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.

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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."

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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