

## CRISPR Cas A Laboratory

The CRISPR-Cas9 genome-editing system is creating a revolution in the science world. In the laboratory, CRISPR-Cas9 can efficiently be used to target specific genes, correct mutations and regulate gene expression of a wide array of cells and organisms, including human cells. CRISPR-/Cas9 Based Genome Editing for Treating Genetic Disorders and Diseases is a unique reading material for college students, academicians, and other health professionals interested in learning about the broad range of applications of CRISPR-Cas9 genetic scissors. Some topics included in this book are: the role of the CRISPR/Cas9 system in neuroscience, gene therapy, epigenome editing, genome mapping, cancer, virus infection control strategies, regulatory challenges and bioethical considerations.

Reprogramming the Genome: CRISPR-Cas-based Human Disease Therapy, presents the collation of chapters written by eminent scientists worldwide. CRISPR-Cas9 is a key technology for targeted genome editing and regulation in a number of organisms including mammalian cells. It is a rapid, simple, and cost-effective solution. CRISPR-Cas system has recently gained much scientific and public attention. This volume covers CRISPR-Cas9 based mammalian genome editing, creating disease models, cancer therapy, neurological, heredity, blood disorders, defective gene correction, stem cells therapy, epigenetic modifications, patents, ethics, bioethical issues, challenges and opportunities. This book is a key source of information on mammalian genome editing available in a single volume. This book will be useful for beginners in mammalian genome editing and also students, researchers, scientists, policymakers, clinicians and stakeholders interested in genome editing in several areas. Offers basic understanding and a clear picture of mammalian genome editing through CRISPR-Cas systems Discusses how to create mammalian disease models, stem cell modification, epigenetic modifications, correction of defective gene in blood disorders, heredity, neurological disorders and many more Discusses the application of CRISPR-Cas9 systems in basic sciences, biomedicine, molecular biology, translational sciences, neurobiology, neurology, cancer, stem cells, and many more

**BY THE WINNER OF THE 2020 NOBEL PRIZE IN CHEMISTRY!** [Finalist for the Los Angeles Times Book Prize “A powerful mix of science and ethics. . . . This book is required reading for every concerned citizen—the material it covers should be discussed in schools, colleges, and universities throughout the country.”—New York Review of Books Not since the atomic bomb has a technology so alarmed its inventors that they warned the world about its use. That is, until 2015, when biologist Jennifer Doudna called for a worldwide moratorium on the use of the gene-editing tool CRISPR—a revolutionary new technology that she helped create—to make heritable changes in human embryos. The cheapest, simplest, most effective way of manipulating DNA ever known, CRISPR may well give us the cure to HIV, genetic diseases, and many cancers. Yet even the tiniest changes to DNA could have myriad, unforeseeable consequences, to say nothing of the ethical and societal repercussions of intentionally mutating embryos to create “better” humans. Writing with fellow researcher Sam Sternberg, Doudna—who has since won the Nobel Prize for her CRISPR research—shares the thrilling story of her discovery and describes the enormous responsibility that comes with the power to rewrite the code of life. “The future is in our hands as never before, and this book explains the stakes like no other.” —George Lucas “An invaluable account. . . . We owe Doudna several times over.” —Guardian

What does the birth of babies whose embryos had gone through genome editing mean—for science and for all of us? In November 2018, the world was shocked to learn that two babies had been born in China with DNA edited while they were embryos—as dramatic a development in genetics as the 1996 cloning of Dolly the sheep. In this book, Hank Greely, a leading authority on law and genetics, tells the fascinating story of this human experiment and its consequences. Greely explains what Chinese scientist He Jiankui did, how he did it, and how the public and other scientists learned about and reacted to this unprecedented genetic intervention. The two babies, nonidentical twin girls, were the first “CRISPR’d” people ever born (CRISPR, Clustered Regularly Interspaced Short Palindromic Repeats, is a powerful gene-editing method). Greely not only describes He’s experiment and its public rollout (aided by a public relations adviser) but also considers, in a balanced and thoughtful way, the lessons to be drawn both from these CRISPR’d babies and, more broadly, from this kind of human DNA editing—“germline editing” that can be passed on from one generation to the next. Greely doesn’t mince words, describing He’s experiment as grossly reckless, irresponsible, immoral, and illegal. Although he sees no inherent or unmanageable barriers to human germline editing, he also sees very few good uses for it—other, less risky, technologies can achieve the same benefits. We should consider the implications carefully before we proceed.

Advances in Research and Applications

Reprogramming the Genome: Applications of CRISPR-Cas in non-mammalian systems Part B

From TALENs, ZFNs and CRISPRs to Molecular Surgery

Gene Editing in Plants

A Laboratory Manual

Editing Humanity

Gene Editing in Plants, Volume 149 aims to provide the reader with an up-to-date survey of cutting-edge research with gene editing tools and an overview of the implications of this research on the nutritional quality of fruits, vegetables and grains. New chapters in the updated volume include topics relating to Genome Engineering and Agriculture: Opportunities and Challenges, the Use of CRISPR/Cas9 for Crop Improvement in Maize and Soybean, the Use of Zinc-Finger Nucleases for Crop Improvement, Gene Editing in Polyploid Crops: Wheat, Camellia, Canola, Potato, Cotton, Peanut, Sugar Cane, and Citrus, and Gene Editing With TALEN and CRISPR/Cas in Rice. This ongoing serial contain contributions from leading scientists and researchers in the field of gene editing in plants who describe the results of their own research in this rapidly expanding area of science. Shows the importance of revolutionary gene editing technology on plant biology research and its application to agricultural production Provides insight into what may lie ahead in this rapidly expanding area of plant research and development Contains contributions from major leaders in the field of plant gene editing

Reprogramming the Genome: Applications of CRISPR-Cas in Non-mammalian Systems, Part A presents a collation of chapters written by global, eminent scientists. CRISPR-Cas9 system is an RNA-mediated immune system of bacteria and archaea that protects from bacteriophage infections. It is one of the revolutionized technologies to uplift biology to the next stages. Chapters in this release include An Introduction and applications of CRISPR-Cas Systems, History, evolution and classification of CRISPR-Cas associated systems, CRISPR based bacterial genome editing and removal of pathogens, CRISPR based genome editing and removal of human viruses, CRISPR based development of RNA editing and diagnostic platform, and much more. Additional sections cover genome engineering in insects for control of vector borne diseases, Development of insect cell line using CRISPR technology, CRISPR/protozoan parasites to better understand the biology of diseases, CRISPR based genome editing of Caenorhabditis elegans, and a variety of other important topics. Offers a basic understanding and clear picture of genome editing CRISPR-Cas systems in different organisms Explains how to create an animal model for disease diagnosis/research and reprogram CRISPR for removal of virus, bacteria, fungi, protozoan, and many more Discusses the advances, patents, applications, challenges and opportunities in CRISPR-Cas9 systems in basic sciences, biomedicine, virology, bacteriology, molecular biology, and many more

This book presents descriptive overviews of gene editing strategies across multiple species while also offering in-depth insight on complex cases of application in the field of tissue engineering and regenerative medicine. Chapters feature contributions from leaders in stem cell therapy and biology, providing a comprehensive view of the application of gene therapy in numerous fields with an emphasis on ophthalmology, stem cells, and agriculture. The book also highlights recent major technological advances, including ZFN, TALEN, and CRISPR. Precision Medicine, CRISPR, and Genome Engineering is part of the highly successful Advances in Experimental Medicine and Biology series. It is an indispensable resource for researchers and students in genetics as well as clinicians.

CRISPR-Cas-based techniques are revolutionizing the way geneticists and molecular biologists modify DNA sequences and modulate gene expression in cells and organisms. This laboratory manual presents step-by-step protocols for applying this cutting-edge technology to any system of interest. Contributors describe approaches for de-

Case Studies from North-South Research Collaborations

Science, Ethics, and Governance

CRISPR-Cas

CRISPR-Cas system based diagnosis of infectious diseases

Stem Cell Laboratory Techniques

Technical Advances and New Therapeutic Opportunities

Innovations in molecular biology are allowing neuroscientists to study the brain with unprecedented resolution, from the level of single molecules to integrated gene circuits. Chief among these innovations is the CRISPR-Cas genome editing technology, which has the precision and scalability to tackle the complexity of the brain. This Colloque M é decine et Recherche has brought together experts from around the world that are applying genome editing to address important challenges in neuroscience, including basic biology in model organisms that has the power to reveal systems-level insight into how the nervous system develops and functions as well as research focused on understanding and treating human neurological disorders. This work was published by Saint Philip Street Press pursuant to a Creative Commons license permitting commercial use. All rights not granted by the work’s license are retained by the author or authors.

The sequencing of the human genome and subsequent elucidation of the molecular pathways that are important in the pathology of disease have provided unprecedented opportunities for the development of new therapeutics. Nucleic acid-based drugs have emerged in recent years to yield extremely promising candidates for drug therapy to a wide range of diseases. Advances in Nucleic Acid Therapeutics is a comprehensive review of the latest advances in the field, covering the background of the development of nucleic acids for therapeutic purposes to the array of drug development approaches currently being pursued using antisense, RNAi, aptamer, immune modulatory and other synthetic oligonucleotides. Nucleic acid therapeutics is a field that has been continually innovating to meet the challenges of drug discovery and development; bringing contributions together from leaders at the forefront of progress, this book depicts the many approaches currently being pursued in both academia and industry. A go-to volume for medicinal chemists, Advances in Nucleic Acid Therapeutics provides a broad overview of techniques of contemporary interest in drug discovery.

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 biological and ethical implications of genome editing, 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.

This volume provides readers with wide-ranging coverage of CRISPR systems and their applications in various plant species. The chapters in this book discuss topics such as plant DNA repair and genome editing; analysis of CRISPR-induced mutations; multiplexed CRISPR/Cas9 systems; CRISPR-Cas12a (Cpf1) editing systems; and non-agrobacterium based CRISPR delivery systems. Written in the highly successful Methods in Molecular Biology series format, chapters include introductions to their respective topics, lists of the necessary materials and reagents, step-by-step, readily reproducible laboratory protocols, and tips on troubleshooting and avoiding known pitfalls. Comprehensive and thorough,

Plant Genome Editing with CRISPR Systems: Methods and Protocols is a valuable resource for any researcher interested in learning about and using CRISPR systems in plants.

RNA Interference and CRISPR Technologies

CRISPR-Cas Enzymes

The Liver

CRISPR People

Gene Editing and the Unthinkable Power to Control Evolution

The Use of CRISPR/cas9, ZFNs, TALENs in Generating Site-Specific Genome Alterations

Bridging the gap between basic scientific advances and the understanding of liver disease — the extensively revised new edition of the premier text in the field. The latest edition of The Liver: Biology and Pathobiology remains a definitive volume in the field of hepatology, relating advances in biomedical sciences and engineering to understanding of liver structure, function, and disease pathology and treatment. Contributions from leading researchers examine the cell biology of the liver, the pathobiology of liver disease, the liver’s growth, regeneration, metabolic functions, and more. Now in its sixth edition, this classic text has been exhaustively revised to reflect new discoveries in biology and their influence on diagnosis, managing, and preventing liver disease. Seventy new chapters — including substantial original sections on liver cancer and groundbreaking advances that will have significant impact on hepatology — provide comprehensive, fully up-to-date coverage of both the current state and future direction of hepatology. Topics include liver RNA structure and function, gene editing, single-cell and single-molecule genomic analyses, the molecular biology of hepatitis, drug interactions and engineered drug design, and liver disease mechanisms and therapies. Edited by globally-recognized experts in the field, this authoritative volume: Relates molecular physiology to understanding disease pathology and treatment Links the science and pathology of the liver to practical clinical applications Features 16 new “Horizons” chapters that explore new and emerging science and technology Includes plentiful full-color illustrations and figures The Liver: Biology and Pathobiology, Sixth Edition is an indispensable resource for practicing and trainee hepatologists, hepatology and liver transplant surgeons, and researchers and scientists in areas including hepatology, cell and molecular biology, virology, and drug metabolism.

Genome Engineering via CRISPR-Cas9 Systems presents a compilation of chapters from eminent scientists from across the globe who have established expertise in working with CRISPR-Cas9 systems. Currently, targeted genome engineering is a key technology for basic science, biomedical and industrial applications due to the relative simplicity to which they can be designed, used and applied. However, it is not easy to find relevant information gathered in a single source. The book contains a wide range of applications of CRISPR in research of bacteria, virus, algae, plant and mammalian and also discusses the modeling of drosophila, zebra fish and protozoan, among others. Other topics covered include diagnosis, sensor and therapeutic applications, as well as ethical and regulatory issues. This book is a valuable source not only for beginners in genome engineering, but also researchers, clinicians, stakeholders, policy makers, and practitioners interested in the potential of CRISPR-Cas9 in several fields. Provides basic understanding and a clear picture on how to design, use and implement the CRISPR-Cas9 system in different organisms Explains how to create an animal model for disease research and screening purposes using CRISPR Discusses the application of CRISPR-Cas9 systems in basic sciences, biomedicine, virology, bacteriology, molecular biology, neurology, cancer, industry, and many more

Presents a fully updated, self-contained textbook covering the core theory and practice of both classical and modern optical microscopy techniques.

Yeast Metabolic Engineering: Methods and Protocols provides the widely established basic tools used in yeast metabolic engineering, while describing in deeper detail novel and innovative methods that have valuable potential to improve metabolic engineering strategies in industrial biotechnology applications. Beginning with an extensive section on molecular tools and technology for yeast engineering, this detailed volume is not limited to methods for Saccharomyces cerevisiae, but describes tools and protocols for engineering other yeasts of biotechnological interest, such as Pichia pastoris, Hansenula polymorpha and Zygosaccharomyces bailii. Tools and technologies for the investigation and determination of yeast metabolic features are described in detail as well as metabolic models and their application for yeast metabolic engineering, while a chapter describing patenting and regulations with a special glance at yeast biotechnology closes the volume. Written in the highly successful Methods in Molecular Biology series format, most chapters include an introduction to their respective topic, lists of the necessary materials and reagents, step-by-step, readily reproducible laboratory protocols and tips on troubleshooting and avoiding known pitfalls. Comprehensive and authoritative, Yeast Metabolic Engineering: Methods and Protocols aims to familiarize researchers with the current state of these vital and increasingly useful technologies.

Yeast Metabolic Engineering

Genome Editing and Engineering

CRISPR

CRISPR: Genome Editing and Engineering And Related Issues

Precision Medicine, CRISPR, and Genome Engineering

Reprogramming the Genome: Applications of CRISPR-Cas in non-mammalian systems part A

Since its discovery as a part of the bacterial defense mechanism, the Nobel Prize-winning technology CRISPR-Cas system has revolutionized the fields of genome editing and genetic engineering. Beyond gene-editing ability, scientists have leveraged its potential in the diagnosis of infectious diseases including COVID-19. This book provides a detailed understanding of CRISPR-based rapid and point-of-care diagnostic kits like SHERLOCK, DETECTR, FELUDA, AIOD CRISPR-Cas12a, etc. Although these CRISPR-based tests are performed using isothermal nucleic acid amplification processes like RPA and LAMP, they promise a real-time RT-PCR sensitivity. Furthermore, the tests’ results can be interpreted using paper-based lateral flow strips, potentially reducing laboratory and test costs. In this technique, the colored lines on the strip, similar to pregnancy tests, indicate whether the test is positive or negative. Because of the ease of performing the test and simple interpretation of the test results, CRISPR-based tests can be used at airports, ports, clinics, schools, etc., for better disease diagnosis, monitoring, management, and containment of infectious diseases like COVID-19. Additionally, the book also discusses Monoclonal Antibodies, which have revolutionized the treatment for cancer, arthritis, autoimmune diseases, etc. This book also talks about various strategies to isolate monoclonal antibodies from the COVID-19 recovered people and different ways to engineer these antibodies using hybridoma technology.

This volume assembles protocols for chromosome engineering and genome editing in two recently developed approaches for manipulating chromosomal and genomic DNA in plants. The first approach is a “plant chromosome vector” system which uses the introduction of desired genes or DNA into target sites on the chromosome vector, particularly by sequence-specific recombination. The second approach is “genome-editing,” which makes it possible to introduce mutations into any of the genes of DNA that we wish to change. In addition, this book also covers other related techniques used to accelerate progress in plant chromosome and genome engineering. Written in the highly successful Methods in Molecular Biology series format, chapters include introductions to their respective topics, lists of the necessary materials and reagents, step-by-step, readily reproducible laboratory protocols, and tips on troubleshooting and avoiding known pitfalls. Cutting-edge and thorough, Chromosome and Genomic Engineering in Plants: Methods and Protocols provides a comprehensive source of protocols and other necessary information to anyone interested in this field of study.

This new volume of Methods in Enzymology continues the legacy of this premier serial with quality chapters authored by leaders in the field. This volume covers recent research and methods development for changing the DNA sequence within the genomes of cells and organisms. Focusing on enzymes that generate double-strand breaks in DNA, the chapters describe use of molecular tools to introduce or delete genetic information at specific sites in the genomes of animal, plant and bacterial cells. Continues the legacy of this premier serial with quality chapters authored by leaders in the field Covers research methods in biomerinal science Contains sections on such topics as genome editing, genome engineering, CRISPR, Cas9, TALEN and zinc finger nucleases

One of the world’s leading experts on genetics unravels one of the most important breakthroughs in modern science and medicine. If our genes are, to a great extent, our destiny, then what would happen if mankind could engineer and alter the very essence of our DNA coding? Millions might be spared the devastating effects of hereditary disease or the challenges of disability, whether it was the pain of sickle-cell anemia to the ravages of Huntington’s disease. But this power to “play God” also raises major ethical questions and poses threats for potential misuse. For decades, these questions have lived exclusively in the realm of science fiction, but as Kevin Davies powerfully reveals in his new book, this is all about to change. Engrossing and page-turning, Editing Humanity takes readers inside the fascinating world of a new gene editing technology called CRISPR, a high-powered genetic toolkit that enables scientists to not only engineer but to edit the DNA of any organism down to the individual building blocks of the genetic code. Davies introduces readers to arguably the most profound scientific breakthrough of our time. He tracks the scientists on the front lines of his research to the patients whose powerful stories bring the narrative movingly to human scale. Though the birth of the “CRISPR babies” in China made international news, there is much more to the story of CRISPR than headlines seemingly ripped from science fiction. In Editing Humanity, Davies sheds light on the implications that this new technology can have on our everyday lives and in the lives of generations to come.

CRISPR-Cas Systems

Human Genome Editing

Chromosome and Genomic Engineering in Plants

Study the Effects of CRISPR/Cas in the Pathogenesis of Streptococcus Pyogenes

Advancing Science, Navigating Uncertainty, and Aligning Research with Public Values

Advancing Science, Navigating Uncertainty, and Aligning Research with Public Values

This volume reviews our understanding of two RNA worlds: the primordial RNA world before DNA, in which RNA was both information store and biocatalyst; and the contemporary RNA world, in which mRNA, tRNA, rRNA, siRNA, miRNA, and a host of other RNAs operate.

A Best Book of 2021 by Bloomberg BusinessWeek, Time, and The Washington Post The bestselling author of Leonardo da Vinci and Steve Jobs returns with a “compelling” (The Washington Post) account of how Nobel Prize winner Jennifer Doudna and her colleagues launched a revolution that will allow us to cure diseases, fend off viruses, and have healthier babies. When Jennifer Doudna was in sixth grade, she came home one day to find that her dad had left a paperback titled The Double Helix on her bed. She put it aside, thinking it was one of those detective tales she loved. When she read it on a rainy Saturday, she discovered she was right, in a way. As she sped through the pages, she became enthralled by the intense drama behind the competition to discover the code of life. Even though her high school counselor told her girls didn’t become scientists, she decided she would. Driven by a passion to understand how nature works and to turn discoveries into inventions, she would help to make what the book’s author, James Watson, told her was the most important biological advance since his codiscovery of the structure of DNA. She and her collaborators turned a curiosity of nature into an invention that will transform the human race: an easy-to-use tool that can edit DNA. Known as CRISPR, it opened a new world of medical miracles and moral questions. The development of CRISPR and the race to create vaccines for coronavirus will hasten our transition to the next great innovation revolution. The past half-century has been a digital age, based on the microchip, computer, and internet. Now we are entering a life-science revolution. Children who study digital coding will be joined by those who study genetic code. Should we use our new evolution-hacking powers to make us less susceptible to viruses? What a wonderful boon that would be! And what about preventing depression? Hmmmm...Should we allow parents, if they can afford it, to enhance the height or muscles or IQ of their kids?

After helping to discover CRISPR, Doudna became a leader in wrestling with these moral issues and, with her collaborator Emmanuelle Charpentier, won the Nobel Prize in 2020. Her story is an “enthralling detective story” (Oprah Daily) that involves the most profound wonders of nature, from the origins of life to the future of our species.

CRISPR-Cas Enzymes, Volume 149, the latest release in the Methods in Enzymology series, continues the legacy of this premier serial with quality chapters authored by leaders in the field. Topics covered in this release include CRISPR bioinformatics. A method for one-step assembly of Class 2 CRISPR arrays, Biochemical reconstitution and structural analysis of ribonucleoprotein complexes in Type I-E CRISPR-Cas systems, Mechanistic dissection of the CRISPR interference pathway in Type I-E CRISPR-Cas system, Site-specific fluorescent labeling of individual proteins within CRISPR complexes, Fluorescence-based methods for measuring target interference by CRISPR-Cas systems, Native State Structural Characterization of CRISPR-Associated Complexes using Mass Spectrometry, and more. Provides the authority and expertise of leading contributors from an international board of authors Presents the latest release in the Methods in Enzymology series Updated release includes the latest information on the CRISPR-Cas Enzymes

A complete guide to endonuclease-based genome engineering, from basic science to application in disease biology and clinical treatment.

Genome Editing in Neurosciences

CRISPR-Cas Methods

Methods and Protocols

Gene Drives on the Horizon

Ethics Dumping

Gene Therapy in Neurological Disorders

This detailed volume explores rice molecular biology, genetic engineering, and genome editing technologies. Dividing into three parts, the book covers subjects such as genetic engineering and tissue culture of rice, including efficient methods for rice transformation and regeneration, genome editing, targeted integration, and gene stacking in rice, including multiple methods utilizing CRISPR systems for targeted gene knock-out or genome modification via base editing, and diverse methods describing bioinformatic, molecular, and cellular analyses in rice. Written for the highly successful Methods in Molecular Biology series, chapters include introductions to their respective topics, lists of the necessary materials and reagents, step-by-step, readily reproducible laboratory protocols, and tips on troubleshooting and avoiding known pitfalls. Authoritative and practical, Rice Genome Engineering and Gene Editing: Methods and Protocols serves as a valuable resource for researchers worldwide striving to further their efforts on advancing research and producing genetically improved rice varieties.

Research on gene drive systems is rapidly advancing. Many proposed applications of gene drive research aim to solve environmental and public health challenges, including the reduction of poverty and the burden of vector-borne diseases, such as malaria and dengue, which disproportionately impact low and middle income countries. However, due to their intrinsic qualities of rapid spread and irreversibility, gene drive systems raise many questions with respect to their safety relative to public and environmental health. Because gene drive systems are designed to alter the environments we share in ways that will be hard to anticipate and impossible to completely roll back, questions of ethical considerations are complex and will require very careful exploration. Gene Drives on the Horizon outlines the state of knowledge relative to the science, ethics, public engagement, and risk assessment as they pertain to research directions of gene drive systems and governance of the research process. This report offers principles for responsible practices of gene drive research and related applications for use by investigators, their institutions, the research funders, and regulators.

This volume provides readers with a collection of the latest protocols used to study plant genome editing and trait engineering. The chapters in this book are organized into five parts: genome engineering systems; machinery design and validation; delivery tools; generation and analysis of engineering materials; and crop genome engineering applications. The chapters cover topics such as methods of applying the popular CRISPR-Cas9 or CRISPR-Cas12 systems for editing genes in different crop species, the use of the small synthetic plasmid for potato genome engineering, and the use of CRISPR-Cas9 for algal cell genome engineering. Written in the highly successful Methods in Molecular Biology series format, chapters include introductions to their respective topics, lists of the necessary materials and reagents, step-by-step, readily reproducible laboratory protocols, and tips on troubleshooting and avoiding known pitfalls. Cutting-edge and comprehensive, Plant Genome Engineering: Methods and Protocols is a valuable tool for researchers interested in learning more about this developing and important field.

CRISPR/Cas is a recently described defense system that protects bacteria and archaea against invasion by mobile genetic elements such as viruses and plasmids. A wide spectrum of natural CRISPR/Cas systems has been identified in at least half of the available prokaryotic genomes. On-going structural and functional analyses have resulted in a far greater insight into the functions and possible applications of these systems, although many secrets remain to be discovered. In this book, experts summarize the state of the art in this exciting field.

RNA Worlds

Plant Genome Editing with CRISPR Systems

Application of Next Generation Sequencing (NGS) and CRISPR-Cas Systems in The Diagnosis of Infectious Diseases

A Crack In Creation

RNA-mediated Adaptive Immunity in Bacteria and Archaea

A Guide for Researchers and Students

eBook content that offers a clear and comprehensive introduction to CRISPR and related topics. Entries include foundational concepts, key scientific figures and historical themes, ethical issues, and advances in the science.

This open access book provides original, up-to-date case studies of “ethics dumping” that were largely facilitated by loopholes in the ethics governance of low and middle-income countries. It is instructive even to experienced researchers since it provides a voice to vulnerable populations from the fore mentioned countries. Ensuring the ethical conduct of North-South collaborations in research is a process fraught with difficulties. The background conditions under which such collaborations take place include extreme differentials in available income and power, as well as a past history of colonialism, while differences in culture can add a new layer of complications. In this context, up-to-date case studies of unethical conduct are essential for research ethics training.

This volume presents a list of cutting-edge protocols for the study of CRISPR-Cas defense systems and their applications at the genomic, genetic, biochemical and structural levels. CRISPR: Methods and Protocols guides readers through techniques that have been developed specifically for the analysis of CRISPR-Cas and techniques adapted from standard protocols of DNA, RNA and protein biology. Written in the highly successful Methods in Molecular Biology series format, chapters include introductions to their respective topics, lists of the necessary materials and reagents, step-by-step, readily reproducible laboratory protocols, and tips on troubleshooting and avoiding known pitfalls. Authoritative and cutting-edge, CRISPR: Methods and Protocols provides a broad list of tools and techniques to study the interdisciplinary aspects of the prokaryotic CRISPR-Cas defense systems.

This detailed volume guides readers through strategic planning and user-friendly guidelines in order to select the most suitable CRISPR-Cas system and target sites with high activity and specificity. Methods covering CRISPR gRNA design, CRISPR delivery, CRISPR activity quantification (indel quantification), and examples of applying CRISPR gene editing in human pluripotent stem cells, primary cells, gene therapy, and genetic screening are included. Written for the highly successful Methods in Molecular Biology series, chapters include introductions to their respective topics, lists of the necessary materials and reagents, step-by-step, readily reproducible laboratory protocols, and tips on troubleshooting and avoiding known pitfalls. Authoritative and invaluable, CRISPR Gene Editing: Methods and Protocols will assist undergraduates, graduates, and researchers with detailed guidelines and methods for the vitally important CRISPR gene editing field. Chapter 3 is available open access under a CC BY 4.0 license via link.springer.com.

CRISPR-/Cas9 Based Genome Editing for Treating Genetic Disorders and Diseases

Volume 2

Genome Engineering via CRISPR-Cas9 System

Moving from Association to Biology and Therapeutics

Biology and Pathobiology

Introduction to Optical Microscopy

This second volume provides new and updated methods detailing advances in CRISPR-Cas technical protocols. Chapters guide readers through protocols on prime editing, base editing, multiplex editing, editing in cell-free extract, in silico analysis of gRNA secondary structure and CRISPR-diagnosis. Authoritative and cutting-edge, CRISPR-Cas Methods, Volume 2 aims to serves as a laboratory manual providing scientists with a holistic view of CRISPR-Cas methodologies and its practical application for the editing of crop plants, cell lines, nematode and microorganism. The chapter “CRISPR/Cas9-mediated gene editing in human induced pluripotent stem cell models” is available open access under a Creative Commons Attribution 4.0 International License via link.springer.com.

Stem Cell Laboratory Techniques: A Guide for Researchers and Students introduces the reader to stem cell culture, handling techniques and versatile applications used by researchers. Sections introduce stem cells, including definitions, types and basic use of stem cells in biomedical science research. The book explains laboratory procedures and techniques ranging from the extraction of stem cells from animals, cell seeding and culture, harvest and maintenance of stem cells, stem cell characterization, accurate recording, quality control, and more. In addition, it guides researchers on topics such as transcriptome analysis, proliferation study analysis, and microphysiological study. Final sections cover useful and recent applications in stem cells, such as gene editing techniques and the preparation of stem cells for in vitro study, as well as stem cell lab design and equipment used in the lab. Lastly, human and animal research ethics are discussed. Introduces readers to the stem cell culture and moves to handling techniques and versatile applications Includes coverage of gene editing techniques for stem cells and stem cells for in vitro study Presents stem cell lab design and equipment used in the lab

Gene therapy has tremendous potential for the treatment of neurological disorders. There has been substantial progress in the development of gene therapy strategies for neurological disorders over the last two decades. Gene Therapy in Neurological Disorders thoroughly reviews currently available gene therapy tools and presents examples of their application in a variety of neurological diseases. The book begins with general reviews of gene therapy strategies with a focus on neurological disorders. The remainder of the chapters present approaches to specific neurological disorders. Each chapter gives an in-depth introduction to the relevant field before diving into the specific tool or application. The book aims to help investigators, students and research staff better understand the principles of gene therapy and its application in the nervous system. Provides background information and experimental details of gene therapy tools applied for neuroscience research and neurological disorders Covers a broad range of gene delivery and regulation tools, therapeutic agents, and target cells, including emerging new technologies such as CRISPR/Cas9 genome editing Discusses applications of gene therapy tools to neurological disorders including neurodegeneration, muscular dystrophy, trauma and chronic pain, and neoplastic diseases

Reprogramming the Genome: Applications of CRISPR-Cas in Non-mammalian Systems Part B, represents the collation of chapters written by eminent scientists worldwide. CRISPR-Cas9 system is an RNA-mediated immune system of bacteria and archaea that protects from bacteriophage infections. It is one of the revolutionized technologies to uplift biology to the next stages. It is a simple, rapid, precise, and cost-effective tool for genome editing and regulation of a wide range of organisms. It has gained scientific and public attention worldwide. This volume mainly covers insect cell line, protozoans, zebrafish, drosophila, CRISPR, patents as well as technology transfer, and many more. This book is a key source of information available in a single volume. This book will be useful for not only beginners in genome engineering, but also students, researchers, scientists, policymakers, and stakeholders interested in harnessing the potential of reprogramming of the genomes in several areas. Offers basic understanding and a clear picture of genome editing CRISPR-Cas systems in different organisms Explains how to create an animal model for disease diagnosis/research and reprogram CRISPR for insect cell line, protozoans, zebrafish, drosophila, and many more Discusses the advances, patents, applications, challenges and opportunities in CRISPR-Cas9 systems in basic sciences, biomedicine, molecular biology and many more

CRISPR Gene Editing

Reprogramming the Genome: CRISPR-Cas-based Human Disease Therapy

Jennifer Doudna, Gene Editing, and the Future of the Human Race

Rice Genome Engineering and Gene Editing

The Code Breaker

From Life’s Origins to Diversity in Gene Regulation

This volume explores the uses of RNAi and CRISPR interferences as a general method for inhibiting gene expression, with focus on their biological functions, design, chemical modifications, delivery, and preclinical/clinical applications. In addition to relevant backgrounds, the chapters in this book discuss simple and accurate protocols dealing with the latest advances in RNAi and CRISPR applications and look at how these methods differ from one another. Written in the highly successful Methods in Molecular Biology series format, chapters include introductions to their respective topics, lists of the necessary materials and reagents, step-by-step, readily reproducible laboratory protocols, and tips on troubleshooting and avoiding known pitfalls. Comprehensive and cutting-edge, RNA Interference and CRISPR Technologies: Technical Advances and New Therapeutic Opportunities is a valuable resource for any scientist, teachers, graduate student, postdoc, and clinician interested in this field. This book also benefits anyone in research and development in biotech and pharmaceutical companies who want to understand more about these technologies, and their applications in biology and medicine.

Gene Editing using CRISPR has been identified as one breakthrough technology in recent research. Today, it is difficult to open a journal or a newspaper without reading about the application of CRISPR gene editing technology to basic research, public health, therapeutics or diagnostics. Although some problems of CRISPR remain to be solved, such as bio-safety and ethical issues, it may change peoples’ futures. This book is to meet the needs of basic molecular biologists, pharmacologists, medical students, clinical practitioners and scientists, as well as a broad spectrum of readers who wish to understand the advances in research and applications of CRISPR. The contributing authors are basic scientists as well as students who major in biochemistry and pharmacology. This book presents the current research in the CRISPR model, focusing on its advances and applications. Topics discussed in this compilation include: Targeting of hepatic diseases using CRISPR; applications and advances of CRISPR in animal models; gene targeting on the Cyp2b2-Locus in rats via CRISPR; applications of CRISPR for therapy in human genetic diseases; utilization of CRISPR in gene function and drug target validation; applications of CRISPR in plant genome editing; and genome editing on human embryos using CRISPR.

The Science and Ethics of Editing Humans

The CRISPR Revolution and the New Era of Genome Editing

Plant Genome Engineering