introduction to the ideas (as opposed to the methods) of quantum mechanics. The general introduction to quantum mechanical ideas is often *ad hoc* and might be incomprehensible to the student without understanding of the historical background which led to wave mechanics.

In short, this book is an excellent reference for those interested in atomic physics but requires a good deal of supplementary material if used in an introductory course in quantum mechanics.

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Six Days or Forever? Tennessee vs. John Thomas Scopes. Ray Ginger. Beacon Press, Boston, 1958. 258 pp. $3.95.

This book is a complete historical account of the notorious "monkey trial" in Dayton, Tennessee, in 1925; it includes, also, a biographical sketch of each of the principal actors—the judge, the author of the antievolution law, Scopes, Bryan, Darrow, and many other public figures involved in one way or another; still further, there is a thoughtful analysis of the influence of world events on public thinking and of the factors motivating the various personalities. The major immediate facts and events were brought to everyone at the time by public press and radio; the sequence and background have never before been portrayed in full.

After a third of a century, dispassionate judgment brings the sober conviction that everyone behaved very badly; after all, it was an event without precedent in the experience of anyone in public life at the time. And one must now realize that the trial was but a symbol of something not immediately apparent then—something that was neither secular, regional, nor political, an eruption of an element ever-present in any population, but, fortunately, suppressed most of the time. Recent world events had upset the balances that usually temper violent fanaticism. Efforts at restrictive legislation appeared, north, south, east, and west—sometimes succeeding, sometimes failing, taking varied forms, but almost invariably compounded of the same basic ingredients: prohibition, antievolution, antitobacco, antifeminism, antisuffrage, antivaccination, antitransfusion, antihairbob, anti-Teutonism.

Several states still retain restrictive laws of one kind or another enacted during the period between World War I and the onset of the depression. The spirit was rampant, and the fact that repeals have not been more general suggests that the present dormancy could evaporate quickly. One ardent zealot in New York was busily inveighing against medicine while another in Illinois wanted the earth made flat by legislative fiat. In Indiana, a little earlier, the legislature decreed that the value of pi should be fixed at 4! Another reason for the quiescent phase of antievolution is that canny politicians, always sensitive to ridicule, sidestep the issue by way of textbook commissions, whose members are always political appointees and have absolute authority to reject textbooks not meeting the requirements adopted by the commissions themselves and seldom subject to review by any authoritative agency.

Representative John W. Butler introduced the bill in Tennessee which was enacted into law when political expediency smothered opposition. Bryan suggested, just as a psychological compromise, that no penalty clause be attached to the measure. Some legislators voted for passage because they thought (as claimed later) that Governor Peay would veto the bill as a matter of course. He, however, said the bill was absurd and that the legislature had no right to pass on to him the onus of decision. Political demands prompted him to rationalize. He was reelected. Law-enforcement agencies generally ignored the Butler act until the American Civil Liberties Union took note and decided on a test case (but failed at first to find anyone willing to file a complaint). Genuine religious zeal, civic promotion, and political opportunism combined to initiate the next step, when a New York born mining engineer operating in Dayton persuaded John T. Scopes, a naive young high-school science teacher, to be a test subject. He acknowledged guilt and was bound over to the grand jury. Ironically, he admitted later that on the specific day named in the indictment he was absent from school and did not actually teach anything about evolution at all.

As legal formality, the trial was a farce. Bryan volunteered his services as council for the prosecution, although he had not tried a case in 30 years. There was considerable local resentment at this unnecessary intrusion into a case which was an open-and-shut minor legal episode. The law was clear, and Scopes's guilt was admitted. Such a case would not, ordinarily, call for a jury trial; nor would a defendent ordinarily need to import council. The Civil Liberties Union persuaded Clarence Darrow to lend his services, along with other distinguished legal lights. His dominant pesonality more or less overshadowed the others. He was inexcusably insulting at times, and just as dogmatically fanatical as Bryan. He did, despite that, conduct a brilliant defense, the highlight of which came when he forced Bryan onto the witness stand, where, for the first time in his life, Bryan was obliged to answer questions. Bryan's whole thesis collapsed, and he left the stand an object of pity to his more staunch supporters, of contempt to those who had expected him to demolish the atheist lawyer from Chicago. The constitutionality of the law was not affected by the trial.

Bryan had been an antievolutionist for many years but, shrewd politician that he was, he did not openly declare himself until he was sure that the fundamentalist crusade was strong enough to furnish a "cause" for a public figure badly in need of one. He seldom endorsed any move until he was sure it had gathered enough momentum to carry him along on the crest of the wave.

As a biologist engaged in teaching during those years, I recall vividly the ingenious methods adopted by many teachers for saying "evolution" without letting red-hot zealots know that was what they were saying. Today, those of more recent vintage may regard those situations with amusement, but the sobering realization is ever present in the minds of those who shivered through class sessions with glowering critics listening in for something that might stamp the lecturer as an evolutionist that such a wave of fanaticism could yet sweep up a holocaust of disastrous proportions. Only three years ago, two students in one of our largest medical schools announced to one of their professors that they were antievolutionists and members of a large and powerful group which could, and would, be very influential if it decided to become vociferous.

Every scientist inclined to smugness needs to read this book in a serious mood and then pledge himself to avoid the error of his predecessors in allowing the antievolution movement to creep up because they were overconfident of their own positions in society and never troubled to translate their convictions into terms that the public could comprehend. Many potential scientists were deterred from risking careers in science by this trial and other related events of the period.

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The Motility of Muscle and Cells. Hans H. Weber. Harvard University Press, Cambridge, 1958. 69 pp. $3.50.

This attractive little booklet contains the three Dunham lectures delivered at Harvard University in March 1957. The first of the three chapters, containing the first lecture, deals with the chemical factors producing contraction and relaxation in the muscle fiber. The factors considered in detail are the relaxing factor

contained in the granules ("Marsh factor"), adenosine triphosphate, and calcium and magnesium ions. Adenosine triphosphate has two functions: In rest it renders the muscle plastic and extensible, while in activity it makes the muscle contract, supplying it with energy by means of the splitting of its terminal high-energy phosphate bond. During contraction, Mg^{++} activates actomyosin, while in relaxation it activates the relaxing factor. In rest, Ca^{++} is bound to actomyosin, while it inactivates the relaxing factor during contraction. Major significance is attributed to the alternate binding and release of these two ions on the two sites in the chemical mechanism of contraction and relaxation.

The second chapter deals with the mechanism of muscular contraction. The author shows the inadequacy of earlier theories and takes sides with the "sliding theory," for which he offers a detailed chemical interpretation.

In the third chapter Weber deals with "the four mechanisms involved in the movement of cells." He shows that the mechanism of contraction found in muscle underlays various forms of motion in diverse cells but represents in no way the only mechanism found in nature. "Nature apparently made experiments with different mechanisms of movements," such as stretching and contraction of organelles by Ca^{++}, prevented or reversed by adenosine triphosphate, and stretching induced by adenosine triphosphate and other polyphosphates.

Not all researchers in this field will necessarily subscribe to Weber's views on all points. But even if the views expressed are at many points individual ones, they are interesting, Weber being one of the leading pioneers of muscle research. The personal touch makes the little book refreshing and interesting reading.

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Handbuch der Physik. vol. 5, pt. 1, *Principles of Quantum Theory.* S. Flügge, Ed. Springer, Berlin, 1958. 376 pp. Illus. DM. 90.

This volume of the *Handbuch* contains two articles. *"Die allgemeinen Principien der Wellenmechanik,"* by W. Pauli, is largely a reprint of an article that appeared in the previous (1933) edition; "Quantenelektrodynamik," by G. Källén, contains subject matter that, on the average, is less than a decade old.

Pauli's work remains a classic account of both wave and matrix mechanics for systems with a finite number of degrees of freedom. The deletion of the final sections, which contained a now inadequate introduction to, and critique of, quantum electrodynamics, is the only noteworthy change from the prior version. Because of the undiminished luster of the author's reputation, and because of the intrinsic virtues of the article, it will continue to attract serious students of quantum mechanics who wish to deepen their understanding of the subject beyond what is offered in the usual first course.

In the article on quantum electrodynamics, G. Källén describes the most impressive achievement of theoretical physics of the last decade. This has been the development of the theory of renormalization and its application to the interaction of the Maxwell field with the electron-positron field, permitting the extraction, from a mathematically meaningless theory, of physical predictions which have had a striking experimental confirmation. The account of the interaction of the two fields, the central theme of the work, is strongly influenced by the author's own contributions to the subject: a most careful application of the adiabatic hypothesis to the discussion of scattering processes and an early realization of the superiority of the Heisenberg picture (representation) for the definition of the concept of physical particle.

Nevertheless, the deduction of physical results follows well-established lines. The Dyson form of the S-matrix is developed briefly and applied to the simplest scattering processes. The discussion of the so-called radiative corrections, which embrace the new practical achievements of theory, is carried through by means of an effective current operator—almost the earliest satisfactory method applied to these problems—but the detailed calculations are simplified considerably by the fullest use of those analytic properties of the theory which follow from its "causal" character. The concepts of charge and mass renormalization are introduced, and such decisive tests of the theory as the corrections to the scattering of an electron by a Coulomb field, the anomalous electron moment, the Lamb shift and the hyperfine structure of hydrogen-like atoms, and the fine structure of positronium are calculated to lowest order. The results of higher order calculations are summarized, and the striking agreement with experiment is indicated.

The article concludes with a detailed presentation of the author's own most basic contribution to the subject, the development of a general theory of renormalization of mass and charge without the use of perturbation theory and his so far inconclusive attempt to establish the mathematical *inconsistency* of the renormalization theory.

The only conspicuous omissions from Källén's painstakingly constructed article are an account of Dyson's classic proof of the renormalizability of the S-matrix and the current postulational studies of the general structure of the theory along the lines laid out in part by the author himself. Presumably the latter will loom large in the so far elusive part 2 of this volume.

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Proceedings of the International Symposium on Isotope Separation. Held in Amsterdam, 23–27 Apr. 1957. J. Kistemaker, J. Bigeleisen, A. O. C. Nier, Eds. North-Holland, Amsterdam; Interscience, New York, 1958. xx + 704 pp. Illus. $15.

Although the separation of isotopes has been of increasing interest in the last two decades, the first broad international conference in this field was held in Amsterdam in April 1957.

The papers presented there have been compiled into an excellent reference volume, nicely balanced between theory and practice. Many of those most actively engaged in isotope separation are among the contributors. Sixty-three papers are included; most of them are in English, a few are in French and German. At least 14 nations are represented.

This book is conveniently arranged in nine parts, as follows: "Chemical engineering" (four papers pertaining to plant processes); "Molecular interactions" (four papers on isotope effects); "Chemical exchange" (ten papers); "Electromigration" (six papers); "Distillation" (seven papers); "Thermal diffusion" (seven papers); "Diffusion" (nine papers); "Electromagnetic separation" (11 papers, two abstracts); and "Ultracentrifuges" (two papers).

Chemical exchange and electromagnetic separation receive the most attention, as would be expected, considering the success of these methods in producing a variety of useful quantities of isotopes. Workers on these methods have extended wartime progress, to the benefit of isotope separation and isotope application.

However, this comment is not intended to take any credit from the excellent original research done and reported in this book on other methods of isotope separation. It is good that this conference covered all methods so well.

Much progress has been made in the gaseous diffusion process, but security classification continues to obscure most of this technology.

This volume will be happily received by all those interested in or engaged in isotope separation. Such a complete com-