is a book of conversations and explorations with thirty five such nano research scientists and engineers who share their ideas Governing Future Technologies Mario Kaiser,Monika Kurath,Sabine Maasen,Christoph Rehmann-Sutter,2009-10-29 Nanotechnology has been the subject of extensive assessment hype unlike any previous field of research and development A multiplicity of stakeholders have started to analyze the implications of nanotechnology Technology assessment institutions around the world non governmental organizations think tanks re insurance companies and academics from science and technology studies and applied ethics have turned their attention to this growing field s implications In the course of these assessment efforts a social phenomenon has emerged a phenomenon the editors define as assessment regime Despite the variety of organizations methods and actors involved in the evaluation and regulation of emerging nanotechnologies the assessment activities comply with an overarching scientific and political imperative Innovations are only welcome if they are assessed against the criteria of safety sustainability desirability and acceptability So far such deliberations and reflections have played only a subordinate role This book argues that with the rise of the nanotechnology assessment regime however things have changed dramatically Situated at the crossroads of democratizing science and technology good governance and the quest for sustainable innovations the assessment regime has become constitutive for technological development The contributions in this book explore and critically analyse nanotechnology s assessment regime To what extent is it constitutive for technology in general for nanotechnology in particular What social conditions render the regime a phenomenon sui generis And what are its implications for science and society

Nanotoxicology and Nanoecotoxicology Vol. 1 Vineet Kumar,Praveen Guleria,Shivendu Ranjan,Nandita Dasgupta,Eric Lichtfouse,2021-04-13 This book discusses the basics of nanotoxicity and gives a detailed account of methods used for toxicity evaluation of nanomaterials It also gives indepth coverage of the effect of different types of nanomaterials including organic and inorganic on various aquatic animals microorganisms and plants and outlines recent challenges regulatory frameworks and advances in nanotoxicity testing Nanotechnology Research and Development Act of 2003 United States. Congress. House. Committee on Science,2003 *America Inc.?* Linda Weiss,2014-04-01 For more than half a century the United States has led the world in developing major technologies that drive the modern economy and underpin its prosperity In America Inc Linda Weiss attributes the U S capacity for transformative innovation to the strength of its national security state a complex of agencies programs and hybrid arrangements that has developed around the institution of permanent defense preparedness and the pursuit of technological supremacy She examines how that complex emerged and how it has evolved in response to changing geopolitical threats and domestic political constraints from the Cold War period to the post 9 11 era Weiss focuses on state funded venture capital funds new forms of technology procurement by defense and security related agencies and innovation in robotics nanotechnology and renewable energy since the 1980s Weiss argues that the national security state has been the crucible for breakthrough innovations a catalyst for entrepreneurship and the

formation of new firms and a collaborative network coordinator for private sector initiatives Her book appraises persistent myths about the military commercial relationship at the core of the National Security State Weiss also discusses the implications for understanding U S capitalism the American state and the future of American primacy as financialized corporations curtail investment in manufacturing and innovation

The Visioneers W. Patrick McCray, 2017-06-06 The story of the visionary scientists who invented the future In 1969 Princeton physicist Gerard O Neill began looking outward to space colonies as the new frontier for humanity s expansion A decade later Eric Drexler an MIT trained engineer turned his attention to the molecular world as the place where society s future needs could be met using self replicating nanoscale machines These modern utopians predicted that their technologies could transform society as humans mastered the ability to create new worlds undertook atomic scale engineering and if truly successful overcame their own biological limits The Visioneers tells the story of how these scientists and the communities they fostered imagined designed and popularized speculative technologies such as space colonies and nanotechnologies Patrick McCray traces how these visioneers blended countercultural ideals with hard science entrepreneurship libertarianism and unbridled optimism about the future He shows how they built networks that communicated their ideas to writers politicians and corporate leaders But the visioneers were not immune to failure or to the lures of profit celebrity and hype O Neill and Drexler faced difficulty funding their work and overcoming colleagues skepticism and saw their ideas co opted and transformed by Timothy Leary the scriptwriters of Star Trek and many others Ultimately both men struggled to overcome stigma and ostracism as they tried to unshackle their visioneering from pejorative labels like fringe and pseudoscience The Visioneers provides a balanced look at the successes and pitfalls they encountered The book exposes the dangers of promotion oversimplification misuse and misunderstanding that can plague exploratory science But above all it highlights the importance of radical new ideas that inspire us to support cutting edge research into tomorrow s technologies

Nanotechnology in Textile Finishing Satyaranjan Bairagi, Shakeel Ahmed, S. Wazed Ali, 2024-09-24 This book is focused on the latest developments and practical applications of nanotechnology in textile finishing It covers the fundamentals of nanotechnology including the properties and behavior of nanoparticles and how they can be used to enhance the performance of textiles The book also explores the various types of nanomaterials that are used in textile finishing such as nanoparticles nanocomposites and nano coatings and their properties advantages and limitations The book covers the different types of textile finishing techniques including dyeing printing and coating and how nanotechnology is used to improve their performance It also covers the environmental health and safety aspects of using nanotechnology in textile finishing and the challenges and opportunities that lie ahead The book is targeted at textile scientists engineers and researchers working in the textile industry as well as students and academics in textile science and engineering It is also useful for those in related fields such as materials science chemistry and chemical engineering

Review of the Federal Strategy for Nanotechnology-Related Environmental, Health, and Safety Research National

Research Council, Division on Engineering and Physical Sciences, National Materials Advisory Board, Division on Earth and Life Studies, Board on Environmental Studies and Toxicology, Committee for Review of the Federal Strategy to Address Environmental, Health, and Safety Research Needs for Engineered Nanoscale Materials, 2009-02-17 This new book from the National Research Council finds serious weaknesses in the government's plan for research on the potential health and environmental risks posed by nanomaterials which are increasingly being used in consumer goods and industry An effective national plan for identifying and managing potential risks is essential to the successful development and public acceptance of nanotechnology enabled products The book recommends a robust national strategic plan for addressing nanotechnology related EHS risks which will need to focus on promoting research that can assist all stakeholders including federal agencies in planning controlling and optimizing the use of engineered nanomaterials while minimizing EHS effects of concern to society Such a plan will ensure the timely development of engineered nanoscale materials that will bring about great improvements in the nation's health its environmental quality its economy and its security

Technology Infrastructure Cristiano Antonelli, Albert N. Link, Stan Metcalfe, 2013-09-13 Technology infrastructure supports the design deployment and use of both individual technology based components and the systems of such components that form the knowledge based economy As such it plays a central role in the innovation process and in the promotion of the diffusion of technologies Thus it is an important element contributing to the operation of innovation systems and innovation performance in any modern economy Technology infrastructure either in the narrow or broad sense is not well understood as an element of a sector's technology platform or of a national innovation system Similarly misunderstood are the processes by which such infrastructure is embodied in standards or diffused through various institutional frameworks In fact because of the public and quasi public good nature of technology infrastructure firms as well as public sector agencies under invest in it thus inhibiting long term technological advancement and economic growth This volume of essays brings together a collection of papers from eminent scholars on all of the various dimensions of technology infrastructure mentioned above To our knowledge it is the first such collection of papers and we expect this scholarship to become the foundation for future research in this area This book was published as a special issue of Economics of Innovation and New Technology

Nano-Hype David M. Berube, 2009-12-04 Nanotechnology the science of molecular engineering at the atomic scale has captured the popular imagination From movies to TV series to video games utopian fantasies and horror scenarios involving nanotechnology have become a staple of the entertainment industry The hyperbole surrounding this new technology comes not only from the media but also from scientists who exaggerate the anticipated benefits of nanotechnology to justify research funding as well as from environmentalists and globalization opponents who sometimes indulge in doom and gloom prophecies to advance their own agendas The result is widespread misinformation and an uninformed public In an effort to set the record straight professor of communication studies David M Berube has written this thoroughly researched accessible overview of

nanotechnology in contemporary culture He evaluates the claims and counterclaims about nanotechnology by a broad range of interested parties including government officials and bureaucrats industry leaders and entrepreneurs scientists journalists and other persons in the media Berube appraises programs and grand initiatives here and abroad and he examines the environmental concerns raised by opponents as well as the government and private responses to these concerns With so much argumentation on both sides it is difficult for anyone to determine what is true Nano Hype provides up to date objective information to inform the public Based on over a decade of research and interviews with many of the movers and shakers in nanotechnology this critical study will help the reader separate the realistic prospects from the hype surrounding this important cutting edge technology

Assessment of Directions in Microgravity and Physical Sciences Research at NASA National Research Council, Division on Engineering and Physical Sciences, Space Studies Board, Committee on Microgravity Research, 2003-07-11 For thirty years the NASA microgravity program has used space as a tool to study fundamental flow phenomena that are important to fields ranging from combustion science to biotechnology This book assesses the past impact and current status of microgravity research programs in combustion fluid dynamics fundamental physics and materials science and gives recommendations for promising topics of future research in each discipline Guidance is given for setting priorities across disciplines by assessing each recommended topic in terms of the probability of its success and the magnitude of its potential impact on scientific knowledge and understanding terrestrial applications and industry technology needs and NASA technology needs At NASA's request the book also contains an examination of emerging research fields such as nanotechnology and biophysics and makes recommendations regarding topics that might be suitable for integration into NASA's microgravity program

Innovation, Entrepreneurship, and Technological Change Albert N. Link, Donald S. Siegel, 2007-06-07 This book presents a reader friendly analysis and synthesis of the key economic and management approaches to innovation entrepreneurship and technological change Link and Siegel provide precise definitions of key concepts present numerous historical examples to illustrate these concepts outline a framework for analyzing key topics compare and contrast different theoretical frameworks provide a reader friendly interpretation of quantitative and qualitative findings and emphasize international comparisons of innovation infrastructure and technology policy Key topics covered include basic concepts of innovation and technological change a history of the role of the entrepreneur in innovation the impact of innovation and information technology on performance the analysis of technological spillovers innovation in the service sector university technology commercialization and entrepreneurship including property based institutions such as research parks and incubators entrepreneurship in the public sector the first systematic analysis and synthesis of the new interdisciplinary literature on technology commercialization and entrepreneurship at universities While the book reflects the complexities of debate around these topics it will be an important guide to the area for academics graduate and advanced undergraduate students of Business Studies Economics Entrepreneurship and Innovation Studies The

book also provides a roadmap of specific recommendations for managers and policymakers *Nanotechnology* R E Hester, R M Harrison, 2007-10-31 Nanotechnology is a much talked about and rapidly expanding area of science which is sometimes little understood It looks set to make a significant impact on human life and with numerous commercial developments emerging will become a major industry over the coming years Nanotechnology can be broadly described as developing or exploiting products at nanometre dimensions i e as having one dimension less than 100 nanometres Such materials have a larger surface area to volume ratio than conventional materials which provides them with an increased level of reactivity and consequently toxicity per unit mass This book sets the subject into context by first of all describing the current range of products containing nano materials and then looking at the consequences for the environment and human health relating to the introduction of nanoparticles and nano tubes Nanotechnology Consequences for Human Health and the Environment discusses some of the more controversial issues associated with the field including nanoparticles in the environment occupational exposure toxicological properties human health issues and safety This authoritative and comprehensive book will be of interest to both scientists and technologists but also to regulators and government This title is also available in hardback **Instrumental Community** Cyrus C. M. Mody, 2011-10-21 How networked structures of collaboration and competition within a community of researchers led to the invention spread and commercialization of scanning probe microscopy The scanning tunneling microscope STM has been hailed as the key enabling discovery for nanotechnology the catalyst for a scientific field that attracts nearly 20 billion in funding each year In Instrumental Community Cyrus Mody argues that this technology centric view does not explain how these microscopes helped to launch nanotechnology and fails to acknowledge the agency of the microscopists in making the STM and its variants critically important tools Mody tells the story of the invention spread and commercialization of scanning probe microscopy in terms of the networked structures of collaboration and competition that came into being within a diverse colorful and sometimes fractious community of researchers By forming a community he argues these researchers were able to innovate rapidly share the microscopes with a wide range of users and generate prestige including the 1986 Nobel Prize in Physics and profit as the technology found applications in industry Mody shows that both the technology of probe microscopy and the community model offered by the probe microscopists contributed to the development of political and scientific support for nanotechnology and the global funding initiatives that followed In the course of his account Mody charts the shifts in U S science policy over the last forty years from the decline in federal basic research funding in the 1970s through the rise in academic patenting in the 1980s to the emergence of nanotechnology discourse in the 1990s that have resulted in today s increasing emphasis on the commercialization of academic research **Functional Nanomaterials for Regenerative Tissue Medicines** Mariappan Rajan, 2021-12-08 This book covers nanomaterials in tissue engineering for regenerative therapies of heart skin eye skeletal muscle and the nervous system The book emphasizes fundamental design concepts and emerging forms of nanomaterials in

soft and hard tissue engineering FEATURES Fills a gap in the literature related to the application of nanomaterials in hard and soft tissue regeneration repair and restructure Discusses a variety of applications including cardiac kidney liver bone wound healing artificial organs and dental Presents advantages and limitations of various nanomaterials alongside future challenges Functional Nanomaterials for Regenerative Tissue Medicines is essential for academics and industry professionals working in tissue engineering biomedicine biopharmaceuticals and nanotechnology It is primarily intended for materials researchers to develop the platforms related to tissue regeneration as well as clinicians to learn and apply nanomaterials in their practice and industrial scientists to develop commercial blood substitute products *Nanotechnology in Construction* Peter Bartos, 2004 The importance of nanotechnology related research and development has become recognised worldwide Substantial public and private investment is now being ploughed into research and development in a number of industrial sectors where nanotechnology has become established and has led to new commercial products The construction industry having major economic significance with nano scale research and development which is only emerging offers a wide scope for exploitation of nanotechnology With international contributions from experts in the field Nanotechnology in Construction amalgamates previously fragmented research and emerging trends It reflects the inherent multi disciplinary nature of nano scale research in construction and contributions cover a wide spectrum from highly scientific investigations to futuristic applications The book is organised into four broad sections the first reviews and analyses the prospects of exploitation of nanotechnology in construction the second discusses novel tools and their capabilities the final two sections show existing significant products where nanotechnology has been already been exploited or where product development is under way Nanotechnology in Construction will appeal to researchers already working in this field as well as those wishing to enter it It will also inform governmental and other funding agencies of the most promising future directions and their related timescales Practical applications are considered and explanations of the underlying basics are given raising awareness and understanding of what nanotechnology can offer to construction professionals in general **Emerging Technologies and Ethical Issues in Engineering** National Academy of Engineering, 2004-10-02 Engineers and ethicists participated in a workshop to discuss the responsible development of new technologies Presenters examined four areas of engineering sustainability nanotechnology neurotechnology and energy in terms of the ethical issues they present to engineers in particular and society as a whole Approaches to ethical issues include analyzing the factual conceptual application and moral aspects of an issue evaluating the risks and responsibilities of a particular course of action and using theories of ethics or codes of ethics developed by engineering societies as a basis for decision making Ethics can be built into the education of engineering students and professionals either as an aspect of courses already being taught or as a component of engineering projects to be examined along with research findings Engineering practice workshops can also be effective particularly when they include discussions with experienced engineers This volume includes papers on all of these topics by experts in many

fields The consensus among workshop participants is that material on ethics should be an ongoing part of engineering education and engineering practice

Triennial Review of the National Nanotechnology Initiative National Research Council, Division on Engineering and Physical Sciences, National Materials and Manufacturing Board, Committee on Triennial Review of the National Nanotechnology Initiative: Phase II, 2014-01-20

The National Nanotechnology Initiative NNI is a multiagency multidisciplinary federal initiative comprising a collection of research programs and other activities funded by the participating agencies and linked by the vision of a future in which the ability to understand and control matter at the nanoscale leads to a revolution in technology and industry that benefits society As first stated in the 2004 NNI strategic plan the participating agencies intend to make progress in realizing that vision by working toward four goals Planning coordination and management of the NNI are carried out by the interagency Nanoscale Science Engineering and Technology NSET Subcommittee of the National Science and Technology Council NSTC Committee on Technology CoT with support from the National Nanotechnology Coordination Office NNCO

Triennial Review of the National Nanotechnology Initiative is the latest National Research Council review of the NNI an assessment called for by the 21st Century Nanotechnology Research and Development Act of 2003 The overall objective of the review is to make recommendations to the NSET Subcommittee and the NNCO that will improve the NNI's value for basic and applied research and for development of applications in nanotechnology that will provide economic societal and national security benefits to the United States In its assessment the committee found it important to understand in some detail and to describe in its report the NNI's structure and organization how the NNI fits within the larger federal research enterprise as well as how it can and should be organized for management purposes and the initiative's various stakeholders and their roles with respect to research Because technology transfer one of the four NNI goals is dependent on management and coordination the committee chose to address the topic of technology transfer last following its discussion of definitions of success and metrics for assessing progress toward achieving the four goals and management and coordination Addressing its tasks in this order would the committee hoped better reflect the logic of its approach to review of the NNI

Triennial Review of the National Nanotechnology Initiative also provides concluding remarks in the last chapter

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