The Origins of Order: Self-Organization and Selection in Evolution

Stuart Kauffman here presents a brilliant new paradigm for evolutionary biology, one that extends the basic concepts of Darwinian evolution to accommodate recent findings and perspectives from the fields of biology, physics, chemistry and mathematics. The book drives to the heart of the exciting debate on the origins of life and maintenance of order in complex biological systems. It focuses on the concept of self-organization: the spontaneous emergence of order that is widely observed throughout nature Kauffman argues that self-organization plays an important role in the Darwinian process of natural selection. Yet until now no systematic effort has been made to incorporate the concept of self-organization into evolutionary theory. The construction requirements which permit complex systems to adapt are poorly understood, as is the extent to which selection itself can yield systems able to adapt more successfully. This book explores these themes. It shows how complex systems, contrary to expectations, can spontaneously exhibit stunning degrees of order, and how this order, in turn, is essential for understanding the emergence and development of life on Earth. Topics include the new biotechnology of applied molecular evolution, with its important implications for developing new drugs and vaccines; the balance between order and chaos observed in many naturally occurring systems; new insights concerning the predictive power of statistical mechanics in biology; and other major issues. Indeed, the approaches investigated here may prove to be the new center around which biological science itself will evolve. The work is written for all those interested in the cutting edge of research in the life sciences.

Stuart Kauffman, M.D.

, is a MacArthur Fellow, and a philosopher, biologist, evolutionary theorist, and one of the founders of the discipline known as complexity.

"Biology is the science of the organizational principles that make living things living. Kauffman's book is a massive attempt to provide the foundations for a theory of such organization. . .The book is as much an explication of a specific style of scientific thinking as it is a book on adaptation, the origin of life, and ontogeny. The style of thinking can be characterized by the assumption that there are deep and simple conceptual structures that will allow us to understand life and not merely describe it. . .I hope that Kauffman's book will be a strong stimulus for many scientists to search actively for the principles that govern the organization of living states of matter." --Science

"This book does a real service in building a bridge between reductionist and holistic ways of thinking about systems. . .Kauffman writes with great intelligence and clarity and is able to bring together a large range of theory and experimental information without getting bogged down in detail." --Whole Earth Review

"For all the recent advances in molecular biology, we still lack a convincing explanation of how self-organising and self-replicating entities originated. Stuart Kauffman enters this arena with a book that seeks to show that self-organising structures of great complexity can assemble themselves much more easily, and much more understandably, than

previous intuition suggested. . .Building on recent work in nonlinear mathematics, the idea at the heart of the book is truly important: even in vastly complicated interactive networks, a few simple rules can easily--if amazingly--lead to order and self-organised patterns and processes. This represents a major advance in understanding how the living world works." --Robert M. May, The Observer

"Stuart Kauffman's book. . .is a global representation of a new field, that will greatly enhance our physical understanding of Nature. It treats from a physical standpoint the processes of molecular selfordering, as biologists witness them in the living world, and it does so in a most original and authoritative way. A superb reading, not limited to physicists and biologists, having most important implications in natural philosophy." --Manfred Eigen, Max-Planck Institut f r Biophysikalische Chemie

"There are very few people in this world who ever ask the right questions of science, and they are the ones who affect its future most profoundly. Stuart Kauffman is one of these. Read this book." --Philip Anderson, Nobel Laureate, Dept. of Physics, Princeton University

"The conventional concept of Darwinian evolution views populations of organisms as randomly varying systems shaped to adaptation by the external force of natural selection. But Darwinian theory must be expanded to recognize other sources of order based on the internal genetic and developmental constraints of organisms and on the structural limits and possibilities of general physical laws. Stu Kauffman has been exploring these unorthodox sources of order for many years and has now produced an integrative book that will become a landmark and a classic as we grope towards a more comprehensive and satisfying theory of evolution." --Stephen Jay Gould, Harvard University

"Has there been time, since the origin of life on earth, for natural selection to produce the astonishing complexity of living organisms? Kauffman offers a new and unorthodox answer to this question. Given what we know about the way genes signal to one another, he argues that complexity can arise more readily than one would expect. I am not sure he is right, but I am sure that we should take his ideas seriously. --John Maynard Smith, University of Sussex

"Professor Kauffman's book is highly imaginative and provocative." --Lewis Wolpert, University College and Middlesex School of Medicine

"The facile claim that natural selection can accomplish every adaptive change fails to grapple with the problems posed by a highly structured system with its own laws of assembly and interaction. Stuart Kauffman's book, The Origins of Order, returns the problem of evolution to the central issue that evolutionists have been avoiding for too long,

the problem of the evolution of a complex, organized system that we call, appropriately, an organism. Evolutionists had better take Kauffman's arguments seriously." --Richard C. Lewontin, Harvard University

"I rarely agree with Stuart Kauffman, but I always enjoy arguing with him. If you are interested in novel theories, buy this book--you will find lots of ideas worth wrestling with." --Leslie E. Orgel, The Salk Institute

Other Books
In Silico Bees, Bees are critically important for ecosystem function and biodiversity maintenance through their pollinating activity. Unfortunately, bee populations are faced with many threats, and evidence of a massive global pollination crisis is steadily growing. As a result, there is a need to understand and, ideally, predict how bees respond to pollution disturbance, to the changes over landscape gradients, and how their responses can vary in different habitats, which are influenced to different degrees by human activities. Modeling approaches are useful to simulate the behavior of whole population dynamics as well as to focus on important phenomena detrimental to bee-life history traits. They also allow simulation of how a disease or a pesticide can impact the survival and growth of a bee population. In Silico Bees provides a collection of computational methods to those primarily interested in the study of the ecology, ethology, and ecotoxicology of bees. The book presents different cases studies to enable readers to understand the significance and also the limitations of models in theoretical and applied bee research. The text covers modeling of honey bee society organization, infectious diseases in colonies, pesticide toxicity, chemical contamination of the hive, and more. Written by an international team of scientists, this book is of primary interest to those whose research or professional activity is directly concerned with the study of bees. It is also intended to provide graduate and post-graduate students with a clear and accessible text covering the main types of modeling approaches that can be used in terrestrial ecology and ecotoxicology.
□ □ □ □ □ . Written by an international team of scientists, this book is of primary interest to those whose research or professional activity is directly concerned with the study of bees."