
A New Kind Of Science

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New Kind of Science

A New Kind of Science

This work presents a series of dramatic discoveries never before made public. Starting from a collection of simple computer experiments---illustrated in the book by striking computer graphics---Wolfram shows how their unexpected results force a whole new way of looking at the operation of our universe. Wolfram uses his approach to tackle a remarkable array of fundamental problems in science: from the origin of the Second Law of thermodynamics, to the development of complexity in biology, the computational limitations of mathematics, the possibility of a truly fundamental theory of physics, and the interplay between free will and determinism.

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Why Society is a Complex Matter *Springer Science & Business Media*

Society is complicated. But this book argues that this does not place it beyond the reach of a science that can help to explain and perhaps even to predict social behaviour. As a system made up of many interacting agents – people, groups, institutions and governments, as well as physical and technological structures such as roads and computer networks – society can be regarded as a complex system. In recent years, scientists have made great progress in understanding how such complex systems operate, ranging from animal populations to earthquakes and weather. These systems show behaviours that cannot be predicted or intuited by focusing on the individual components, but which emerge spontaneously as a consequence of their interactions: they are said to be ‘self-organized’. Attempts to direct or manage such emergent properties generally reveal that ‘top-down’

approaches, which try to dictate a particular outcome, are ineffectual, and that what is needed instead is a 'bottom-up' approach that aims to guide self-organization towards desirable states. This book shows how some of these ideas from the science of complexity can be applied to the study and management of social phenomena, including traffic flow, economic markets, opinion formation and the growth and structure of cities. Building on these successes, the book argues that the complex-systems view of the social sciences has now matured sufficiently for it to be possible, desirable and perhaps essential to attempt a grander objective: to integrate these efforts into a unified scheme for studying, understanding and ultimately predicting what happens in the world we have made. Such a scheme would require the mobilization and collaboration of many different research communities, and would allow society and its interactions with the physical environment to be explored through realistic models and large-scale data collection and analysis. It should enable us to find new and effective solutions to major global problems such as conflict, disease, financial instability, environmental despoliation and poverty, while avoiding unintended policy consequences. It could give us the foresight to anticipate and ameliorate crises, and to begin tackling some of the most intractable problems of the twenty-first century.

A Project to Find the Fundamental Theory of Physics

Description to come

Reinventing Discovery *Princeton University Press*

"Reinventing Discovery argues that we are in the early days of the most dramatic change in how science is done in more than 300 years. This change is being driven by new online tools, which are transforming and radically accelerating scientific discovery"--

The Second Kind of Impossible *Simon & Schuster*

Shortlisted for the 2019 Royal Society Insight Investment Science Book Prize One of the most fascinating scientific detective stories of the last fifty years, an exciting quest for a new form of matter. "A riveting tale of derring-do" (Nature), this book reads like James Gleick's *Chaos* combined with an Indiana Jones adventure. When leading Princeton physicist Paul Steinhardt began working in the 1980s, scientists thought they knew all the conceivable forms of matter. The Second Kind of Impossible is the story of Steinhardt's thirty-five-year-long quest to challenge conventional wisdom. It begins with a curious geometric pattern that inspires two theoretical physicists to propose a radically new type of matter—one that raises the possibility of new materials with never before seen properties, but that violates laws set in stone for centuries. Steinhardt dubs this new form of matter "quasicrystal." The rest of the scientific community calls it simply impossible. The Second Kind of Impossible captures Steinhardt's scientific odyssey as it unfolds over decades, first to prove viability, and then to pursue his wildest conjecture—that nature made quasicrystals long before humans discovered them. Along the way, his team encounters clandestine collectors, corrupt scientists, secret diaries, international smugglers, and KGB agents. Their quest culminates in a daring expedition to a distant corner of the Earth, in pursuit

of tiny fragments of a meteorite forged at the birth of the solar system. Steinhardt's discoveries chart a new direction in science. They not only change our ideas about patterns and matter, but also reveal new truths about the processes that shaped our solar system. The underlying science is important, simple, and beautiful—and Steinhardt's firsthand account is "packed with discovery, disappointment, exhilaration, and persistence...This book is a front-row seat to history as it is made" (Nature).

Cellular Automata *John Wiley & Sons*

An accessible and multidisciplinary introduction to cellular automata. As the applicability of cellular automata broadens and technology advances, there is a need for a concise, yet thorough, resource that lays the foundation of key cellular automata rules and applications. In recent years, Stephen Wolfram's *A New Kind of Science* has brought the modeling power that lies in cellular automata to the attention of the scientific world, and now, *Cellular Automata: A Discrete View of the World* presents all the depth, analysis, and applicability of the classic Wolfram text in a straightforward, introductory manner. This book offers an introduction to cellular automata as a constructive method for modeling complex systems where patterns of self-organization arising from simple rules are revealed in phenomena that exist across a wide array of subject areas, including mathematics, physics, economics, and the social sciences. The book begins with a preliminary introduction to cellular automata, including a brief history of the topic along with coverage of sub-topics such as randomness, dimension, information, entropy, and fractals. The author then provides a completed discussion of

dynamical systems and chaos due to their close connection with cellular automata and includes chapters that focus exclusively on one- and two-dimensional cellular automata. The next and most fascinating area of discussion is the application of these types of cellular automata in order to understand the complex behavior that occurs in natural phenomena. Finally, the continually evolving topic of complexity is discussed with a focus on how to properly define, identify, and marvel at its manifestations in various environments. The author's focus on the most important principles of cellular automata, combined with his ability to present complex material in an easy-to-follow style, makes this book a very approachable and inclusive source for understanding the concepts and applications of cellular automata. The highly visual nature of the subject is accentuated with over 200 illustrations, including an eight-page color insert, which provide vivid representations of the cellular automata under discussion. Readers also have the opportunity to follow and understand the models depicted throughout the text and create their own cellular automata using Java applets and simple computer code, which are available via the book's FTP site. This book serves as a valuable resource for undergraduate and graduate students in the physical, biological, and social sciences and may also be of interest to any reader with a scientific or basic mathematical background.

Mathematica *Addison Wesley Publishing Company*

Adapted from Stephen Wolfram's definitive work *Mathematica: A System for Doing Mathematics by Computer*, 2nd Ed., this is the beginning student's ideal road map and guidebook to Mathematica. This adaptation addresses the student's need for

more concise and accessible information. Beck has trimmed to book to half its original size, focusing on the functions and topics likely to be encountered by students.

Idea Makers *Wolfram Media*

This book of thoroughly engaging essays from one of today's most prodigious innovators provides a uniquely personal perspective on the lives and achievements of a selection of intriguing figures from the history of science and technology. Weaving together his immersive interest in people and history with insights gathered from his own experiences, Stephen Wolfram gives an ennobling look at some of the individuals whose ideas and creations have helped shape our world today. Contents includes biographical sketches of: Richard Feynman Kurt Godel Alan Turing John von Neumann George Boole Ada Lovelace Gottfried Leibniz Benoit Mandelbrot Steve Jobs Marvin Minsky Russell Towle Bertrand Russell Alfred Whitehead Richard Crandall Srinivasa Ramanujan Solomon Golomb

Combinators *Wolfram Media*

Combinators have inspired ideas about computation ever since they were first invented in 1920, and in this innovative book, Stephen Wolfram provides a modern view of combinators and their significance. Informed by his work on the computational universe of possible programs and on computational language design, Wolfram explains new and existing ideas about combinators with unique clarity and stunning visualizations, as well as provides insights on their historical connections and the curious story of Moses Schönfinkel, inventor of combinators.

Though invented well before Turing machines, combinators have often been viewed as an inaccessibly abstract approach to computation. This book brings them to life as never before in a thought-provoking and broadly accessible exposition of interest across mathematics and computer science, as well as to those concerned with the foundations of formal and computational thinking, and with the history of ideas.

A Nonlinear Dynamics Perspective of Wolfram's New Kind of Science *World Scientific Publishing Company Incorporated*

When not immersed in science, he relaxes by searching for Wagner's leitmotifs, musing over Kandinsky's chaos, and contemplating Wittgenstein's inner thoughts. This penultimate volume contains numerous original, elegant, and surprising results in 1-dimensional cellular automata. Perhaps the most exciting, if not shocking, new result is the discovery that only 82 local rules, out of 256, suffice to predict the time evolution of any of the remaining 174 local rules from an arbitrary initial bit-string configuration. This is contrary to the well-known folklore that 256 local rules are necessary, leading to the new concept of quasi-global equivalence. Another surprising result is the introduction of a simple, yet explicit, infinite bit string called the super string S , which contains all random bit strings of finite length as substrings. As an illustration of the mathematical subtlety of this amazing discrete testing signal, the super string S is used to prove mathematically, in a trivial and transparent way, that rule 170 is as chaotic as a coin toss. Yet another unexpected new result, among many others, is the derivation of an explicit basin tree generation formula which provides an analytical relationship

between the basin trees of globally-equivalent local rules. This formula allows the symbolic, rather than numerical, generation of the time evolution of any local rule corresponding to any initial bit-string configuration, from one of the 88 globally-equivalent local rules. But perhaps the most provocative idea is the proposal for adopting rule 137, over its three globally-equivalent siblings, including the heretofore more well-known rule 110, as the prototypical universal Turing machine.

Fractals Everywhere *Academic Press*

Fractals Everywhere, Second Edition covers the fundamental approach to fractal geometry through iterated function systems. This 10-chapter text is based on a course called "Fractal Geometry", which has been taught in the School of Mathematics at the Georgia Institute of Technology. After a brief introduction to the subject, this book goes on dealing with the concepts and principles of spaces, contraction mappings, fractal construction, and the chaotic dynamics on fractals. Other chapters discuss fractal dimension and interpolation, the Julia sets, parameter spaces, and the Mandelbrot sets. The remaining chapters examine the measures on fractals and the practical application of recurrent iterated function systems. This book will prove useful to both undergraduate and graduate students from many disciplines, including mathematics, biology, chemistry, physics, psychology, mechanical, electrical, and aerospace engineering, computer science, and geophysical science.

Real Life *Penguin*

A FINALIST for the Booker Prize, the National Book Critics Circle

John Leonard Prize, the VCU/Cabell First Novelist Prize, the Lambda Literary Award, the NYPL Young Lions Award, and the Edmund White Debut Fiction Award "A blistering coming of age story" —O: The Oprah Magazine Named a Best Book of the Year by The New York Times, The Washington Post, New York Public Library, Vanity Fair, Elle, NPR, The Guardian, The Paris Review, Harper's Bazaar, Financial Times, Huffington Post, BBC, Shondaland, Barnes & Noble, Vulture, Thrillist, Vice, Self, Electric Literature, and Shelf Awareness A novel of startling intimacy, violence, and mercy among friends in a Midwestern university town, from an electric new voice. Almost everything about Wallace is at odds with the Midwestern university town where he is working uneasily toward a biochem degree. An introverted young man from Alabama, black and queer, he has left behind his family without escaping the long shadows of his childhood. For reasons of self-preservation, Wallace has enforced a wary distance even within his own circle of friends—some dating each other, some dating women, some feigning straightness. But over the course of a late-summer weekend, a series of confrontations with colleagues, and an unexpected encounter with an ostensibly straight, white classmate, conspire to fracture his defenses while exposing long-hidden currents of hostility and desire within their community. Real Life is a novel of profound and lacerating power, a story that asks if it's ever really possible to overcome our private wounds, and at what cost.

Brain Theory *Elsevier*

The present collection of papers focuses on the subject of vision. The papers bring together new insights and facts from various

branches of experimental and theoretical neuroscience. The experimental facts presented in the volume stem from disparate fields, such as neuroanatomy, electrophysiology, optical imaging and psychophysics. The theoretical models in part are unsophisticated, yet still inspiring, while others skilfully apply advanced mathematical reasoning to results of experimental measurements. The book is the fifth in a series of volumes intending to define a theory of the brain by bringing together formal reasoning and experimental facts. The reader is thus being introduced to a new kind of brain science, where facts and theory are beginning to blend together.

Automatic Sequences *Cambridge University Press*

This book is the first integrated treatment of sequences generated by finite automata and their generalizations.

Cellular Automata And Complexity *CRC Press*

Are mathematical equations the best way to model nature? For many years it had been assumed that they were. But in the early 1980s, Stephen Wolfram made the radical proposal that one should instead build models that are based directly on simple computer programs. Wolfram made a detailed study of a class of such models known as cellular automata, and discovered a remarkable fact: that even when the underlying rules are very simple, the behaviour they produce can be highly complex, and can mimic many features of what we see in nature. And based on this result, Wolfram began a program of research to develop what he called *A Science of Complexity*. "The results of Wolfram's work found many applications, from the so-called Wolfram

Classification central to fields such as artificial life, to new ideas about cryptography and fluid dynamics. This book is a collection of Wolfram's original papers on cellular automata and complexity. Some of these papers are widely known in the scientific community others have never been published before. Together, the papers provide a highly readable account of what has become a major new field of science, with important implications for physics, biology, economics, computer science and many other areas.

Axiom's End *St. Martin's Press*

THE INSTANT NEW YORK TIMES BESTSELLER The alternate history first contact adventure *Axiom's End* is an extraordinary debut from Hugo finalist and video essayist Lindsay Ellis. Truth is a human right. It's fall 2007. A well-timed leak has revealed that the US government might have engaged in first contact. Cora Sabino is doing everything she can to avoid the whole mess, since the force driving the controversy is her whistleblower father. Even though Cora hasn't spoken to him in years, his celebrity has caught the attention of the press, the Internet, the paparazzi, and the government—and with him in hiding, that attention is on her. She neither knows nor cares whether her father's leaks are a hoax, and wants nothing to do with him—until she learns just how deeply entrenched her family is in the cover-up, and that an extraterrestrial presence has been on Earth for decades. Realizing the extent to which both she and the public have been lied to, she sets out to gather as much information as she can, and finds that the best way for her to uncover the truth is not as a whistleblower, but as an intermediary. The alien

presence has been completely uncommunicative until she convinces one of them that she can act as their interpreter, becoming the first and only human vessel of communication. Their otherworldly connection will change everything she thought she knew about being human—and could unleash a force more sinister than she ever imagined.

Foundations of Computation

Foundations of Computation is a free textbook for a one-semester course in theoretical computer science. It has been used for several years in a course at Hobart and William Smith Colleges. The course has no prerequisites other than introductory computer programming. The first half of the course covers material on logic, sets, and functions that would often be taught in a course in discrete mathematics. The second part covers material on automata, formal languages and grammar that would ordinarily be encountered in an upper level course in theoretical computer science.

Why Elephants Have Big Ears *Macmillan*

Why Elephants Have Big Ears is the result of one man's lifelong quest to understand why the creatures of the earth appear and act as they do. In a wry manner and personal tone, Chris Lavers explores and solves some of nature's most challenging evolutionary mysteries, such as why birds are small and plentiful, why rivers and lakes are dominated by the few remaining large reptiles, why most of the large land-dwellers are mammals, and many more.

Essays on Cellular Automata *Urbana : University of Illinois Press*

Euler's Gem *Princeton University Press*

How a simple equation reshaped mathematics Leonhard Euler's polyhedron formula describes the structure of many objects—from soccer balls and gemstones to Buckminster Fuller's buildings and giant all-carbon molecules. Yet Euler's theorem is so simple it can be explained to a child. From ancient Greek geometry to today's cutting-edge research, Euler's Gem celebrates the discovery of Euler's beloved polyhedron formula and its far-reaching impact on topology, the study of shapes. Using wonderful examples and numerous illustrations, David Richeson presents this mathematical idea's many elegant and unexpected applications, such as showing why there is always some windless spot on earth, how to measure the acreage of a tree farm by counting trees, and how many crayons are needed to color any map. Filled with a who's who of brilliant mathematicians who questioned, refined, and contributed to a remarkable theorem's development, Euler's Gem will fascinate every mathematics enthusiast. This paperback edition contains a new preface by the author.

Genius *Open Road Media*

New York Times Bestseller: This life story of the quirky physicist is "a thorough and masterful portrait of one of the great minds of the century" (The New York Review of Books). Raised in Depression-era Rockaway Beach, physicist Richard Feynman was irreverent, eccentric, and childishly enthusiastic—a new kind of

scientist in a field that was in its infancy. His quick mastery of quantum mechanics earned him a place at Los Alamos working on the Manhattan Project under J. Robert Oppenheimer, where the giddy young man held his own among the nation's greatest minds. There, Feynman turned theory into practice, culminating in the Trinity test, on July 16, 1945, when the Atomic Age was born. He was only twenty-seven. And he was just getting started. In this sweeping biography, James Gleick captures the forceful personality of a great man, integrating Feynman's work and life in a way that is accessible to laymen and fascinating for the scientists who follow in his footsteps.

Irreducibility and Computational Equivalence *Springer*

It is clear that computation is playing an increasingly prominent role in the development of mathematics, as well as in the natural and social sciences. The work of Stephen Wolfram over the last several decades has been a salient part in this phenomenon helping founding the field of Complex Systems, with many of his constructs and ideas incorporated in his book *A New Kind of Science* (ANKS) becoming part of the scientific discourse and general academic knowledge--from the now established Elementary Cellular Automata to the unconventional concept of mining the Computational Universe, from today's widespread Wolfram's Behavioural Classification to his principles of Irreducibility and Computational Equivalence. This volume, with a Foreword by Gregory Chaitin and an Afterword by Cris Calude, covers these and other topics related to or motivated by Wolfram's seminal ideas, reporting on research undertaken in the decade following the publication of Wolfram's NKS book.

Featuring 39 authors, its 23 contributions are organized into seven parts: Mechanisms in Programs & Nature Systems Based on Numbers & Simple Programs Social and Biological Systems & Technology Fundamental Physics The Behavior of Systems & the Notion of Computation Irreducibility & Computational Equivalence Reflections and Philosophical Implications.

The Lifebox, the Seashell, and the Soul: What Gnarly Computation Taught Me About Ultimate Reality, The Meaning of Life, And How to Be Happy

A playful and profound survey of the concept of computation across the entire spectrum of human thought-written by a mathematician novelist who spent twenty years as a Silicon Valley computer scientist. The logic is correct, and the conclusions are startling. Simple rules can generate gnarly patterns. Physics obeys laws, but the outcomes aren't predictable. Free will is real. The mind is like a quantum computer. Social strata are skewed by universal scaling laws. And there can never be a simple trick for answering all possible questions about our world's natural processes. We live amid splendor beyond our control.

The Story of Science: Newton at the Center *Smithsonian Institution*

In volume two, students will watch as Copernicus's systematic observations place the sun at the center of our universe—to the dismay of establishment thinkers. After students follow the achievements and frustrations of Galileo, Kepler, and Descartes, they will appreciate the amazing Isaac Newton, whose

discoveries about gravity, motion, colors, calculus, and Earth's place in the universe set the stage for modern physics, astronomy, mathematics, and chemistry. In the three-book *The Story of Science* series, master storyteller Joy Hakim narrates the evolution of scientific thought from ancient times to the present. With lively, character-driven narrative, Hakim spotlights the achievements of some of the world's greatest scientists and encourages a similar spirit of inquiry in readers. The books include hundreds of color photographs, charts, maps, and diagrams; informative sidebars; suggestions for further reading; and excerpts from the writings of great scientists.

Loonshots *St. Martin's Press*

* Instant WSJ bestseller * Translated into 18 languages * #1 Most Recommended Book of the year (Bloomberg annual survey of CEOs and entrepreneurs) * An Amazon, Bloomberg, Financial Times, Forbes, Inc., Newsweek, Strategy + Business, Tech Crunch, Washington Post Best Business Book of the year * Recommended by Bill Gates, Daniel Kahneman, Malcolm Gladwell, Dan Pink, Adam Grant, Susan Cain, Sid Mukherjee, Tim Ferriss Why do good teams kill great ideas? *Loonshots* reveals a surprising new way of thinking about the mysteries of group behavior that challenges everything we thought we knew about nurturing radical breakthroughs. Bahcall, a physicist and entrepreneur, shows why teams, companies, or any group with a mission will suddenly change from embracing new ideas to rejecting them, just as flowing water will suddenly change into brittle ice. Mountains of print have been written about culture. *Loonshots* identifies the small shifts in structure that control this

transition, the same way that temperature controls the change from water to ice. Using examples that range from the spread of fires in forests to the hunt for terrorists online, and stories of thieves and geniuses and kings, Bahcall shows how a new kind of science can help us become the initiators, rather than the victims, of innovative surprise. Over the past decade, researchers have been applying the tools and techniques of this new science—the science of phase transitions—to understand how birds flock, fish swim, brains work, people vote, diseases erupt, and ecosystems collapse. *Loonshots* is the first to apply this science to the spread of breakthrough ideas. Bahcall distills these insights into practical lessons creatives, entrepreneurs, and visionaries can use to change our world. Along the way, readers will learn how chickens saved millions of lives, what James Bond and Lipitor have in common, what the movie *Imitation Game* got wrong about WWII, and what really killed Pan Am, Polaroid, and the Qing Dynasty. “If *The Da Vinci Code* and *Freakonomics* had a child together, it would be called *Loonshots*.” —Senator Bob Kerrey

A Little Life *Anchor*

NATIONAL BESTSELLER • A stunning “portrait of the enduring grace of friendship” (NPR) about the families we are born into, and those that we make for ourselves. A masterful depiction of love in the twenty-first century. A NATIONAL BOOK AWARD FINALIST • A MAN BOOKER PRIZE FINALIST • WINNER OF THE KIRKUS PRIZE *A Little Life* follows four college classmates—broke, adrift, and buoyed only by their friendship and ambition—as they move to New York in search of fame and fortune. While their

relationships, which are tinged by addiction, success, and pride, deepen over the decades, the men are held together by their devotion to the brilliant, enigmatic Jude, a man scarred by an unspeakable childhood trauma. A hymn to brotherly bonds and a masterful depiction of love in the twenty-first century, Hanya Yanagihara's stunning novel is about the families we are born into, and those that we make for ourselves. Look for Hanya Yanagihara's new novel, *To Paradise*, coming in January 2022.

Mathematica

Valley of the Geeks *iUniverse*

Valley of the Geeks skewers Silicon Valley with high-tech hijinks that keep you laughing out loud. This new collection of essays includes the best original humor from the award-winning web site. Urlocker's unique blend of wit and wisdom cover everything from Larry Ellison's ego to Bill Gates' secret plan to take over the government. "Valley of the Geeks is very funny. It's supposed to be funny, right?"-Bruce Eckel, "Thinking in Java" "Let Valley of The Geeks treat you to banner ads we'd like to see."-USA Today · Cellular Hell · Entrepreneuritis · Akamai Sues Self · Towards Simplicity · Recession Cancelled · Lonely at the Middle · Dot Com Survivor.com · Dear Miss Management · Oracle Teams With Mafia · A New Spin on Marketing · Fast Track to the Ground Floor · Microsoft Apologizes for Nukes · What Not To Say To A Recruiter · More Banner Ads We'd Like to See · RTFM: The New High Tech Dictionary 2.0 · Telecom Depressed - Still Can't Get Out Of Bed

A New Kind of Wild *Penguin*

This sweet author-illustrator debut celebrates imagination, the magic of friendship, and all the different ways we make a new place feel like home. For Ren, home is his grandmother's little house, and the lush forest that surrounds it. Home is a place of magic and wonder, filled with all the fantastical friends that Ren dreams up. Home is where his imagination can run wild. For Ava, home is a brick and cement city, where there's always something to do or see or hear. Home is a place bursting with life, where people bustle in and out like a big parade. Home is where Ava is never lonely because there's always someone to share in her adventures. When Ren moves to Ava's city, he feels lost without his wild. How will he ever feel at home in a place with no green and no magic, where everything is exactly what it seems? Of course, not everything in the city is what meets the eye, and as Ren discovers, nothing makes you feel at home quite like a friend. Inspired by the stories her father told her about moving from Puerto Rico to New York as a child, Zara González Hoang's author-illustrator debut is an imaginative exploration of the true meaning of "home."

Chaos *Penguin Group USA*

Explains the meaning and application of chaos--the study of patterns emerging from seemingly random phenomena--and introduces the scientists responsible for major discoveries in this field

Occupational Outlook Handbook

Nano Comes to Life *Princeton University Press*

"Increasingly, scientists are gaining control over matter at the nanometer scale. Spearheaded by physical scientists operating at the interfaces of physics and biology (such as the author herself), advances in nanoscience and technology are transforming how we think about life and treat human health. This is due to a convergence of size. To do medicine, one must understand and be able to reach the nanoscale environment of healthy cells in tissues and organs, as well as other nano-sized building blocks that constitute a living organism, such as proteins and DNA. The ground-breaking advances being made at the frontiers of nanoscience and -technology, specifically in the areas of biology and medicine, are the subject of this short, popular-level book. Chapter 1 describes how nanotechnology and quantitative methods in biology are progressively being deployed to embrace life in all its multiscale, hierarchical intricacy and multiplicity. Chapters 2 through 4 review how bioinspired and biomimetic nanostructures and nanomachines are being created and integrated into strategies aimed at solving specific medical problems. In particular, Chapter 2 summarizes how scientists are seeking to build artificial nanostructures using both biological molecules and the organizational principles of biology. Chapter 3 gives an account of how nanotechnology is being used to develop drug-delivery strategies that specifically target cancer cells and tumors to improve the efficacy of current cancer chemotherapies. Chapter 4 reviews the science of one of the most potentially transformative scientific fields: tissue engineering. In a concluding chapter (Chapter 5), Contera reviews how nanotechnology, biology, and medicine will continue fusing with other sciences and technologies - incorporating more

mathematical and computational modelling, as well as AI and robotics. Nanoscale devices will be used to learn biology; and biology will be used to inspire increasingly sophisticated "transmaterial" devices that mimic some of the characteristics of biology and incorporate new features that are not available in the biological world. The effects on human health and longevity will be profound. In a more personal epilogue, Contera describes the crossroads at which we find ourselves. Accessing our own biology evokes a mixture of possibility and dread. However, Contera maintains that we can create a positive transmaterial world for the benefit of humankind, and she describes ways in which scientists are proactively engaging with the public, politicians, industry, and entrepreneurs, as well as the media and the arts, to communicate the power and risks of new advances and to influence the ways in which new technologies will affect our future"--

Book Lovers *Penguin*

"One of my favorite authors."—Colleen Hoover An insightful, delightful, instant #1 New York Times bestseller from the author of *Beach Read* and *People We Meet on Vacation*. Named a Most Anticipated Book of 2022 by Oprah Daily • Today • Parade • Marie Claire • Bustle • PopSugar • Katie Couric Media • Book Bub • SheReads • Medium • The Washington Post • and more! One summer. Two rivals. A plot twist they didn't see coming... Nora Stephens' life is books—she's read them all—and she is not that type of heroine. Not the plucky one, not the laidback dream girl, and especially not the sweetheart. In fact, the only people Nora is a heroine for are her clients, for whom she lands enormous deals

as a cutthroat literary agent, and her beloved little sister Libby. Which is why she agrees to go to Sunshine Falls, North Carolina for the month of August when Libby begs her for a sisters' trip away—with visions of a small town transformation for Nora, who she's convinced needs to become the heroine in her own story. But instead of picnics in meadows, or run-ins with a handsome country doctor or bulging-forearmed bartender, Nora keeps bumping into Charlie Lastra, a bookish brooding editor from back in the city. It would be a meet-cute if not for the fact that they've met many times and it's never been cute. If Nora knows she's not an ideal heroine, Charlie knows he's nobody's hero, but as they are thrown together again and again—in a series of coincidences no editor worth their salt would allow—what they discover might just unravel the carefully crafted stories they've written about themselves.

The Second Digital Turn *MIT Press*

The first digital turn in architecture changed our ways of making; the second changes our ways of thinking. Almost a generation ago, the early software for computer aided design and manufacturing (CAD/CAM) spawned a style of smooth and curving lines and surfaces that gave visible form to the first digital age, and left an indelible mark on contemporary architecture. But today's digitally intelligent architecture no longer looks that way. In *The Second Digital Turn*, Mario Carpo explains that this is because the design professions are now coming to terms with a new kind of digital tools they have adopted—no longer tools for making but tools for thinking. In the early 1990s the design professions were the first to intuit and interpret the new technical

logic of the digital age: digital mass-customization (the use of digital tools to mass-produce variations at no extra cost) has already changed the way we produce and consume almost everything, and the same technology applied to commerce at large is now heralding a new society without scale—a flat marginal cost society where bigger markets will not make anything cheaper. But today, the unprecedented power of computation also favors a new kind of science where prediction can be based on sheer information retrieval, and form finding by simulation and optimization can replace deduction from mathematical formulas. Designers have been toying with machine thinking and machine learning for some time, and the apparently unfathomable complexity of the physical shapes they are now creating already expresses a new form of artificial intelligence, outside the tradition of modern science and alien to the organic logic of our mind.

The Book of Why *Penguin UK*

A pioneer of artificial intelligence shows how the study of causality revolutionized science and the world 'Correlation does not imply causation.' This mantra was invoked by scientists for decades in order to avoid taking positions as to whether one thing caused another, such as smoking and cancer and carbon dioxide and global warming. But today, that taboo is dead. The causal revolution, sparked by world-renowned computer scientist Judea Pearl and his colleagues, has cut through a century of confusion and placed cause and effect on a firm scientific basis. Now, Pearl and science journalist Dana Mackenzie explain causal thinking to general readers for the first time, showing how it

allows us to explore the world that is and the worlds that could have been. It is the essence of human and artificial intelligence. And just as Pearl's discoveries have enabled machines to think better, *The Book of Why* explains how we can think better.

The Fractalist *Vintage*

Here is the remarkable life story of Benoit Mandelbrot, the creator of fractal geometry, and his unparalleled contributions to science mathematics, the financial world, and the arts. Mandelbrot recounts his early years in Warsaw and in Paris, where he was mentored by an eminent mathematician uncle, through his days evading the Nazis in occupied France, to his education at Caltech, Princeton, and MIT, and his illustrious career at the IBM Thomas J. Watson Research Center. An outside to mainstream scientific research, he managed to do what others had thought impossible: develop a new geometry that combines revelatory beauty with a radical way of unfolding formerly hidden scientific laws. In the process he was able to use geometry to solve fresh, real-world problems. With exuberance and an eloquent fluency, Benoit Mandelbrot recounts the high points of his fascinating life, offering us a glimpse into the evolution of his extraordinary mind. With full-color inserts and black-and-white photographs throughout.

Fossil Men *HarperCollins*

"Riveting. ... Pattison's uncanny ability [is] to write evocatively about science. ... In this, he is every bit as good as the best scientist writers." —New York Times Book Review (Editors' Choice) "Brilliant. ... A work of staggering depth." —Minneapolis

Star Tribune A decade in the making, *Fossil Men* is a scientific detective story played out in anatomy and the natural history of the human body: the first full-length account of the discovery of a startlingly unpredicted human ancestor more than a million years older than Lucy It is the ultimate mystery: where do we come from? In 1994, a team led by fossil-hunting legend Tim White uncovered a set of ancient bones in Ethiopia's Afar region. Radiometric dating of nearby rocks indicated the resulting skeleton, classified as *Ardipithecus ramidus*—nicknamed "Ardi"—was an astounding 4.4 million years old, more than a million years older than the world-famous "Lucy." The team spent the next 15 years studying the bones in strict secrecy, all while continuing to rack up landmark fossil discoveries in the field and becoming increasingly ensnared in bitter disputes with scientific peers and Ethiopian bureaucrats. When finally revealed to the public, Ardi stunned scientists around the world and challenged a half-century of orthodoxy about human evolution—how we started walking upright, how we evolved our nimble hands, and, most significantly, whether we were descended from an ancestor that resembled today's chimpanzee. But the discovery of Ardi wasn't just a leap forward in understanding the roots of humanity—it was an attack on scientific convention and the leading authorities of human origins, triggering an epic feud about the oldest family skeleton. In *Fossil Men*, acclaimed journalist Kermit Pattison brings us a cast of eccentric, obsessive scientists, including White, an uncompromising perfectionist whose virtuoso skills in the field were matched only by his propensity for making enemies; Gen Suwa, a Japanese savant whose deep expertise about teeth rivaled anyone on Earth; Owen

Lovejoy, a onetime creationist-turned-paleoanthropologist with radical insights into human locomotion; Berhane Asfaw, who survived imprisonment and torture to become Ethiopia's most senior paleoanthropologist; Don Johanson, the discoverer of Lucy, who had a rancorous falling out with the Ardi team; and the Leakeys, for decades the most famous family in paleoanthropology. Based on a half-decade of research in Africa, Europe and North America, *Fossil Men* is not only a brilliant investigation into the origins of the human lineage, but the oldest of human emotions: curiosity, jealousy, perseverance and wonder.

The Story of Science: Einstein Adds a New Dimension
Smithsonian Institution

In volume three, students will look over Albert Einstein's shoulder

as he and his colleagues develop a new kind of physics. It leads in two directions: to knowledge of the vast universe and its future (insights build on Einstein's theories of relativity), and to an understanding of the astonishingly small subatomic world (the realm of quantum physics). Students will learn why relativity and quantum theory revolutionized our world and led to the most important ideas in modern science, maybe of all time. In the three-book *The Story of Science* series, master storyteller Joy Hakim narrates the evolution of scientific thought from ancient times to the present. With lively, character-driven narrative, Hakim spotlights the achievements of some of the world's greatest scientists and encourages a similar spirit of inquiry in readers. The books include hundreds of color photographs, charts, maps, and diagrams; informative sidebars; suggestions for further reading; and excerpts from the writings of great scientists.