In claiming (chapter 7, p. 300) to have devised something comparable in significance to Einsteinian relativity, the authors indulge in hubris and bombast. The latter word reminds me, by the false etymology from his middle name, Bombastus, of Paracelsus. Brooks and Wiley have in their joint enterprise fabricated a modern similitude of his extraordinary character. Does the mixed-up medieval, initiator in his day of a fusion of chemistry and biology that was later completed in more orderly fashion by van Helmont, have the fitness to survive in the more highly evolved ecosystem of 20th-century science? Possibly, but he must take heed of his Achilles' heel, that great weakness in basics of classical thermodynamics, and do something about it.

Read this book, then as Paracelsian: muddled philosophy, to be read quickly, requiring disregard of obvious errors but with a genuine fire burning in it for provocation and stimulation.

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Muscle Contraction

Energetic Aspects of Muscle Contraction. ROGER C. WOLEDGE, NANCY A. CURTIN, and EARL HOMSHER. Academic Press, Orlando, FL, 1985. xiv, 360 pp., illus. $79.50. Monographs of the Physiological Society, no. 41.

The use of energetics as a framework for developing and testing hypotheses about muscle contraction, which began in earnest with the work of Fenn in the 1920's and continued with the publication of Huxley's crossbridge theory in 1957, diminished in the early '70's as recognition of thermodynamic constraints introduced complexities into energetics studies, causing many outside the immediate field to lose interest. The considerable progress made since then, presented in *Energetic Aspects of Muscle Contraction*, shows that the time has come for renewed attention to what energetics is telling us about muscle contraction.

Most of the book, which treats the energetics of vertebrate skeletal muscle, is contained in three chapters describing relevant studies of the mechanics of intact contractile systems, the biochemical kinetics of isolated contractile proteins, and heat production and chemical change measured in whole muscles. A short introductory chapter describes general properties of muscle, summarizes the crossbridge hypothesis, and presents a list of unanswered questions. The final chapter describes the 1957 theory and its recent variants and discusses them in the context of the experimental results presented in the book.

The organization of sections on biochemical kinetics and energy balance reflects the more rigorous hypothesis-testing characteristic of these relative newcomers among experimental approaches to muscle. The chapter on kinetics explains briefly how models of biochemical mechanisms are tested experimentally and summarizes some important issues concerning the mechanism of adenosine triphosphate hydrolysis by the isolated contractile proteins, all with commendable clarity. It is a palatable introduction to the subject and is especially recommended to those plagued by a high activation energy for learning about kinetics.

A section on energy balance contains the best lessons on energetics. The importance of studies on this subject and the progress made in recent years is readily appreciated by comparing the results of biochemical experiments by Kushmerick and Davies published in 1969 with those of very recent experiments by Homsher and colleagues in which both energy liberation and high-energy phosphate hydrolysis were measured. Kushmerick and Davies showed that although phosphate hydrolysis was adequate to account for the work done by active muscles it could not account for the heat production expected during rapid shortening, raising the possibility that heat is produced by a process unrelated to work production, which would call into question the relevance of Hill's heat measurements and thus compromise much of the predictive success of the 1957 theory. Homsher's experiments show that all the energy liberated by shortening muscles is explained by the quantity of phosphate hydrolyzed. The discrepancy appears because at high velocities phosphate hydrolysis lags behind energy liberation, and energy balance is achieved only after shortening ends. Although no existing model can accommodate this behavior, current crossbridge theories might be made to do so without drastic changes, and in the last chapter it is suggested that a branching physiological crossbridge pathway be explored.

The presence of so many facts and figures in one smallish volume makes it a handy reference. The book is also quite fun to read, for it provides the reader with many pieces of a large puzzle. One's sense of rediscovery in reading it is complemented by the style of presentation in sections on mechanics and on energy liberation. Sufficient information is included to make the uninitiated comfortable with concepts and methods, but the intellectual context of the experiments is not so well developed that it discourages the reader from rearranging the facts into novel hypotheses. An additional advantage is that many sections can be read individually.

The book contains minor flaws. The figure legends are too brief, and some information, such as the magnifications of several micrographs in chapter 1, is omitted altogether. On p. 16 we read "what is the nature of the binding between actin and myosin, covalent, electrostatic, . . . ?" and on p. 147 "actin binds, noncovalently but very tightly, to myosin." Some calculations are more obscure than they need be; for example, the work done by a crossbridge (p. 24) and the lifetime of an isometric crossbridge (p. 117) could have been clarified by more specific references to appropriate sections of later chapters. But the flaws are not serious, and chasing the numbers is rewarded by enhancement of insight into how facts, theories, and guesses can be blended most productively to stimulate better questions and experiments.

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Neuroanatomy

The Thalamus. EDWARD G. JONES. Plenum, New York, 1985. xx, 935 pp., illus. $135.

Seduction by passionate interest in the thalamus must have its hazards. Jones relates with charm an anecdote about Sir Wilfrid Le Gros Clark, one of his mentors, facing his fellow Oxford dons proclaiming expertise on the thalamus—a word endowed with a nuptial or bedchamber connotation in classical Greek. For all that, Jones has succumbed to a scholarly and research interest that has resulted in the production of a truly monumental contribution. There are few books of such enormous scope in modern times—perhaps Grant's *Anatomy* and Boyd's *Pathology* may serve as exemplars—and in neuroanatomy nothing of such magnitude since the extraordinary contribution of Ramón y Cajal.

One of the extraordinary and valuable features of the book is that it contains a large number of high-quality photomicrographs, a large proportion of the best of them derived from the author's own preparations. There are several series of sections in different species, mostly transverse and Nissl-stained and all of high technical quality. They are not quite sufficient to serve as atlases, but they do provide a good guide for comparative anatomy. There are a few con-