Allee Effects in Ecology and Conservation
Franck Courchamp, Ludek Berec, and Joanna Gascoigne

Published in print: 2008 Published Online: May 2008
Item type: book

Allee effects are broadly defined as a decline in individual fitness at low population size or density, that can result in critical population thresholds below which populations crash to extinction. As such, they are very relevant to many conservation programmes, where scientists and managers are often working with populations that have been reduced to low densities or small numbers. There are a variety of mechanisms that can create Allee effects, including mating systems, predation, environmental modification, and social interactions among others. The abrupt and unpredicted collapses of many exploited populations is just one illustration of the need to bring Allee effects to the forefront of conservation and management strategies. This book provides an overview of the topic, collating and integrating a widely dispersed literature from various fields: marine and terrestrial, plant and animal, theoretical and empirical, academic and applied.

Spirituality in the Flesh
Robert C. Fuller

Published in print: 2008 Published Online: September 2008
Item type: book

This book examines the biological underpinnings of religion. We can only experience, the book argues, what our bodies allow us to experience. As a consequence, religious thought and feeling are heavily influenced by our sensory organs, emotional programs, sexual sensibilities, and the neural structure of our brains. Studying “spirituality in the flesh” opens up new and exciting agendas for understanding the nature and value of human religiosity. This exploration of embodied spirituality establishes middle ground between the explanations of religion typically
made by either scientists or humanists. The book takes most scientific interpreters to task for failing to understand the inherently cultural aspects of embodied experience, even as he chides most religion scholars for ignoring new knowledge about the biological substrates of human thought and behavior. Each chapter takes up a different facet of embodied experience and shows the ways it helps us understand just how and why humans reconstruct their worlds in religious ways. Emotional programs such as fear or wonder, altered consciousness, sexuality, pain, and spatial orientation to the environment provide critical categories that are used to interpret selected episodes in American religious history. Topics as diverse as apocalypticism, nature religion, Native American peyotism, and the sexual experimentalism found in 19th-century communal societies illustrate how the study of spirituality in the flesh enriches our appreciation of religion.

The Porous Medium Equation
Juan Luis Vazquez

The heat equation is one of the three classical linear partial differential equations of second order that form the basis of any elementary introduction to the area of PDEs, and only recently has it come to be fairly well understood. This book provides a presentation of the mathematical theory of the nonlinear heat equation usually called the Porous Medium Equation (PME). This equation appears in a number of physical applications, such as to describe processes involving fluid flow, heat transfer, or diffusion. Other applications have been proposed in mathematical biology, lubrication, boundary layer theory, and other fields. Each chapter contains a detailed introduction and is supplied with a section of notes, providing comments, historical notes or recommended reading, and exercises.

Mr. Bloomfield's Orchard
Nicholas P. Money

Stinkhorns, puffballs, the “corpse finder”, deadly galerina, Satan's bolete, birch conks, black mold, the old man of the woods — the world of fungi is infinitely varied and this book introduces readers to a dazzling...
array of fungi. We learn of Madurella, which can erode bones until they look moth-eaten; Cordyceps, which wracks insects with convulsions, kills them, then sends a stalk out of the insect's head to release more infectious spores; and Claviceps, the poisonous ergot fungus, which causes hallucinations (the women charged with “demonic possession” in Salem in 1691 may have been victims of ergot consumption). The book's author recounts his own childhood introduction to fungi in Mr. Bloomfield's orchard — where trees and fruit were devoured by a rogue's gallery of bitter rot, canker, rust, powdery mildew, rubbery wood and scab — as well as outlining the lives of famed mycologists, including Reginald Buller who wore horse blinders as he walked to work, the better to study luminescent fungi in his dark lab. This book provides an introduction to the biology of fungi as well as insight into how scientists study fungi in the lab and in the field.

SUMMARY AND CONCLUDING REMARKS
Rolf Niedermeier

in Invitation to Fixed-Parameter Algorithms

Published in print: 2006 Published Online: September 2007
DOI: 10.1093/acprof:oso/9780198566076.003.0012
Item type: chapter

This chapter gives a summary of what happens in Part II and Part III.

Mind Design and Minimal Syntax
Wolfram Hinzen

Published in print: 2006 Published Online: September 2007
DOI: 10.1093/acprof:oso/9780199289257.001.0001
Item type: book

This book introduces generative grammar as an area of study, asking what it tells us about the human mind. It lays the foundation for the unification of modern generative linguistics with the philosophies of mind and language. It introduces Chomsky's program of a 'minimalist' syntax as a novel explanatory vision of the human mind. It explains how the Minimalist Program originated from work in cognitive science, biology, linguistics, and philosophy, and examines its implications for work in these fields. It also considers the way the human mind is designed when seen as an arrangement of structural patterns in nature, and argues that its design is the product not so much of adaptive evolutionary history as of principles and processes that are historical and internalist in character. The book suggests that linguistic meaning arises in the
mind as a consequence of structures emerging on formal rather than functional grounds. From this, the book substantiates an unexpected and deeply unfashionable notion of human nature. It also provides an insight into the nature and aims of Chomsky's Minimalist Program.

Implicit Learning and Tacit Knowledge
Arthur S. Reber

The book is an extended essay on implicit learning, a topic that emerged in recent years as an important but previously overlooked process. Implicit learning is learning that takes place independent of both the process and products of learning. It occurs without the intention to learn and largely without awareness of the nature of what has been learned. The process is “bottom-up”; information is acquired automatically when individuals focus attention on complex displays; and the knowledge base is “tacit” and largely opaque to introspection. Examples abound in everyday life, notably natural language learning and the acquisition of the mores of social behavior. A core assumption is that this implicit acquisitional mechanism is a fundamental “root” process that is based on evolutionarily old neurological structures and lies at the heart of the adaptive behavioral repertoire of every complex organism. Firstly, the book outlines the essential features of implicit learning that have emerged from controlled studies carried out over the past several decades. It also presents alternative perspectives that have been proposed and accommodates these views to the proposed theoretical model. It then structures the literature within the framework of Darwinian evolutionary biology that lies at the core of the theory. Finally, it shows how the evolutionary stance makes a series of predictions about how functions based on implicit mechanisms should differ from those mediated by consciousness.

Across the Boundaries
Daniel Steel

The biological and social sciences often generalize causal conclusions from one context to others that may differ in some relevant respects, as is illustrated by inferences from animal models to humans or from
a pilot study to a broader population. Inferences like these are known as extrapolations. How and when extrapolation can be legitimate is a fundamental question for the biological and social sciences that has not received the attention it deserves. This book argues that previous accounts of extrapolation are inadequate and proposes a better approach that is able to answer methodological critiques of extrapolation from animal models to humans.

Macromolecular Crystallization and Crystal Perfection
Naomi E. Chayen, John R. Helliwell, and Edward H. Snell

Published in print: 2010 Published Online: May 2010
Publisher: Oxford University Press
Item type: book

Structural crystallography provides key information to understand the mechanism involved for biological processes. The technique requires high-quality crystals. The book Macromolecular crystallization and crystal perfection covers the techniques to get these high quality crystals and then obtain the best structural data from them. We focus on two areas, the crystal and the diffraction experiment. We briefly address crystallization theory and then focus on practical crystallization strategies discussing screening and optimization. Where high quality crystals are not initially obtained, remediation strategies and alternative approaches are discussed. Diffraction is covered from both the X-ray and neutron viewpoint. A physical analysis of long and short-range order is used to explain features seen in the diffraction pattern and the causes of those features. Diffraction disorders are discussed. Factors that cause degradation to the diffraction and strategies to mitigate those factors are addressed. We then address beamline and detector optimization as a means to improve the data quality. Crystallization is still a largely empirical process and our final chapters focus on the use of powder methods, where crystals are small, complementary techniques where we have no crystals at all and what the future holds with the advent of fourth generation X-ray sources. Overall the book is aimed at both more experienced researchers and graduate students. We aim for it to become a reference work for all researchers in these interdisciplinary subjects on these topics.
This brief chapter draws out the implications of the earlier chapters, particularly in respect of the fact that even where it appears that morality is responsive to natural facts which can be determined first by biology, in reality there are no such facts, and their relevance is not given in nature. The relevance of certain facts is determined by our moral outlook, and different moral outlooks seem to be available. However, the chapter suggests that not all moral outlooks are equally sound. This is not because one is more true to some independent facts of nature, but one is more true to independent facts of moral truth, about the more noble and generous outlook towards our fellow creatures; this is where the distinction between the humane and the sentimental is drawn.

The Limits of the Self
Thomas Pradeu

What counts as an individual in the living world? What does it mean for a living thing to remain the same through time while constantly changing? Immunology, one of the most dynamic fields of today’s biology, considers these questions its province, and answers them through its crucial concepts of “self” and “nonself.” Though immunology has been dominated since the 1940s by the self-nonself theory, this book argues that this theory is inadequate, because immune responses to self constituents and immune tolerance of foreign entities are the rule, not the exception. An alternative theory, the continuity theory, is advanced instead. This theory offers a new way to answer the question of what triggers an immune response. It also echoes the recent realization that all organisms, and not higher vertebrates only, have an immune system. This book’s main thesis is that the self-nonself theory should be abandoned, but that immunology still proves to be decisive for delineating the boundaries of the organism. Articulating an evolutionary
and an immunological perspective, it offers an original conception of the organism. Tolerance of the fetus by the mother and of countless bacteria on the body’s surfaces proves that every organism is heterogeneous, that is, made of entities of different origins. In other words, every organism appears as a chimera, a mixed living thing the cohesiveness of which is ensured by the constant action of its immune system. The Limits of the Self will be essential reading for anyone interested in the definition of biological individuality and the understanding of the immune system.

Conclusion
Mario Mazzocchi, W. Bruce Traill, and Jason F. Shogren

in Fat Economics: Nutrition, Health, and Economic Policy

Published in print: 2009 Published Online: October 2011
Item type: chapter

This final chapter summarizes the evidence and identifies remaining questions. It argues that obesity policy is as much a question of social choice as of biology. It gives the key points raised by the book. It claims that obesity poses a modern day challenge to understanding human health and welfare and that it may be due to technological change. Obesity policy needs economics for risk assessment and management. It also offers that obesity cannot be changed by information policy alone but with a combination of fat taxes and thin subsidies.

Hidden Markov Processes
M. Vidyasagar

Published in print: 2014 Published Online: October 2017
Item type: book

This book explores important aspects of Markov and hidden Markov processes and the applications of these ideas to various problems in computational biology. It starts from first principles, so that no previous knowledge of probability is necessary. However, the work is rigorous and mathematical, making it useful to engineers and mathematicians, even those not interested in biological applications. A range of exercises is provided, including drills to familiarize the reader with concepts and more advanced problems that require deep thinking about the theory. Biological applications are taken from post-genomic biology, especially genomics and proteomics. The topics examined include standard material such as the Perron–Frobenius theorem, transient
and recurrent states, hitting probabilities and hitting times, maximum likelihood estimation, the Viterbi algorithm, and the Baum–Welch algorithm. The book contains discussions of extremely useful topics not usually seen at the basic level, such as ergodicity of Markov processes, Markov Chain Monte Carlo (MCMC), information theory, and large deviation theory for both i.i.d and Markov processes. It also presents state-of-the-art realization theory for hidden Markov models. Among biological applications, it offers an in-depth look at the BLAST (Basic Local Alignment Search Technique) algorithm, including a comprehensive explanation of the underlying theory. Other applications such as profile hidden Markov models are also explored.

Conclusion
John Dupré

in Darwin’s Legacy: What Evolution Means Today
Published in print: 2005 Published Online: October 2011
Publisher: Oxford University Press
DOI: 10.1093/acprof:oso/9780199284214.003.0009
Item type: chapter

Countless features of human evolution cannot be explained in detail by Charles Darwin's theory, as abstract models are more represented than the tiny part of the totality. Scientific works are, however, being developed, and this is one of the positive sides of the book, taking into account the power of genes on evolution through scientific methodologies. Science and culture play differing roles on the evolutionary perspective of humans, as various studies such as those that deal with fossils are considered. Although science has not told all the important things to understand about the world, the explanations and satisfaction of having known something takes away the ignorance. Still, there are religious and superstitious mythologies that influence human culture but this philosophy is argued as part of human evolution.

Ethical Life
Webb Keane

Published in print: 2015 Published Online: October 2017
Publisher: Princeton University Press
DOI: 10.23943/princeton/9780691167732.001.0001
Item type: book

The human propensity to take an ethical stance toward oneself and others is found in every known society, yet we also know that values taken for granted in one society can contradict those in another. Does ethical life arise from human nature itself? Is it a universal human trait?
Or is it a product of one's cultural and historical context? This book offers a new approach to the empirical study of ethical life that reconciles these questions, showing how ethics arise at the intersection of human biology and social dynamics. Drawing on the latest findings in psychology, conversational interaction, ethnography, and history, the book takes readers from inner city America to Samoa and the Inuit Arctic to reveal how we are creatures of our biology as well as our history—and how our ethical lives are contingent on both. The book looks at Melanesian theories of mind and the training of Buddhist monks, and discusses important social causes such as the British abolitionist movement and American feminism. It explores how styles of child rearing, notions of the person, and moral codes in different communities elaborate on certain basic human tendencies while suppressing or ignoring others. Certain to provoke debate, the book presents an entirely new way of thinking about ethics, morals, and the factors that shape them.

Sounding the Limits of Life
Stefan Helmreich

Published in print: 2015 Published Online: October 2017
Item type: book

What is life? What is water? What is sound? This book investigates how contemporary scientists—biologists, oceanographers, and audio engineers—are redefining these crucial concepts. Life, water, and sound are phenomena at once empirical and abstract, material and formal, scientific and social. In the age of synthetic biology, rising sea levels, and new technologies of listening, these phenomena stretch toward their conceptual snapping points, breaching the boundaries between the natural, cultural, and virtual. Through examinations of the computational life sciences, marine biology, astrobiology, acoustics, and more, the book follows scientists to the limits of these categories. Along the way, it offers critical accounts of such other-than-human entities as digital life forms, microbes, coral reefs, whales, seawater, extraterrestrials, tsunamis, seashells, and bionic cochlea. It develops a new notion of “sounding”—as investigating, fathoming, listening—to describe the form of inquiry appropriate for tracking meanings and practices of the biological, aquatic, and sonic in a time of global change and climate crisis. The book shows that life, water, and sound no longer mean what they once did, and that what count as their essential natures are under dynamic revision.
This book addresses the most paradoxical finding of recent aging research: the cessation of demographic aging. The authors show that aging stops at the level of the individual organism, and explain why evolution allows this. The implications of this counter-intuitive conclusion are profound. Aging research now needs to accept three uncomfortable truths. First, aging is not a cumulative physiological process. Second, the fundamental theory that is required to explain, manipulate, and probe the phenomena of aging comes from evolutionary biology. Third, strong-inference experimental strategies for aging must be founded in evolutionary research, not cell or molecular biology. But there are also significant consequences of this work for human aging. First, biomedical strategies that are founded on the traditional cell-molecular theories of aging are bound to fail, because their fundamental premises are incorrect. Second, the ultimate technological problem of controlling human aging is redefined by the authors as having two parts: (a) ameliorating an aging phase that can now be seen as merely transitory; and (b) achieving an earlier and healthier post-aging phase. Third, the authors propose one possibility by which both of these goals might be achieved. The outcome of fifteen years of research by the authors, this book brings together new applications of evolutionary theory, new models for demography, and massive experimentation. As hard as it is to deal scientifically with the paradoxes and complexities of aging that stops, this key finding unlocks the box containing one of the most profound mysteries of biology.

Viruses as Complex Adaptive Systems

Richard Sole and Santiago F. Elena

Viruses are everywhere, infecting all sorts of living organisms, from the tiniest bacteria to the largest mammals. Many are harmful parasites, but viruses also play a major role as drivers of our evolution as a species and are essential regulators of the composition and complexity of ecosystems on a global scale. This book draws on complex systems theory to provide a fresh look at viral origins, populations, and evolution.
and the coevolutionary dynamics of viruses and their hosts. New viruses continue to emerge that threaten people, crops, and farm animals. Viruses constantly evade our immune systems, and antiviral therapies and vaccination campaigns can be powerless against them. These unique characteristics of virus biology are a consequence of their tremendous evolutionary potential, which enables viruses to quickly adapt to any environmental challenge. This book presents a unified framework for understanding viruses as complex adaptive systems. It shows how the application of complex systems theory to viral dynamics has provided new insights into the development of AIDS in patients infected with HIV-1, the emergence of new antigenic variants of the influenza A virus, and other cutting-edge advances. The book also extends the analogy of viruses to the evolution of other replicators such as computer viruses, cancer, and languages.

The Population Biology of Tuberculosis

Christopher Dye

Published in print: 2015 Published Online: October 2017
Publisher: Princeton University Press
Item type: book

Despite decades of developments in immunization and drug therapy, tuberculosis remains one of the leading causes of human mortality, and no country has successfully eradicated the disease. Reenvisioning TB from the perspective of population biology, this book examines why the disease is so persistent and what must be done to fight it. Treating TB and its human hosts as dynamic, interacting populations, the book seeks new answers to key questions by drawing on demography, ecology, epidemiology, evolution, and population genetics. It uses simple mathematical models to investigate how cases and deaths could be reduced, and how interventions could lead to TB elimination. It reveals a striking gap between the actual and potential impact of current interventions, especially drug treatment, and suggests placing more emphasis on early case detection and the treatment of active or incipient TB. The book argues that the response to disappointingly slow rates of disease decline is not to abandon long-established principles of chemotherapy, but to implement them with greater vigor. Summarizing epidemiological insights from population biology, the book stresses the need to take a more inclusive view of the factors that affect disease, including characteristics of the pathogen, individuals and populations, health care systems, and physical and social environments. In broadening the horizons of TB research, the book demonstrates what must be done to prevent, control, and defeat this global threat in the twenty-first century.
Understanding the mechanisms driving biological diversity remains a central problem in ecology and evolutionary biology. Traditional explanations assume that differences in selection pressures lead to different adaptations in geographically separated locations. This book takes a different approach and explores adaptive diversification—diversification rooted in ecological interactions and frequency-dependent selection. In any ecosystem, birth and death rates of individuals are affected by interactions with other individuals. What is an advantageous phenotype therefore depends on the phenotype of other individuals, and it may often be best to be ecologically different from the majority phenotype. Such rare-type advantage is a hallmark of frequency-dependent selection and opens the scope for processes of diversification that require ecological contact rather than geographical isolation. This book investigates adaptive diversification using the mathematical framework of adaptive dynamics. Evolutionary branching is a paradigmatic feature of adaptive dynamics that serves as a basic metaphor for adaptive diversification, and the book explores the scope of evolutionary branching in many different ecological scenarios, including models of coevolution, cooperation, and cultural evolution. It also uses alternative modeling approaches. Stochastic, individual-based models are particularly useful for studying adaptive speciation in sexual populations, and partial differential equation models confirm the pervasiveness of adaptive diversification. Showing that frequency-dependent interactions are an important driver of biological diversity, the book provides a comprehensive theoretical treatment of adaptive diversification.