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Holism and evolution Springer

Why is life the way it is? Bacteria evolved into complex life just once in four billion years of life on earth-and all complex life shares many strange properties, from sex to ageing and death. If life evolved on other planets, would it be the same or completely different? In *The Vital Question*, Nick Lane radically reframes evolutionary history, putting forward a cogent solution to conundrums that have troubled scientists for decades. The answer, he argues, lies in energy: how all life on Earth lives off a voltage with the strength of a bolt of lightning. In unravelling these scientific enigmas, making sense of life's quirks, Lane's explanation provides a solution to life's vital questions: why are we as we are, and why are we here at all? This is ground-breaking science in an accessible form, in the tradition of Charles Darwin's *The Origin of Species*, Richard Dawkins' *The Selfish Gene*, and Jared Diamond's *Guns, Germs and Steel*.

The Vital Question Рипол Классик

Winner of the 2010 Royal Society Prize for science books *Powerful new research methods are providing fresh and vivid insights into the makeup of life. Comparing gene sequences, examining the atomic structure of proteins and looking into the geochemistry of rocks have all helped to explain creation and evolution in more detail than ever before.* Nick Lane uses the full extent of this new knowledge to describe the ten greatest inventions of life, based on their historical impact, role in living organisms today and relevance to current controversies. DNA, sex, sight and consciousnesses are just four examples. Lane also explains how these findings have come about, and the extent to which they can be relied upon. The result is a gripping and lucid account of the ingenuity of nature, and a book which is essential reading for anyone who has ever questioned the science behind the glories of everyday life.

Life's Ratchet Princeton University Press

While it is barely 50 years since the first reliable reports of the recovery of living cells frozen to cryogenic temperatures, there has been tremendous growth in the use of cryobiology in medicine, agriculture, horticulture, forestry, and the conservation of endangered or economically important species. As the first major text on cryobiology

The Story of the Human Body Templeton Foundation Press

Life is an enduring mystery. Yet, science tells us that living beings are merely sophisticated structures of lifeless molecules. If this view is correct, where do the seemingly purposeful motions of cells and organisms originate? In *Life's Ratchet*, physicist Peter M. Hoffmann locates the answer to this age-old question at the nanoscale. Below the calm, ordered exterior of a living organism lies microscopic chaos, or what Hoffmann calls the molecular storm -- specialized molecules immersed in a whirlwind of colliding water molecules. Our cells are filled with molecular machines, which, like tiny ratchets, transform random motion into ordered activity, and create the "purpose" that is the hallmark of life. Tiny electrical motors turn electrical voltage into motion, nanoscale factories custom-build other molecular machines, and mechanical machines twist, untwist, separate and package strands of DNA. The cell is like a city -- an unfathomable, complex collection of molecular workers working together to create something greater than themselves. Life, Hoffman argues, emerges from the random motions of atoms filtered through these sophisticated structures of our evolved machinery. We are agglomerations of interacting nanoscale machines more amazing than anything in science fiction. Rather than relying on some mysterious "life force" to drive them -- as people believed for centuries -- life's ratchets harness instead the second law of thermodynamics and the disorder of the molecular storm. Grounded in Hoffmann's own cutting-edge research, *Life's Ratchet* reveals the incredible findings of modern nanotechnology to tell the story of how the noisy

world of atoms gives rise to life itself.

Life Ascending PUM

Story of the Human Body explores how the way we use our bodies is all wrong. From an evolutionary perspective, if normal is defined as what most people have done for millions of years, then it's normal to walk and run 9 -15 kilometers a day to hunt and gather fresh food which is high in fibre, low in sugar, and barely processed. It's also normal to spend much of your time nursing, napping, making stone tools, and gossiping with a small band of people. Our 21st-century lifestyles, argues Dan Lieberman, are out of synch with our stone-age bodies. Never have we been so healthy and long-lived - but never, too, have we been so prone to a slew of problems that were, until recently, rare or unknown, from asthma, to diabetes, to - scariest of all - overpopulation. *Story of the Human Body* asks how our bodies got to be the way they are, and considers how that evolutionary history - both ancient and recent - can help us evaluate how we use our bodies. How is the present-day state of the human body related to the past? And what is the human body's future? Daniel Lieberman is the Chair of the Department of Human Evolutionary Biology at Harvard and a leader in the field. He has written nearly 100 articles, many appearing in the journals *Nature* and *Science*, and his cover story on barefoot running in *Nature* was picked up by major media the world over. His research and discoveries have been highlighted in newspapers and magazines, including *The New York Times*, *The Boston Globe*, *Discover*, and *National Geographic*.

Rethinking Evolution: The Revolution That's Hiding In Plain Sight Penguin UK

This novel text provides a concise synthesis of how the interactions between mitochondrial and nuclear genes have played a major role in shaping the ecology and evolution of eukaryotes. The foundation for this new focus on mitonuclear interactions originated from research in biochemistry and cell biology laboratories, although the broader ecological and evolutionary implications have yet to be fully explored. The imperative for mitonuclear coadaptation is proposed to be a major selective force in the evolution of sexual reproduction and two mating types in eukaryotes, in the formation of species, in the evolution of ornaments and sexual selection, in the process of adaptation, and in the evolution of senescence. The book highlights the importance of mitonuclear coadaptation to the evolution of complex life and champions mitonuclear ecology as an important subdiscipline in ecology and evolution.

In Search of Cell History University of Chicago Press

In Ryan's view, cooperation, not competition, lies at the heart of human society."

What is Life? HarperCollins UK

Mitochondria are tiny structures located inside our cells that carry out the essential task of producing energy for the cell. They are found in all complex living things, and in that sense, they are fundamental for driving complex life on the planet. But there is much more to them than that. Mitochondria have their own DNA, with their own small collection of genes, separate from those in the cell nucleus. It is thought that they were once bacteria living independent lives. Their enslavement within the larger cell was a turning point in the evolution of life, enabling the development of complex organisms and, closely related, the origin of two sexes. Unlike the DNA in the nucleus, mitochondrial DNA is passed down exclusively (or almost exclusively) via the female line. That's why it has been used by some researchers to trace human ancestry daughter-to-mother, to 'Mitochondrial Eve'. Mitochondria give us important information about our evolutionary history. And that's not all. Mitochondrial genes mutate much faster than those in the nucleus because of the free radicals produced in their energy-generating role. This high mutation rate lies behind our ageing and certain congenital diseases. The latest research suggests that mitochondria play a key role in degenerative diseases such as cancer, through their involvement in precipitating cell suicide. Mitochondria, then, are pivotal in power, sex, and suicide. In this fascinating and thought-provoking book, Nick Lane brings together the latest research findings in this exciting field to show how our

growing understanding of mitochondria is shedding light on how complex life evolved, why sex arose (why don't we just bud?), and why we age and die. This understanding is of fundamental importance, both in understanding how we and all other complex life came to be, but also in order to be able to control our own illnesses, and delay our degeneration and death. 'An extraordinary account of groundbreaking modern science... The book abounds with interesting and important ideas.' Mark Ridley, Department of Zoology, University of Oxford

Adaptation and Natural Selection Cambridge University Press

A comprehensive account of how energy has shaped society throughout history, from pre-agricultural foraging societies through today's fossil fuel-driven civilization. "I wait for new Smil books the way some people wait for the next 'Star Wars' movie. In his latest book, *Energy and Civilization: A History*, he goes deep and broad to explain how innovations in humans' ability to turn energy into heat, light, and motion have been a driving force behind our cultural and economic progress over the past 10,000 years. —Bill Gates, *Gates Notes*, Best Books of the Year *Energy* is the only universal currency; it is necessary for getting anything done. The conversion of energy on Earth ranges from terra-forming forces of plate tectonics to cumulative erosive effects of raindrops. Life on Earth depends on the photosynthetic conversion of solar energy into plant biomass. Humans have come to rely on many more energy flows—ranging from fossil fuels to photovoltaic generation of electricity—for their civilized existence. In this monumental history, Vaclav Smil provides a comprehensive account of how energy has shaped society, from pre-agricultural foraging societies through today's fossil fuel-driven civilization. Humans are the only species that can systematically harness energies outside their bodies, using the power of their intellect and an enormous variety of artifacts—from the simplest tools to internal combustion engines and nuclear reactors. The epochal transition to fossil fuels affected everything: agriculture, industry, transportation, weapons, communication, economics, urbanization, quality of life, politics, and the environment. Smil describes humanity's energy eras in panoramic and interdisciplinary fashion, offering readers a magisterial overview. This book is an extensively updated and expanded version of Smil's *Energy in World History* (1994). Smil has incorporated an enormous amount of new material, reflecting the dramatic developments in energy studies over the last two decades and his own research over that time.

The Equations of Life Prosci

In humanity's more than 100,000 year history, we have evolved from vulnerable creatures clawing sustenance from Earth to a sophisticated global society manipulating every inch of it. In short, we have become the dominant animal. Why, then, are we creating a world that threatens our own species? What can we do to change the current trajectory toward more climate change, increased famine, and epidemic disease? Renowned Stanford scientists Paul R. Ehrlich and Anne H. Ehrlich believe that intelligently addressing those questions depends on a clear understanding of how we evolved and how and why we're changing the planet in ways that darken our descendants' future. *The Dominant Animal* arms readers with that knowledge, tracing the interplay between environmental change and genetic and cultural evolution since the dawn of humanity. In lucid and engaging prose, they describe how *Homo sapiens* adapted to their surroundings, eventually developing the vibrant cultures, vast scientific knowledge, and technological wizardry we know today. But the Ehrlichs also explore the flip side of this triumphant story of innovation and conquest. As we clear forests to raise crops and build cities, lace the continents with highways, and create chemicals never before seen in nature, we may be undermining our own supremacy. The threats of environmental damage are clear from the daily headlines, but the outcome is far from destined. Humanity can again adapt—if we learn from our evolutionary past. Those lessons are crystallized in *The Dominant Animal*. Tackling the fundamental challenge of the human predicament, Paul and Anne Ehrlich offer a vivid and unique exploration of our origins, our evolution, and our future.

Energy and Civilization Hachette UK

For 65 million years dinosaurs ruled the Earth—until a deadly asteroid forced their extinction. But what accounts for the incredible longevity of dinosaurs? A renowned scientist now provides a startling explanation that is rewriting the history of the Age of Dinosaurs. Dinosaurs were pretty amazing creatures—real-life monsters that have the power to fascinate us. And their fiery Hollywood ending only serves to make the story that much more dramatic. But fossil evidence demonstrates that dinosaurs survived several mass extinctions, and were seemingly unaffected by catastrophes that decimated most other life on Earth. What could explain their uncanny ability to endure through the ages? Biologist and earth scientist Peter Ward now accounts for the remarkable indestructibility of dinosaurs by connecting their unusual respiration system with their ability to adapt to Earth's changing environment—a system that was ultimately bequeathed to their descendants, birds. By tracing the evolutionary path back through time and carefully connecting the dots from birds to dinosaurs, Ward describes the unique form of breathing shared by these two distant relatives and demonstrates how this simple but remarkable characteristic provides the elusive explanation to a question that has thus far stumped scientists. Nothing short of revolutionary in its bold presentation of an astonishing theory, *Out of Thin Air* is a story of science at the edge of discovery. Ward is an outstanding guide to the process of scientific detection. Audacious and innovative in his thinking, meticulous and thoroughly detailed in his research, only a scientist of his caliber is capable of telling this surprising story.

The Runes of Evolution Pan Macmillan

Mitochondria are sometimes called the powerhouses of eukaryotic cells, because mitochondria are the site of ATP synthesis in the cell. ATP is the universal energy currency, it provides the power that runs all other life processes. Humans need oxygen to survive because of ATP synthesis in mitochondria. The sugars from our diet are converted to carbon dioxide in mitochondria in a process that requires oxygen. Just like a fire needs oxygen to burn, our mitochondria need oxygen to make ATP. From textbooks and popular literature one can easily get the impression that all mitochondria require oxygen. But that is not the case. There are many groups of organisms known that make ATP in mitochondria without the help of oxygen. They have preserved biochemical relicts from the early evolution of eukaryotic cells, which took place during times in Earth history when there was hardly any oxygen available, certainly not enough to breathe. How the anaerobic forms of mitochondria work, in which organisms they occur, and how the eukaryotic anaerobes that possess them fit into the larger picture of rising atmospheric oxygen during Earth history are the topic of this book.

Energy Law and Economics Oxford University Press

Seventy years ago, Erwin Schrödinger posed a profound question: 'What is life, and how did it emerge from non-life?' This problem has puzzled biologists and physical scientists ever since. Living things are hugely complex and have unique properties, such as self-maintenance and apparently purposeful behaviour which we do not see in inert matter. So how does chemistry give rise to biology? What could have led the first replicating molecules up such a path? Now, developments in the emerging field of 'systems chemistry' are unlocking the problem. Addy Pross shows how the

different kind of stability that operates among replicating molecules results in a tendency for chemical systems to become more complex and acquire the properties of life. Strikingly, he demonstrates that Darwinian evolution is the biological expression of a deeper, well-defined chemical concept: the whole story from replicating molecules to complex life is one continuous process governed by an underlying physical principle. The gulf between biology and the physical sciences is finally becoming bridged. This new edition includes an Epilogue describing developments in the concepts of fundamental forms of stability discussed in the book, and their profound implications. Oxford Landmark Science books are 'must-read' classics of modern science writing which have crystallized big ideas, and shaped the way we think.

ADKAR Houghton Mifflin Harcourt

Biological evolution is a fact—but the many conflicting theories of evolution remain controversial even today. When *Adaptation and Natural Selection* was first published in 1966, it struck a powerful blow against those who argued for the concept of group selection—the idea that evolution acts to select entire species rather than individuals. Williams's famous work in favor of simple Darwinism over group selection has become a classic of science literature, valued for its thorough and convincing argument and its relevance to many fields outside of biology. Now with a new foreword by Richard Dawkins, *Adaptation and Natural Selection* is an essential text for understanding the nature of scientific debate.

The Dominant Animal Springer

The Nature of Technology will change the way you think about this fundamental subject forever. W. Brian Arthur's many years of thinking and writing about technology have culminated in a unique understanding of his subject. Here he examines the nature of technology itself: what is it and how does it evolve? Giving rare insights into the evolution of specific technologies and a new framework for thinking about others, every sentence points to some further truth and fascination. At a time when we are ever more reliant on technological solutions for the world's problems, it is extraordinary how little we actually understand the processes that lead to innovation and invention. Until now. This will be a landmark book that will define its subject, and inspire people to think about technology in depth for the very first time.

The Epigenetics Revolution Profile Books

Plant breeders have long sought technologies to extend human control over nature. Early in the twentieth century, this led some to experiment with startlingly strange tools like x-ray machines, chromosome-altering chemicals, and radioactive elements. Contemporary reports celebrated these mutation-inducing methods as ways of generating variation in plants on demand. Speeding up evolution, they imagined, would allow breeders to genetically engineer crops and flowers to order. Creating a new food crop or garden flower would soon be as straightforward as innovating any other modern industrial product. In *Evolution Made to Order*, Helen Anne Curry traces the history of America's pursuit of tools that could intervene in evolution. An immersive journey through the scientific and social worlds of midcentury genetics and plant breeding and a compelling exploration of American cultures of innovation, *Evolution Made to Order* provides vital historical context for current worldwide ethical and policy debates over genetic engineering.

Achieving the Paris Climate Agreement Goals University of Chicago Press

In this stunningly original book, Richard Wrangham argues that it was cooking that caused the extraordinary transformation of our ancestors from apelike beings to *Homo erectus*. At the heart of *Catching Fire* lies an explosive new idea: the habit of eating cooked rather than raw food permitted the digestive tract to shrink and the human brain to grow, helped structure human society, and created the male-female division of labour. As our ancestors adapted to using fire, humans emerged as "the cooking apes". Covering everything from food-labelling and overweight pets to raw-food faddists, *Catching Fire* offers a startlingly original argument about how we came to be the social, intelligent, and sexual species we are today. "This notion is surprising, fresh and, in the hands of Richard Wrangham, utterly persuasive ... Big, new ideas do not come along often in evolution these days, but this is one." —Matt Ridley, author of *Genome*

The Origin and Nature of Life on Earth Bloomsbury Publishing

In just a half century, humanity has made an astounding leap in its understanding of life. Now, one of the giants of biological science, Christian de Duve, discusses what we've learned in this half century, ranging from the tiniest cells to the future of our species and of life itself. With wide-ranging erudition, De Duve takes us on a dazzling tour of the biological world, beginning with the invisible workings of the cell, the area in which he won his Nobel Prize. He describes how the first cells may have arisen and suggests that they may have been like the organisms that exist today near deep-sea hydrothermal vents. Contrary to many scientists, he argues that life was bound to arise and that it probably only took millennia—maybe tens of thousands of years—to move from rough building blocks to the first organisms possessing the basic properties of life. With equal authority, De Duve examines topics such as the evolution of humans, the origins of consciousness, the development of language, the birth of science, and the origin of emotion, morality, altruism, and love. He concludes with his conjectures on the future of humanity—for instance, we may evolve, perhaps via genetic engineering, into a new species—and he shares his personal thoughts about God and immortality. In *Life Evolving*, one of our most eminent scientists sums up what he has learned about the nature of life and our place in the universe. An extraordinarily wise and humane volume, it will fascinate readers curious about the world around them and about the impact of science on philosophy and religion.

The Power of Vital Force Profile Books

An estimated 4.6 billion years ago, the Earth and Moon were formed in a violent impact. On this, many agree, and even more that a long time after that, life began. However, few know that the first life on the Earth may not have emerged on this planet, but could, in fact, have begun on Mars, brought here by meteorites. In this revolutionary book, leading scientists Peter Ward and Joe Kirschvink rewrite the principal account of the history of life on Earth. They show not only how the rise of animals was delayed for billions of years, but also what it was that first forced fish out of the sea and onto the land. Together, the two scientists explain how developments in the environment led to multiple Ice Ages before the emergence of dinosaurs and other giant animals, and what the true cause of these great beasts' eventual extinction was. Finally, charting the course of our own evolution, they explore whether this generation will see the end of the human species. A *New History of Life* proves not only that much of what we think we know should be unlearned, but also that the true history of life on Earth is much more surprising and wonderful than we could ever have imagined.

A New History of Life OUP Oxford

Acclaimed author Matt Ridley's thrilling follow-up to his bestseller *Genome*. Armed with the extraordinary new discoveries about our genes, Ridley turns his attention to the nature versus nurture debate to bring the first popular account of the roots of human behaviour.