sort of omission is not just a matter of history: There are places where the adoption of a different technique would produce results far more transparent—for example, the calculation of determinantal factors by the parametric method of Bruno Zumino and Charles M. Sommerfield is far clearer, while touching related aspects of gaussian functional integration, than the ζ-function method Ramond uses (the essence of which appeared in Schwinger's papers and lecture notes almost 30 years ago). Another annoying aspect of this neglect of the work of others is notational—for example, the use of the symbol Δ_F to represent the causal propagator Δ_C of E. C. G. Stückelberg and Schwinger—and can present a problem to younger readers who might lose a factor of $2i$ in transcribing the notation of this book to, for instance, the canonical QED work of Freeman Dyson (no reference to him, either). There are better ways to describe the physical content and calculation of the Lamb shift, even when one is restricted to a single page. And there *is* a distinction between a Feynman path integral (FPI) and functional integration, although by page 333 the use of "FPI" has mercifully given way to the phrase "generating functional." And so on.

However, these complaints and annoyances must not stand in the way of the really good material which Ramond presents, at just the right level, for his introductory course. The best sections are those dealing with supersymmetry, dimensional regularization, renormalization-group arguments, and various topics centering about Yang–Mills interactions. Many things are missing, but these really important modern topics are handled just right. In addition, there are small sets of very nice problems at the end of each chapter, a very useful part of any text at this level. The references appended to each section could be more extensive, but they are certainly adequate, and the serious student should have no difficulty in using this book as a jumping-off point for more detailed studies.

In summary, while I suspect the author has spent too much time at Caltech, he has nevertheless put together a book that can be used with profit by students everywhere. Buy it—but watch those factors of $2i$!

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Electric Fields of the Brain: The Neurophysics of EEG

P. L. Nunez
484 pp. Oxford, New York, 1981. $45.00

Electrical signals connect the billions of neurons in the human brain via a dense network of fibers of incomparable complexity. The signals consist of changes in membrane potentials propagated by cable conduction along dendritic fibers and by a regenerative process along axons. These so-called *action potentials* mediate postsynaptic potentials on the dendritic membranes of other neurons across special junctions, the *synapses*. Not only does communication occur over these private lines, but also special chemicals that affect groups of neurons equipped with appropriate receptor sites are broadcast throughout the nervous system. How are we to monitor the performance of this incredibly complex system?

One of the main tools of the neurophysiologist has been the microelectrode. Developed in the 1940s, it allows the experimenter to select a particular neuron for study and obtain a precise record of its electrical activity. By comparison, the alternative of recording electrical changes by gross electrodes attached to the scalp—while having the virtue of being noninvasive—was at first crude and rather uninformative. Initially, only certain global features, the various EEG rhythms, could be made out in the squiggly lines of the recordings and assigned to particular states.

The increasing importance of the EEG has emerged from a better understanding of the relationship between scalp potentials and the various current sources in the brain, especially in the cerebral cortex. In another dramatic development on-line computer averaging of large numbers of EEG traces has brought out the so-called *event-related potentials* or *evoked potentials*. Unlike the unprocessed EEG, these waveforms are highly reproducible in detail and represent the course of activity in specific cortical and subcortical centers following a sensory stimulus.

Today the EEG is a widely used and valuable clinical tool whose diagnostic capabilities include "brain tumors, epileptic conditions, infectious diseases, mental retardation, head injury, drug overdose, and ultimately brain death."

In *Electric Fields of the Brain* Paul Nunez, a research neuroscientist at the University of California Medical School in San Diego, aims to bridge the "communications gaps between the many scientific fields related to EEG research." The book is written with the understanding that many clinicians who use EEG techniques routinely do not thoroughly comprehend the physical principles involved.

At the same time Nunez attributes the "paucity of good physics and engineering support for EEG studies" to "the reputation of EEG as a scientific backwater." While EEG research has long outgrown that early reputation, the scientific support is still inadequate. This volume therefore fills an urgent need. It brings together the encephalographer and the physicist and enlightens both. It belongs on the bookshelf of anyone working in the broad and burgeoning field of neuroscience. Reginald G. Bickford is fully justified when he predicts in a brief foreword that the book will become "a classic in the field," comparable to Robert Plonsey's 1968 *Bioelectrical Phenomena*.

The author's language is exceptionally clear throughout, even in the necessarily technical discussions. In eleven chapters Nunez takes the reader from a general description of the nature of cerebral current sources and an overview of electromagnetic theory to more detailed treatments of current sources in homogeneous and inhomogeneous media. Discussions follow on temporal and spatial properties in EEG, neural circuits and brain waves.

A practical discussion of EEG techniques, contributed by Ron D. Katznelson, covers electrode placement, multichannel recording and the problem of locating current sources and sinks and includes a brief and elementary discussion on brain-generated magnetic fields and their detection by means of SQUID devices. In another chapter Katznelson attempts to relate details of cortical microstructure, in particular, the cortico-cortical connections and their intrinsic time delays to the dominant frequency components in the EEG.

There are eight appendices that cover such topics as quasistatic formulation of Maxwell's equations (with particular attention paid to the dielectric properties of tissue and membrane), the membrane diffusion equation, and specialized matters, including dipoles and dipole layers inside concentric spheres.

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The Physics of Glaciers

W. S. B. Paterson
Second edition, 380 pp. Pergamon, New York, 1981. $48.00 cloth, $17.50 paper

The second edition of W. S. B. Paterson's book on *The Physics of Glaciers* will be welcomed by glaciologists and glacial geologists. Paterson's first edition (1969) became one of the most quoted sources for glaciological data, concepts, and ideas and enjoyed wide acclaim from his peers. As Paterson notes in the preface to the second edition, the 12 years that have passed since the publication of the first edition have seen major advances in glaciology. These new advances have been incorporated into existing chapters in many cases, and when the advances have been sufficiently extensive they