

The Structure Of Evolutionary Theory Stephen Jay Gould

Year 2009 was the triumph of Darwin as a global superstar, spinning from the pop icon to the actual understanding to what make him a great innovator, able to give a turn to whole modern culture. Does all this activity mean evolution has lost its ability to excite fear and opposition? After such a deluge of books, conferences, reviews, gadgets, what is today our vision on theory of Evolution and its Impact? These are the questions asked at an inter-academy conference held in Torino (May 27-29, 2010) among the Accademia delle Scienze di Torino, the Accademia Nazionale dei Lincei and the Berlin-Brandenburgische Akademie der Wissenschaften. The present book collects the contributions from the meeting, mixing styles, arguments, topics, history and philosophy of science, modern biology and epistemology . This kind of inter-disciplinary approach may appear erratic, but it conveys flashes of lights on the changing scene where the theory of evolution plays. This is in line with the idea to reopen the file of the Two Cultures, looking at shared problems, which are not yet really the Third Culture invoked by Charles Percy Snow half a century ago, but they can foster it, at least in such a pivotal domain as evolution. According to the philosopher Michael Ruse, the conclusion is “that in fifty years or a hundred years we will still have the theory of the Origin around. Great, precisely because it does not stand still, but remakes itself and grows and changes by virtue of the fact that it gives such a terrific foundation. Is Darwinism past its sell-by date? Not by a long chalk yet!” This work has been selected by scholars as being culturally important and is part of the knowledge base of civilization as we know it. This work is in the public domain in the United States of America, and possibly other nations. Within the United States, you may freely copy and distribute this work, as no entity (individual or corporate) has a copyright on the body of the work. Scholars believe, and we concur, that this work is important enough to be preserved, reproduced, and made generally available to the public. To ensure a quality reading experience, this work has been proofread and republished using a format that seamlessly blends the original graphical elements with text in an easy-to-read typeface. We appreciate your support of the preservation process, and thank you for being an important part of keeping this knowledge alive and relevant.

Essays examine the accomplishments of Charles Darwin, his theory of evolution, and his impact on society and science

As always in his popular writing, Gould conveys the ideas that science professionals exchange among themselves, minus only the technical jargon. In the title essay, he details his grandfather's journey from Hungary to America, and in a moving epilogue that has been hailed as a powerful testament, Gould writes about September 11.

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The world's most revered and eloquent interpreter of evolutionary ideas offers here a work of explanatory force unprecedented in our time—a landmark publication, both for its historical sweep and for its scientific vision. With characteristic attention to detail, Stephen Jay Gould first describes the content and discusses the history and origins of the three core commitments of classical Darwinism: that natural selection works on organisms, not genes or species; that it is almost exclusively the mechanism of adaptive evolutionary change; and that these changes are incremental, not drastic. Next, he examines the three critiques that currently challenge this classic Darwinian edifice: that selection operates on multiple levels, from the gene to the group; that evolution proceeds by a variety of mechanisms, not just natural selection; and that causes operating at broader scales, including catastrophes, have figured prominently in the course of evolution. Then, in a stunning tour de force that will likely stimulate discussion and debate for decades, Gould proposes his own system for integrating these classical commitments and contemporary critiques into a new structure of evolutionary thought. In 2001 the Library of Congress named Stephen Jay Gould one of America's eighty-three Living Legends—people who embody the “quintessentially American ideal of individual creativity, conviction, dedication, and exuberance.” Each of these qualities finds full expression in this peerless work, the likes of which the scientific world has not seen—and may not see again—for well over a century.

Today many school students are shielded from one of the most important concepts in modern science: evolution. In engaging and conversational style, *Teaching About Evolution and the Nature of Science* provides a well-structured framework for understanding and teaching evolution. Written for teachers, parents, and community officials as well as scientists and educators, this book describes how evolution reveals both the great diversity and similarity among the Earth's organisms; it explores how scientists approach the question of evolution; and it illustrates the nature of science as a way of knowing about the natural world. In addition, the book provides answers to frequently asked questions to help readers understand many of the issues and misconceptions about evolution. The book includes sample activities for teaching about evolution and the nature of science. For example, the book includes activities that investigate fossil footprints and population growth that teachers of science can use to introduce principles of evolution. Background information, materials, and step-by-step presentations are provided for each activity. In addition, this volume: Presents the evidence for evolution, including how evolution can be observed today. Explains the nature of science through a variety of examples. Describes how science differs from other human endeavors and why evolution is one of the best avenues for helping students understand this distinction. Answers frequently asked questions about evolution. *Teaching About Evolution and the Nature of Science* builds on the 1996 National Science Education Standards released by the National Research Council—and offers detailed guidance on how to evaluate

and choose instructional materials that support the standards. Comprehensive and practical, this book brings one of today's educational challenges into focus in a balanced and reasoned discussion. It will be of special interest to teachers of science, school administrators, and interested members of the community. Since its origin in the early 20th century, the Modern Synthesis theory of evolution has grown to become the orthodox view on the process of organic evolution. Its central defining feature is the prominence it accords to genes in the explanation of evolutionary dynamics. Since the advent of the 21st century, however, the Modern Synthesis has been subject to repeated and sustained challenges. These are largely empirically driven. In the last two decades, evolutionary biology has witnessed unprecedented growth in the understanding of those processes that underwrite the development of organisms and the inheritance of characters. The empirical advances usher in challenges to the conceptual foundations of evolutionary theory. The extent to which the new biology challenges the Modern Synthesis has been the subject of lively debate. Many current commentators charge that the new biology of the 21st century calls for a revision, extension, or wholesale rejection of the Modern Synthesis Theory of evolution. Defenders of the Modern Synthesis maintain that the theory can accommodate the exciting new advances in biology. The original essays collected in this volume survey the various challenges to the Modern Synthesis arising from the new biology of the 21st century. The authors are evolutionary biologists, philosophers of science, and historians of biology from Europe and North America. Each of the essays discusses a particular challenge to the Modern Synthesis treatment of inheritance, development, or adaptation. Taken together, the essays cover a spectrum of views, from those that contend that the Modern Synthesis can rise to the challenges of the new biology, with little or no revision required, to those that call for the abandonment of the Modern Synthesis. The collection will be of interest to researchers and students in evolutionary biology, and the philosophy and history of the biological sciences. The impact of evolutionary theory on the philosophy of science has been no less profound than its impact on the science of biology itself. Advances in this theory provide a rich set of examples for thinking about the nature of scientific explanation and the structure of science. Many of the developments in our understanding of evolution resulted from contributions by both philosophers and biologists engaging over theoretical questions of mutual interest. This volume traces some of the most influential exchanges in this field over the last few decades. Focal topics include the nature of biological functions, adaptationism as an explanatory and methodological doctrine, the levels of selection debate, the concepts of fitness and drift, and the relationship of evolutionary to developmental biology.

Evolutionary theory ranks as one of the most powerful concepts of modern civilization. Its effects on our view of life have been wide and deep. One of the most world-shaking books ever published, Charles Darwin's *On the Origin of Species*, first appeared in

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print over 130 years ago, and it touched off a debate that rages to this day. Every modern evolutionist turns to Darwin's work again and again. Current controversies in the life sciences very often have as their starting point some vagueness in Darwin's writings or some question Darwin was unable to answer owing to the insufficient biological knowledge available during his time. Despite the intense study of Darwin's life and work, however, many of us cannot explain his theories (he had several separate ones) and the evidence and reasoning behind them, nor do we appreciate the modifications of the Darwinian paradigm that have kept it viable throughout the twentieth century. Who could elucidate the subtleties of Darwin's thought and that of his contemporaries and intellectual heirs—A. R. Wallace, T. H. Huxley, August Weismann, Asa Gray—better than Ernst Mayr, a man considered by many to be the greatest evolutionist of the century? In this gem of historical scholarship, Mayr has achieved a remarkable distillation of Charles Darwin's scientific thought and his enormous legacy to twentieth-century biology. Here we have an accessible account of the revolutionary ideas that Darwin thrust upon the world. Describing his treatise as "one long argument," Darwin definitively refuted the belief in the divine creation of each individual species, establishing in its place the concept that all of life descended from a common ancestor. He proposed the idea that humans were not the special products of creation but evolved according to principles that operate everywhere else in the living world; he upset current notions of a perfectly designed, benign natural world and substituted in their place the concept of a struggle for survival; and he introduced probability, chance, and uniqueness into scientific discourse. This is an important book for students, biologists, and general readers interested in the history of ideas—especially ideas that have radically altered our worldview. Here is a book by a grand master that spells out in simple terms the historical issues and presents the controversies in a manner that makes them understandable from a modern perspective.

As a species, we are currently experiencing dramatic shifts in our lifestyle, family structure, health, and global contact. Evolutionary Anthropology provides a powerful theoretical framework to study such changes, revealing how current environments and legacies of past selection shape human diversity. This book is the first major review of the emerging field of Applied Evolutionary Anthropology bringing together the work of an international group of evolutionary scientists, addressing many of the major public health and social issues of this century. Through a series of case studies that span both rural and urban situations in Africa, Asia, Europe and South America, each chapter addresses topics such as natural resource management, health service delivery, population growth and the emergence of new family structures, dietary, and co-operative behaviours. The research presented identifies the great, largely untapped, potential that Applied Evolutionary Anthropology holds to guide the design, implementation and evaluation of effective social and public health policy. This book will be of interest to policy-makers and applied researchers, along with academics and students across the biological and social sciences.

Jerry Fodor and Massimo Piatelli-Palmarini, a distinguished philosopher and scientist working in tandem, reveal major flaws at the heart of Darwinian evolutionary theory. They do not deny Darwin's status as an outstanding scientist but question the inferences he drew from his observations. Combining the results of cutting-edge work in experimental biology with crystal-clear philosophical argument they mount a

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devastating critique of the central tenets of Darwin's account of the origin of species. The logic underlying natural selection is the survival of the fittest under changing environmental pressure. This logic, they argue, is mistaken. They back up the claim with evidence of what actually happens in nature. This is a rare achievement - the short book that is likely to make a great deal of difference to a very large subject. What Darwin Got Wrong will be controversial. The authors' arguments will reverberate through the scientific world. At the very least they will transform the debate about evolution.

Collects forty-four key segments from the late paleontologist and evolutionary biologist's books, papers, and essays, in a collection that includes an assortment of previously unpublished articles and speeches.

Outgrowth of a meeting of the "Altenberg 16" at the Konrad Lorenz Institute for Evolution and Cognition Research in Altenberg, Austria, in July 2008. Cf. pref.

Less than 450 years ago, all European scholars believed that the Earth was at the centre of a Universe that was at most a few million miles in extent, and that the planets, sun, and stars all rotated around this centre. Less than 250 years ago, they believed that the Universe was created essentially in its present state about 6000 years ago. Even less than 150 years ago, the view that living species were the result of special creation by God was still dominant. The recognition by Charles Darwin and Alfred Russel Wallace of the mechanism of evolution by natural selection has completely transformed our understanding of the living world, including our own origins. In this Very Short Introduction Brian and Deborah Charlesworth provide a clear and concise summary of the process of evolution by natural selection, and how natural selection gives rise to adaptations and eventually, over many generations, to new species. They introduce the central concepts of the field of evolutionary biology, as they have developed since Darwin and Wallace on the subject, over 140 years ago, and discuss some of the remaining questions regarding processes. They highlight the wide range of evidence for evolution, and the importance of an evolutionary understanding for instance in combating the rapid evolution of resistance by bacteria to antibiotics and of HIV to antiviral drugs. This reissue includes some key updates to the main text and a completely updated Further Reading section. ABOUT THE SERIES: The Very Short Introductions series from Oxford University Press contains hundreds of titles in almost every subject area. These pocket-sized books are the perfect way to get ahead in a new subject quickly. Our expert authors combine facts, analysis, perspective, new ideas, and enthusiasm to make interesting and challenging topics highly readable. Wide-ranging and inclusive, this text provides an invaluable review of an expansive selection of topics in human evolution, variation and adaptability for professionals and students in biological anthropology, evolutionary biology, medical sciences and psychology. The chapters are organized around four broad themes, with sections devoted to phenotypic and genetic variation within and between human populations, reproductive physiology and behavior, growth and development, and human health from evolutionary and ecological perspectives. An introductory section provides readers with the historical, theoretical and methodological foundations needed to understand the more complex ideas presented later. Two hundred discussion questions provide starting points for class debate and assignments to test student understanding.

"Legend is overdue for replacement, and an adequate replacement must attend to the

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process of science as carefully as Hull has done. I share his vision of a serious account of the social and intellectual dynamics of science that will avoid both the rosy blur of Legend and the facile charms of relativism. . . . Because of [Hull's] deep concern with the ways in which research is actually done, *Science as a Process* begins an important project in the study of science. It is one of a distinguished series of books, which Hull himself edits."—Philip Kitcher, *Nature* "In *Science as a Process*, [David Hull] argues that the tension between cooperation and competition is exactly what makes science so successful. . . . Hull takes an unusual approach to his subject. He applies the rules of evolution in nature to the evolution of science, arguing that the same kinds of forces responsible for shaping the rise and demise of species also act on the development of scientific ideas."—Natalie Angier, *New York Times Book Review* "By far the most professional and thorough case in favour of an evolutionary philosophy of science ever to have been made. It contains excellent short histories of evolutionary biology and of systematics (the science of classifying living things); an important and original account of modern systematic controversy; a counter-attack against the philosophical critics of evolutionary philosophy; social-psychological evidence, collected by Hull himself, to show that science does have the character demanded by his philosophy; and a philosophical analysis of evolution which is general enough to apply to both biological and historical change."—Mark Ridley, *Times Literary Supplement* "Hull is primarily interested in how social interactions within the scientific community can help or hinder the process by which new theories and techniques get accepted. . . . The claim that science is a process for selecting out the best new ideas is not a new one, but Hull tells us exactly how scientists go about it, and he is prepared to accept that at least to some extent, the social activities of the scientists promoting a new idea can affect its chances of being accepted."—Peter J. Bowler, *Archives of Natural History* "I have been doing philosophy of science now for twenty-five years, and whilst I would never have claimed that I knew everything, I felt that I had a really good handle on the nature of science, Again and again, Hull was able to show me just how incomplete my understanding was. . . . Moreover, [*Science as a Process*] is one of the most compulsively readable books that I have ever encountered."—Michael Ruse, *Biology and Philosophy*

In his final book, Gould offers a surprising and nuanced study of the complex relationship between our two great ways of knowing: science and the humanities, twin realms of knowledge that have been divided against each other for far too long. This book contains the most sustained and serious attack on mainstream, neoclassical economics in more than forty years. Nelson and Winter focus their critique on the basic question of how firms and industries change overtime. They marshal significant objections to the fundamental neoclassical assumptions of profit maximization and market equilibrium, which they find ineffective in the analysis of technological innovation and the dynamics of competition among firms. To replace these assumptions, they borrow from biology the concept of natural selection to construct a precise and detailed evolutionary theory of business behavior. They grant that firms are motivated by profit and engage in search for ways of improving profits, but they do not consider them to be profit maximizing. Likewise, they emphasize the tendency for the more profitable firms to drive the less profitable ones out of business, but they do not focus their analysis on hypothetical states of industry equilibrium. The results of their new paradigm and analytical framework are impressive. Not only have they been able to develop more

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coherent and powerful models of competitive firm dynamics under conditions of growth and technological change, but their approach is compatible with findings in psychology and other social sciences. Finally, their work has important implications for welfare economics and for government policy toward industry.

Traditionally a scientific theory is viewed as based on universal laws of nature that serve as axioms for logical deduction. In analyzing the logical structure of evolutionary biology, Elisabeth Lloyd argues that the semantic account is more appropriate and powerful. This book will be of interest to biologists and philosophers alike.

If you accept evolutionary theory, can you also believe in God? Are human beings superior to other animals, or is this just a human prejudice? Does Darwin have implications for heated issues like euthanasia and animal rights? Does evolution tell us the purpose of life, or does it imply that life has no ultimate purpose? Does evolution tell us what is morally right and wrong, or does it imply that ultimately 'nothing' is right or wrong? In this fascinating and intriguing book, Steve Stewart-Williams addresses these and other fundamental philosophical questions raised by evolutionary theory and the exciting new field of evolutionary psychology. Drawing on biology, psychology and philosophy, he argues that Darwinian science supports a view of a godless universe devoid of ultimate purpose or moral structure, but that we can still live a good life and a happy life within the confines of this view.

In 1972 Stephen Jay Gould took the scientific world by storm with his paper on punctuated equilibrium. Challenging a core assumption of Darwin's theory of evolution, it launched the controversial idea that the majority of species originates in geological moments (punctuations) and persists in stasis. Now, thirty-five years later, *Punctuated Equilibrium* offers his only book-length testament on a theory he fiercely promoted, repeatedly refined, and tirelessly defended.

"Ontogeny recapitulates phylogeny" was Haeckel's answer—the wrong one—to the most vexing question of nineteenth-century biology: what is the relationship between individual development (ontogeny) and the evolution of species and lineages (phylogeny)? In this, the first major book on the subject in fifty years, Stephen Jay Gould documents the history of the idea of recapitulation from its first appearance among the pre-Socratics to its fall in the early twentieth century. Mr. Gould explores recapitulation as an idea that intrigued politicians and theologians as well as scientists. He shows that Haeckel's hypothesis—that human fetuses with gill slits are, literally, tiny fish, exact replicas of their water-breathing ancestors—had an influence that extended beyond biology into education, criminology, psychoanalysis (Freud and Jung were devout recapitulationists), and racism. The theory of recapitulation, Gould argues, finally collapsed not from the weight of contrary data, but because the rise of Mendelian genetics rendered it untenable. Turning to modern concepts, Gould demonstrates that, even though the whole subject of parallels between ontogeny and phylogeny fell into disrepute, it is still one of the great themes of evolutionary biology.

Heterochrony—changes in developmental timing, producing parallels between ontogeny and phylogeny—is shown to be crucial to an understanding of gene regulation, the key to any rapprochement between molecular and evolutionary biology. Gould argues that the primary evolutionary value of heterochrony may lie in immediate ecological advantages for slow or rapid maturation, rather than in long-term changes of form, as all previous theories proclaimed. Neoteny—the opposite of recapitulation—is shown to be

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the most important determinant of human evolution. We have evolved by retaining the juvenile characters of our ancestors and have achieved both behavioral flexibility and our characteristic morphology thereby (large brains by prolonged retention of rapid fetal growth rates, for example). Gould concludes that “there may be nothing new under the sun, but permutation of the old within complex systems can do wonders. As biologists, we deal directly with the kind of material complexity that confers an unbounded potential upon simple, continuous changes in underlying processes. This is the chief joy of our science.”

In this New York Times bestseller and longlist nominee for the National Book Award, “our greatest living chronicler of the natural world” (The New York Times), David Quammen explains how recent discoveries in molecular biology affect our understanding of evolution and life’s history. In the mid-1970s, scientists began using DNA sequences to reexamine the history of all life. Perhaps the most startling discovery to come out of this new field—the study of life’s diversity and relatedness at the molecular level—is horizontal gene transfer (HGT), or the movement of genes across species lines. It turns out that HGT has been widespread and important; we now know that roughly eight percent of the human genome arrived sideways by viral infection—a type of HGT. In *The Tangled Tree*, “the grandest tale in biology....David Quammen presents the science—and the scientists involved—with patience, candor, and flair” (Nature). We learn about the major players, such as Carl Woese, the most important little-known biologist of the twentieth century; Lynn Margulis, the notorious maverick whose wild ideas about “mosaic” creatures proved to be true; and Tsutomu Wantanabe, who discovered that the scourge of antibiotic-resistant bacteria is a direct result of horizontal gene transfer, bringing the deep study of genome histories to bear on a global crisis in public health. “David Quammen proves to be an immensely well-informed guide to a complex story” (The Wall Street Journal). In *The Tangled Tree*, he explains how molecular studies of evolution have brought startling recognitions about the tangled tree of life—including where we humans fit upon it. Thanks to new technologies, we now have the ability to alter even our genetic composition—through sideways insertions, as nature has long been doing. “*The Tangled Tree* is a source of wonder....Quammen has written a deep and daring intellectual adventure” (The Boston Globe).

Evolutionary Theory is for graduate students, researchers, and advanced undergraduates who want an understanding of the mathematical and biological reasoning that underlies evolutionary theory. The book covers all of the major theoretical approaches used to study the mechanics of evolution, including classical one- and two-locus models, diffusion theory, coalescent theory, quantitative genetics, and game theory. There are also chapters on theoretical approaches to the evolution of development and on multilevel selection theory. Each subject is illustrated by focusing on those results that have the greatest power to influence the way that we think about how evolution works. These major results are developed in detail, with many accompanying illustrations, showing exactly how they are derived and how the mathematics relates to the biological insights that they yield. In this way, the reader learns something of the actual machinery of different branches of theory while gaining a deeper understanding of the evolutionary process. Roughly half of the book focuses on gene-based models, the other half being concerned with general phenotype-based

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theory. Throughout, emphasis is placed on the fundamental relationships between the different branches of theory, illustrating how all of these branches are united by a few basic, universal, principles. The only mathematical background assumed is basic calculus. More advanced mathematical methods are explained, with the help of an extensive appendix, when they are needed.

A comprehensive treatment of the concept of causation in evolutionary biology that makes clear its central role in both historical and contemporary debates. Most scientific explanations are causal. This is certainly the case in evolutionary biology, which seeks to explain the diversity of life and the adaptive fit between organisms and their surroundings. The nature of causation in evolutionary biology, however, is contentious. How causation is understood shapes the structure of evolutionary theory, and historical and contemporary debates in evolutionary biology have revolved around the nature of causation. Despite its centrality, and differing views on the subject, the major conceptual issues regarding the nature of causation in evolutionary biology are rarely addressed. This volume fills the gap, bringing together biologists and philosophers to offer a comprehensive, interdisciplinary treatment of evolutionary causation. Contributors first address biological motivations for rethinking evolutionary causation, considering the ways in which development, extra-genetic inheritance, and niche construction challenge notions of cause and process in evolution, and describing how alternative representations of evolutionary causation can shed light on a range of evolutionary problems. Contributors then analyze evolutionary causation from a philosophical perspective, considering such topics as causal entanglement, the commingling of organism and environment, and the relationship between causation and information. Contributors John A. Baker, Lynn Chiu, David I. Dayan, Renée A. Duckworth, Marcus W Feldman, Susan A. Foster, Melissa A. Graham, Heikki Helanterä, Kevin N. Laland, Armin P. Moczek, John Odling-Smee, Jun Otsuka, Massimo Pigliucci, Arnaud Pocheville, Arlin Stoltzfus, Karola Stotz, Sonia E. Sultan, Christoph Thies, Tobias Uller, Denis M. Walsh, Richard A. Watson

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Photographs and essays affirm the authors' theory that science and art complement each other, and dispute the popular opinion that the two subjects clash in opposition.

From fads to fungus, baseball to beeswax, Gould always circles back to the great themes of time, change, and history, carrying readers home to the centering theme of evolution.

The Nature of Selection is a straightforward, self-contained introduction to philosophical and biological problems in evolutionary theory. It presents a powerful analysis of the evolutionary concepts of natural selection, fitness, and adaptation and clarifies controversial issues concerning altruism, group selection, and the idea that organisms are survival machines built for the good of the genes that inhabit them. "Sober's is the answering philosophical voice, the voice of a first-rate philosopher and a knowledgeable student of contemporary evolutionary theory. His book merits broad attention among both communities. It should also inspire others to continue the conversation."-Philip Kitcher, Nature "Elliott Sober has made extraordinarily important contributions to our understanding of biological problems in evolutionary biology and causality. The Nature of Selection is a major contribution to understanding epistemological problems in evolutionary theory. I predict that it will have a long lasting place in the literature."-Richard C. Lewontin

Neoclassical economics assumes that people are highly rational and can reason their way through even the most complex economic problems. In Individual Strategy and Social Structure, Peyton Young argues for a more realistic view in which people have a limited understanding of their environment, are sometimes short-sighted, and occasionally act in perverse ways. He shows how the cumulative experiences of many such individuals coalesce over time into customs, norms, and institutions that govern economic and social life. He develops a theory that predicts how such institutions evolve and characterizes their welfare

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properties. The ideas are illustrated through a variety of examples, including patterns of residential segregation, rules of the road, claims on property, forms of economic contracts, and norms of equity. The book relies on new results in evolutionary game theory and stochastic dynamical systems theory, many of them originated by the author. It can serve as an introductory text, or be read on its own as a contribution to the study of economic and social institutions.

It is widely understood that Charles Darwin's theory of evolution completely revolutionized the study of biology. Yet, according to David Sloan Wilson, the Darwinian revolution won't be truly complete until it is applied more broadly—to everything associated with the words "human," "culture," and "policy." In a series of engaging and insightful examples—from the breeding of hens to the timing of cataract surgeries to the organization of an automobile plant—Wilson shows how an evolutionary worldview provides a practical tool kit for understanding not only genetic evolution but also the fast-paced changes that are having an impact on our world and ourselves. What emerges is an incredibly empowering argument: If we can become wise managers of evolutionary processes, we can solve the problems of our age at all scales—from the efficacy of our groups to our well-being as individuals to our stewardship of the planet Earth.

An ethologist shows man to be a gene machine whose world is one of savage competition and deceit

'Slim and readable... the aficionado of evolutionary theory and the intense debate it engenders would do well to read Dawkins vs. Gould.' Nature, on the first edition
The central role of mathematical modeling in modern evolutionary theory has raised a concern as to why and how abstract formulae can say anything about empirical phenomena of evolution. This Element introduces existing philosophical approaches to this problem and proposes a new account according to which evolutionary models are based on causal, and not just mathematical, assumptions. The novel account features causal models both as the Humean 'uniform nature' underlying evolutionary induction and as the organizing framework that integrates mathematical and empirical assumptions into a cohesive network of beliefs that functions together to achieve epistemic goals of evolutionary biology.

A large sophisticated telescope complex sits atop a dormant volcano in one of Earth's most remote locations. Some incredibly bright but fiercely independent folks operate it much of the time. They detect, map, and perform threat analysis of near-Earth objects. Shortly after the world narrowly escapes an extinction event, they start collecting pieces of a related cosmic puzzle. When they've connected enough of them, an intriguing and disturbing picture emerges. Yet the most revealing pieces don't reveal themselves until after all life on Earth already has begun marching in lockstep toward possible oblivion.

The author of Darwin's Black Box draws on new findings in genetics to pose an argument for intelligent design that refutes Darwinian beliefs about evolution while offering alternative analyses of such factors as disease, random mutations, and the human struggle for survival. Reprint. 40,000 first printing.

Changes the conceptual hierarchy between biology and evolution, providing new insights into biology and philosophy. It introduces the science of 'evology' and

defines its six core themes of mechanics, dynamics, pattern, structure, function, and scale.

A FINALIST FOR THE PULITZER PRIZE NAMED A BEST BOOK OF THE YEAR BY THE NEW YORK TIMES BOOK REVIEW, SMITHSONIAN, AND WALL STREET JOURNAL A major reimagining of how evolutionary forces work, revealing how mating preferences—what Darwin termed "the taste for the beautiful"—create the extraordinary range of ornament in the animal world. In the great halls of science, dogma holds that Darwin's theory of natural selection explains every branch on the tree of life: which species thrive, which wither away to extinction, and what features each evolves. But can adaptation by natural selection really account for everything we see in nature? Yale University ornithologist Richard Prum—reviving Darwin's own views—thinks not. Deep in tropical jungles around the world are birds with a dizzying array of appearances and mating displays: Club-winged Manakins who sing with their wings, Great Argus Pheasants who dazzle prospective mates with a four-foot-wide cone of feathers covered in golden 3D spheres, Red-capped Manakins who moonwalk. In thirty years of fieldwork, Prum has seen numerous display traits that seem disconnected from, if not outright contrary to, selection for individual survival. To explain this, he dusts off Darwin's long-neglected theory of sexual selection in which the act of choosing a mate for purely aesthetic reasons—for the mere pleasure of it—is an independent engine of evolutionary change. Mate choice can drive ornamental traits from the constraints of adaptive evolution, allowing them to grow ever more elaborate. It also sets the stakes for sexual conflict, in which the sexual autonomy of the female evolves in response to male sexual control. Most crucially, this framework provides important insights into the evolution of human sexuality, particularly the ways in which female preferences have changed male bodies, and even maleness itself, through evolutionary time. The Evolution of Beauty presents a unique scientific vision for how nature's splendor contributes to a more complete understanding of evolution and of ourselves.

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