

Science The Endless Frontier

On the Frontier of Science Scientists at War Science, The Endless Frontier Pursuing the Endless Frontier Engineering—An Endless Frontier The State of Science Pieces of the Action Science and Scepticism Pasteur's Quadrant Science--the Endless Frontier Broader Impacts of Science on Society Thomas Kuhn Science The Usefulness of Useless Knowledge Science, the Endless Frontier; A Report to the President on a Program for Postwar Scientific Research Put Your Science to Work Ptolemy's Philosophy Kant's Theory of Science The Fragile Contract Endless Horizons Cycles of Invention and Discovery Endless Frontier The Blind Spot Science Policy Up Close Atom and Void Politics on the Endless Frontier Frontiers Of Illusion On the Future Biology of Aminoacyl-tRNA Synthetases The Changing Frontier Expanding Underrepresented Minority Participation Jump-Starting America A Short History of Physics in the American Century Why Trust Science? The Social Function of Science Fashion, Faith, and Fantasy in the New Physics of the Universe International Friction and Cooperation in High-Technology Development and Trade Science, the Endless Frontier The New ABCs of Research 50 Years of Ocean Discovery

On the Frontier of Science

“The frontier of science” is a metaphor that has become ubiquitous in American rhetoric, from its first appearance in the public address of early twentieth-century American intellectuals and politicians who aligned a mythic national identity with scientific research, to its more recent use in scientists’ arguments in favor of increased research funding. Here, Leah Ceccarelli explores what is selected and what is deflected when this metaphor is deployed, its effects on those who use it, and what rhetorical moves are made by those who try to counter its appeal. In her research, Ceccarelli discovers that “the frontier of science” evokes a scientist who is typically male, a risk taker, an adventurous loner—someone separated from a public that both envies and distrusts him, with a manifest destiny to penetrate the unknown. It conjures a competitive desire to claim the riches of a new territory before others can do the same. Closely reading the public address of scientists and politicians and the reception of their audiences, this book shows how the frontier of science metaphor constrains American speakers, helping to guide the ends of scientific research in particular ways and sometimes blocking scientists from attaining the very goals they set out to achieve.

Scientists at War

One of the world's leading physicists questions some of the most fashionable ideas in physics today, including string theory What can fashionable ideas, blind faith, or pure fantasy possibly have to do with the scientific quest to understand the universe? Surely, theoretical physicists are immune to mere trends, dogmatic beliefs, or flights of fancy? In fact, acclaimed physicist and bestselling author Roger Penrose argues that researchers working at the extreme frontiers of physics are just as susceptible to these forces as anyone else. In this provocative book, he argues that fashion, faith, and fantasy, while sometimes productive and even essential in physics, may be leading today's researchers astray in three of the field's most important areas—string theory, quantum mechanics, and cosmology. Arguing that string theory has veered away from physical reality by positing six extra hidden dimensions, Penrose cautions that the fashionable nature of a theory can cloud our judgment of its plausibility. In the case of quantum mechanics, its stunning success in explaining the atomic universe has led to an uncritical faith that it must also apply to reasonably massive objects, and Penrose responds by suggesting possible changes in quantum theory. Turning to cosmology, he argues that most of the current fantastical ideas about the origins of the universe cannot be true, but that an even wilder reality may lie behind them. Finally, Penrose describes how fashion, faith, and fantasy have ironically also shaped his own work, from twistor

theory, a possible alternative to string theory that is beginning to acquire a fashionable status, to "conformal cyclic cosmology," an idea so fantastic that it could be called "conformal crazy cosmology." The result is an important critique of some of the most significant developments in physics today from one of its most eminent figures.

Science, The Endless Frontier

The Greco-Roman mathematician Claudius Ptolemy is one of the most significant figures in the history of science. He is remembered today for his astronomy, but his philosophy is almost entirely lost to history. This groundbreaking book is the first to reconstruct Ptolemy's general philosophical system—including his metaphysics, epistemology, and ethics—and to explore its relationship to astronomy, harmonics, element theory, astrology, cosmology, psychology, and theology. In this stimulating intellectual history, Jacqueline Feke uncovers references to a complex and sophisticated philosophical agenda scattered among Ptolemy's technical studies in the physical and mathematical sciences. She shows how he developed a philosophy that was radical and even subversive, appropriating ideas and turning them against the very philosophers from whom he drew influence. Feke reveals how Ptolemy's unique system is at once a critique of prevailing philosophical trends and a conception of the world in which mathematics reigns supreme. A compelling work of scholarship, Ptolemy's Philosophy demonstrates how Ptolemy situated mathematics at the very foundation of all philosophy—theoretical and practical—and advanced the mathematical way of life as the true path to human perfection.

Pursuing the Endless Frontier

Over fifty years ago, Vannevar Bush released his enormously influential report, *Science, the Endless Frontier*, which asserted a dichotomy between basic and applied science. This view was at the core of the compact between government and science that led to the golden age of scientific research after World War II—a compact that is currently under severe stress. In this book, Donald Stokes challenges Bush's view and maintains that we can only rebuild the relationship between government and the scientific community when we understand what is wrong with that view. Stokes begins with an analysis of the goals of understanding and use in scientific research. He recasts the widely accepted view of the tension between understanding and use, citing as a model case the fundamental yet use-inspired studies by which Louis Pasteur laid the foundations of microbiology a century ago. Pasteur worked in the era of the "second industrial revolution," when the relationship between basic science and technological change assumed its modern form. Over subsequent decades, technology has been increasingly science-based. But science has been increasingly technology-based—with the choice of problems and the conduct of research often inspired by societal needs. An example is the work of the quantum-effects physicists who are probing the phenomena revealed by the miniaturization of semiconductors from the time of the transistor's discovery after World War II. On this revised, interactive view of science and technology, Stokes builds a convincing case that by recognizing the importance of use-inspired basic research we can frame a new compact between science and government. His conclusions have major implications for both the scientific and policy communities and will be of great interest to those in the broader public who are troubled by the current role of basic science in American democracy.

Engineering—An Endless Frontier

New research and innovations in the field of science are leading to life-changing and world-altering discoveries like never before. What does the horizon of science look like? Who are the scientists that are making it happen? And, how are we to introduce these revolutions to a society in which a segment of the population has become more and more skeptical of science? Climate change is the biggest challenge

facing our nation, and scientists are working on renewable energy sources, meat alternatives, and carbon dioxide sequestration. At the same time, climate change deniers and the politicization of funding threaten their work. CRISPR, (Clustered Regularly Interspaced Short Palindromic Repeats) repurposes bacterial defense systems to edit genes, which can change the way we live, but also presents real ethical problems. Optogenetics will help neuroscientists map complicated neural circuitry deep inside the brain, shedding light on treating Alzheimer's and Parkinson's disease. Zimmer also investigates phony science ranging from questionable "health" products to the fervent anti-vaccination movement. Zimmer introduces readers to the real people making these breakthroughs. Concluding with chapters on the rise of women in STEM fields, the importance of US immigration policies to science, and new, unorthodox ways of DIY science and crowdsource funding, *The State of Science* shows where science is, where it is heading, and the scientists who are at the forefront of progress.

The State of Science

J. Robert Oppenheimer was one of the outstanding physicists of his generation. He was also an immensely gifted writer and speaker, who thought deeply about the way that scientific discoveries have changed the way people live and think. Displaying his subtlety of thought and expression as do few other documents, this book of his lectures discusses the moral and cultural implications of developments in modern physics. Originally published in 1989. The Princeton Legacy Library uses the latest print-on-demand technology to again make available previously out-of-print books from the distinguished backlist of Princeton University Press. These editions preserve the original texts of these important books while presenting them in durable paperback and hardcover editions. The goal of the Princeton Legacy Library is to vastly increase access to the rich scholarly heritage found in the thousands of books published by Princeton University Press since its founding in 1905.

Pieces of the Action

Published by the American Geophysical Union as part of the Special Publications Series. Whether you are a science undergraduate or graduate student, post-doc or senior scientist, you need practical career development advice. *Put Your Science to Work: The Take-Charge Career Guide for Scientists* can help you explore all your options and develop dynamite strategies for landing the job of your dreams. Completely revised and updated from the best-selling *To Boldly Go: A Practical Career Guide for Scientists*, this second edition offers expert help from networking to negotiating a job offer. This is the book you need to start moving your career in the right direction.

Science and Scepticism

In a career that included Presidential Science Advisor to George W. Bush, John Marburger stood on the front line of battles that pulled science deep into the political arena. Science controversies, he discovered, are never just about science. As his reflections show, science can no longer be shielded from public scrutiny and government supervision.

Pasteur's Quadrant

While interest in Kant's philosophy has increased in recent years, very little of it has focused on his theory of science. This book gives a general account of that theory, of its motives and implications, and of the way it brought forth a new conception of the nature of philosophical thought. To reconstruct Kant's theory of science, the author identifies unifying themes of his philosophy of mathematics and philosophy of physics, both undergirded by his distinctive logical doctrines, and shows how they come

together to form a relatively consistent system of ideas. A new analysis of the structure of central arguments in the Critique of Pure Reason and the Prolegomena draws on recent developments in logic and the philosophy of science. Professor Brittan's unified account of the philosophies of mathematics and physics explores the nature of Kant's commitment to Euclidean geometry and Newtonian mechanics as well as providing an integrated reading of the Critique of Pure Reason and the Metaphysical Foundations of Natural Science. Contemporary ideas help both to illuminate Kant's position and to show how that position, in turn, illuminates contemporary problems in the philosophy of science. Originally published in 1978. The Princeton Legacy Library uses the latest print-on-demand technology to again make available previously out-of-print books from the distinguished backlist of Princeton University Press. These editions preserve the original texts of these important books while presenting them in durable paperback and hardcover editions. The goal of the Princeton Legacy Library is to vastly increase access to the rich scholarly heritage found in the thousands of books published by Princeton University Press since its founding in 1905.

Science--the Endless Frontier

A prodigiously researched biography of Vannevar Bush, one of America's most awe-inspiring polymaths and the secret force behind the biggest technological breakthroughs of the twentieth century. As the inventor and public entrepreneur who launched the Manhattan Project, helped to create the military-industrial complex, conceived a permanent system of government support for science and engineering, and anticipated both the personal computer and the Internet, Vannevar Bush is the twentieth century's Ben Franklin. In this engaging look at one of America's most awe-inspiring polymaths, writer G. Pascal Zachary brings to life an American original—a man of his time, ours, and beyond. Zachary details how Bush cofounded Raytheon and helped build one of the most powerful early computers in the world at MIT. During World War II, he served as Roosevelt's adviser and chief contact on all matters of military technology, including the atomic bomb. He launched the Manhattan Project and oversaw a collection of 6,000 civilian scientists who designed scores of new weapons. After the war, his attention turned to the future. He wrote essays that anticipated the rise of the Internet and boldly equated national security with research strength, outlining a system of permanent federal funding for university research that endures to this day. However, Bush's hopeful vision of science and technology was leavened by an understanding of the darker possibilities. While cheering after witnessing the Trinity atomic test, he warned against the perils of a nuclear arms race. He led a secret appeal to convince President Truman not to test the Hydrogen Bomb and campaigned against the Red Scare. Elegantly and expertly relayed by Zachary, Vannevar's story is a grand tour of the digital leviathan we know as the modern American life.

Broader Impacts of Science on Society

Thomas Kuhn

In 1945, Vannevar Bush, founder of Raytheon and one-time engineering dean at MIT, delivered a report to the president of the United States that argued for the importance of public support for science, and the importance of science for the future of the nation. The report, *Science: The Endless Frontier*, set America on a path toward strong and well-funded institutions of science, creating an intellectual architecture that still defines scientific endeavor today. In *The Changing Frontier*, Adam B. Jaffe and Benjamin Jones bring together a group of prominent scholars to consider the changes in science and innovation in the ensuing decades. The contributors take on such topics as changes in the organization of scientific research, the geography of innovation, modes of entrepreneurship, and the structure of research

institutions and linkages between science and innovation. An important analysis of where science stands today, *The Changing Frontier* will be invaluable to practitioners and policy makers alike.

Science

The Usefulness of Useless Knowledge

Genetic engineering, nanotechnology, astrophysics, particle physics: We live in an engineered world, one where the distinctions between science and engineering, technology and research, are fast disappearing. This book shows how, at the dawn of the twenty-first century, the goals of natural scientists--to discover what was not known--and that of engineers--to create what did not exist--are undergoing an unprecedented convergence. Sunny Y. Auyang ranges widely in demonstrating that engineering today is not only a collaborator with science but its equal. In concise accounts of the emergence of industrial laboratories and chemical and electrical engineering, and in whirlwind histories of the machine tools and automobile industries and the rise of nuclear energy and information technology, her book presents a broad picture of modern engineering: its history, structure, technological achievements, and social responsibilities; its relation to natural science, business administration, and public policies. Auyang uses case studies such as the development of the F-117A Nighthawk and Boeing 777 aircraft, as well as the experiences of engineer-scientists such as Oliver Heaviside, engineer-entrepreneurs such as Henry Ford and Bill Gates, and engineer-managers such as Alfred Sloan and Jack Welch to give readers a clear sense of engineering's essential role in the future of scientific research.

Table of Contents: Preface 1. Introduction 2 . Technology Takes Off 2.1 From Practical Art to Technology 2.2 Construction Becomes Mathematical 2.3 Experimenting with Machines 2.4 Science and Chemical Industries 2.5 Power and Communication 3. Engineering for Information 3.1 From Microelectronics to Nanotechnology 3.2 Computer Hardware and Software 3.3 Wireless, Satellites, and the Internet 4. Engineering in Society 4.1 Social Ascent and Images of Engineers 4.2 Partnership in Research and Development 4.3 Contributions to Sectors of the Economy 5. Innovation by Design 5.1 Inventive Thinking in Negative Feedback 5.2 Design Processes in Systems Engineering 5.3 "Working Together" in Aircraft Development 5.4 From Onboard Computers to Door Hinges 6. Sciences of Useful Systems 6.1 Mathematics in Engineering and Science 6.2 Information and Control Theories 6.3 Wind Tunnels and Internet Simulation 6.4 Integrative Materials Engineering 6.5 Biological Engineering Frontiers 7. Leaders Who Are Engineers 7.1 Business Leaders in the Car Industry 7.2 Public Policies and Nuclear Power 7.3 Managing Technological Risks Appendix A. Statistical Profiles of Engineers Appendix B. U.S. Research and Development Notes Index

I am impressed by the scope of *Engineering - An Endless Frontier*, and fascinated by Sunny Auyang's comprehensive knowledge of the subject. This is just the kind of book the National Academy of Engineering has been encouraging to promote the importance of engineering to the public. It will have a long shelf-life in that it pulls together material that is not readily accessible, and will serve as a reference for anyone interested in engineering as a profession. Engineering needs this book! --John Hutchinson, Harvard University

Engineering - An Endless Frontier is extraordinary in scope. Sunny Auyang describes the different kinds of contemporary engineering practices and productions, attempts to provide historical background, explains the scientific basis for engineering innovation in different fields, and addresses the broad, systems level managerial, entrepreneurial, and design activities of professionals. It's rare to find a single author who can grasp and explain the essential features of modern technologies across such an array of industrial sectors and engineering disciplines and explain how they work, why they work they way they do, and what is required for their innovation, development and, yes, even maintenance. --Louis L. Bucciarelli, Professor Emeritus of Engineering and Technology Studies, MIT

Science, the Endless Frontier; A Report to the President on a Program for Postwar Scientific Research

This book contains important technical innovations, including comparative measures for the testable content, depth, and unity of scientific theories. Originally published in 1984. The Princeton Legacy Library uses the latest print-on-demand technology to again make available previously out-of-print books from the distinguished backlist of Princeton University Press. These editions preserve the original texts of these important books while presenting them in durable paperback and hardcover editions. The goal of the Princeton Legacy Library is to vastly increase access to the rich scholarly heritage found in the thousands of books published by Princeton University Press since its founding in 1905.

Put Your Science to Work

Thomas Kuhn (1922-96) transformed the philosophy of science. His seminal 1962 work "The Structure of Scientific Revolutions" introduced the term 'paradigm shift' into the vernacular and remains a fundamental text in the study of the history and philosophy of science. This introduction to Kuhn's ideas covers the breadth of his philosophical work, situating "The Structure of Scientific Revolutions" within Kuhn's wider thought and drawing attention to the development of his ideas over time. Kuhn's work is assessed within the context of other philosophies of science notably logical empiricism and recent developments in naturalized epistemology. The author argues that Kuhn's thinking betrays a residual commitment to many theses characteristic of the empiricists he set out to challenge. Kuhn's influence on the history and philosophy of science is assessed and where the field may be heading in the wake of Kuhn's ideas is explored.

Ptolemy's Philosophy

Toward what end does the U.S. government support science and technology? How do the legacies and institutions of the past constrain current efforts to restructure federal research policy? Not since the end of World War II have these questions been so pressing, as scientists and policymakers debate anew the desirability and purpose of a federal agenda for funding research. Probing the values that have become embodied in the postwar federal research establishment, *Politics on the Endless Frontier* clarifies the terms of these debates and reveals what is at stake in attempts to reorganize that establishment. Although it ended up as only one among a host of federal research policymaking agencies, the National Science Foundation was originally conceived as central to the federal research policymaking system. Kleinman's historical examination of the National Science Foundation exposes the sociological and political workings of the system, particularly the way in which a small group of elite scientists shaped the policymaking process and defined the foundation's structure and future. Beginning with Vannevar Bush's 1945 manifesto *The Endless Frontier*, Kleinman explores elite and populist visions for a postwar research policy agency and shows how the structure of the American state led to the establishment of a fragmented and uncoordinated system for federal research policymaking. His book concludes with an analysis of recent efforts to reorient research policy and to remake federal policymaking institutions in light of the current "crisis" of economic competitiveness. A particularly timely study, *Politics on the Endless Frontier* will be of interest to historians and sociologists of science and technology and to science policy analysts.

Kant's Theory of Science

This influential report described science as "a largely unexplored hinterland" that would provide the "essential key" to the economic prosperity of the post World War II years.

The Fragile Contract

The untold story of how America once created the most successful economy the world has ever seen and how we can do it again. The American economy glitters on the outside, but the reality is quite different. Job opportunities and economic growth are increasingly concentrated in a few crowded coastal enclaves. Corporations and investors are disproportionately developing technologies that benefit the wealthiest Americans in the most prosperous areas--and destroying middle class jobs elsewhere. To turn this tide, we must look to a brilliant and all-but-forgotten American success story and embark on a plan that will create the industries of the future--and the jobs that go with them. Beginning in 1940, massive public investment generated breakthroughs in science and technology that first helped win WWII and then created the most successful economy the world has ever seen. Private enterprise then built on these breakthroughs to create new industries--such as radar, jet engines, digital computers, mobile telecommunications, life-saving medicines, and the internet-- that became the catalyst for broader economic growth that generated millions of good jobs. We lifted almost all boats, not just the yachts. Jonathan Gruber and Simon Johnson tell the story of this first American growth engine and provide the blueprint for a second. It's a visionary, pragmatic, sure-to-be controversial plan that will lead to job growth and a new American economy in places now left behind.

Endless Horizons

In order for the United States to maintain the global leadership and competitiveness in science and technology that are critical to achieving national goals, we must invest in research, encourage innovation, and grow a strong and talented science and technology workforce. *Expanding Underrepresented Minority Participation* explores the role of diversity in the science, technology, engineering and mathematics (STEM) workforce and its value in keeping America innovative and competitive. According to the book, the U.S. labor market is projected to grow faster in science and engineering than in any other sector in the coming years, making minority participation in STEM education at all levels a national priority. *Expanding Underrepresented Minority Participation* analyzes the rate of change and the challenges the nation currently faces in developing a strong and diverse workforce. Although minorities are the fastest growing segment of the population, they are underrepresented in the fields of science and engineering. Historically, there has been a strong connection between increasing educational attainment in the United States and the growth in and global leadership of the economy. *Expanding Underrepresented Minority Participation* suggests that the federal government, industry, and post-secondary institutions work collaboratively with K-12 schools and school systems to increase minority access to and demand for post-secondary STEM education and technical training. The book also identifies best practices and offers a comprehensive road map for increasing involvement of underrepresented minorities and improving the quality of their education. It offers recommendations that focus on academic and social support, institutional roles, teacher preparation, affordability and program development.

Cycles of Invention and Discovery

A provocative and inspiring look at the future of humanity and science from world-renowned scientist and bestselling author Martin Rees. Humanity has reached a critical moment. Our world is unsettled and rapidly changing, and we face existential risks over the next century. Various outcomes—good and bad—are possible. Yet our approach to the future is characterized by short-term thinking, polarizing debates, alarmist rhetoric, and pessimism. In this short, exhilarating book, renowned scientist and bestselling author Martin Rees argues that humanity's prospects depend on our taking a very different approach to planning for tomorrow. The future of humanity is bound to the future of science and hinges

on how successfully we harness technological advances to address our challenges. If we are to use science to solve our problems while avoiding its dystopian risks, we must think rationally, globally, collectively, and optimistically about the long term. Advances in biotechnology, cybertechnology, robotics, and artificial intelligence—if pursued and applied wisely—could empower us to boost the developing and developed world and overcome the threats humanity faces on Earth, from climate change to nuclear war. At the same time, further advances in space science will allow humans to explore the solar system and beyond with robots and AI. But there is no “Plan B” for Earth—no viable alternative within reach if we do not care for our home planet. Rich with fascinating insights into cutting-edge science and technology, this accessible book will captivate anyone who wants to understand the critical issues that will define the future of humanity on Earth and beyond.

Endless Frontier

Using Nobel Prize–winning examples like the transistor, laser, and magnetic resonance imaging, Venky Narayanamurti and Tolu Odumosu explore the daily micro-practices of research and show that distinctions between the search for knowledge and creative problem solving break down when one pays attention to how pathbreaking research actually happens.

The Blind Spot

Science Policy Up Close

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Atom and Void

This book describes the development of ocean sciences over the past 50 years, highlighting the contributions of the National Science Foundation (NSF) to the field's progress. Many of the individuals who participated in the exciting discoveries in biological oceanography, chemical oceanography, physical oceanography, and marine geology and geophysics describe in the book how the discoveries were made possible by combinations of insightful individuals, new technology, and in some cases, serendipity. In addition to describing the advance of ocean science, the book examines the institutional structures and technology that made the advances possible and presents visions of the field's future. This book is the first-ever documentation of the history of NSF's Division of Ocean Sciences, how the structure of the division evolved to its present form, and the individuals who have been responsible for ocean sciences at NSF as "rotators" and career staff over the past 50 years.

Politics on the Endless Frontier

The former president of MIT discusses challenges and policy issues confronting academia, science and technology, and the world at large. In his fourteen years as president of MIT, Charles Vest worked continuously to realize his vision of rebuilding America's trust in science and technology. In a time when the federal government dramatically reduced its funding of academic research programs and industry shifted its R&D resources into the short-term product-development process, Vest called for new partnerships with business and government. He called for universities to meet the intellectual challenges posed by the innovation-driven, globally connected needs of industry even as he reaffirmed basic academic values and the continuing need for longer-term scientific inquiry. In Pursuing the Endless

Frontier, Vest addresses these and other issues in a series of essays written during his tenure as president of MIT. He discusses the research university's need to shift to a broader, more international outlook, the value of diversity in the academic community, the greater leadership role for faculty outside the classroom, and the boundless opportunity of new scientific and technological developments even when coupled with financial constraints. In the provocative essay "What We Don't Know," Vest reminds us of what he calls "the most critical point of all," that science is driven by a deep human need to understand nature, to answer the "big questions"—that what we don't know is more important than what we do. In another essay, on the future of MIT, he celebrates MIT's strengths as being extraordinarily well-suited to the needs of an era of unprecedented change in science and technology. In "Disturbing the Educational Universe: Universities in the Digital Age—Dinosaurs or Prometheans," he describes MIT's innovative OpenCourseWare initiative, which builds on the fundamental nature of the Internet as an enabling and liberating technology. Vest, who is stepping down from MIT's presidency in the fall of 2004, writes with clarity and insight about the issues facing academic institutions in the twenty-first century. His essays in Pursuing the Endless Frontier offer inspiration to educators and researchers seeking the way forward.

Frontiers Of Illusion

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On the Future

The problems we face in the 21st century require innovative thinking from all of us. Be it students, academics, business researchers or government policy makers. Hopes for improving our healthcare, food supply, community safety and environmental sustainability depend on the pervasive application of research solutions. The research heroes who take on the immense problems of our time face bigger than ever challenges, but if they adopt potent guiding principles and effective research lifecycle strategies, they can produce the advances that will enhance the lives of many people. These inspirational research leaders will break free from traditional thinking, disciplinary boundaries, and narrow aspirations. They will be bold innovators and engaged collaborators, who are ready to lead, yet open to new ideas, self-confident, yet empathetic to others. In this book, Ben Shneiderman recognizes the unbounded nature of human creativity, the multiplicative power of teamwork, and the catalytic effects of innovation. He reports on the growing number of initiatives to promote more integrated approaches to research so as to promote the expansion of these efforts. It is meant as a guide to students and junior researchers, as well as a manifesto for senior researchers and policy makers, challenging widely-held beliefs about how applied innovations evolve and how basic breakthroughs are made, and helping to plot the course towards tomorrow's great advancements.

Biology of Aminoacyl-tRNA Synthetases

Invaluable guidance on how scientists can communicate the societal benefits of their work to the public and funding agencies. This will help scientists submit proposals to the US National Science Foundation and other funding agencies with a 'Broader Impacts' section, as well as helping to develop successful wider outreach activities.

The Changing Frontier

Expanding Underrepresented Minority Participation

In today's unpredictable and chaotic world, we look to science to provide certainty and answers--and often blame it when things go wrong. The Blind Spot reveals why our faith in scientific certainty is a dangerous illusion, and how only by embracing science's inherent ambiguities and paradoxes can we truly appreciate its beauty and harness its potential. Crackling with insights into our most perplexing contemporary dilemmas, from climate change to the global financial meltdown, this book challenges our most sacredly held beliefs about science, technology, and progress. At the same time, it shows how the secret to better science can be found where we least expect it--in the uncertain, the ambiguous, and the inevitably unpredictable. William Byers explains why the subjective element in scientific inquiry is in fact what makes it so dynamic, and deftly balances the need for certainty and rigor in science with the equally important need for creativity, freedom, and downright wonder. Drawing on an array of fascinating examples--from Wall Street's overreliance on algorithms to provide certainty in uncertain markets, to undecidable problems in mathematics and computer science, to Georg Cantor's paradoxical but true assertion about infinity--Byers demonstrates how we can and must learn from the existence of blind spots in our scientific and mathematical understanding. The Blind Spot offers an entirely new way of thinking about science, one that highlights its strengths and limitations, its unrealized promise, and, above all, its unavoidable ambiguity. It also points to a more sophisticated approach to the most intractable problems of our time.

Jump-Starting America

Sarah Bridger examines the ethical debates that tested the U.S. scientific community during the Cold War, and scientists' contributions to military technologies and strategic policymaking, from the dawning atomic age through the Strategic Defense Initiative (Star Wars) in the 1980s, which sparked cross-generational opposition among scientists.

A Short History of Physics in the American Century

As the twentieth century ended, computers, the Internet, and nanotechnology were central to modern American life. Yet the physical advances underlying these applications are poorly understood and underappreciated by U.S. citizens. In this overview, Cassidy views physics through America's engagement with the political events of a tumultuous century.

Why Trust Science?

The Social Function of Science

Is there a crisis in the relations between research universities and the federal government? Is our system, which has been the most successful in the world, breaking down? The Fragile Contract brings together

essays by scientists, university leaders, scholars, and seasoned science watchers from government agencies and nonprofit groups to address this issue. Neither advocacy nor polemic, it explores the social contexts for and influences on research in the university setting to encourage greater understanding of core issues by both politicians and scientists. The contributors offer concrete suggestions for building the foundation of a firmer contract that reflects current realities. The *Fragile Contract* appears at a time when congressional committees have openly questioned whether scientists are capable of policing fraud in their own ranks, and when fundamental agreements that have covered reimbursements to the universities throughout the post-World War II period have been called into question. It also addresses the problems of finding science after the Cold War and as well as the problems faced by universities in an international context. The *Fragile Contract* reveals that we are seeing not so much a crisis as a reflection of changing times: Neither science nor government is the same institution that it was when the modern social contract between the two was forged in the late 1940s. The authors agree that all parties must make major adjustments to the new environment, and research universities must become more active in promoting links to the local and national community. Contents *The Fragile Contract*, David H. Guston and Kenneth Keniston * *Universities, the Public, and the Government*, Charles M. Vest * *Doing One's Damndest: The Evolution of Trust in Scientific Findings*, Gerald Holton * *Integrity and Accountability in Research*, Patricia Woolf * *The Public Faces of Science*, Dorothy Nelkin * *How Large an R&D Enterprise?: Reinventing the Government-University Compact*, Daryl E. Chubin * *Views from the Benches: Funding Biomedical Research and Funding the Physical Sciences*, Phillip A. Sharp and Daniel Kleppner * *Financing Science after the Cold War*, Harvey M. Sapolsky * *Indirect Costs and the Government-University Partnership*, Peter Likins and Albert H. Teich * *Science and Technology in Universities in a Technologically Competitive World*, Eugene B. Skolnikoff * *Concluding Remarks*, David Hamburg

Fashion, Faith, and Fantasy in the New Physics of the Universe

Why the social character of scientific knowledge makes it trustworthy Are doctors right when they tell us vaccines are safe? Should we take climate experts at their word when they warn us about the perils of global warming? Why should we trust science when so many of our political leaders don't? Naomi Oreskes offers a bold and compelling defense of science, revealing why the social character of scientific knowledge is its greatest strength—and the greatest reason we can trust it. Tracing the history and philosophy of science from the late nineteenth century to today, this timely and provocative book features a new preface by Oreskes and critical responses by climate experts Ottmar Edenhofer and Martin Kowarsch, political scientist Jon Krosnick, philosopher of science Marc Lange, and science historian Susan Lindee, as well as a foreword by political theorist Stephen Macedo.

International Friction and Cooperation in High-Technology Development and Trade

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Science, the Endless Frontier

An incisive argument for fostering stronger links between the interests of society and progress in science.

The New ABCs of Research

50 Years of Ocean Discovery

J. D. Bernal's important and ambitious work, *The Social Function of Science*, was first published in January 1939. As the subtitle -What Science Does, What Science Could Do - suggests it is in two parts. Both have eight chapters. Part 1: What Science Does: Introductory, Historical, The Existing Organization of Scientific Research in Britain, Science in Education, The Efficiency of Scientific Research, The Application of Science, Science and War and International Science. Part II: What Science Could Do: The Training of the Scientist, The Reorganization of Research, Scientific Communication, The Finance of Science, The Strategy of Scientific Advance; Science in the Service of Man, Science and Social Transformation and The Social Function of Science. To quote Bernal's biographer, Andrew Brown, 'The Social Function of Science . . . was Bernal's attempt to ensure that science would no longer be just a protected area of intellectual inquiry, but would have as an inherent function the improvement of life for mankind everywhere. It was a groundbreaking treatise both in exploring the scope of science and technology in fashioning public policy, with Bernal arguing that science is the chief agent of change in society, and in devising policies that would optimize the way science was organized. The sense of impending war clearly emerges. Bernal deplored the application of scientific discoveries in making war ever more destructive, while acknowledging that the majority of scientific and technical breakthroughs have their origins in military exigencies, both because of the willingness to spend money and the premium placed on novelty during wartime.' Anticipating by two decades the schism C. P. Snow termed 'The Two Cultures', Bernal remarked that 'highly developed science stands almost isolated from a traditional literary culture.' He found that wrong. Again, quoting Andrew Brown, 'to him, science was a creative endeavour that still depended on inspiration and talent, just as much as in painting, writing or composing.' The importance of this book was such that twenty-five years after its publication, a collection of essays, *The Science of Science*, was published, in part in celebration, but also to explore many of the themes Bernal had first developed.

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