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Book Review: *Fluctuations and Scaling in Biology*

Fluctuations and Scaling in Biology. Tamas Vicsek. Oxford University Press, 2001, 246 p.

This book is one of the more recent ones in the field of biologically inspired physics. It is written by a group of researchers that have contributed to the various subdomains of this field and edited by T. Vicsek, a noted researcher utilizing techniques widely applied by the school of H. E. Stanley. The book is an idiosyncratic mixture of interesting problems related to biological physics and gives a certain broad perspective on applications of scaling, noise and (self-organized) critical phenomena (SOC) as applied to physiological and ecological systems. Though I found the choice of topics interesting and the book well written, it lacks the focus and depth that would make it a required reading for people working in the field. On the other hand I do believe it can become a very appropriate introductory text for interested physicists and graduate students trying to understand how methods mainly developed in statistical physics can be applied to describe the growth and distribution of species, as well as certain classes of physiological phenomena. The book is organized as a set of essays on different phenomena that are first of all biologically relevant and interesting. Further, they allow for creative applications of concepts and methods derived in the framework of critical phenomena, SOC, scaling analysis and fluctuation analysis. Various problems described in the book include: the dynamics of bacterial colonies, statistical analysis of DNA sequences, analysis of brain electrical activity, microscopic mechanisms of molecular motors, flocking in animal groups and correlated motion of pedestrians. Of all the chapters I find the most well written and informative one to be on molecular motors and the most interesting one to be the one on collective motions. All of the topics summed up in the book have recently seen a period of intense study leading to a number of interesting and fundamental results and insights. Conveniently, the book starts with a brief course on the basic concepts of fractal geometry, stochastic processes, continuous phase transitions and self organized criticality. All of these

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essays are mostly informative with a brief description of major results and methods. They are basically geared to an audience with some knowledge in these fields. Then follow the chapters with specific applications to biology (this term is used very cavalierly since we have examples from very different domains of life sciences). Each of these chapters starts with a broad and fairly well written introduction to the problem and then discusses some specific points mostly connected with the previous work of the authors. Some phenomenology and some results of detailed calculations are presented with ample referencing to original papers for followups. The quality of the chapters varies quite a bit and I find the best ones being written by Vicsek himself. I think for the most part the authors do choose interesting problems and they present them in digestible form. There is however a fundamental lack of unity to the discussion which however pertains to the subject field itself and is no fault of the authors themselves. Some readers might be bothered by that but others might just go for whatever subject they want to learn about. As already pointed out the drawback of the book is that it does not really give a throrough in- depth coverage of any of the topics. That does not mean that the book is superficial, but researchers trying to work on these topics will have to turn to original literature, amply cited in the book, to pursue their interests. On the other hand I would tend to hand out the book to graduate students who would like to learn something more about this area of research, its methods, and its outstanding problems. In this respect the authors of the book have accomplished what they have set out to do. I think that in this way the book will find its readers.

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