Growth Patterns in Physical Sciences and Biology, edited by Juan Manuel Garcia-Ruiz, Enrique Louis, Paul Meakin, and Leonard M. Sander

Plenum Press, New York, 1993. 429 pages. $115.00

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This volume, the three hundred and fourth in the NATO ASI (Advanced Scientific Institute) Physics Series, consists of a set of papers given at a 1991 NATO Advanced Research Workshop "organized with the objective of bringing together physicists and biologists with a common interest in pattern growth and in applying new tools across the areas of their disciplines to explore the similarities and differences in their subjects." The forty-four chapters, loosely organized into eight sections (Cell Colonies, Surface and Interfaces, Diffusion Limited Aggregation, Viscous Fingering and Fracture, Cellular Patterns, Dynamical Systems, Self Replication, Self Organization, Measurement and Characterization), do indeed present an impressive, almost overwhelming array of experimental and simulated patterns accompanied by discussion of a powerful set of experimental and theoretical tools and models. On the other hand, despite its many successes, I found "Growth Patterns" taken as a whole to be a less than totally satisfactory presentation of its subject matter.

Most of my reservations apply not specifically to "Growth Patterns," but to the genre of conference and workshop proceedings. A colleague recently observed that conference proceedings are where he publishes results that have been sitting in a drawer because they weren't quite ready to be published in a refereed journal. Those whose drawers happen to be empty at the moment may recycle or repackage previously published results. Why should this be so, and is it necessarily a bad thing?

The typical two year delay, which occurs in "Growth Patterns," between the conference or workshop and the publication of the proceedings accounts in large measure for the reluctance of most workers to relegate exciting new results to proceedings. If such results are sent first to a proceedings volume, they are usually "scooped" by another publication of the same material, submitted later, but appearing sooner, in a refereed journal. The narrower readership of most conference volumes compared with journals is also a consideration for most authors.

Despite this difficulty in obtaining the very newest material, conference proceedings can, and often do, play a valuable role in bringing previously disparate subjects together or in providing an introduction to a field for those seeking to enter it. These functions, however, require somewhat more editorial intervention than is often exercised, or indeed, has been shown in "Growth Patterns." The present collection, as far as I can see, consists of a very brief introduction by the editors plus a complete or nearly complete set of camera-ready submissions of widely varying length and quality by the presenters at the workshop. Typographical and grammatical errors abound. More seriously, no effort was made to select a few of the best papers for expansion, to provide some connecting material and a glossary of terms to bring together the wide range of topics covered, or to include some of the discussion during which, presumably, biologists and physicists engaged one another in dialogue. "Growth Patterns" was probably a successful and exciting workshop, but that success and excitement are only weakly perceptible from the proceedings.

Despite my quarrels with its format, I found much of value in "Growth Patterns." The volume contains contributions from essentially every major worker in the field. The reader who seeks examples of pattern formation in systems ranging from bacterial colony formation to zinc electrodeposition will be rewarded by a visually impressive and suggestively similar encyclopedia of such phenomena. A variety of model calculations, primarily using the diffusion limited aggregation and Eden models, show that we can generate and, to some extent, understand the origins of many of these patterns.

A number of contributions provide fresh ways of looking at biological problems and hint at the potential power of an interdisciplinary approach. I was impressed, for example, by the discussion of "toys" and "models" and the call for a "physical biology" in the treatment of *dictyostelium* aggregation by Levine and Reynolds, by the characterization of long range order in intron DNA's by Stanley et al, by the clear understanding of the differences between biological and nonbiological patterns ("no two lightning strokes are identical...elements of basic body patterns are very reproducible") in Meinhardt's review of deterministic models of biological pattern formation, and by the ferrofluid experiments and computer simulations offered by Douady and Couder in an attempt to understand the origin of phyllotaxis. Even Selig and Mandell's treatment of popping frequency in microwave popcorn as an analog of bursting intermittency in

neural firing, a subject strongly suggestive of the drawer-emptying approach mentioned above, provided some thought-provoking ideas.

I suspect that most readers of *Biophysical Journal* will find the book's contributions weighted too heavily toward physics. Less than a third of the chapters address biological problems, and of these only a smaller subset attempt to forge links between biology and physics. The few papers that do address "the confrontation between the point of view of physics and biology" that the editors refer to in their introduction offer valuable insights, a hint of what this volume might have been and perhaps of what the workshop was for those who were there.

Electricity and Magnetism in Biology and Medicine, edited by Martin Blank

San Francisco Press, Inc., San Francisco, 1993. 940 pages

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Electricity and magnetism attract public attention. Especially in recent years, the public has become concerned about the potential risk of cancer and other health related problems caused by the exposure of large populations to the ever increasing electromagnetic pollutants in our environment. These concerns have stimulated discussion among scientists and have resulted in the formation of numerous organizations. Four of these organizations, Bioelectromagnetic Society (BEMS), Biological Repair and Growth Society (BRAGS), Bioelectrochemical Society (BES), and the European Bioelectromagnetic Association (EBEA), joined forces to organize the First World Congress for Electricity And Magnetism in Biology and Medicine, which was held in June 14–19, 1992 in Florida. The Congress attracted nearly 400 participants from every continent. This book is the proceedings volume of the Congress, covering more than 270 presentations. Not every presentor submitted a report, however. I have found no reports in this volume on some of the interesting presentations. Still, the volume covers topics as diverse as the epidemiology of environmental electromagnetic fields (EMF), effects of microwave radiation on health, electromagnetic bone healing, electroporation and electrofusion of cell membranes, electromechanical transduction, molecular electronics and molecular computers, electric wire codes, exposure assessment, science policy, and more than 20 sub-fields of biological electromagnetic research. Most of the active investigators in these areas today can be found from the list of contributors. As such, the volume represents a Who's Who in electric and magnetic fields research, their studies of effects of electric and magnetic fields on cells and organisms, and medical and health implications arising from these interactions.

Electromagnetic fields can cause numerous changes in cells. Some are easily discernible, and others are not. Those reactions induced by high intensity electric fields (100 V/cm and greater) are easily observed or measured. They can be quantitatively studied using common biochemical methods. The reproducibility of these experiments is good, and effects of electromagnetic fields are seldom in doubt. Electroporation, electrofusion, electrotransfection (electric pulse-facilitated transfection of cells by foreign DNA), electroinsertion (incorporation of recombinant membrane integral proteins into cell membranes by the aide of electric pulses), electrorotation of cells, electroactivation of membrane enzymes, etc. belong to this category. Results of studies with low fields (mV/cm, mTesla, or lower), on the other hand, are not as reproducible as the high field experiments, mainly because of the small effects and the potential interference of the ambient electromagnetic fields and other environmental disturbances surrounding an experiment. However, many investigators have reported that such levels of EMF can cause changes in gene expression, in the activities of certain membrane enzymes, in neuron and embryo development, in cell morphology, in cell transformation, or increased cancer risk in the EMF-exposed population, etc. The volume also includes studies of electrochemistry of biological reactions, especially those of the photosynthetic reactions, the redox reactions, and reactions of molecules in organized molecular arrays or micro structures, although these reactions are investigated with respect to their potential utility in molecular electronics or molecular computers.

Electromagnetic fields are media-suitable for the rapid transmission and reception of signals over distance, in contrast to chemical signaling, which is effective only for communication at short distances. This being the case, the possible implication of low level electromagnetic fields in cell-to-cell, organ-to-organ, and organism-to-organism communication has not been seriously or systematically