theories of vital activity and material organization maintained by, among others, Buffon, La Mettrie, Bordeu, Blumenbach, and Hunter. The highlight of this section is the illuminating account of late 18th century vitalism that runs through several of the chapters. A long section devoted to Tissue, Cell, and Molecule follows. This part of the second volume is one of the most successful of Hall's book. He here blends incisive remarks about vitalistic explanations in general physiology with useful reviews of his central themes. Apt summaries of 19th-century views on protoplasm as a unique vital substance and cells as special vital units are also included, taking on heightened significance when interspersed with Hall's reminders of recurring classic questions and interpretive strategies. The work of Dujardin, Schwann, von Mohl, Schultze, and Huxley receives real illumination. Finally, Hall concludes his second volume with a discussion of The Physical Basis of Life, 1860–1900. The ideas of Haeckel, Nägeli, and Weismann directly relating to the life-matter problem are of principal interest here.

As should be obvious from the foregoing summary, *Ideas of Life and Matter* is a major contribution to the history of biology. It is organized around large, interesting, and important themes, and it is filled out with ample supporting evidence presented in a scholarly manner. One develops the sense when reading this book that Hall has both a clear vision of what the history of biology should be about and erudition to match his vision. And yet Hall's two volumes add up to something less than the perfect book, for *Ideas of Life and Matter* is marred by two disquieting faults. First, it is simply too vast. Hall's erudition occasionally gets in his way, sometimes hindering rather than helping the development of his central thesis. To make his points most effectively, one feels in retrospect, Hall would have done better to limit his illustrative material to certain episodes while substantially ignoring or very succinctly summarizing others. The sections on the Pro-Socratics, Descartes, the 18th-century vitalists, and the mid-19th-century microscopists struggling with cells, sarcode, and protoplasm would have been perfectly appropriate and not at all tedious elaborations of the ideas sketched in the introductory and concluding essays. These sections, by and large, read better than the others, and this probably results from the fact that the life-matter problem was obviously and insistently central to these writers whereas it was not necessarily so to others. By adding large amounts of additional material on other authors or periods Hall greatly inflates his study, at times almost bringing it unwittingly close to the encyclopedic summary he wishes to avoid. The second fault with *Ideas of Life and Matter* is closely related to the first: it is repetitive. Hall all too frequently reviews his main interpretive ideas in the body of his text, now and then managing to exasperate rather than further enlighten his reader. Indeed, the problem is sometimes acute, because Hall seems to be most repetitive exactly where his text is most swollen with extraneous or near-extraneous matter. Why, for example, do we need to know about Epicurus's views on atomic indeterminacy (volume 1, pp. 133–134), Hooke's mechanical inventions (volume 1, p. 296), or Priestley's contributions to phlogiston theory (volume 2, pp. 150–53)? It is exactly at these and similar points that one sometimes finds it hard to resist the thought that Hall returns to still another review of his central themes just when his narrative has actually wandered from them. Essays of 800 pages are not necessarily twice as good as those of 400.

Despite its imperfections, *Ideas of Life and Matter* is a good, solid, and extremely valuable book. Its basic themes, however often repeated, deserve to be thought over by biologists and historians of science for a good while. For should not biologists wonder whether they are not still caught in the net of ancient questions and analytical techniques, and ought not historians ponder whether biology, as Hall sometimes straightforwardly insists, really grew directly out of grapplings with the life-matter problem? Hall's ideas on these subjects are important, and his enthusiasm for their continuing consideration or, if need be, perfection is infectious. The book itself will quite probably become a standard textbook or work of reference on the history of biology, and it ought to be respected as such even if it was not exactly so intended.

In short, like his previous *Source Book in Animal Biology*, Hall's *Ideas of Life and Matter* can and should be turned to with confidence, interest, and admiration.

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Biological Radiation

Luminescence of Biopolymers and Cells. GRIGORII M. BARENBOIM, ALEKSANDR N. DOMANSKII, and KONSTANTIN K. TUROVEROV. Translated from the Russian edition (Leningrad, 1966). F. Chen, Transl. Ed. Plenum, New York, 1969. viii + 232 pp., illus. $12.50.

This book should be useful to anyone taking up or already somewhat experienced in the theoretical or practical study of luminescence in biological systems. Despite its modest length, and the by no means exhaustive treatment, the major aspects of the subject are clearly presented. Moreover, the book is reasonably well up to date. A statement that "the original Russian text . . . has been thoroughly revised by the authors for the present edition" notwithstanding, the bibliography contains only one reference to literature other than Russian later than 1966, the year the original text was published. Even so, one of the impressive features of the book, and certainly one of the most useful, is its coverage of the large amount of research, with a resulting multitude of technical publications, many of which have not been readily available in the West, that has taken place in this field in Russia during the past few years.

An introduction of 17 pages undertakes, with considerable success, to provide "a summary of the fundamentals of molecular luminescence," including brief reference to the energies of molecules, transitions between molecular energy levels, fluorescence, anti-Stokes fluorescence, "Vavilov's law" (constant quantum yield of fluorescence over broad ranges of wavelengths), the "Shpol'skii effect," the effects of the solvent on electronic spectra of molecules, polarized fluorescence, optical transitions between singlet and triplet states, the transfer of electronic excitation energy or sensitized luminescence, and luminescence quenching.

The introduction is followed by six chapters, the first four of which deal with "Photoluminescence of aromatic amino acids, synthetic polypeptides, proteins, and cells," "Luminescence of purines, pyrimidines, and nucleic acids," "Radioluminescence of biopolymers and their components," and "Chemiluminescence of cells and organisms." The last two chapters, which deal exclusively with methods and instrumentation, constitute a valuable source of information and ideas for detecting and

quantitatively recording various types of radiations, including those which are extremely weak. The problematic "mitogenetic" radiations in the ultraviolet, described by A. G. Gurvich as detectable by biological systems, which were the basis of so much controversy in the 1930's, are conservatively treated by the authors of this book, who point out that "the solution of the whole problem of mitogenetic radiation is in its initial phase." The authors suggest that cellular ultraviolet radiation, the existence of which is indicated by some recent work, may merely be a special case of "dark chemiluminescence," the significance of which is as yet anything but clear.

The credibility of the existence of weak cellular ultraviolet radiation is enhanced by the detection of "dark luminescence," in the ultraviolet or in the visible below the threshold of visibility, from a variety of sources, such as mouse liver, lipids extracted from various human tissues, mitochondria, and growing cultures of yeast. (The data are summarized in a table.) The information pertaining to dark luminescence and the brief discussion of its significance are one of the unusual, interesting features of the book.

In chapter 4, the section on functional chemiluminescence (bioluminescence) is apt to prove disappointing to those who are well versed in this subject, partly because of certain errors, some of which (for example concerning the structure of *Cypridina* luciferin) could have been avoided by bringing the subject more up to date, and partly because of the brevity of the treatment, which includes detailed consideration of only three systems, among which, however, is the extraordinary system of the jellyfish *Aequorea*, along with the more familiar types found in luminous bacteria and the firefly. The molecular weight of the active component, that is, the bioluminescent protein aequorin, of the jellyfish system is given, probably through a misprint, as 3.5×10^3, instead of the more nearly correct figure of 3.5×10^4.

Some awkwardnesses in the translation are greatly outweighed by the value of the book as a whole. It is highly recommended to anyone who is more than casually interested in bioluminescence. Even some specialists may be impressed with the comprehensive discussions of the somewhat neglected use of fluorescence, which provides an unusually sensitive technique, in the investigation of structural and conformational changes in biomolecules, and also by certain other sections of the book.

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Approaches to Pulmonary Dynamics

Pulmonary and Bronchial Vascular Systems. Their Reactions under Controlled Conditions of Ventilation and Circulation. I. DE BURGH DALY and CATHERINE HEBB. Williams and Wilkins, Baltimore, 1967. xvi + 432 pp., illus. $16.25. Monographs of the Physiological Society, No. 16.

The Pulmonary Circulation and Interstitial Space. Proceedings of a symposium, Chicago, Aug.–Sept. 1968. ALFRED P. FISHMAN and HANS H. HECHT, Eds. University of Chicago Press, Chicago, 1969. xiv + 434 pp., illus. $15.

Daly and Hebb's *Pulmonary and Bronchial Vascular Systems* is an exposition based on classical physiological approaches to its subject. The two authors have devoted their professional lives to a consideration of the factors governing pressure, volume, and flow in the vascular systems of the lung. This book reflects this devotion, reviewing pulmonary and bronchial vascular hemodynamics, particularly as these are influenced by nervous impulses, vasomotor changes, and pharmacologic agents. The writing is lucid (in the best English tradition); the references are exhaustive and the conclusions are conservative.

Though the use of the smoked drum is now supplemented by the use of the oscilloscope, tubing of plastic and not of glass is used, and perfusion systems are more sophisticated, there is substantial doubt that the basic issues involved in the regulation of hemodynamics in the pulmonary circulation can be resolved by the methods of classical organ physiology. Thus this book, though it has a certain charm, does not have a modern flavor.

The Pulmonary Circulation and Interstitial Space presents newer approaches to the subject. This volume is an edited summary of a conference on the pulmonary circulation organized by the two editors as one of the satellite conferences of the International Physiological Meeting in 1968. Fishman has extensive experience and great skill in organizing meetings of this type, and this expertise is reflected in the book.

The book represents an attempt to focus on some new techniques and approaches for solving current problems involving the pulmonary circulation. This involves a multidisciplinary approach employing a number of experts, many of whom are not card-carrying pulmonary physiologists. The results are worthwhile though uneven. Organ physiology is frequently eclectic, and the same has been true of pulmonary physiology. Thus in embracing new disciplines (such as transport physiology, electrolyte metabolism, and systems analysis), there is a danger of simplistic approaches and interpretations. On the other hand, the book deals with a number of important subjects. The treatment of the role of the interstitial space of the lung in pulmonary hemodynamics, in liquid and solute exchanges in the lung, and in gas exchange is particularly noteworthy (indeed, the "interstitial space" was appended to the title of the book in the process of editing). The sections on pleural hydrodynamics and engineering approaches to pulmonary hemodynamics are also excellent. The comments by the invited discussants are generally pertinent and are an important element of the book, as are the summary statements of the section chairmen. In brief, the conference outlines some of the unsolved problems involved in understanding the pulmonary circulation. After reading the volume, one awaits the next conference (in say ten years) with some impatience.

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A Mineral Group

Feldspars. TOM. F. W. BARTH. Wiley-Interscience, New York, 1969. xii + 264 pp., illus. $14.50.

This book is the first modern attempt at a comprehensive review of feldspar mineralogy and crystallography. It is subdivided into six major sections: one on the general mineralogy and classification of the rock-forming feldspars, one on pseudosymmetry and twinning, one each on the structures, physical properties, and thermodynamic proper-