construct a mathematical model of the arteries. As it stands, these pieces of information are not yet in sufficiently quantitative form to be used directly for mathematical modeling. But this is an important first step.

The same can be said of the five chapters on circulation in the abdominal viscera, the extremities, the kidney, the nerves, and the innervations of arteries. The unhurried presentation is delightful.

Dr. Strandness's chapter on collateral circulation and Dr. Ludbrook's two chapters on the measurement and regulation of blood pressure, flow, and resistance are brief, but superior.

I believe that this book supplies a lot of information which is needed by the bioengineer and thus should be in the bioengineer's reference library.

Cardiac Dynamics, edited by Jan Baan, Alexander C. Arntzenius, and Edward L. Yellin, 549 pp., $81.60, Martinus Nijhoff, Hague/Boston/London, 1980.

This is a volume of the proceedings of a meeting on cardiac dynamics sponsored by the Cardiovascular System Dynamics Society. The meeting was held in Leiden, in August 1978. The volume contains 48 papers written by over 100 authors. It is divided into the following sections:

1 Cardiac muscle mechanics: from the fiber down to the sarcomere
2 Cardiac chamber dynamics: from the fiber up to the myocardium
3 Pump function and filling: interaction with the low pressure system
4 Pump function and ejection: interaction with systemic load and coronary perfusion
5 Measuring cardiac performance: aims and validity of invasive and noninvasive measurement
6 Energy losses: hemodynamics of valves

Thus, the book covers the entire field of cardiac dynamics. There are many good papers in this volume. Most of them are reviews of recent work with comments on the author's perspectives. Everyone is concise, and thus serves well for the purpose of quick review of the field.

The book opens with a provocative chapter by B. R. Jewell, who doubted the existence of a separation between inotropic state and preload. He suggests that the activation depends on the muscle length. Tei Keurs in another article supports his idea. Huntsman and Joseph, in Chapter 1.5, conclude that the contractility parameters are independent of preload only at muscle lengths larger than 85 percent of Lumax.

In the opening paper for Section 2, Sagawa discusses similarities and discrepancies between force-length relations of isolated muscle on the one hand and end-systolic pressure-volume relations of the ventricles on the other.

I find this book very useful for the bioengineer.

Biomechanics of Medical Devices, edited by Dhanjoo N. Ghista, 667 pp., $95 (price is 20 percent higher outside the U.S. and Canada), Marcel Dekker, New York and Basel, 1981.

The intensity of research and rapid advances made in the field of biomechanics is evident in this book. There are thirteen chapters:

Part 1: Monitoring Devices

Part 2: Prostheses and Implants

Part 3: Skeletal Correction and Rehabilitative Devices

From this list it is clear that the various chapters are written by authorities in the respective fields. Of the authors, Kenneth Latimer, from Middlesex, England, has passed away. Latimer coauthored two very good and useful chapters in this book, one on manometer, another on stethoscope. It is a comfort to see that these two common instruments are given the deserved attention. This book is a legacy given by Mr. Latimer to this world; it endears his name to our hearts.

An evidence of some unusual dynamics in the field of medical instrumentation can be perceived from the list of contributors. Of the 21 living authors of the book, 9 changed their affiliations between the times when the manuscripts were delivered and when the book was published. It must mean that the field and the workers in it are changing rapidly.

Dr. Kobayashi's chapter on tonometry, i.e., the measurement of the pressure in the eyeball, which is most important in the diagnosis of glaucoma, is very good. It first reviews the existing empirical and theoretical analyses on the structural responses of the corneoscleral shell due to plunger loadings by Schiotz, applanation, and Mackay-Marg tonometers. These were found to be either based on improper engineering assumptions or too complicated for clinical use. The author then describes a numerical method of solution: the finite element modeling approach using nonlinear elastic properties of the corneoscleral shell. The developed model is then used to estimate the structural response of a cornea with keratoconus for which no experimental or theoretical analysis exists.

Dr. Kobayashi's review and his presentation of the finite elements method is useful. His style is lucid and concise, informative and easily understandable. However, nothing is reported about the clinical applications of this method. Has it been used somewhere? With what kind of success? How can they be used to supplement or improve the instruments currently in use in every ophthalmologist or optometrist's office? The literature cited appears a little old: in a total of 55 references, only 4 were published after 1973, 2 in 1975 and 2 in 1977. Tonometry seems to be a neglected field. As glaucome is one of the most prevalent serious diseases of the eye, this field deserves more attention.

There are three chapters on locomotion (Chapters 3, 12, and 13), one on spine (Chapter 11), and one on hip prosthesis (Chapter 8). There is one chapter on respiratory sounds (Chapter 4), one chapter on aortic valve (Chapter 6), one on arterial grafts (Chapter 7), one on contact lens (Chapter 10), and one on material selection for direct skeletal attachment via tissue growth (Chapter 9). Altogether the book is a welcome addition to the literature. Although it is too heterogeneous to be a textbook, it is certainly a useful reference book for instruction on biomechanics. I strongly recommend this book as a reference book to clinicians and medical technologies who are interested in these devices.

The price of the book is too high. It precludes the use of the book by students. At such a high price, the evidence of cutting corners on quality is less excusable. Thus the Appendix, pp. 641–644, "Recent Developments, Chapter 3" is awkward. A very small amount of additional effort and expenditure would have enabled the author to incorporate the information contained in the Appendix into the text in Chapter 3.

Advances in Biomedical Engineering, edited by David O. Cooney, Part 1, Apr. 1980, $35.00, Part 2, June 1980, $39.50, Marcel Dekker, Inc., New York and Basel.

This two-volume set is a record of some of the advances made by chemical engineers in the field of Bioengineering. The chapters in volume are:

1 Modeling the Human Thermal System, by C. E. Huckaba and H. S. Tam
2 Heat Transfer in Tumors: Characterization and Application to Thermography and Hyperthermia, by R. K. Jain
3 Dynamics of Hemodialysis Systems, by A. L. Babb and B. H. Scribner
4 Mass Transfer in the Renal Microcirculation, by C. R. Robertson and W. M. Deen
5 Lung Microvascular Permeability: Transport Theory and Measurement Methods, by T. R. Harris
6 Drug Permeation Through Skin: Controlled Delivery for Topical or Systemic Therapy, by S. K. Chandrasekaran

The chapters in Vol. 2 are:

7 Physico-Chemical Aspects of Platelet Adhesion and Thrombogenesis, by A. Marmur and E. Ruckenstein
8 Mass Transfer in Atherosclerosis, by J. L. Gainer and G. M. Chisolm
9 Mass Transfer in Systems of Artificial Liver Support, by E. H. Dunlop
10 The Pharmacokinetics of Inert Gases, by R. S. Tepper, S. H. Hobbs, E. H. Lanphier, and E. N. Lightfoot
11 Ultrafiltration of Plasma and Blood, by W. J. Dorson, Jr., and V. B. Pizziconi

From this list one sees that the book is concerned with transport phenomena of one kind or another. The topics selected here are all of importance to medicine.

The first chapter deals with modeling of human thermal system. The hypothalamic temperature is accepted as the basic controlled system parameter. The discussion is general and clear, but the reviewer wishes that there were more hard data on the thermal properties of biological systems presented.

The second chapter, on heat transfer in tumors, is also clearly written; but it is rather brief. Hyperthermic techniques for the selective destruction of cancerous cells are discussed, but the question of how to increase the temperature locally in the tumor area without having to raise the whole body temperature is not considered in detail. Future success in practical clinical applications of hyperthermia to tumor treatment would rely on such localized heating of internal organs.

Chapter 3 presents a mathematical description of hemodialysis systems, including the transport of solutes by ultrafiltration. The following chapter discusses the complex problem of mass transfer in renal microcirculation. The great variety of transport processes in the renal tubules is not considered in any detail: the focus is on renal microcirculation, that is, on the movement of water and macromolecules based on Starling's law of membrane permeability. One of the objectives is to calculate the colloidal osmotic pressure. Besides mathematical modeling, the experimental method of micropuncture and the results obtained are discussed. But the active transport mechanisms are not discussed at all. The authors conclude that the glomerular capillary wall behaves in many respects as a membrane with uniform cylindrical pores of approximately 50 Å radius. Data obtained with various charged macromolecules lead them to conclude also that electrostatic factors are important in governing capillary permeability, and they infer that this is important in understanding certain kidney disease.

The chapter on lung microvascular permeability by Thomas Harris is excellent. It contains a detailed exposition of the indicator-dilution method.

A chapter of particular interest to the reviewer is Chapter 8, on mass transfer in artherosclerosis, by John Gainer and Guy Chisolm. This is a topic on which many papers have been published in this journal. Most papers of the JOURNAL OF BIOMECHANICAL ENGINEERING are concerned with the mechanical events, involving the distribution of shear stress, concentration profile of lipid molecules in the boundary layer, and stress modulated changes in permeability, etc. The present chapter, however, is devoted to a review of experimental and theoretical contributions made by studies of mass transfer and atherosclerosis by chemical engineers. It is interesting to note that a different set of bibliography results. Some names most familiar to mechanical engineers and hemodynamicists, for example, Blackshear, Caro, and Nerem, are not mentioned at all. Fry was quoted once, but only for one of his short reviews and not his original papers. I find this quite amusing. In the institution in which the reviewer works, there is a large and respected group of researchers on atherosclerosis; but they see the problem as a problem of nutrition and biochemistry, and the mechanical events cannot attract much of their attention.

The whole book is interesting, and is a welcome review of the field. The longer chapters, with more substantial presentation of data, are especially valuable.

Variational Methods in the Mechanics of Solids, edited by Sia Nemat-Nasser, 406 pp., Pergamon Press, 1980.

This is the proceedings of an IUTAM Symposium held at Northwestern University, Evanston, Illinois, on September 11–13, 1978. It contains 65 papers written by authors from 22 countries. Most of the papers are very mathematical in nature, but many are aimed at developing numerical methods for solving boundary-value problems. Since a bioengineer needs these methods, I am including this book on the Bioengineer's Bookshelf.

None of the papers mentioned direct applications to bioengineering except the one by Maurice Biot (pp. 29–39). In his paper entitled "New Variational Irreversible Thermodynamics of Open Physical-Chemical Continua," Biot presented a further generalization of his well-known irreversible thermodynamics method. This method is general enough to embrace biology. A special example is the active pumping of ions in biological membranes. I trust that Biot's method will become widely known to bioengineers in the future.