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

Reviewed by Tian Y. Tsong, Hong Kong University of Science and Technology and University of Minnesota

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

explored. There are even questions, especially from the policy makers of the federal funding agencies, whether studies of this sort of cellular activities are essential for biomedical research, or in the mainstream of the modern biological sciences. However, a conference that could attract several hundred attendees must reflect considerable interest in this topic in the scientific community. This volume gives readers a glimpse of an emerging area of interdisciplinary research. Readers who are looking for a more in-depth understanding of EMF effects on biosystem or mechanistic information will find the short report format of the book unsatisfactory. These short papers also defy judgment on the reliability of data and the credibility of experiments because the details of these experiments cannot be presented in a two-page report. However, most abstracts give references to which readers can refer. This volume will not help a student gain knowledge in the field because a student is more likely to be overwhelmed by the vast knowledge that is required to understand these experiments and be confused by the broadness of the field. However, the volume should be a useful reference for investigators who wish to update their knowledge or to find names and references in biological electromagnetics for otherwise difficult to find information.

Cell Biological Applications of Confocal Microscopy, edited by Brian Matsumoto

Academic Press, San Diego, 1993. 380 pages. $49.95

Reviewed by Ray A. Ghanbari, Department of Pharmacology, Mayo Foundation

For the past several years, the *Handbook of Biological Confocal Microscopy* (edited by James B. Pawley, Plenum Press, 1990) has been the resource of choice for investigators seeking information on techniques and methodologies for biological confocal microscopy. Unfortunately, rapid changes in the capabilities of commercially available instrumentation, and the availability of a wide variety of new fluorescent dyes, have made many of the practical details in the volume less relevant for new microscopists. "Cell Biological Applications of Confocal Microscopy," the latest volume in the fine *Methods in Cell Biology* series, seeks to fill this void by presenting in one volume a variety of contributions targeted specifically to researchers who seek to quickly become proficient at confocal microscopy.

The first half of the volume focuses on the more technical aspects of biological confocal microscopy, including introductory chapters on confocal microscopy, video rateconfocal microscopy, sample preparation techniques for three-dimensional imaging, and labeling techniques for multicolored immunofluorescence confocal microscopy. Of particular note are the chapters contributed by L. Majlof and P.-O. Forsgren of Molecular Dynamics, and Wright et al. of the University of Wisconsin, which do a superb job detailing the various optical factors that can adversely affect confocal imaging, as well as provide detailed protocols for sample preparation to avoid artifacts during three-dimensional imaging.

However, the bulk of the first part of the book is the 85-page opus by T. Clark Brelje et al. of the University of Minnesota on multicolored confocal immunofluorescence microscopy. Although of daunting size, this chapter serves as a wonderful technical reference for a wide variety of fluorophores commonly used for antibody staining. Each fluorophore is briefly described, including discussions on typical applications, advantages, and shortcomings, as well as measured excitation and emission spectra for each dye. Knowledge of these spectra is particularly important when imaging samples that have been double- and triple-labeled, to avoid cross-talk between various detection channels. The chapter by Brelje et al. also includes detailed discussions about laser and filter combinations necessary to image samples double and triple labeled with a variety of common dyes.

Although the first half of the volume serves as an introduction to confocal imaging and sample preparation, the second half focuses more on specific applications of confocal microscopy, with topics ranging from imaging of the development of neuronal projections to imaging of sea urchin embryogenesis and endoplasmic reticulum. Most of the chapters are expanded versions of previously published work, with greatly expanded methods sections. In particular, the chapter by Cornell-Bell et al. of Yale University on membrane glycolipid trafficking in acinar cells includes a very detailed methods section, including details on the design of perfusion chambers for confocal imaging. Given the variety of applications that are included, chances are good that readers will find sample preparation and imaging protocols that are relevant to their work.

Overall, "Cell Biological Applications of Confocal Microscopy" is a first rate resource for investigators interested