rounded out by a description of relaxation-contraction coupling and of various fiber types differing in structure and function.

Two major chapters deal with techniques of x-ray diffraction and electron microscopy as applied to muscle research, including technical details of sample preparation and image analysis. Both of these chapters include topics that usually receive a heavily mathematical treatment; Squire manages to convey the important ideas of x-ray and optical diffraction and of image reconstruction from electron micrographs with a minimum of mathematical apparatus. For readers wishing to go deeper into the subject appropriate books are recommended.

A review of current ideas of protein structure introduces ordered forms such as the β-conformation and the α-helix as well as the coiled coil structure that plays an important role in many fibrous proteins. The discussion of the three-dimensional packing of coiled coil molecules prepares the reader for the detailed analysis of structural elements of muscle in terms of the constituent molecules and their assemblies. The biochemistry and structure of actin, tropomyosin, and troponin, the proteins composing the thin filaments, are discussed, as is the organization of the proteins in the filament. This is one of the subjects about which controversies abound. X-ray diffraction evidence concerning changes in thin filament structure during regulation and the subject of the movement of tropomyosin in relation to actin and to myosin binding are clearly presented. Work on this subject is moving rapidly, and there have been new insights since the completion of the book. The structure of the thin filaments is discussed along similar lines; the assembly of the filament from myosin is analyzed on the basis of known properties of myosin and its aggregation tendencies. After a detailed review of the structure of various vertebrate (including smooth) and nonvertebrate muscles an extensive chapter deals with the molecular packing of myosin filaments, a subject on which Squire has made significant contributions. Though the subject is one about which there may be unresolved questions and differences of opinion, the presentation is fair and well balanced.

The last two chapters deal with evidence concerning the contractile event and the various models that attempt to give a detailed molecular understanding of the events that occur during contraction. A variety of biochemical, structural, and mechanical evidence is brought together with a view to establishing correspondences between physiologically distinct states such as relaxation, activity, and rigor and crossbridge motion and interactions between myosin and actin.

The book has many excellent illustrations, both original x-ray diffraction patterns and electron micrographs, as well as clear and instructive diagrams. There are an extensive list of references, with a separate list of various types of books and review articles, and a well-organized index. Newcomers to the field will find the book a valuable introductory guide, and experienced workers will undoubtedly find it of value on subjects somewhat removed from their own research. All in all, it is a book to be highly recommended.

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History of Chemistry

Jacob Berzelius. The Emergence of His Chemical System. EVAN M. MELHADO. Almqvist & Wiksell, Stockholm, and University of Wisconsin Press, Madison, 1982. 358 pp. $40. Also published as Swedish History of Science Society Studies and Sources, No. 34.

The historiography of 18th- and 19th-century chemistry has been conditioned by the response to the chemical revolution. Wurtz in the 1860's was able to begin his dictionary of chemistry with the statement that chemistry was a French science, invented by Lavoisier. So successful had Lavoisier been in laying the foundations for this view that 18th-century chemistry came to appear as simply what Lavoisier had to transcend; and Jöns Jacob Berzelius, by far the most important chemist in the first half of the 19th century, is featured often in the literature as Lavoisier's heir, a consolidator essentially derivative in his views.

Those writers who have sought to understand Berzelius's achievement have, moreover, generally found some one thing "characteristically Berzelian"—for example, his electrochemical dualism—to which his other achievements could be referred. H. G. Söderbaum in 1899 was a significant exception in his recognition of the importance of the construction of the *system*. In the present book Melhado follows that approach, seeking to develop a "genetic analysis" of Berzelius's thought and to observe the "functions performed by the system." The result is a significant contribution to the history of chemistry and the most coherent account to date of Berzelius's innovative research program, although there are reasonable and deliberately imposed limitations that make this study less than comprehensive.

In order to understand Berzelius's achievements, Melhado has to provide an account of the background. He draws skillfully on a wide literature, giving deserved prominence to the writings of Hélène Melzger and constructing an admirable primer in 18th-century chemical issues. The synthesis achieved in this part of the book is important in its own right. Melhado discusses two-component theories of classification, in which bodies are assigned to a chemical genus on the basis of a constituent principle, phlogiston for example, and then identified as particular species according to different specific ingredients. He considers the relation between corpuscular theory and the qualitative chemistry of principles and shows how Lavoisier was heir to these theories and debates. He also shows how French supporters of Stahl encouraged the resurgence of affinity tables in chemistry and laid the foundation of a radical theory. These are complex issues; but Melhado argues convincingly that their effect was to emphasize generic over specific properties, for example in Lavoisier's theory of acidity, that depended upon oxygen as the acidifying principle.

The second part of the book provides a clear demonstration that Berzelius developed a chemistry of specific components and specific properties, with both the acid and basic components in salts having equal importance. He did so by applying stoichiometric principles about the simplicity and invariance of chemical proportions and by using highly accurate analytical techniques that enabled him to distinguish specific compounds from one another and from mixtures. This research program was particularly effective in handling oxides, sulfides, and salts. The second part of Melhado's book is, indeed, entitled The Berzelian Theory of Salts.

Electrochemistry is discussed briefly for its contribution to the qualitative specification of compounds; and aspects of Berzelius's work not immediately germane to this goal are ignored or deemphasized, so that there is little or no discussion of affinity theory, atomism, and the like. But these conceptual aspects of Berzelius's thought were not unconnected to his overall research pro-

gram, and a brief indication of their role would have been welcome.

In mineralogy, especially since Werner, minerals had been classified according to their external characteristics. Berzelius's extension of stoichiometry and analysis, to bring mineralogy into chemical science, is well handled. So too is his relative failure to subordinate organic chemistry to chemical procedure, in part because of the difficulty of reaching the specific level—that is, of obtaining pure organic substances. The result was that Berzelius, at least into the 1820's, regarded organic chemistry as essentially natural history, not science. Nonetheless, his work provided the foundation of the reinterpretation of the radical theory that was to underpin organic chemistry in its subsequent development—a theme left for subsequent studies. This book, scrupulous and thorough in its research, ends with the full articulation of Berzelius's system around 1820.

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