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Safety of Genetically Engineered Foods **Genetics and Genetic Engineering** **The Potential Environmental Consequences of Genetic Engineering** An Introduction to Genetic Engineering **Beyond Biotechnology** Genetically Engineered Crops **Jobs in Genetic Engineering** What is Genetic Engineering and how Does it Work? *Altering the Biological Blueprint* **Ingenious Genes** Zero to Genetic Engineering Hero Genetically Engineered Food **Genes at Work** **Genetic Engineering** **Genetic Engineering** Setting Genes to Work **Hacking Darwin** Genetic Engineering of Plants *Genetic Engineering* **Genetic Engineers** *Guidelines for Small Scale Genetic Manipulation Work* General Microbiology Biotechnology: Genetic engineering, mutagenesis, separation technology Genetic Engineering **Genetic Engineering of Plants** **Field Testing Genetically Modified Organisms** **Human Genetic Engineering** **Advances in New Technology for Targeted Modification of Plant Genomes** Pragmatism and Human Genetic Engineering **Plant Genetic Engineering** *Regenerative Medicine and Human Genetic Modification* *New Directions for Biosciences Research in Agriculture* **Understanding Genetic Engineering** **Genetic Engineering** **Chromosome Engineering in Plants** **Art's Work in the Age of Biotechnology** **Heritable Human Genome Editing** **Genetically Modified Organisms** **The Green Phoenix** *Techniques in Genetic Engineering*

This two-volume work surveys the entire range of general aspects of chromosome research on plants. This first volume is divided into two sections. Section A consists of 11 chapters covering the entire range of general aspects of chromosome research in plants (including a chapter on genetic engineering in crop improvement). Section B is devoted to cytogenetics of cereals and millets (wheat, rye, barley, triticale, oats, maize, rice, pearl millet, and minor millets). More than one chapter is devoted to the same crop to give a detailed treatment of chromosome research (including molecular biology) in these crops. The second volume deals with cytogenetics of plant materials including legumes, vegetable and oil crops, sugar crops, forage crops, fibre crops, medicinal crops and ornamentals. This work will be useful both as a reference work and a teaching aid to satisfy a wide range of workers. Every chapter has been written by an expert who has been involved in chromosome research on a particular plant material for many years. Evolution has gotten us this far. Design may take it from here. Aimed at raising awareness about genetic engineering, biotechnologies, and their consequences through the lens of art and design, Art's Work in the Age of Biotechnology: Shaping Our Genetic Futures is an art-science exhibition curated by Hannah Star

Rogers and organized by the NC State University Libraries and the Genetic Engineering and Society Center, and shown at the Gregg Museum of Art & Design, in the physical and digital display spaces of the Libraries, and on the grounds of the North Carolina Museum of Art. By combining science and art and design, artists offer new insights about genetic engineering by bringing it out of the lab and into public places to challenge viewers' understandings about the human condition, the material of our bodies, and the consequences of biotechnology. Exhibition participants include Kirsten Stolle, Paul Vanouse, Adam Zaretsky, Joe Davis, Emilia Tikka, Emeka Ikebude, Jennifer Willet, Charlotte Jarvis, Maria McKinney, Ciara Redmond, Aaron Ellison, David Buckley Borden, Joel Ong, and others. 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. "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 A groundbreaking exploration of genetic engineering and its impact on the future of our species from leading geopolitical expert and technology futurist, Jamie Metzl. 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. In this captivating and thought-provoking nonfiction science book, Jamie Metzl delves into the ethical, scientific, political, and technological dimensions of genetic engineering, and shares how it will shape the course of human evolution. Cutting-edge insights into the field of genetic engineering and its implications for humanity's future Explores the transformative power of genetic technologies and their potential to reshape human life Examines the ethical considerations surrounding genetic engineering and the choices we face as a species Engaging narrative that delves into the scientific breakthroughs and real-world applications of genetic technologies Provides a balanced perspective on the promises and risks associated with genetic engineering Raises thought-provoking questions about the future of reproduction, human health, and our relationship with nature Drawing on his extensive background in genetics, national security, and foreign policy, Metzl paints a vivid picture of a world where advancements in technology empower us to take control of our own evolution, but also cautions against the pitfalls and ethical dilemmas that could arise if not properly managed. Hacking Darwin is a must-read for anyone interested in the intersection of science, technology, and humanity's future. Providing the first account of the story behind genetically engineered plants, Paul F. Lurquin covers the controversial birth of the field, its sudden death, phoenixlike reemergence, and ultimate triumph as not only a legitimate field of science but a new tool of multinational corporate interests. In addition, Lurquin looks ahead to the potential impact this revolutionary technology will have on human welfare. As Lurquin shows, it was the intense competition between international labs that resulted in the creation of the first transgenic plants. Two very different approaches to plant genetic engineering came to fruition at practically the same time, and Lurquin's account demonstrates how cross-fertilization between the two areas was critical to success. The scientists concerned were trying to tackle some very basic scientific problems and did not foresee the way that corporations would apply their methodology. With detailed accounts of the work of individual scientists and teams all over the world, Lurquin pieces together a remarkable account. 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. Potential benefits from the use of genetically modified organismsâ€"such as bacteria that biodegrade environmental pollutantsâ€"are enormous. To minimize the risks of releasing such organisms into the environment, regulators are working to develop rational safeguards. This volume provides a comprehensive examination of the issues surrounding testing these organisms in the laboratory or the field and a practical framework for making decisions about organism release. Beginning with a discussion of classical versus molecular techniques for genetic alteration, the volume is divided into major sections for plants and microorganisms and covers the characteristics of altered organisms, past experience with releases, and such specific issues as whether plant introductions could promote weediness. The executive summary presents major conclusions and outlines the recommended decision-making framework. The end of cancer and other fatal diseases. Plants that can not only survive but thrive in a changing climate. Food that makes us healthier simply by eating it. All these developments and more may be on the horizon, thanks to developments in the fields of genetics, genomics, and biotechnology. Our society will need workers who understand all these developments--not just scientists and engineers but counselors, educators, and ethicists. In this book you'll learn about the many opportunities that exist for people with a background in genetics; the typical educational paths; key skills for success; how to start honing your skills; and much more. Genetic Engineers is just one of the many exciting titles in the Cool Careers in Science series. Readers will discover cutting-edge science, technology, and engineering careers, and dozens of subspecialties. You will also learn why these careers are some of the most exciting, best paying, and fastest growing occupations in the world. 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 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 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. 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. The author presents a basic introduction to the world of genetic engineering. 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). Welcome to the wonderful world of microbiology! Yay! So. What is microbiology? If we break the word down it translates to "the study of small life," where the small life refers to microorganisms or microbes. But who are the microbes? And how small are they? Generally microbes can be divided in to two categories: the cellular microbes (or organisms) and the acellular microbes (or agents). In the cellular camp we have the bacteria, the archaea, the fungi, and the protists (a bit of a grab bag composed of algae, protozoa, slime molds, and water molds). Cellular microbes can be either unicellular, where one cell is the entire organism, or multicellular, where hundreds, thousands or even billions of cells can make up the entire organism. In the acellular camp we have the viruses and other infectious agents, such as prions and viroids. In this textbook the focus will be on the bacteria and archaea (traditionally known as the "prokaryotes,") and the viruses and other acellular agents. A common tool in both research and agriculture, genetic engineering involves the direct manipulation of genes. Today’s areas of medical research include genetic engineering to produce vaccines against disease, pharmaceutical development, and the treatment of disease. In agriculture, genetic engineering is used to modify crops and domestic animals to increase their yields, aid in production, and enhance nutritive aspects. This important book covers new research and studies in genetic engineering in the areas of medicine and agriculture. Plant biotechnology offers important opportunities for agriculture, horticulture, and the pharmaceutical and food industry by generating transgenic varieties with altered properties. This is likely to change farming practice and reduce the potential negative impact of plant production on the environment. This volume shows the worldwide advances and potential benefits of plant genetic engineering focusing on the third millennium. The authors discuss the production of transgenic plants resistant to biotic and abiotic stress, the improvement of plant qualities, the use of transgenic plants as bioreactors, and the use of plant genomics for genetic improvement and gene cloning. Unique to this book is the integrative point of view taken between plant genetic engineering and socioeconomic and environmental issues. Considerations of regulatory processes to release genetically modified plants, as well as the public acceptance of the transgenic plants are also discussed.This book will be welcomed by biotechnologists, researchers and students alike working in the biological sciences. It should also prove useful to everyone dedicated to the study of the socioeconomic and environmental impact of the new technologies, while providing recent scientific information on the progress and perspectives of the production of genetically modified plants. The work is dedicated to Professor Marc van Montagu. 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. "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." Genetics and Genetic Engineering explores the great discoveries in genetics-the study of genes and the inherited information they contain. Genetic engineering alters the genetic make-up of an organism using techniques that remove heritable material or that introduce DNA prepared outside the organism either directly into the host or into a cell that is then fused or hybridized with the host. This involves using recombinant nucleic acid (DNA or RNA) techniques to form new combinations of heritable genetic material followed by the incorporation of that material either indirectly through a vector system or directly through micro-injection, macro-injection and micro-encapsulation techniques. Genetic engineering, also called genetic modification, is the direct manipulation of an organism's genes using biotechnology. It is a set of technologies used to change the genetic makeup of cells, including the transfer of genes within and across species boundaries to produce improved or novel organisms. New DNA is obtained by either isolating or copying the genetic material of interest using recombinant DNA methods or by artificially synthesizing the DNA. A construct is usually created and used to insert this DNA into the host organism. The first recombinent DNA molecule was made by

Paul Berg in 1972 by combining DNA from the monkey virus SV40with the lambda virus. As well as inserting genes, the process can be used to remove, or "e;knock out"e;, genes. The new DNA can be inserted randomly, or targeted to a specific part of the genome. This book will prove equally useful for physicians, nurses, animal breeders, and laboratory technicians-in fact, everyone whose daily work involves genetics and genetic engineering. 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. 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. Genes - Cells and proteins - Gene structure - Biotechnology - Molecular genetics - Plants - Genetic engineering fo animals - Diagnosing diseases - Vaccines - Biocontrol of pests - The food industry. The debate over human Genetic Engineering (GE) is about to go mainstream. Not as a one-day wonder about cloning or a theological disagreement about embryos, but as a major political issue, driven in part by a grassroots movement of opposition. Human Genetic Engineering is a highly readable and entertaining guide. It explains in accessible language for a popular audience the essential questions that will arise in the future debates: What is human GE? Will it work? What perspectives should we remember? Who is doing what, and why? 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. Authored by an integrated committee of plant and animal scientists, this review of newer molecular genetic techniques and traditional research methods is presented as a compilation of high-reward opportunities for agricultural research. Directed to the Agricultural Research Service and the agricultural research community at large, the volume discusses biosciences research in genetic engineering, animal science, plant science, and plant diseases and insect pests. An optimal climate for productive research is discussed. Vol. II The work presented in these two volumes is the collaborative effort of over twenty undergraduate science faculty, whose common goal was to develop a text of unique and flexible laboratory activities focusing on the theory and practice of biotechnology for undergraduate students. The books are designed to provide flexibility for easy integration into any course in the life sciences with an experimental emphasis. "Genetic engineering-the rearranging of bits of DNA-has helped crops survive droughts and decreased the need for pesticides. It has helped make the production of human insulin possible for people with diabetes. And many in the field are seeking even more treatments and cures for a variety of diseases. Those interested in a career in genetic engineering or just wondering more about how the process works will find lots of interesting information in this accessible text supported by informative photographs and images, enlightening sidebars, and truly fascinating fact boxes"-- This work reviews the theoretical and historical basis of genetic engineering, particularly in regard to genetically modified plants, and details techniques of creating genetically modified organisms. It describes research programs and results in areas such as agro-food, health, and the environment, and examines practical, legal, and ethical questions posed by society and the responses of scientists, legislators, and industry. B&W photographs of equipments are given. 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. Learn how scientists copy and change genes within individual living cells and explore the new science of genetic engineering. “First Genetically Modified Babies Born,” read the news headline. While not technically examples of genetically modified humans, the fact is when the babies were genetically fingerprinted they had the genes from two mothers and one father, which would alarm most people. One of the scientists involved said this is child's play, a mere “tweaking” of the reproductive process. Imagine before you Tinker Toys or Legos of all different sizes, shapes and colors. Imagine those pieces are actually genes from insects, plants, animals and people that can be used interchangeably to provide humans characteristics only comic book superheroes possess. Scientists have already taken the gene that provides the jellyfish its green color and inserted it into the DNA of a white rabbit to create a "green rabbit." Scientists have taken the genes that enable spiders to make webbing and combined them with a goat's DNA as a way for the goat to make "spider silk”, a strong new fiber. We can do similar things with human DNA. Genomics provides us the equivalent of the "Application Program Interface” (API) for each human. Genomics, genetic engineering, embryonic stem cells, and nuclear transfer (cloning) independently have great promise and peril for us. There are numerous similarities between computer programing and “genetic programing” or genetic modification. Instead of programing with zero's and one's, we use C, T, A, G. We can reprogram DNA, cells and genes. The excitement with these new technologies is we can more effectively treat chronic diseases such as Parkinson's disease, osteoarthritis, osteoporosis, age-related macular degeneration, and atherosclerosis, which accounts for over 75% of medical costs. There are over 3,000 genetic diseases such as sickle cell anemia we could treat. We could treat infectious diseases such as HIV by developing an HIV resistant immune system. However, there are also dangers. The same way computers and software can be hacked, genetic structures can be hacked. Genetic “doping” is possible. Because of the similarity between digital and genetic technologies, much of what we learned in the digital revolution can be transferred to the application of genetic modification and regenerative medicine. This similarity and the potential applications have not escaped the attention of companies such as Google who have announced major investments in these areas and are prepared to spend in the hundreds of millions for research. As a result of these powerful technologies we are on the brink of a genetic revolution similar in size and scope to the digital revolution (think biological versions of Google, Amazon, and Apple, but without any rules or guidelines). Because of the similarity, this revolution will occur faster, as many of the lessons learned in the digital revolution will be applied to the genetic revolution, and there is an abundance of venture capital looking for these types of game changing, disruptive technologies.Developing new genetic applications might be similar to developing cell phone apps sold at the iTunes store. These new technologies are patentable and potentially worth billions of dollars. We should not trust industry to do the right thing. There is a need to have as much discussion on the genetic modification of humans as we do on the GMO labeling of food. Currently we lack a national discussion, legislation or regulatory guidance on these controversial topics. We have not had a national discussion on bioethics since we debated the use of embryonic stem cells and cloning, over a decade ago. This book reviews the religious and scientific arguments, and refines the work of Norman Ford who was writing in the context of reproductive technologies, not the debates concerning embryonic stem cells and therapeutic cloning, and looks at where we are headed, with a focus on Dr. Michael West, a thought leader in this area.