an overdriven furnace. The end product in the furnace would have been a tin-iron "bear" exhibiting the metallic properties of iron. The chronological proximity of regular smelting of tin ores for metallic tin and the advent of iron metallurgy in the Late Bronze Age appears to be more than coincidental.

To conclude, though much of the basic information about ancient tin has appeared elsewhere in a variety of sources, this volume serves the useful purpose of bringing together the latest information in a single reference. Moreover, the volume is important in that in it physical scientists, archeologists, and historians confront a single problem, the sources for and the initial uses of tin. These scholars go beyond the barriers of their particular disciplines and provide an interdisciplinary dialogue not generally achieved in similar academic endeavors.

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Energy Transitions

Non-Radiative Decay of Ions and Molecules in Solids. R. ENGLMAN. North-Holland, Amsterdam, 1979 (U.S. distributor, Elsevier, New York). xiv, 336 pp., illus. $58.50.

In a review of nonradiative decay processes in solids—basically the mechanisms by which the energy of electronic excitation of molecules or ions is converted into vibrational or thermal energy—I would have expected to find reference to a few definitive theoretical papers that would serve as the basis for interpretation of a wide variety of experimental results.

A perusal of Englman's book confirms the breadth of the experimental activity in the field, as evidenced by the reference to over 250 papers, most of them published in the last ten years, giving nonradiative decay rates for transition element ions, rare earth ions, defect centers, *s*- or *p*-state impurities, organic molecules, and biological systems. A surprise, however, was to discover that over two-thirds of the more than 1000 papers cited are theoretical discussions. Though in part perhaps a reflection of the author's own role as a contributor to the theoretical basis of the subject, the extensive citation of theoretical literature is primarily an indication of the intrinsic complexity of the subject. There are many distinct relaxation mechanisms to be treated and a number of limiting cases to be taken as a starting point for model calculations; and the essential roles of many degrees of freedom and of vibrational inharmonicity give the virtuosic theorist ample opportunity to display his or her wares.

Englman presents an exhaustive, and exhausting, review of the field. The style is terse and to the point, often with arguments abridged to the point that they are not easy to follow. An advanced student familiar with the techniques of theoretical condensed-matter physics will find this a splendid introduction to and review of the field. An experienced experimentalist, with principal theoretical reliance on the "Golden Rule," will make contact with many familiar points but will not find sufficient detail of exposition to follow the arguments presented. The book will serve him or her, however, as a valuable guide to the literature and as an important source of questions and ideas that deserve careful consideration.

Particularly refreshing is the attention to related, often deeper, issues such as coherence effects, the properties of state evolution, the consequence of the memory of state preparation, and irreversibility. Here, particularly, one would have liked to see a more extensive and occasionally (in the case of Poincare cycles, for example) more accurate discussion of these issues.

Englman's book would seem an essential reference for anyone seriously involved in studies of nonradiative transitions in biology or condensed-matter physics or chemistry.

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Neurophysiology

The Concept of a Blood-Brain Barrier. MICHAEL BRADBURY. Wiley-Interscience, New York, 1979. viii, 466 pp., illus. $55.

In this book Michael Bradbury describes in quite considerable detail the current state of knowledge concerning an important aspect of neural plumbing: the processes involved in the exchanges of water and solutes between the blood and the extracellular fluids of the central nervous system.

The vertebrate blood-brain barrier has always seemed to me, an invertebrate physiologist, to be a rather mysterious article. First, there is the daunting complexity of the vertebrate brain, which presents formidable conceptual problems and also very considerable practical difficulties, for example in the application of electrophysiological techniques that are routinely used in the relatively simple invertebrate preparations. Second, there are the lingering uncertainties from the "years of doubt" when, as chronicled by Bradbury, the very existence of the blood-brain barrier was questioned by various heretics armed with the then recently acquired ultrastructural knowledge of cerebral tissues and a desire for economy of hypothesis. The beleaguered faithful (led by Hugh Davson and sustained by August Krogh's original concept) were eventually relieved, largely by the acquisition of additional ultrastructural observations that provided an anatomical basis for a barrier to water-soluble substances in the form of the tight junctions that appear to effectively seal the clefts between the endothelial cells of the cerebral capillaries. Finally, there is the confusion created by the retention of the term "barrier" to describe phenomena some of which clearly do not involve obstruction or restricted access to the cerebral tissues, for example the rapid transcellular transport of monosaccharides and some amino compounds or the rapid permeation by substances that have favorable partition coefficients. It seems to me that it would be more logical if the phenomena described in the book were merely regarded as properties of the blood-brain interface and not lumped together with one particular property—the restricted intercellular access of water-soluble ions and molecules.

The book provides a clear and authoritative description of these properties. Account is given of the ultrastructural organization and the permeability of the blood-brain interface and of the various physiological processes that occur behind it, for example the exchanges of ions and molecules between the underlying extracellular fluids and the nerve cells. Consideration is also given to ontogeny and phylogeny, to equivalent systems in insects, and to the "blood-testis barrier" of vertebrate animals.

The combined effect of the processes described in the book is to provide fluid environments, of appropriately controlled composition, that are necessary for the integrated electrical signaling within the central nervous system. It is surprising therefore that the extensive studies of the homeostatic control mechanisms in vertebrate brain seem rarely to have been related to the actual processes of nervous transmission. This is reflected in the book by the absence of even a single action potential in the illustrations