earlier works and is an outstanding contribution to analytical literature.

The subject matter is presented in 14 chapters. The initial chapter on reactions, indicators, and general techniques is followed by chapters on potassium permanganate as both a volumetric and an oxidimetric reagent employed in methods for the determination of many inorganic and organic substances. Similar chapters cover the oxidimetry and use of ceric salts, potassium dichromate, iodine, iodates, periodates (Malaprade reaction), bromates, and hypohalites. In addition, there are chapters on the determination of water with the Karl Fischer reagent and on miscellaneous oxidizing and reducing titrants—for example, ferric salts and arsenious oxide.

The text material is up to date and is presented in the clear, orderly style characteristic of the senior author and his associates. The book is well-indexed. Cross references throughout the text will enable the reader to pin-point desired information readily—a very useful aid to those searching for reliable and thorough information when carrying on analytical operations. The student, teacher, and experienced chemist will find a great amount of information in this text with which their objectives can be more quickly and easily attained.

H. A. BRIGHT
National Bureau of Standards

Studies on Fossil Vertebrates. Presented to David Meredith Seares Watson. T. Stanley Westoll, Ed. University of London, Athlone Press; Essential Books, Fair Lawn, N.J., 1958. xii + 263 pp. Illus. $5.60.

This series of papers, honoring D. M. S. Watson on his retirement from the University of London, includes interesting, authoritative, and well-written theoretical studies, review articles, and discussions of new material in many of the fields Watson himself investigated.

Five chapters deal with fossil fish. Dorothy H. Rayner discusses the problems in determining the life habitats of fossil fish. Fish remains are very rare in modern dredging except in areas of low oxygen content, which suggests that the abundance of fossil fish in any environment may be inversely related to their abundance as living fish.

Errol I. White concludes that the evidence indicates that the original home of the craniates or Vertebrata was salt water, not fresh. Evidence for a freshwater origin often involves fish which lived in fresh water at some unspecified time after their origin, but this has no bearing on where the origin actually was. Perhaps the problem is complicated by there being no universally accepted definition of the precise point at which organisms became vertebrates. White cites zoological, geologic, and paleogeographic evidence, indicating that craniate conditions were achieved in marine (presumably coastal) waters, though the vertebrates may soon have entered fresh water.

T. S. Westoll concludes that, in early fishes, there was probably never "an ancestral type with continuous paired finfolds with segmented endoskeleton and segmental muscles," but that "there was a paired line of potential skin-folding, from which keel-like structures could develop," and that such structures developed several times among the early vertebrates, the invasion by muscles being independent in the different groups. The general homology of paired fins is indicated by the similarity of blood supply and innervation in the cephalaspids and sharks.

A new restoration of *Lasanius* accompanies F. R. Parrington's discussion of the Anaspida. Resemblances to cyclostomes are striking, suggesting the presence of similar gill sacs. These organisms probably buried their heads in the mud for feeding and pumped water in and out of the gill pouches for respiration.

The head of another anaspid, *Birkenia,* is restored by Anatol Heintz, who believes that the mouth and feeding habits were like those of *Amphioxus* rather than of cyclostomes.

Three papers summarize important aspects of the evolution of higher vertebrates: the stratigraphy, fauna, and environment of the Texas Permian, by A. S. Romer; evolutionary trends among Triassic tetrapods and indications of the similarity of Triassic and Cretaceous extinctions, by Edwin H. Colbert; and annotated faunal lists of the fossil vertebrates of Australia, which, E. Sherborn Hills states, show that Australia has always had closer faunal relationships with Europe than with South America or Africa.

The remaining three chapters are more theoretical. Causation in evolution, correlation of structure and function, relationships of internal and external environment, and evolutionary rates and directions are discussed by W. K. Gregory, Sir Gavin de Beer and W. E. Swinton stress paedomorphism (that is, the younger stages of the ancestor prophesy the adult stages of the descendant) in fossil sequences, both vertebrate and invertebrate. The neo-Darwinian basis of major evolutionary changes is questioned by James Brough, who feels that families and smaller units may arise by natural selection but that orders and higher groups have arisen very rapidly, due both to a former much higher mutation rate and to directional mutations. He observes that no new animal phyla have arisen since the Cambrian, and no new classes (except birds and mammals) since the Paleozoic, and concludes that "evolution is almost or quite spent as a major creative force."

ALBERT E. WOOD
Department of Biology,
Amherst College

Quantum Mechanics. Non-relativistic theory. L. D. Landau and E. M. Lifshitz. vol. 3, of *Course of Theoretical Physics.* Translated by J. B. Sykes and J. S. Bell. Pergamon Press, London; Addison Wesley, Reading, Mass., 1958. xii + 515 pp. $12.50.

This volume is the second to appear in a projected series of nine volumes on theoretical physics by these authors. It is in many ways an excellent introduction to the ideas and the applications to atomic phenomena of nonrelativistic quantum mechanics.

The strong point of this text is the completeness with which it treats atomic problems. There is an almost exhaustive discussion of angular momentum and spin on an elemenatry level. Of particular interest are the detailed computations of matrix elements for angular momentum problems and the introduction and use of spinors in the discussion. The treatment of the semiclassical (Wentzel-Kramer-Brillouin) approximation is far more detailed and interesting than that given in comparable available texts and includes, for example, a little-known calculation by Landau of the matrix elements in this approximation.

It is difficult to show restraint in praising the chapters on elementary many-body systems. Besides the usual self-consistent field analysis, a good account is given of the Thomas-Fermi model of the atom. Following these more or less general methods there is a long exposition of results for the diatomic molecule. The chapter on polyatomic molecules is preceded by a very readable introduction to the theory of groups, particularly as it relates to the representation of molecular symmetry. These ideas are then applied in discussion of the vibrational properties of the polyatomic molecule.

The concluding chapters are devoted to the theory of scattering, both elastic and inelastic. The authors make very effective use of the semiclassical approximation in scattering problems. They make mention of the Gelfand-Levitan recipe for deriving the potential energy from the phase shifts but do little more than quote it.

It seems to me that this text is not as good as many now available as a general

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.

GEORGE H. WEISS
Institute for Fluid Dynamics and Applied Mathematics, University of Maryland

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.

C. I. REED
Greensboro, North Carolina

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