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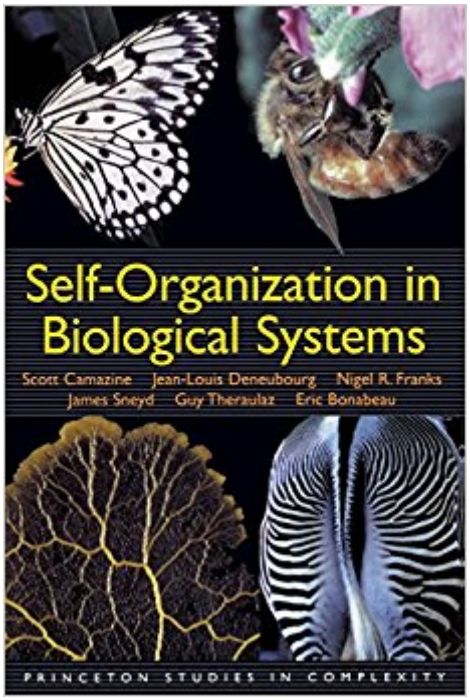
Self-Organization In Biological Systems (Princeton Studies In Complexity)



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Synopsis

The synchronized flashing of fireflies at night. The spiraling patterns of an aggregating slime mold. The anastomosing network of army-ant trails. The coordinated movements of a school of fish. Researchers are finding in such patterns--phenomena that have fascinated naturalists for centuries--a fertile new approach to understanding biological systems: the study of self-organization. This book, a primer on self-organization in biological systems for students and other enthusiasts, introduces readers to the basic concepts and tools for studying self-organization and then examines numerous examples of self-organization in the natural world. Self-organization refers to diverse pattern formation processes in the physical and biological world, from sand grains assembling into rippled dunes to cells combining to create highly structured tissues to individual insects working to create sophisticated societies. What these diverse systems hold in common is the proximate means by which they acquire order and structure. In self-organizing systems, pattern at the global level emerges solely from interactions among lower-level components. Remarkably, even very complex structures result from the iteration of surprisingly simple behaviors performed by individuals relying on only local information. This striking conclusion suggests important lines of inquiry: To what degree is environmental rather than individual complexity responsible for group complexity? To what extent have widely differing organisms adopted similar, convergent strategies of pattern formation? How, specifically, has natural selection determined the rules governing interactions within biological systems? Broad in scope, thorough yet accessible, this book is a self-contained introduction to self-organization and complexity in biology--a field of study at the forefront of life sciences research.

Book Information

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Customer Reviews

One of Choice’s Outstanding Academic Titles for 2002Winner of the 2001 Award for Best Professional/Scholarly Book in Biological Science, Association of American Publishers"We suspect that the ideas associated with self-organization will play an increasingly prominent role in biology for some time to come. . . . Self-Organization in Biological Systems presents a unique opportunity to watch a group of active researchers apply these intriguing concepts to formerly mystifying feats of social organization in animals. We know of no better guide for those who wish to understand how modeling can be used to dissect the mechanisms of self-organized biological systems."--John W. Pepper and Guy Hoelzer, Science"[An] exceptionally well organized and superbly illustrated volume."--Choice"An important contribution to biology, and to complex systems research more generally, and certainly an enthralling subject."--Carl Anderson, Complexity"This is a fascinating and thought-provoking book. . . . The authors provide an excellent introduction to the main ideas underlying the theory of self-organization and also deal with some of the criticisms leveled at this emerging field. . . . An eminently readable and stimulating book."--Jens Krause and Iain Couzin, The Quarterly Review of Biology"This book is an entertaining and well-written introduction to the basics of self-organization. . . . Given the clear prose and interesting examples, this book should have wide appeal."--Diane Lipscomb, Science Books & Film"Considering the complexity of the subject, this account is surprisingly and pleasantly accessible and readable. It is one of the few biology books that will appeal equally to research workers and undergraduates."--Bulletin of the British Ecological Society"Broad in scope, thorough yet accessible, this book is a self-contained introduction to self-organization and complexity in biology--at the forefront of life sciences research."--Zentralblatt MATH

This ambitious volume has the potential to be a pivotal (even breakthrough) contribution to the biology of complex systems. It aims to facilitate both conceptual understanding and also correct application of the principles of self-organization in a biological context. --This text refers to an out of print or unavailable edition of this title.

This book is a wonderful treatment of self-organization in biological systems (as per title...) The writing is extremely accessible and the case studies very illuminating. One of the great virtues of the studies in here is how careful the writers are of making hasty assumptions in modeling complex

systems and self-organization. They are explicit about the limitations of each model and the assumptions built into each. I found it to be a very responsible text in a field that has been booming with publications often striding from one hasty assumption to the next.Another property I found very valuable, as someone interested in emergence and complexity in human systems, is the description of other kinds of organizational processes that, while many may not appear in cellular slime molds, may occur more routinely in human society. For instance, one of the chapters on wasps (I believe it was on nest construction) discussed the role of stigmergy (response to work done) in the construction of nests, which would be different than the common multi-agent self-organizing processes assumed for many of the models. This further suggests the intellectually responsible methodology of the authors. Excellent book and a fun read!

I strongly agree with everything the reviewer above had to say.... with one caveat. At several points in the text, the authors refer to programs that apparently were available on the web when the book first appeared. If anyone out there knows where that site migrated, you'd be doing the readers of this book a great service by letting us know.Otherwise, this is a very interesting text, well worth it.

A very good read. Enjoyed every chapter. No complaints!

Wow, it looks dense! Binding looks sturdy and the pages look to be made of thick enough paper that my scribblings wont leak through the pages!I wish there was an e book version I ould have gotten though, my eyes are just not what they once were, and I admit to having really gotten addicted to the increase font function on computers and e readers!

I buy a used book, but I cannot find out any difference with a new one!The shipment was much quicker than I expect. It was supposed to be delivered with 6 week, but I got it within 2 weeks.

Many books containing theory upon theory about self-organization in the biosphere have appeared in recent years. This book could be an important catalyst towards putting more of these theories to the test. While it has long been recognized that self-organization could be important in biological systems, many of these studies are computational models only. Many are very convincing, but unless steps are taken towards verifying these models and scrutinizing their validity, it is very difficult to know whether the theories have any real value towards understanding real life.The strenght of this book lies in its rigorous introductions to the relevant theoretical concepts in

self-organization, followed up by a general debate of self-organization versus competing explanations. The book spends many chapters looking at particular natural phenomena in detail, and examines possibilities for self-organization in these. In spite of the fact that these chapters have different authors, they follow each other well. The book is unusually well put together for this kind of collection of works by multiple authors.The majority of the case study chapters involve studies of social insects, which narrows the topic a little in comparison with the more ambitious title. Self-organization also occurs elsewhere in biology, and personally I am a little dissapointed that a wider range of case studies were not chosen for the book. This could have spawned more interest and further work in other areas of the field.However, the book is definitely well worth reading for biologists and other scientists interested in self-organization, and represents a major step towards establishing studies of self-organization in biology as a serious field.

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