Book Reviews

A Short Career in Science

H. G. J. Moseley. The Life and Letters of an English Physicist, 1887–1915. J. L. HEILBRON. University of California Press, Berkeley, 1974. xiv, 312 pp., illus. $15.

It would be difficult to think of a 20th-century scientist whose career would make him a more suitable protagonist for a novel than Henry Gwyn Jeffreys (Harry) Moseley. The son and grandson of reputable British scientists, Moseley attended Eton as one of the elite King's Scholars, managed to educate himself in physics at Oxford despite the virtual absence of formal opportunites for doing so, and, in the fall of 1910, obtained a research fellowship at Ernest Rutherford's laboratory in Manchester. Two years later, having served his apprenticeship pursuing radioactive decay experiments, he became convinced that x-ray diffraction studies provided the key to the elucidation of atomic structure. This conviction was strengthened by conversations with Niels Bohr, who was in Manchester periodically in 1912 and 1913 and was then publishing the first of his celebrated series of papers on atomic structure. In the autumn of 1913 Moseley returned to Oxford on a fellowship and threw himself into a feverish research program which within a few months led him to a simple empirical relationship between the frequencies of the discrete K- and L- x-rays of the elements and their atomic numbers. This relationship, the description of which is now called Moseley's law, permitted an unambiguous interpretation of atomic number in terms of atomic electron structure, and thereby provided a fundamental basis for the empirical ordering of the elements in the Periodic Table. It also brought Moseley almost instant international recognition.

The recognized importance of his work led to his being invited to read a paper at a special British Association meeting in Australia during the summer of 1914. When World War I broke out he recalled the duty to King and Country he had learned at Eton, and, leaving Australia as soon as he had discharged his obligations to the British Association, rushed back to England to enlist in the Royal Engineers. On 10 August 1915, a little more than two months before his 28th birthday, Moseley was killed in a charge of 30,000 Turks at the battle of Sari Bair in the ill-conceived Gallipoli campaign.

Given material such as this, many authors might not have been able to resist writing a nostalgic romance. Other authors, concerned with the reviews their strict internalist colleagues would write, might have tried to avoid any reference to the admittedly romantic aspects of Moseley's career. Happily, both for historians of 20th-century physics and for more general readers, Heilbron has managed to maintain a balance, providing an exhaustive and comprehensible treatment of Moseley's scientific achievements and a readable account of the other important aspects of his life. He has also permitted himself an epilog in which he speculates on what Moseley's subsequent career might have been had he survived Gallipoli. Indeed, given the fact that he was a contemporary of C. G. Darwin and Julian Huxley and of Henry Tizard and F. A. Lindemann (he and Tizard rushed back from Australia and enlisted simultaneously, and he was the primary contender for the chair at Oxford that Lindemann later obtained) Heilbron would have been remiss had he neglected to consider what Moseley's place in the British scientific establishment could have been.

Moseley's spectacular, short-lived research career and the intellectual climate in which he worked provide the focus for Heilbron's work. His elucidations of the problems that plagued physics and chemistry in the 1910's, when new data and insights were being produced at an unbelievable pace, and his re-creation of the freewheeling atmosphere at Rutherford's Manchester laboratory where Moseley learned his trade are excellent. One wonders whether Moseley could have been led to his x-ray studies at any other laboratory. More experienced physicists such as W. H. Bragg and Maurice DeBroglie used x-ray diffraction techniques to study the nature of the x-rays themselves. Moseley alone judged them to be the ideal tool for studying atomic structure, even as Rutherford had been employing radioactivity as a tool for elucidating nuclear structure. This aspect of Moseley's work would seem to provide an excellent case study in what Holton refers to as the thematic content of science.

Both specialists and nonspecialists should find the chapters on Moseley's careers at Eton and Oxford of interest. Heilbron has used this material as a means for discussing the evolution of science education at the elite English educational institutions during the Victorian and Edwardian eras. As he remarks, "it almost appears that the chief joint objective of British scientists and educational reformers of the 19th century was to smooth the path of Harry Moseley."

Moseley's letters, all of which are reproduced without any essential cuts, occupy almost half the volume. These are written with that combination of elegance and assurance which seems to have been an almost unique product of the British classical education. With Heilbron's biography, they provide a vignette of a brief, almost heroic era in the history of science, during which Moseley and his class could have no doubts that both science and society not only could be comprehended in rather simple terms, but were also unquestionably good.

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Structural Proteins

Conformation in Fibrous Proteins and Related Synthetic Polypeptides. R. D. B. FRASER and T. P. MACRAE. Academic Press, New York, 1973. xviii, 630 pp., illus. $45. Molecular Biology Series.

Because of their dynamic involvement in biochemical interactions, enzymes, and other globular proteins and complexes, have generated a structural interest that is widespread and justified. As a result of the ability to obtain three-dimensionally ordered single crystals of such molecules, modern x-ray diffraction methods are rapidly and straightforwardly opening up our atomic view of this domain. The fibrous proteins generally serve less glamorous biological functions, being primarily structural proteins, and their lower degree of order has made them poor relatives in the high society of

structure-solving by direct methods at atomic resolution. Yet it is not irrelevant to observe that most of what we know about the feasible regular conformations of polypeptide chains derives from the long-continuing studies on fibrous proteins and their simpler analogs, the synthetic polypeptides. It is also likely that the important next phase of elucidating the effect of environmental parameters (temperature, *p*H, ionic strength, and so on) on secondary structure will progress more readily through the study of such fibrous systems than through the study of globular proteins. It is therefore important and timely that we assess critically our knowledge of fibrous protein structure. The authors of the present volume have undertaken to do this, and have in large measure succeeded.

Since x-ray diffraction methods are still the most powerful tools for defining molecular structure, the authors have (properly) concentrated on this approach. The first chapter of the first section of the book, devoted to Methods of Determining Conformation, summarizes the x-ray approach nicely. Diffraction by helical structures is dealt with carefully, and the effects of disorder receive an emphasis appropriate to the imperfect nature of fibrous diffractors. Of the remaining seven chapters in this section, only two—on infrared spectrophotometry and the analysis and prediction of conformation—match the first in utility. The remainder cover a potpourri of techniques superficially, and will mainly serve as a repository of references for the uninitiated.

The second section of the book reviews the work on Synthetic Polypeptides as Models of Fibrous Proteins. Separate chapters deal with the alpha helix, the beta conformation, and the polyglycine II type of conformation. These chapters provide useful summaries of our knowledge of these structures. They are marred mainly by discrepant discussions of some of the infrared work: the amide I modes of the alpha helix are treated with a confidence that hardly accords with the skepticism expressed in an earlier chapter concerning the detailed predictions of the perturbation theory; and the published spectroscopic arguments for possible C–H . . . O bonds in polyglycine II are garbled effectively enough that the authors' conclusion that such bonding is "not proven" follows convincingly from their discussion.

The final section of the book, Conformation in Fibrous Proteins, contains major chapters on silks, collagens, myofibrillar proteins, and keratins (the latter being a subject on which the authors have contributed significantly). These constitute almost half of the descriptive material in the book, are relatively detailed, and probably will be the most useful to the reader. They reveal effectively the richness of structural information that can be obtained from systems of intermediate order by the combined use of several physical methods of structure determination.

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Sensory Psychology

Surface Color Perception. JACOB BECK. Cornell University Press, Ithaca, N.Y., 1972. xvi, 206 pp., illus. $11.50.

The questions with which Jacob Beck is concerned in this monograph are the fundamental ones about how we achieve an internal representation of "the world out there" through the mediation of our senses. To what extent is the representation determined by the stimulus array impinging on our receptor systems, by the characteristic organization and response properties of a particular sensory system, by prior experience, memory, judgment, interpretation, expectancy, and so on? Beck explores these questions with reference to the visual perception of surface color, placing them in the context of such historically important issues in psychology as nativism versus empiricism, structuralism versus Gestalt. He reviews an extensive body of experiments concerned with various aspects of surface color perception: modes of appearance, constancy, contrast, adaptation, and so on. Particular emphasis is given to experiments designed to measure the influence of different variables (such as background, depth cues, shape) on the extent to which we perceive as constant surfaces whose reflectance characteristics do not change but whose light images on the retina vary widely accordingly to the level, spectral quality, and uniformity of the illumination on the object.

Assessment of the results of experiments of this sort places a special burden on an author whose hope is, as Beck states in his preface, that there will emerge from his review "an understanding of the essential processes that underlie the perception of a surface color." It hardly needs saying that what we see under normal circumstances is sometimes, at least, subject to alternative, and possibly contradictory, interpretations. Who, for example, has never mistaken a shadow for a spot, or vice versa? It is unfortunately true that many of the findings of perceptual experiments are subject to even greater uncertainty of interpretation than are the percepts whose essential determinants the experiments are intended to discover or establish. It is thus almost inevitable that the informed reader will disagree with some of Beck's assessments in particular instances, and this reviewer wishes that he had included explicit notice of the difficulty of interpretation in other instances.

In an era of overspecialization and proliferation of research reports, Beck has rendered a real service by reviewing together a variety of different experimental approaches that are congenial to the readership of one specialized journal or another (12 different journals are cited in the first two pages of the bibliography) but that are all relevant to some aspect of the ever-intriguing problem of surface color perception.

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Books Received

Advances in Aerosol Physics. No. 7. V. A. Fedoseev, Ed. Translated from the Russian edition (Kiev, 1972). Halsted (Wiley), New York, and Israel Program for Scientific Translations, Jerusalem, 1974. viii, 168 pp., illus. $17.50.

Advances in Chemical Engineering. Vol. 9. Thomas B. Drew, Giles R. Cokelet, John W. Hoopes, Jr., and Theodore Vermeulen, Eds. Academic Press, New York, 1974. xiv, 312 pp., illus. $29.50.

Advances in Heterocyclic Chemistry. Vol. 16. A. R. Katritzky and A. J. Boulton, Eds. Academic Press, New York, 1974. x, 350 pp., illus. $35.

Agricultural Geography. John R. Tarrant. Halsted (Wiley), New York, 1974. 280 pp., illus. $12.50. Problems in Modern Geography.

The Amateur Navigator's Handbook. Sallie Townsend and Virginia Ericson. Crowell, New York, 1974. xiv, 226 pp., illus. $7.95.

Anger. Leo Madow. Scribner, New York, 1974. x, 132 pp. Paper, $2.45. Reprint of the 1972 edition.

Annual Review of Fluid Mechanics. Vol. 6. Milton Van Dyke, Walter G. Vincenti, and J. V. Wehausen, Eds. Annual