There is much that is not found in other textbooks.

Chapters 11 and 12 are entitled The Wave Equation and Diffusion, Wave Mechanics, respectively. These include a good collection of interesting and useful special examples of the use of methods developed in the earlier chapters, including an unusual amount of attention to scattering problems. Chapter 13 is devoted to vector fields and is an excellent presentation of the special boundary value problems for vector fields, such as those particularly arising in electromagnetic theory, which are not derivable from a scalar potential.

The book is immensely valuable both as a textbook and as a reference collection concerning methods and special results. The authors have gone to considerable trouble to take the reader into their confidence, explaining as they go along the ideas back of every step they take. My one criticism of the book is that this leads them sometimes to be a little more wordy than necessary. In the preface they say that they make only the most sparing use of the irritating "it can be shown" device for elision of details, but is it any less irritating to be told this in these words (page 749): "By juggling these three equations around or else by further shuffling of the generating function, we can obtain. . . ."? The truth is, no matter how purely the pure mathematicians work, this quote does carry the flavor of the way in which most applied mathematical physics is done, so why not be honest about it?

Thomas Young, Natural Philosopher (1773–1829), a biography by the late Alexander Wood, completed by Frank Oldham. 353 pp. Cambridge University Press, 1954. $6.00. *Reviewed by Richard M. Sutton, Haverford College.*

The late Alexander Wood, Fellow of Emmanuel College and well known for his work in sound, spent forty years gathering materials on Thomas Young. At the time of his death in 1950, he had written ten of the fifteen chapters of this book and had outlined two more. It is fortunate that another admirer of Young, Frank Oldham, who had written a life of Young in 1933, was available to complete the work and give to the world this new estimate of an early nineteenth century genius. Their biography, together with that of George Peacock (1855), will doubtless remain the most definitive works covering the fantastically versatile Thomas Young who rightfully deserves a continuing place in the history of science and letters.

Thomas Young's precocity in reading, his early mastery of languages, and his speedy acquisition of various other skills have become legendary. At the age of thirteen, he knew English, Greek, Latin, French, Italian and Hebrew. His upbringing in a Quaker family and his schooling under a special tutor with his lifelong friend, Hudson Gurney, gave him respect for sound workmanship and for the value of time. He demonstrated an early interest in natural philosophy and medicine, and, at the age of 21, he was admitted as a Fellow of the Royal Society for his work on the power of accommodation of the eye. He ranks with Helmholtz as one of the great figures in that borderline field of physics and physiology, having first enunciated a theory of color vision which Helmholtz later revived (1873) and which now holds an eminent place as the Young-Helmholtz theory. Of this theory, James Clerk-Maxwell, himself a great student of color, once said, "So far as I know, Thomas Young was the first who, starting from the well-known fact that there are three primary colors, sought for an explanation of this fact, not in the nature of light, but in the constitution of man."

A few years ago, your reviewer browsed through Peacock's *Life of Thomas Young* and there was brought again to the connection of Young with the Rosetta Stone, a connection commemorated on the tablet inscribed to Young in Westminster Abbey near the tomb of Newton. The present authors go into that matter carefully and try to draw fair lines of the recognition due to Young and to his rival, Champollion, the French Egyptologist, who went farther than Young did, but whose initial progress was evidently made on the shoulders of Young's inquiries into the mysteries of the Egyptian hieroglyphics. No one, prior to Young, had ever read a single word of the hieroglyphics; and his work on the three-fold text in Greek, Coptic and hieroglyphics, his recognition of the possible phonetic value of the hieroglyphs as well as their ideological value, was the starting point in the highly successful unravelling of the great stone from Rashid.

Young was a medical man, having completed the work for his M.D. from Cambridge in 1799, after prior extensive studies in London, Edinburgh and Göttingen. One of the delights of this book is the insight it gives into the training of a young doctor in the late eighteenth century. As no dissenter could then study at Cambridge (or Oxford), Young joined the Church of England and threw aside some of the restrictive observances of his youth among Quakers, while retaining the more important attitudes and elements of character that were early impressed upon him. But as a doctor, Young was far from an outstanding success. Although for eighteen years he was on the staff of one of London's leading hospitals, he seems not to have made any significant mark as a doctor. There can be no question of his knowledge and skill; but he seems to have lacked those personal qualities in relation to his patients which make the good physician. He was "gentle and gentlemanly, but not genial." For many years, he covered up his scientific publications with pseudonyms and a cloak of anonymity, but one senses that his heart was not in medicine so much as in natural philosophy. However, his contributions relating to the eye, its accommodation, astigmatism, and color vision are of lasting value.

In natural philosophy, Young will be remembered as one of the handful of distinguished men who added lustre to the Royal Institution in its early years, soon after it was founded in 1800 by Count Rumford. During his two years of association with it (1801–1803), he gave a series of lectures on natural philosophy which he later whipped into a two-volume book on the sub-

ject, published in 1807. Young had a way of mastering quickly the work of all previous investigators and then contributing to every subject something of his own genius and insight. But Young was not a success as a lecturer—he probably shot too far over the heads of his listeners. As Wood says, in connection with his brilliant medical lectures, "Like many other great men, he provided a repast much too rich for the average intellectual digestion, and gave his hearers much more than they were able to carry away". One senses that Young moved restively from field to field, often doing more in a few months than all others before him had done in years, yet leaving a field for some new interest before it had been cultivated to the roots.

In no field is this better illustrated, aside from his brilliant work on the Rosetta Stone, than in the field of light where Thomas Young first enunciated the wave nature of light as a result of his famous experiment on interference. It was no mean feat to challenge the authority solidified in the prevailing Newtonian concepts, and Young's work was brought into damaging disrepute by published criticisms from the virulent pen of Henry Brougham to whom Young had been somewhat less than tactful a few years earlier. His ideas on light made little headway for a decade until the brilliant work of Fresnel and others of the French school began to expand them. There was always a cordial relationship between Young and Fresnel, closer perhaps because Young was Foreign Secretary of the Royal Society. In the year of Fresnel's death (1827), Young was elected a Foreign Member of the Academy of Sciences at Paris. In correspondence with Young, Fresnel draws a clear and true line when he says, "It seems to me, however, that what you left me to do in those parts of optics was as difficult as what you yourself did. You have gathered the flowers . . . and I have dug painfully for the roots." Young's famous experiment stands as an important landmark in experimental science; but without the extended and careful work of Fresnel, it would not have reached full fruition so early. Young seems to have been obsessed with the longitudinal nature of light waves (as he supposed them to be), and he was only groping tentatively for a possible transverse part when Fresnel crashed through with his thoroughgoing explanation. The book is well annotated in this and other portions of the crucial history of important developments.

It is pleasant to meet in Wood's biography of Young so many of the people who made the early 1800's memorable: men like Arago, Biot, Airy, Kater, Leslie, Black, Laplace, Legendre, Gay-Lussac, Davey, Brewster, Dalton, the Herschels, and Rumford. Young's contacts were wide; he moved in important circles with brilliance and modesty, touching a great variety of fields meaningfully. For ten years, he wrote for the Encyclopedia Britannica, but he kept his connection with that publication anonymous to protect his standing in the medical profession, though many suspected that only he could write as he did on Egypt, Eye, Sound, and numerous other subjects. He wrote on Carpentry, Bridges, Roads (McAdam was just then revolutionizing road building), Tides—sixty-one topics in all, including many biographical sketches, such as the important one on Legendre whose mathematics he mastered before writing.

Further elaboration of the details of Young's life here would be superfluous. Suffice it to say that this new biography has been written with balance, with careful consideration for all available source materials, with appreciation for the breadth of genius under examination, but with due regard for the weaknesses and short-comings of its principal figure. A thoroughly human Dr. Young emerges, interesting in his abilities, but not infallible or superhuman. Some of the source materials available to Peacock in 1855 are apparently no longer in existence, but other materials not known to Peacock have added new life to this biography. Only a fellow scientist like Alexander Wood could have had the patience and insight to delve into and weigh the evidence so carefully, especially with regard to the impact of Young's scientific discoveries. There is a feeling that the evidence has been evaluated fairly and sanely.

Not to be overlooked is a preface to the volume, a fine memoir on Alex Wood, written by his close friend, C. E. Raven, former Master of Christ's College, Cambridge.

Books Received

ATOMS IN THE FAMILY. MY LIFE WITH ENRICO FERMI. By Laura Fermi. 267 pp. The University of Chicago Press, Chicago, Illinois, 1954. $4.00.

THE KINETIC BASIS OF MOLECULAR BIOLOGY. By Frank H. Johnson, Henry Eyring, Milton J. Polissar. 874 pp. John Wiley & Sons, Inc., New York, 1954. $15.00.

SUBMINIATURIZATION TECHNIQUES FOR LOW-FREQUENCY RECEIVERS. By Gustave Shapiro. 64 pp. NBS Circular 545. U. S. Government Printing Office, Washington, D. C., 1954. $0.50.

LUMPED-PARAMETER TWO-TERMINAL NETWORKS. Volume I of Linear Transient Analysis. By Ernst Weber. 348 pp. John Wiley & Sons, Inc., New York, 1954. $7.50.

OPTIK UND ATOMPHYSIK (Ninth revised edition). Volume 3 of Einführung in die Physik. By Robert Wichard Pohl. 356 pp. Springer-Verlag, Berlin, Germany, 1954. DM 29.70.

WEATHER MODIFICATION: PAST, PRESENT AND FUTURE. By Kenneth M. Arenberg, F. Gregg Bemis, Jr., Chandler A. Cushman, Edward Neisser, Gerard P. Thomas, Donald H. Vetterlein. 50 pp. Weather Modification Group. Wollaston, Massachusetts, 1954. Paperbound $3.00.

PROCEEDINGS OF THE UNIVERSITY RESEARCH REACTOR CONFERENCE (Oak Ridge, Tennessee, February, 1954). Edited by W. W. Grigorieff. 221 pp. Office of Technical Services, Department of Commerce, Washington 25, D. C., 1954. Paperbound $1.35.

THE MAN IN THE THICK LEAD SUIT. By Daniel Lang. 207 pp. Oxford University Press, New York, 1954. $3.50.

ROTATIONAL STATES OF ATOMIC NUCLEI. By Aage Bohr. 55 pp. Ejnar Munksgaard Forlag, Copenhagen, Denmark, 1954. Paperbound kr. 10.

PHYSICAL PROPERTIES OF SOLID MATERIALS. By C. Zwikker. 300 pp. Interscience Publishers, Inc., New York, 1954. $8.75.