lytic "objectivity." This, in short, is not the book *I* would have written. But then, why should it be?

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Introduction to Bioengineering

Edited by Stanley A. Berger, Werner Goldsmith and Edwin R. Lewis
Oxford U. P., New York, 1996. 526 pp. $110.00 hc
ISBN 0-19-856516-X

Bioengineering, sometimes called biomedical engineering or bioelectronics, among other things, had its historical beginnings in antiquity, as for example, the ancient Greek use of electric discharges from eels to treat certain disorders. A more recent example is the invention of the stethoscope in 1819 by René Théophile Hyacinthe Laënnec, the father of chest medicine, when a demure patient refused to allow him to set his ear directly upon her chest to examine her chest sounds, the common practice of the time. The field grew rapidly after World War II, when discharged servicemen and women flocked to colleges and universities, as did many scientists and engineers who had worked in industry and government laboratories during the war.

Among the latter were those who had been educated in the physical sciences and had studied on their own the biology they needed to pursue the bioengineering studies they proposed to undertake. The next-generation engineering students had more opportunity for formal training; they had access to engineering classes dealing with the biology pertinent to their thesis topics. The field has now progressed to the point where students can enroll in undergraduate and graduate bioengineering degree programs, complete with laboratory courses, texts and tenured faculty.

Introduction to Bioengineering, edited by Stanley A. Berger, Werner Goldsmith and Edwin R. Lewis, results from such a program, initiated about 1975 at the University of California, Berkeley, as a two-semester course. It comprises 14 chapters by 19 authors representing mechanical, electrical, chemical and nuclear engineering, and orthopedics and human biodynamics. The book is intended to be at the intermediate undergraduate level, meaning that the student is expected to have already taken basic university courses in mathematics, physics and chemistry. The student coming from the life sciences, without the first-level mechanics and electrical science courses, will probably have to do extra study; an adequate bibliography is provided for this purpose.

Mechanics of solids is presented first, followed by two chapters on fluid mechanics and one each on mass transfer and heat transfer, the general material of mechanical and chemical engineering studies. Next come two chapters on systems and circuits from electrical engineering, which also include the application of mechanics principles. The two chapters dealing with biomaterials that follow also build on the mechanics chapters. Five chapters dealing with, respectively, locomotion and muscle biomechanics, electrophoresis, imaging, ionizing radiation and nonionizing electromagnetic fields, and an appendix dealing with linear transforms, complete the text.

The first nine chapters of underlying, basic material are very quantitative in both discussion and approach and contain worked examples of applications of the principles, many of which are a delight to read. These chapters also provide a reasonable number of homework-type problems, about half of which are supplied with answers. The last five chapters are decidedly less quantitative, with few if any worked examples. Some lack even homework problems for students to practice on.

Though the book should not be criticized too severely for not covering all aspects of an extremely broad topic, I feel compelled to remark that the field to which I devoted 45 years, bio-ultrasonics, receives very little attention, with no mention at all of contrast agents employed for imaging purposes or of physical interaction mechanisms for therapeutic purposes. No doubt there are other topics omitted. Nevertheless, the book can be recommended for those early mechanics-and-circuits and systems chapters, which may be sufficiently extensive to serve alone in rather specialized courses. Similarly, the book could be considered as a reference on how to approach certain biomechanics problems.

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Nonlinear Optics

E. G. Sauter
Wiley, New York, 1996. 214 pp. $59.95 hc ISBN 0-471-14860-1

Nonlinear optics is now a well-established subdiscipline of physics having important extensions to other areas of both fundamental and technological interest. Its study, once concentrated in specialized graduate courses, is increasingly being shifted to the undergraduate level, and it now constitutes an integral and indispensable part of any modern textbook in optics, optical engineering or laser applications. This development has created a need for an appropriate introduction to the subject to go along with the well-established advanced treatises being used by graduate students and practicing scientists.

E. G. Sauter's *Nonlinear Optics* is a simple and well-focused attempt to satisfy this need. It presents the subject in a way that can serve as an introduction for advanced engineering students or engineers who have minimal training in physics or optics but a good command of electromagnetic propagation. The book's presentation of the interaction of light and matter is entirely classical, occasionally illustrated by reference to the classical forced anharmonic oscillator but devoid of any quantum mechanical considerations. The focus of the book is the presentation of some key nonlinear effects in propagation; the generation of the corresponding nonlinear polarization terms is taken for granted.

The book contains eleven chapters. Nonlinear polarization is disposed of in the first, where the main macroscopic characteristics of nonlinear susceptibilities are stated. In chapter 2, a much simplified version of the slow varying envelope approximation is presented and used to derive the nonlinear propagation equation in an anisotropic medium.

In the following three chapters, the essentials of the second-order (quadratic) propagation effects are discussed; these include the effects—Pockels, optical rectification and Faraday effects—arising from modification of the linear optical properties by static fields (chapter 3), second harmonic generation in the weak regime in some specific beam configurations (chapter 4), and a summary of the parametric quadratic effects, including frequency mixing, amplification and oscillation (chapter 5).

In chapters 6 through 8, a few third-order (cubic) optical effects are briefly discussed, with an attempt to include as well their resonant behavior, but this is reduced to its minimal form because of the inadequacy of classical models, on which the presentation relies, to account properly for the resonances. Also mentioned pell-mell are the Raman and Brillouin effects (chapter 6); effects such as optical bistability and self-focusing, which are related to the optical Kerr modification of the refractive index, (chapter 7); and degenerate four-wave mixing (chapter 8).

The final three chapters concern pulse propagation in optical Kerr me-