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Beyond Biotechnology Altering the Biological Blueprint Safety of Genetically Engineered Foods Hacking Darwin Genetic Engineering of Plants An Introduction to Genetic Engineering Genetically Engineered Crops Genetic Engineering Genetic Engineering Understanding Genetic Engineering Ingenious Genes Genetically Engineered Food Genetic Engineering Genetic Engineering - Safety Aspects of Recombinant Dna Work Genetic Engineering: Safety Aspects of Recombinant DNA Work, Etc What is Genetic Engineering and how Does it Work? The Thread of Life Genetic Engineering Genetic Engineering Engineers at Work Genetic Engineering Genetic Engineering of Horticultural Crops Genetic Engineering Beyond Human Principles of Gene Manipulation Genetic Engineering. Safety Aspects of Recombinant DNA Work. Colloquy, 14-15 May 1981 Advances in New Technology for Targeted Modification of Plant Genomes Critical World Issues Zero to Genetic Engineering Hero Biosafety Guidelines in Genetic Engineering and Biotechnology Genetic Engin of Plants for Crop Improvement Playing God? Human

Genome Editing Pragmatism and Human Genetic Engineering Uncertain Peril Techniques in Genetic Engineering Genetic Engineering Heritable Human Genome Editing The Double Helix Genetic Engineering of Plants

"A gifted and thoughtful writer, Metzl brings us to the frontiers of biology and technology, and reveals a world full of promise and peril." — Siddhartha Mukherjee MD, New York Times bestselling author of The Emperor of All Maladies and The Gene Passionate, provocative, and highly illuminating, Hacking Darwin is the must read book about the future of our species for fans of Homo Deus and The Gene. After 3.8 billion years humankind is about to start evolving by new rules... From leading geopolitical expert and technology futurist Jamie Metzl comes a groundbreaking exploration of the many ways genetic-engineering is shaking the core foundations of our lives — sex, war, love, and death. At the dawn of the genetics revolution, our DNA is becoming as readable, writable, and hackable as our information technology. But as humanity starts retooling our own genetic code, the choices we make today will be the difference between realizing breathtaking advances in human well-being and descending into a dangerous and potentially deadly

genetic arms race. Enter the laboratories where scientists are turning science fiction into reality. Look towards a future where our deepest beliefs, morals, religions, and politics are challenged like never before and the very essence of what it means to be human is at play. When we can engineer our future children, massively extend our lifespans, build life from scratch, and recreate the plant and animal world, should we? William James and John Dewey insisted that pragmatic philosophy finds meaning in its struggle to deal with emergent social problems. Ironically, few have attempted to use pragmatism to articulate methods for ameliorating social difficulties. This dissertation attempts to do just that by putting James' and Dewey's philosophy to work on the moral and scientific problems associated with genetic engineering and the Human Genome Project. The intention is to demonstrate the usefulness of a pragmatic approach to applied ethics and philosophy of biology. The work of proponents and critics of genetic engineering is examined, including LeRoy Hood, Hans Jonas, Leon Kass, Robert Nozick, Jeremy Rifkin, Robyn Rowland, and Paul Ramsey. It is concluded that excessive optimism and pessimism about genetic engineering rests primarily on two errors. The first, basic to the Genome Project, is that organisms are essentially

determined by their genes, and that the expression of genes is identical across human populations. I draw both on Richard Lewontin and on Dewey's Logic: The Theory of Inquiry to argue that the formation of human natures is instead the result of a fluid and interpenetrative relationship between hereditary information and varying environmental conditions. Organisms express DNA in different ways under different circumstances, and DNA itself is modified by exposure to mutagens. The second error prevalent in the literature is the belief that genetic engineering is uniquely problematic, requiring a new kind of ethics. To counter the received view, I detail numerous cases in the history of biology and philosophy in which humans have faced moral choices similar to those present in the new genetics. In addition, I resituate new reproductive decisions in the context of everyday problems faced by parents in society, arguing that the hopes and choices of parents provide a matrix within which genetic decisions can be made. I caution against the expansion of genetic diagnosis, and detail some of the greatest real dangers present in positive genetic engineering. Finally, I suggest pragmatic alternatives to positive genetic engineering, including education and health care reform. Continuing the very successful first edition,

this book reviews the most recent changes to the legal situation in Europe concerning genetically engineered food and labeling. Due to the extremely rapid developments in green biotechnology, all the chapters have been substantially revised and updated. Divided into three distinct parts, the text begins by covering applications and perspectives, including transgenic modification of production traits in farm animals, fermented food production and the production of food additives using filamentous fungi. The second section is devoted to legislation, while the final part examines methods of detection, such as DNA-based methods, and methods for detecting genetic engineering in composed and processed foods. From the reviews of the first edition: "This work promises to be a standard reference in the detection of genetically engineered food. I believe this work will find a valued place for any scientist, regulator or technical library that deals with biotechnology or detection of genetically engineered food organisms." —James J. Heinis, Journal of Agricultural & Food Information "The book...is, in fact, a short text on the many practical problems...associated with translating the explosion in basic biotechnological research into the next Green Revolution," explains Economic Botany. The book is "a concise and accurate

narrative, that also manages to be interesting and personal...a splendid little book." Biotechnology states, "Because of the clarity with which it is written, this thin volume makes a major contribution to improving public understanding of genetic engineering's potential for enlarging the world's food supply...and can be profitably read by practically anyone interested in application of molecular biology to improvement of productivity in agriculture." The author presents a basic introduction to the world of genetic engineering.

Beyond Human is an informative and accessible guide for all those interested in the developing sciences of genetic engineering, bio printing and human cloning. Illustrating the ideas with reference to well-known science fiction films and novels, the author provides a unique insight into and understanding of how genetic manipulation, cloning, and other novel bio-technologies will one day allow us to redesign our species. It also addresses the legitimate concerns about “playing God”, while at the same time embracing the positive aspects of the scientific trajectory that will lead to our transhuman future. William C. Taylor Department of Genetics University of California Berkeley, California 94720 It is evident by now that there is a great deal of interest in

exploiting the new technologies to genetically engineer new forms of plants. A purpose of this meeting is to assess the possibilities. The papers that follow are concerned with the analysis of single genes or small gene families. We will read about genes found within the nucleus, plastids, and bacteria which are responsible for agri culturally important traits. Given that these genes can be isolated by recombinant DNA techniques, there are two possible strategies for plant engineering. One involves isolating a gene from a cultivated plant, changing it in a specific way and then inserting it back into the same plant where it produces an altered gene product. An example might be changing the amino acid composition of a seed pro tein so as to make the seed a more efficient food source. A second strategy is to isolate a gene from one species and transfer it to another species where it produces a desirable feature. An example might be the transfer of a gene which encodes a more efficient pho tosynthetic enzyme from a wild relative into a cultivated species. There are three technical hurdles which must be overcome for either strategy to work. The gene of interest must be physically isolated. Over the past decade, our laboratory and others have been concerned with molecular archaeological studies aimed at revealing the origins

and evolutionary histories of permeases (1). These studies have revealed that several different families, defined on the basis of sequence similarities, arose independently of each other, at different times in evolutionary history, following different routes. When complete microbial genomes first became available for analysis, we adapted p- existing software and designed new programs that allowed us quickly to identify probable transmembrane proteins, estimate their topologies and determine the likelihood that they function in transport (2). This work allowed us to expand previously-recognized families and to identify dozens of new families. All of this work then led us to attempt to design a rational but comprehensive classification system that would be applicable to the complete complement of transport systems found in all living organisms (3). The classification system that we have devised is based primarily on mode of transport and energy coupling mechanism, secondarily on molecular phylogeny, and lastly on the substrate specificities of the individual permeases (4). The classic personal account of Watson and Crick's groundbreaking discovery of the structure of DNA, now with an introduction by Sylvia Nasar, author of A Beautiful Mind. By identifying the structure of DNA, the molecule of life, Francis Crick and James Watson

revolutionized biochemistry and won themselves a Nobel Prize. At the time, Watson was only twenty-four, a young scientist hungry to make his mark. His uncompromisingly honest account of the heady days of their thrilling sprint against other world-class researchers to solve one of science's greatest mysteries gives a dazzlingly clear picture of a world of brilliant scientists with great gifts, very human ambitions, and bitter rivalries. With humility unspoiled by false modesty, Watson relates his and Crick's desperate efforts to beat Linus Pauling to the Holy Grail of life sciences, the identification of the basic building block of life. Never has a scientist been so truthful in capturing in words the flavor of his work. A variety of scientific, social, and ethical perspectives comprise this unique collection of primary resources. Over the past 50 years, biotechnology has been the major driving force for increasing crop productivity. Particularly, advances in plant genetic engineering technologies have opened up vast new opportunities for plant researchers and breeders to create new crop varieties with desirable traits. Recent development of precise genome modification methods, such as targeted gene knock-out/knock-in and precise gene replacement, moves genetic engineering to another level and offers even more potentials for improving

crop production. The work provides an overview of the latest advances on precise genomic engineering technologies in plants. Topics include recombinase and engineered nucleases-mediated targeted modification, negative/positive selection-based homologous recombination and oligo nucleotide-mediated recombination. Finally, challenges and impacts of the new technologies on present regulations for genetic modification organisms (GMOs) will be discussed. Heritable human genome editing - making changes to the genetic material of eggs, sperm, or any cells that lead to their development, including the cells of early embryos, and establishing a pregnancy - raises not only scientific and medical considerations but also a host of ethical, moral, and societal issues. Human embryos whose genomes have been edited should not be used to create a pregnancy until it is established that precise genomic changes can be made reliably and without introducing undesired changes - criteria that have not yet been met, says Heritable Human Genome Editing. From an international commission of the U.S. National Academy of Medicine, U.S. National Academy of Sciences, and the U.K.'s Royal Society, the report considers potential benefits, harms, and uncertainties associated with genome editing

technologies and defines a translational pathway from rigorous preclinical research to initial clinical uses, should a country decide to permit such uses. The report specifies stringent preclinical and clinical requirements for establishing safety and efficacy, and for undertaking long-term monitoring of outcomes. Extensive national and international dialogue is needed before any country decides whether to permit clinical use of this technology, according to the report, which identifies essential elements of national and international scientific governance and oversight. Genome editing is a powerful new tool for making precise alterations to an organism's genetic material. Recent scientific advances have made genome editing more efficient, precise, and flexible than ever before. These advances have spurred an explosion of interest from around the globe in the possible ways in which genome editing can improve human health. The speed at which these technologies are being developed and applied has led many policymakers and stakeholders to express concern about whether appropriate systems are in place to govern these technologies and how and when the public should be engaged in these decisions. Human Genome Editing considers important questions about the human application of genome editing including:

balancing potential benefits with unintended risks, governing the use of genome editing, incorporating societal values into clinical applications and policy decisions, and respecting the inevitable differences across nations and cultures that will shape how and whether to use these new technologies. This report proposes criteria for heritable germline editing, provides conclusions on the crucial need for public education and engagement, and presents 7 general principles for the governance of human genome editing. Learn how scientists copy and change genes within individual living cells and explore the new science of genetic engineering. Life on earth is facing unprecedented challenges from global warming, war, and mass extinctions. The plight of seeds is a less visible but no less fundamental threat to our survival. Seeds are at the heart of the planet's life-support systems. Their power to regenerate and adapt are essential to maintaining our food supply and our ability to cope with a changing climate. In Uncertain Peril, environmental journalist Claire Hope Cummings exposes the stories behind the rise of industrial agriculture and plant biotechnology, the fall of public interest science, and the folly of patenting seeds. She examines how farming communities are coping with declining water, soil, and fossil fuels, as well as with

new commercial technologies. Will genetically engineered and "terminator" seeds lead to certain promise, as some have hoped, or are we embarking on a path of uncertain peril? Will the "doomsday vault" under construction in the Arctic, designed to store millions of seeds, save the genetic diversity of the world's agriculture? To answer these questions and others, Cummings takes readers from the Fertile Crescent in Iraq to the island of Kaua'i in Hawai'i; from Oaxaca, Mexico, to the Mekong Delta in Vietnam. She examines the plight of farmers who have planted transgenic seeds and scientists who have been persecuted for revealing the dangers of modified genes. At each turn, Cummings looks deeply into the relationship between people and plants. She examines the possibilities for both scarcity and abundance and tells the stories of local communities that are producing food and fuel sustainably and providing for the future. The choices we make about how we feed ourselves now will determine whether or not seeds will continue as a generous source of sustenance and remain the common heritage of all humanity. It comes down to this: whoever controls the future of seeds controls the future of life on earth. Uncertain Peril is a powerful reminder that what's at stake right now is nothing less than the nature of the future. "With

Uncertain Peril, Claire Hope Cummings offers an indispensable contribution to the debate over biotechnology. She rightly focuses our attention on the seed, and what its privatization and manipulation may mean for the future of food." -Michael Pollan, author of In Defense of Food and The Omnivore's Dilemma "Our current approach to industrial agriculture will someday seem so bizarre that our descendants won't understand what we were thinking. This fine volume provides the details of the way we do things now-and the keys to getting towards a farming future that might actually work." -Bill McKibben, author Deep Economy "As agriculture continues to industrialize and globalize, more and more of the seeds farmers plant every year are owned by multinational corporations. And with the corporate focus on effeciency and rational product lines, monocultures continue to grow. Our society has not thought hard enough about whether this is the kind of agricultural system we want. Fortunately, along comes Claire Cummings with this timely and valuable book, to do a lot of important thinking for us. I hope everyone reads it." -John Seabrook, The New Yorker "Claire Hope Cummings has written the clearest analysis and overview of the biotech seeds debate I've ever encountered. Writing with passion, she tells the story of seeds as not only

the first link in the food chain but also as our only hope for food security in the midst of global warming. I commend Uncertain Peril to anybody who wants to understand who owns, controls, and is directing the fate of our seeds." -Pat Mooney, author of Shattering and Executive Director of the ETC Group "Uncertain Peril gives us passionate and persuasive reasons why we need more public disc Assists policymakers in evaluating the appropriate scientific methods for detecting unintended changes in food and assessing the potential for adverse health effects from genetically modified products. In this book, the committee recommended that greater scrutiny should be given to foods containing new compounds or unusual amounts of naturally occurring substances, regardless of the method used to create them. The book offers a framework to guide federal agencies in selecting the route of safety assessment. It identifies and recommends several pre- and post-market approaches to guide the assessment of unintended compositional changes that could result from genetically modified foods and research avenues to fill the knowledge gaps. Genetic Engineering of Horticultural Crops provides key insights into commercialized crops, their improved productivity, disease and pest resistance, and enhanced nutritional or medicinal

benefits. It includes insights into key technologies, such as marker traits identification and genetic traits transfer for increased productivity, examining the latest transgenic advances in a variety of crops and providing foundational information that can be applied to new areas of study. As modern biotechnology has helped to increase crop productivity by introducing novel gene(s) with high quality disease resistance and increased drought tolerance, this is an ideal resource for researchers and industry professionals. Provides examples of current technologies and methodologies, addressing abiotic and biotic stresses, pest resistance and yield improvement Presents protocols on plant genetic engineering in a variety of wide-use crops Includes biosafety rule regulation of genetically modified crops in the USA and third world countries AcknowledgmentsIntroduction1. Framework for Understanding the Thinning of a Public Debate2. Setting the Stage: The Eugenicists and the Challenge from Theologians3. Gene Therapy, Advisory Commissions, and the Birth of the Bioethics Profession4. The President's Commission: The "Neutral" Triumph of Formal Rationality5. Regaining Lost Jurisdictional Ground and the Triumph of the Bioethics Profession6. "Reproduction" as the New Jurisdictional Metaphor:

Autonomy and the Internal Threat to the Bioethics/Science Jurisdiction7. Conclusion: The Future of Public Bioethics and the HGE DebateAppendix: Methods and TablesNotesWorks CitedIndex Copyright © Libri GmbH. All rights reserved. Genetic Engineering of Plants for Crop Improvement discusses current genetic engineering methods for plants and addresses the commercial opportunities for transgenic plants. Topics covered include Agrobacterium-mediated transformations, the use of electroporation, PEG-mediated transformation, microinjection, the microprojectile bombardment method, and the electrical discharge particle acceleration method. A concise account of the resistance of transgenic plants to insect attack, viral infection, and herbicides has also been provided. Possibilities for genetic manipulation for proteins that have superior nutritional properties are discussed, and a brief account of tests confirming the safety and commercial validity of transgenic plants is included. Genetic Engineering of Plants for Crop Improvement provides valuable information for researchers and students in plant biotechnology, plant gene manipulation, molecular biology, and all areas of the life sciences. Zero to Genetic Engineering Hero is made to provide you with a first glimpse of the inner-workings of a cell. It further

focuses on skill-building for genetic engineering and the Biology-as-a-Technology mindset (BAAT). This book is designed and written for hands-on learners who have little knowledge of biology or genetic engineering. This book focuses on the reader mastering the necessary skills of genetic engineering while learning about cells and how they function. The goal of this book is to take you from no prior biology and genetic engineering knowledge toward a basic understanding of how a cell functions, and how they are engineered, all while building the skills needed to do so. The idea of custom-made life-forms would once have been pure science fiction. Not any more, however, thanks to genetic engineering. Genetic engineering already allows single-cell bacteria to work as drug-making factories. It has made possible new types of plants that resist diseases. It could lead to cures for cancers and other fatal illnesses. Genetic engineers work with DNA, the molecule that genes are made of. They insert new genes into animals, plants, bacteria, and other organisms. Their work, however, has raised ethical concerns. Should humans tamper with the blueprint of life? Headline Science uses news stories and everyday applications to explain the science behind genetic engineering. This powerful Genetic engineering self-assessment will make you

the principal Genetic engineering domain adviser by revealing just what you need to know to be fluent and ready for any Genetic engineering challenge. How do I reduce the effort in the Genetic engineering work to be done to get problems solved? How can I ensure that plans of action include every Genetic engineering task and that every Genetic engineering outcome is in place? How will I save time investigating strategic and tactical options and ensuring Genetic engineering opportunity costs are low? How can I deliver tailored Genetic engineering advise instantly with structured going-forward plans? There's no better guide through these mind-expanding questions than acclaimed best-selling author Gerard Blokdyk. Blokdyk ensures all Genetic engineering essentials are covered, from every angle: the Genetic engineering self-assessment shows succinctly and clearly that what needs to be clarified to organize the business/project activities and processes so that Genetic engineering outcomes are achieved. Contains extensive criteria grounded in past and current successful projects and activities by experienced Genetic engineering practitioners. Their mastery, combined with the uncommon elegance of the self-assessment, provides its superior value to you in knowing how to ensure the outcome of any efforts in Genetic

engineering are maximized with professional results. Your purchase includes access to the $249 value Genetic engineering self-assessment dashboard download which gives you your dynamically prioritized projects-ready tool and shows your organization exactly what to do next. Your exclusive instant access details can be found in your book. Gene Manipulation. Genetic engineering involves the deliberate modification of the characteristics of an organism by manipulating its genetic material. This allows modern scientists to shape characteristics of living things. This technology offers many positives, including the possibility of enabling people to live longer, or creating productive strains of grain or fruit that can feed greater numbers of people. However, some people are concerned about the Frankenstein-like possibility of abuse. This book describes genetic engineering as it is practiced today, and provides information about how genetic engineering can help the fight against sickness and famine. The Critical World Issues series explores some of the most controversial and newsworthy subjects in the modern world. Each book examines the facts about the issue being covered, with information about arguments and opinions from around the globe. Special research projects, as well as a great variety of additional resources, invite the reader to engage

with the issues that are currently shaping our world. Each title in this series contains color photos throughout, maps, and graphics that will help student readers put major events into historical perspective. Back matter includes: timelines, a detailed index and further reading lists for books and internet resources. Key Icons appear throughout the books in this series in an effort to encourage library readers to build knowledge, gain awareness, explore possibilities and expand their viewpoints through our content rich non-fiction books. Key Icons in this series are as follows: Words to Understand are shown at the front of each chapter with definitions. These words are set in boldfaced type in that chapter, so that readers are able to reference back to the definitions--building their vocabulary and enhancing their reading comprehension. Sidebars are highlighted graphics with content rich material within that allows readers to build knowledge and broaden their perspectives by weaving together additional information to provide realistic and holistic perspectives. Text Dependent Questions are placed at the end of each chapter. They challenge the reader's comprehension of the chapter they have just read, while sending the reader back to the text for more careful attention to the evidence presented there. Research Projects are

provided at the end of each chapter as well and provide readers with suggestions for projects that encourage deeper research and analysis. And a Series Glossary of Key Terms is included in the back matter containing terminology used throughout the series. Words found here broaden the reader's knowledge and understanding of terms used in this field. Although designed for undergraduates with an interest in molecular biology, biotechnology, and bioengineering, this book—Techniques in Genetic Engineering—IS NOT: a laboratory manual; nor is it a textbook on molecular biology or biochemistry. There is some basic information in the appendices about core concepts such as DNA, RNA, protein, genes, and genomes; however, in general it is assumed that the reader has a background on these key issues. Techniques in Genetic Engineering briefly introduces some common genetic engineering techniques and focuses on how to approach different real-life problems using a combination of these key issues. Although not an exhaustive review of these techniques, basic information includes core concepts such as DNA, RNA, protein, genes, and genomes. It is assumed that the reader has background on these key issues. The book provides sufficient background and future perspectives for the readers to develop their own

experimental strategies and innovations. This easy-to-follow book presents not only the theoretical background of molecular techniques, but also provides case study examples, with some sample solutions. The book covers basic molecular cloning procedures; genetic modification of cells, including stem cells; as well as multicellular organisms, using problem-based case study examples. Genetically engineered (GE) crops were first introduced commercially in the 1990s. After two decades of production, some groups and individuals remain critical of the technology based on their concerns about possible adverse effects on human health, the environment, and ethical considerations. At the same time, others are concerned that the technology is not reaching its potential to improve human health and the environment because of stringent regulations and reduced public funding to develop products offering more benefits to society. While the debate about these and other questions related to the genetic engineering techniques of the first 20 years goes on, emerging genetic-engineering technologies are adding new complexities to the conversation. Genetically Engineered Crops builds on previous related Academies reports published between 1987 and 2010 by undertaking a retrospective examination of the purported positive

and adverse effects of GE crops and to anticipate what emerging genetic-engineering technologies hold for the future. This report indicates where there are uncertainties about the economic, agronomic, health, safety, or other impacts of GE crops and food, and makes recommendations to fill gaps in safety assessments, increase regulatory clarity, and improve innovations in and access to GE technology. In 2001 the Human Genome Project announced that it had successfully mapped the entire genetic content of human DNA. Scientists, politicians, theologians, and pundits speculated about what would follow, conjuring everything from nightmare scenarios of state-controlled eugenics to the hope of engineering disease-resistant newborns. As with debates surrounding stem-cell research, the seemingly endless possibilities of genetic engineering will continue to influence public opinion and policy into the foreseeable future. Beyond Biotechnology: The Barren Promise of Genetic Engineering distinguishes between the hype and reality of this technology and explains the nuanced and delicate relationship between science and nature. Authors Craig Holdrege and Steve Talbott evaluate the current state of genetic science and examine its potential applications, particularly in agriculture and medicine, as well as the possible

dangers. The authors show how the popular view of genetics does not include an understanding of the ways in which genes actually work together in organisms. Simplistic and reductionist views of genes lead to unrealistic expectations and, ultimately, disappointment in the results that genetic engineering actually delivers. The authors explore new developments in genetics, from the discovery of "non-Darwinian" adaptative mutations in bacteria to evidence that suggests that organisms are far more than mere collections of genetically driven mechanisms. While examining these issues, the authors also answer vital questions that get to the essence of genetic interaction with human biology: Does DNA "manage" an organism any more than the organism manages its DNA? Should genetically engineered products be labeled as such? Do the methods of the genetic engineer resemble the centuries-old practices of animal husbandry? Written for lay readers, Beyond Biotechnology is an accessible introduction to the complicated issues of genetic engineering and its potential applications. In the unexplored space between nature and laboratory, a new science is waiting to emerge. Technology-based social and environmental solutions will remain tenuous and at risk of reversal as long as our culture is alienated from the plants

and animals on which all life depends. Susan Aldridge gives an accessible guide to the world of DNA and also explores the applications of genetic engineering in biotechnology. She takes the reader step by step, through the fascinating study of molecular biology. The first part of the book describes DNA and its function within living organisms. The second part explores genetic engineering and its applications to humans - such as gene therapy, genetic screening and DNA fingerprinting. The third part looks at the wider world of biotechnology and how genetic engineering can be applied to such problems as producing vegetarian cheese or cleaning up the environment. The final part explains how knowledge of the structure and functioning of genes sheds light on evolution and our place in the world. Although easy to read, this book does not avoid the science involved and should be read by anyone who wants to know about DNA and genetic engineering. Engineering is an increasingly important field in our technology-driven marketplace. Those students with an engineering background will have a great advantage in the job market. This essential volume introduces readers to what engineers do as well as the various branches of the field. Also, it helps young people learn to understand problems and find

solutions to them, which is so much of what engineering is all about. This book is a great resource for any student interested in applying math and problem solving to real-world challenges.

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